

Ecological site R003XN544WA Southern Washington Cascades Wet Alpine Tundra

Last updated: 9/09/2023
Accessed: 04/27/2024

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 at middle and high elevations on Mount Rainier in the Southern Washington Cascade Mountains. Elevation is 4,600 to 7,850 feet. The site is in swales of cirques and on glacial-valley floors at the upper limits of plant growth. The main abiotic factor affecting plant growth is the proximity to water and melting snow. Areas at the lower elevation range of this site typically are cooler than other areas at similar elevations due to factors such as proximity to permanent ice.

The soils that support this ecological site are in the cryic soil temperature regime and the aquic soil moisture regime. The climate is characterized by cool, dry summers and cold, wet winters. The soils typically are poorly drained and very deep, and they formed in volcanic ash and glacial till. The water table commonly is at or near the surface for much of the growing season. The soils are coarse textured and low in content of organic matter. The seasonal snowpack melts later on this site than it does on most other ecological sites in Mount Rainier National Park. This influences the hydrology and growing season. The air and soil temperatures on this site are significantly cooler, resulting in a shorter growing season. The vegetation is patchy and limited to areas with sufficient soil moisture and available nutrients. Common plants include Tiling's monkeyflower (*Mimulus tilingii*), arctic lupine (*Lupinus arcticus*), partridgefoot (*Luetkea pectinata*), and black alpine sedge (*Carex nigricans*).

Associated sites

R003XN543WA	<p>Southern Washington Cascades Alpine Tundra Ecological sites R003XN544WA, Southern Washington Cascades Wet Alpine Tundra, and R003XN543WA, Southern Washington Cascades Alpine Tundra, have some similar climatic and physiological features. Ecological site R003XN544WA is at lower elevations that are slightly warmer and receive more precipitation as compared to site R003XN543WA. As a result of the increased moisture availability, site R003XN544WA supports a wider variety of vegetation species that have higher production as compared to site R003XN543WA.</p>
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Similar sites

R003XN540WA	Southern Washington Cascades Wet Subalpine Parkland Ecological sites R003XN544WA, Southern Washington Cascades Wet Alpine Tundra, and R003XN540WA, Southern Washington Cascades Wet Subalpine Parkland are both heavily influenced by the amount and duration of annual snowpack. The main abiotic factor affecting plant growth in ecological site R003XN544WA is the proximity to water and melting snow. Common plants include Tiling's monkeyflower , arctic lupine, partridgefoot, and black alpine sedge. Site R003XN544WA supports a wider variety of vegetation species that have higher production as compared to site R003XN540WA.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Carex nigricans</i> (2) <i>Mimulus tilingii</i>

Physiographic features

This ecological site is in swales of cirques and on glacial-valley floors in the Cascade Mountains (elevation 4,600 to 7,850 feet) of Mount Rainier National Park. Slope and aspect are highly variable and are not significant drivers for this site. Slope commonly is 5 to 25 percent.

Table 2. Representative physiographic features

Landforms	(1) Cirque > Swale (2) Glacial-valley floor
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	4,600–7,850 ft
Slope	5–25%
Water table depth	0–8 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 88 to 160 inches, and the mean annual air temperature is 30 to 45 degrees F. The microclimate may vary depending on soil temperature and site-specific features, creating variations in vegetation response on a localized scale. Generally, the summers are cool and dry and the winters are cold and wet. Heavy snowpack and harsh winds are common throughout the year. Plants are stunted because of the short growing season.

Table 3. Representative climatic features

Frost-free period (characteristic range)	5-45 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	88-160 in

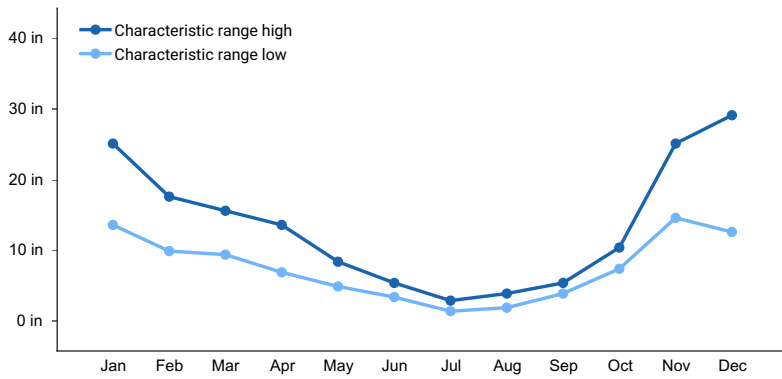


Figure 1. Monthly precipitation range

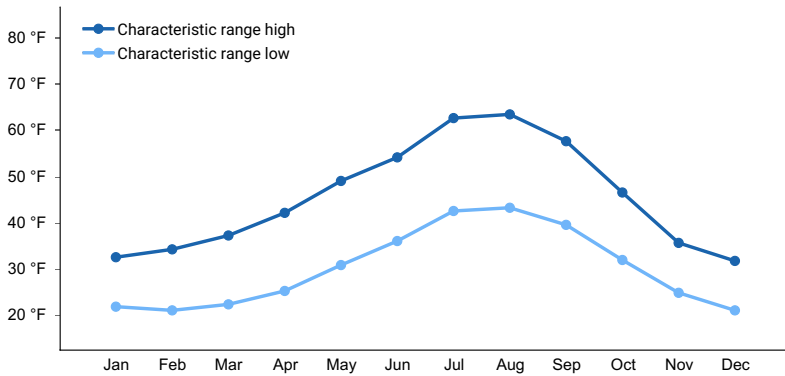


Figure 2. Monthly minimum temperature range

Influencing water features

This site is at the middle to high elevations in swales of cirques and on glacial-valley floors in Mount Rainier National Park. The site is not subject to ponding, and flooding is rare. A seasonal high water table is present during the growing season due to snowmelt.

Soil features

Applicable soils: Meany

Applicable soil map units in Mount Rainier National Park: 9260, 9261

The Meany soils are in the cryic soil temperature regime and the aquic soil moisture regime. They are poorly drained and very deep. They are in swales of cirques and on glacial-valley floors. They formed in volcanic ash and glacial till. These soils have a seasonal high water table at the surface to a depth of 8 inches below the surface during the growing season. The soils are subject to rare periods of flooding in May and June. They are not subject to ponding. The Meany soils have more than 35 percent rock fragments in the particle-size control section. The soils are coarse textured and primarily medial sandy loam or medial loamy sand. All of the horizons have andic soil properties. The dominant pedogenic processes are oxidation-reduction chemistry and gleization due to the high water table and presence of reduced iron. Podsolization is not evident because of the lack of coniferous forest cover. The soils have an ochric epipedon and a cambic horizon.

Soil moisture is not a limiting factor to plant growth on these soils because of the presence of volcanic ash and the abundance of precipitation and snowmelt.

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Supraglacial till
Surface texture	(1) Coarse sandy loam (2) Loamy sand

Drainage class	Poorly drained
Soil depth	60 in
Surface fragment cover <=3"	15–50%
Surface fragment cover >3"	10–45%
Available water capacity (1.5-6in)	Not specified
Soil reaction (1:1 water) (Depth not specified)	5.1–6
Subsurface fragment volume <=3" (Depth not specified)	35–60%
Subsurface fragment volume >3" (Depth not specified)	25–55%

Ecological dynamics

This ecological site is at middle and high elevations on Mount Rainier of the Southern Washington Cascade Mountains. Elevation is 4,600 to 7,850 feet. The site is in swales of cirques and on glacial-valley floors at the upper limits of plant growth on Mount Rainier. Areas at the lower range in elevation typically are cooler than areas at similar elevations in other ecological sites of Mount Rainier National Park due to factors such as proximity to permanent ice.

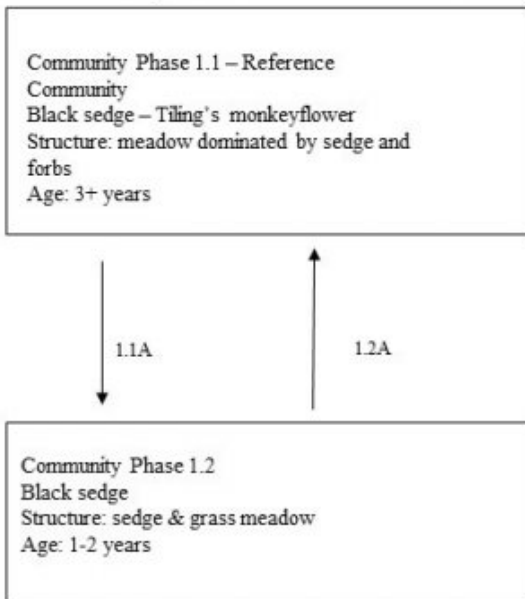
These sites are affected by harsh growing conditions including; strong winds, heavy snowpack, intense solar radiation, and freezing conditions. Seasonal snowpack melts later than in other ecological sites in the park. This influences the hydrology and plant diversity of this site. The growing season is very short, and plants are adapted to harsh conditions. Soils are shallow and soil moisture is a limitation to vegetation. Plant growth is primarily restricted to channels of snow runoff as well as areas with adequate moisture from snow melt and precipitation.

The air and soil temperatures are significantly cooler on this site than on most other sites on Mount Rainier, resulting in a shorter growing season. The vegetation is patchy and limited to areas that have sufficient soil moisture and available nutrients. Areas that have limited soil moisture may be completely barren of vegetation.

Common plants include Tiling's monkeyflower (*Mimulus tilingii*), arctic lupine (*Lupinus arcticus*), partridgefoot (*Luetkea pectinata*), and black alpine sedge (*Carex nigricans*). Tiling's monkeyflower is restricted to channels fed by melting snow, and black alpine sedge is common in saturated areas. Black alpine sedge is adapted to a short growing season (45 to 60 days) and can survive in snowfields. It also has the unique ability to flower within 7 days of snowmelt (Canaday, 1974).

State and transition model

1. Reference State (Site ID: F003XN544WA)

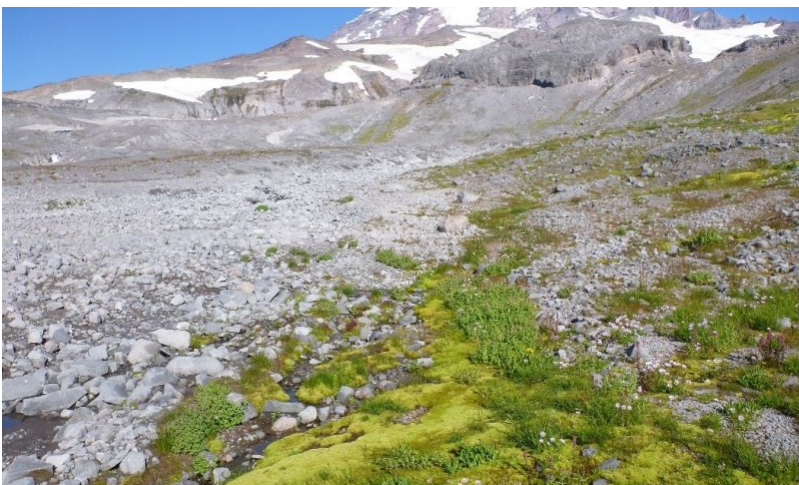


Carex nigricans – *Mimulus tilingii*
Black sedge – Tiling's monkeyflower

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

State 1

Community 1.1 Black sedge and Tiling's monkeyflower





Structure: Meadow consisting dominantly of sedges and forbs The reference community is sparsely vegetated with a mixture of sedges, forbs, and grasses that have been relatively undisturbed by natural and human influences. This subalpine ecosystem is on aspects from which snow melts in midsummer, limiting the growing season. Tiling's

monkeyflower, arctic lupine, and partridgefoot cover the landscape, and black alpine sedge is interspersed. Minor natural disturbances such as frost heaving, wind blasting, and variations in snowpack can have a significant impact on the vegetation.

Dominant plant species

- Tiling's monkeyflower (*Mimulus tilingii*), other herbaceous
- black alpine sedge (*Carex nigricans*), other herbaceous
- arctic lupine (*Lupinus arcticus*), other herbaceous
- partridgefoot (*Luetkea pectinata*), other herbaceous

Community 1.2 Black alpine sedge



Structure: Sedge and grass meadow As the plant community recovers during periods without disturbance, grasses and forbs become established and increase in abundance. Common plants such as arctic lupine and black alpine sedge re-establish.

Pathway 1.1A Community 1.1 to 1.2



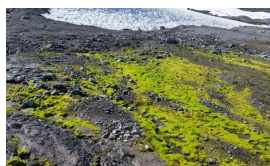
Black sedge and Tiling's monkeyflower



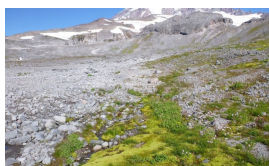
Black alpine sedge

This pathway represents a major disturbance, such as continuous snowpack, avalanches, landslides, or slow mass movement, that removes most of the vegetation.

Pathway 1.2A Community 1.2 to 1.1



Black alpine sedge



Black sedge and Tiling's monkeyflower

This pathway represents no further major disturbance and maturation of present species. Black alpine sedge continues to regenerate and other forbs re-establish. The plant community resembles the reference community.

Additional community tables

Inventory data references

Other Established Classifications

National vegetation classification group: Vancouverian-Rocky Mountain Subalpine-Alpine Snowbed, Wet Meadow and Dwarf-shrubland

U.S. Department of the Interior, National Park Service, plant association: CARNIG, MIMLEW

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T15N R09E S8
Latitude	46° 47' 59"
Longitude	121° 42' 21"

Other references

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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	04/27/2024
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:**
