USDA Natural Resources Conservation Service

Ecological site R003XN540WA
Southern Washington Cascades Wet Subalpine Parkland

Last updated: 1/29/2025
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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

Steep mountains and narrow to broad, gently sloping valleys characterize this region. 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 Cascades. Movement between these plates has resulted in major earthquakes in this area in the past and the formation of large stratovolcanoes. The Cascade Mountains consist primarily of volcanic crystalline rocks with some associated metasedimentary rocks. The average annual precipitation ranges from 60 to 100 inches in much of the region and 30 to 60 inches on the east side of the Cascade Mountains.

The dominant soil orders in this MLRA are Andisols, Spodosols, and Inceptisols, with minor amounts of Entisols, and Histosols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an udic soil moisture regime. They generally are shallow to very deep, well drained, ashy to medial, and loamy or sandy and occur on mountain slopes and ridges.

Ecological site concept

This ecological site occurs in small depressions on cirque floors, debris aprons, swales on glacial valley walls, or cold air drainages in subalpine parkland environments. The most common natural disturbance is heavy snowpack, with the volume and longevity of the snowpack defining the effect on the dynamics of the ecosystem. These sites generally retain snow cover later into the summer than sites on south and west slopes and start growth more slowly due to the cooling effects of the high water table at the beginning of the growing season. Soils that support this ecological site occur in the cryic soil temperature regime and the aquic soil moisture regime. These sites are typically wet with poorly drained soils. They have a very short growing season as a result of cool temperatures and the total heat load during the summer. Ponding on the soil surface is frequent and often persists for long periods of time.
Black sedge (*Carex nigricans*) is the most common species on this site, and it is often a homogenous ecosystem. In areas with snow recession earlier in the growing season, the site may have greater vegetative diversity including lady fern (*Athyrium filix-femina*), black sedge (*Carex nigricans*), bluejoint reedgrass (*Calamagrostis canadensis*), marsh marigold (*Caltha leptosepala*), and water parsley (*Oenanthe sarmentosa*). As a result of the short growing season, flowering will typically occur later in the season and vegetation growth is limited. Alternatively, some growing seasons may be affected by continuous snowpack and vegetation is therefore absent.

Associated sites

R003XN544WA	**Southern Washington Cascades Wet Alpine Tundra** 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.

Similar sites

R003XN541WA	**Southern Washington Cascades Moist Subalpine Parkland** Ecological Site 540, Southern Washington Cascades Wet Subalpine Parkland, has similar features to Ecological Site 541, Southern Washington Cascades Moist Subalpine Parkland. Both ecological sites are found in parklands within the same elevation range, however the position on the landscape affects the persistence of snow cover which create a distinct influence on both sites. Ecological Site 540 is more commonly found in depressions and swales which captures and stores snow for longer periods of the growing season. Wet adapted plants such as black sedge are commonly homogeneous in these growing environments. Ecological Site 541 has a greater level of plant diversity and production as a result of earlier seasonal snow melt which extends the growing season.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex nigricans*

Physiographic features

This ecological site occurs across many landscape positions in depressions on cirque floors, debris aprons, and swales on glacial valley walls of Cascade Mountains (3,300-7,000 ft) in Mt. Rainier National Park. The site is most commonly found between 0 to 15 percent slopes.

Table 2. Representative physiographic features

Landforms	(1) Swale (2) Cirque floor > Closed depression
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	3,300–7,000 ft
Slope	0–15%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This ecological site receives most of its annual precipitation from October to March. The mean annual precipitation ranges from 53 to 125 inches and the annual air temperature ranges from 33 to 45 degrees Fahrenheit. Microclimate may vary depending on soil temperature and site specific features. Generally, this site occupies areas cool, dry summers and cold, wet winters.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	53-125 in

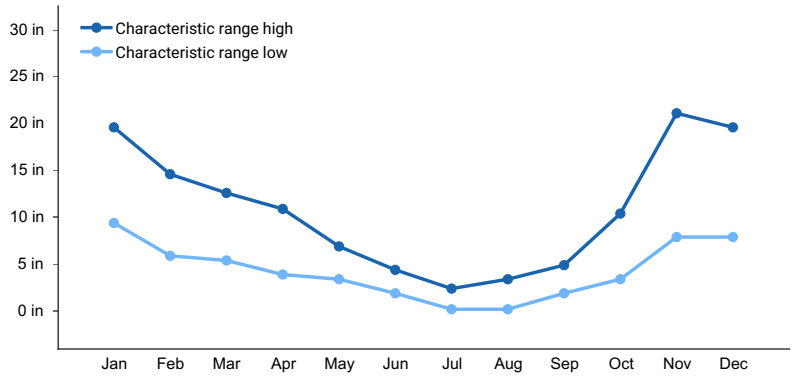


Figure 1. Monthly precipitation range

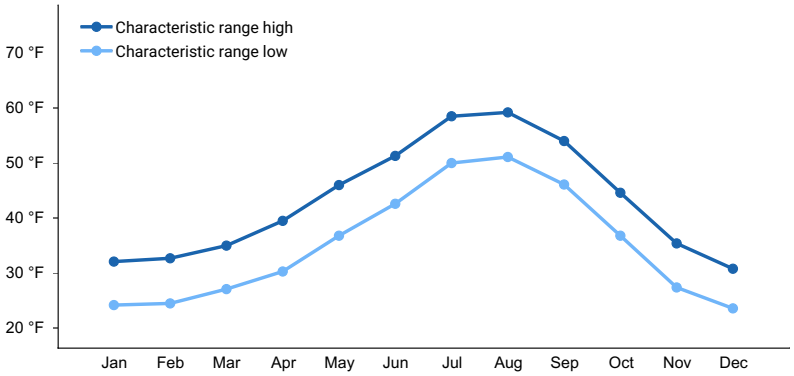


Figure 2. Monthly minimum temperature range

Influencing water features

This site is located in middle to high elevations on depressions on cirque floors, debris aprons, and swales in Mount Rainier National Park. This site does not experience flooding, however ponding occurrences are frequent and may persist for long durations. The Williwakas Series soils are poorly drained and the water table will typically rise during the spring months and recede in the fall.

Soil features

Applicable Soils: Williwakas
Applicable Soil Map Units within Mt. Rainier National Park: 8201, 8211, 8220, 8225, 8250, 8251, 8256, 8257, 9210, 9220, 9225, 9253, 9254, 9258, 9259
The soil that support this ecological site occur in the cryic soil temperature regime and the aquic soil moisture regime. Williwakas soil is poorly drained, very deep, formed from volcanic ash, and is found on depressions on cirque floors, debris aprons, and swales on glacial valley walls. Williwakas soil has a seasonally high water table at the surface at some point during the growing season. Williwakas soil has frequent ponding potential in April, May, June. Williwakas soil has less than 35 percent rock fragments in the control section. Soil textures are coarse, primarily medial sandy loams and medial loamy sands. This soil exhibits andic soil properties in all mineral horizons. Melanization is the dominant pedogenic process and podsolization is not evident in these profiles given the lack of coniferous forest cover. An umbric epipedon and cambic horizons are present.
Excessive soil moisture is a limiting factor to plant growth on this soil owing to the frequently shallow depths to saturated soil horizons and the abundance of precipitation and snow melt. Thin organic horizons consisting of decomposing litter are present on the soil surface, serving to protect the soil from wind and water erosion.

Subsurface Texture Group: medial sandy loam, medial loamy sand, paragravelly medial sandy loam

Table 4. Representative soil features

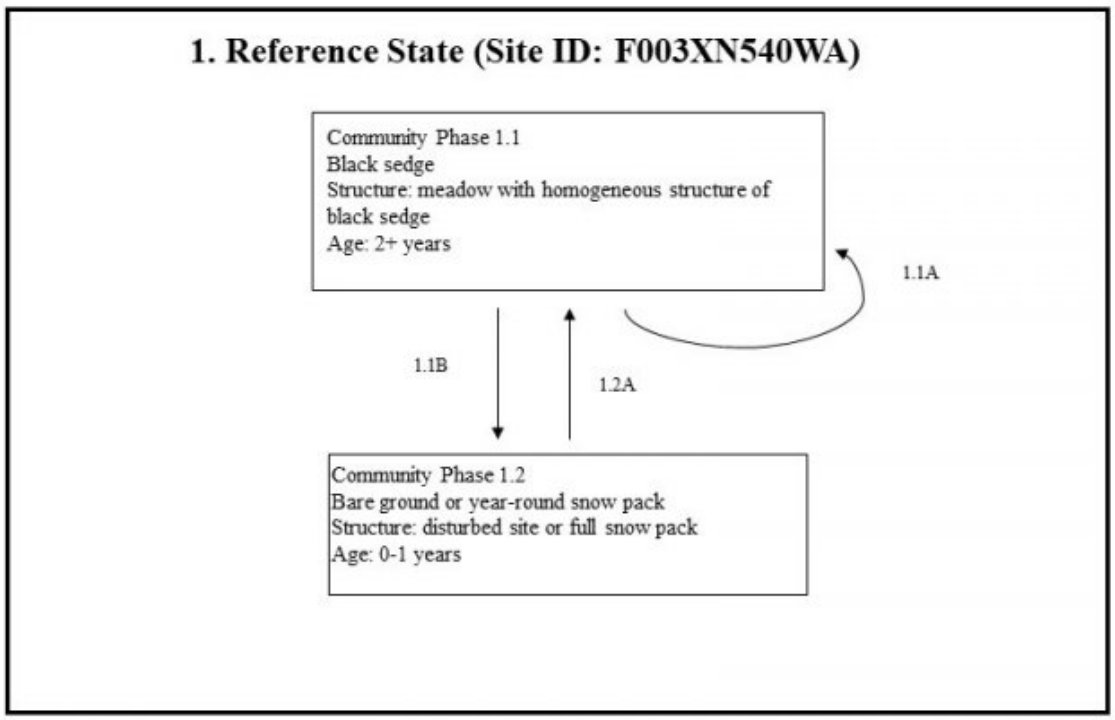
Parent material	(1) Volcanic ash

Surface texture	(1) Sandy loam (2) Loamy sand
Drainage class	Poorly drained
Soil depth	60 in
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0%
Available water capacity (4-12in)	Not specified
Soil reaction (1:1 water) (4.5-5.5in)	Not specified
Subsurface fragment volume <=3" (0-35in)	Not specified
Subsurface fragment volume >3" (0in)	Not specified

Ecological dynamics

This driving abiotic factors for this ecological site are landscape position, landform, and the heavy snow pack that occurs at the higher elevations of Mt. Rainier National Park. The volume and longevity of the snowpack is the primary defining factor that impacts the dynamics of this ecosystem. These sites generally retain snow cover later into the summer than sites on south and west slopes and start growth more slowly due to the cooling effects of the high water table at the beginning of the growing season. Soils that support this ecological site occur in the cryic soil temperature regime and the aquic soil moisture regime and are typically wet and poorly drained. They have a very short growing season as a result of cool temperatures and the total heat load during the summer. Ponding on the soil surface is frequent and often persists for long periods of time.
Black sedge (*Carex nigricans*) is the most common species on this site, and is often a homogenous ecosystem. Black sedge is adapted to a short growing season (45-60 days) and is suited to survive within snowfields. It also has a unique adaptability to flower within seven days of snow release (Canaday, 1974). In years of continuous snowpack vegetation is virtually absent on this ecological site, however in light snow pack years or in areas with snow recession earlier in the growing season, the site may have greater vegetative diversity including lady fern (*Athyrium filix-femina*), black sedge (*Carex nigricans*), bluejoint reedgrass (*Calamagrostis canadensis*), marsh marigold (*Caltha leptosepala*), and water parsley (*Oenanthe sarmentosa*). The short growing season typically results in flowering later in the season and results in limited vegetation growth.

State and transition model



Carex nigricans

Black sedge

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

State 1
Reference

Community 1.1
Black Sedge

Structure: meadow with homogeneous vegetation of black sedge Black sedge is the dominant species in the community phase. The reference community represents a summer growing season without the presence of snow. Snow is often located along the edges of the site for the majority of the growing season which provides moisture to the vegetation well through the summer. Community Phase Pathway 1.1A This pathway is one of minor disturbances (extended snow cover or ponding) which maintain the overall structure of the reference community.

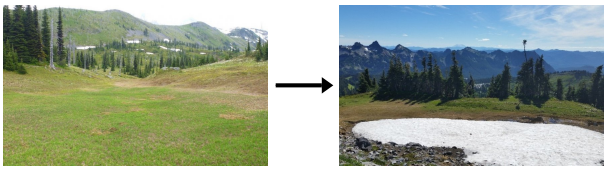
Dominant plant species

- black alpine sedge (*Carex nigricans*), other herbaceous

Community 1.2
Bare Ground or Year-Round Snowpack

Structure: disturbed site with bare ground or full snowpack Community phase 1.2 represents an ecosystem that has been disturbed by excessive ponding or fully covered with snow pack for the entire growing season. Vegetation may undergo regeneration or initiation, however the short growing season may result is very little annual growth.

Pathway 1.1A
Community 1.1 to 1.2



Black Sedge

Bare Ground or Year-Round Snowpack

This pathway represents extended snowpack throughout the entire growing season or disturbance such as fire, vegetation scorching causing the loss of vegetated cover resulting in bare ground or snow covered areas.

Pathway 1.2A
Community 1.2 to 1.1

Bare Ground or Year-Round Snowpack

Black Sedge

This pathway represents growth with a typical growing season with no further significant disturbance. The vegetation is fairly homogenous and reaches the reference community state.

Additional community tables

Inventory data references

Relationship to Other Established Classifications

This ecological site falls within the National Vegetation Classification Group- Vancouverian & Rocky Mountain

Subalpine Snowbed, Wet Meadow & Dwarf-Shrubland Group

This ecological site includes the following USDI National Park Service Associations Groups: CARNIG

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T16N R07E S14
Latitude	46° 52′ 17″
Longitude	121° 53′ 27″

Other references

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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	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:

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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:

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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:**
