USDA Natural Resources
Conservation Service

Ecological site R003XN541WA
Southern Washington Cascades Moist Subalpine Parkland

Last updated: 9/09/2023
Accessed: 05/08/2024

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 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 is found in subalpine parklands at middle and high elevations of the Southern Washington Cascades. The site is predominantly comprised of low growing shrubs, forbs, and grass species. The site is located on south and west slopes of Mount Rainier, but occurs on all aspects and all slopes within that zone. The site is often influenced by heavy snow loads which provide more soil moisture and insulation for plants during the dormant season. In addition, it receives the highest amount of rainfall within the subalpine parklands located in Mount Rainier National Park, and has a wider degree of vegetative diversity and resilience as a result. Soils that support this ecological site occur in the cryic soil temperature regime and the udic soil moisture regime. Several of the soils have a water table between 10 and 20 inches of the surface at some point of the growing season.

The reference community may be most common, but it is likely that all community phases occur as a matrix across the landscape. Common plants include Cascade huckleberry (*Vaccinium deliciosum*), pink mountain-heather (*Phyllodoce empetriformis*), white mountain heather (*Cassiope mertensiana*), Sitka valerian (*Valeriana sitchensis*), false hellebore (*Veratrum viride*), American bistort (*Polygonum bistortoides*), western columbine (*Aquilegia formosa*), arctic lupine (*Lupinus arcticus*), spreading phlox (*Phlox diffusa*), arrow-leafed ragwort (*Senecio triangularis*), mountain hairgrass (*Vahlodea atropurpurea*), and showy sedge (*Carex spectabilis*).

Associated sites

R003XN542WA	**Southern Washington Cascades Subalpine Parkland** Ecological Site R003XN542WA, Southern Washington Cascades Subalpine Parkland, and Ecological Site R003XN541WA, Southern Washington Cascades Moist Subalpine Parkland are found within the same elevations. Both ecological sites are parkland ecosystems, however moisture availability plays a key role in distinguishing the Ecological Sites. Ecological Site R003XN542WA is more commonly found in rain shadow areas and, as a result, are drier and warmer habitats. Ecological Site R003XN541WA has higher soil moisture and able to support a more diverse vegetative ecosystem with a higher percentage of vegetative cover when compared to site R003XN542WA.

Similar sites

R003XN540WA	**Southern Washington Cascades Wet Subalpine Parkland** Ecological Site R003XN540WA, Southern Washington Cascades Wet Subalpine Parkland, has similar features to Ecological Site R003XN541WA, 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 R003XN540WA 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 R003XN541WA 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	(1) *Phyllodoce empetriformis* (2) *Vaccinium deliciosum*
Herbaceous	(1) *Lupinus arcticus* (2) *Valeriana sitchensis*

Physiographic features

This ecological site occurs across many landscape positions on ridges, swales on ridges, cirques, glacial-valley walls, and swales of glacial-valley walls in the Cascade Mountains (3,650-6,975 ft) in Mt. Rainier National Park. The site is found on all slopes, but is most commonly found between 10 to 65 percent slopes. Slope has little impact on the ecological dynamics of the site.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Cirque (3) Glacial-valley wall
Flooding frequency	None
Ponding frequency	None
Elevation	3,650–6,975 ft
Slope	0–100%
Water table depth	10–0 in
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 77 to 140 inches and the annual temperature ranges from 36 to 43 degrees Fahrenheit. Microclimate may vary depending on soil temperature and site specific features. Generally, this site occupies areas with cool, dry summers and cold, wet winters.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-60 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	77-140 in

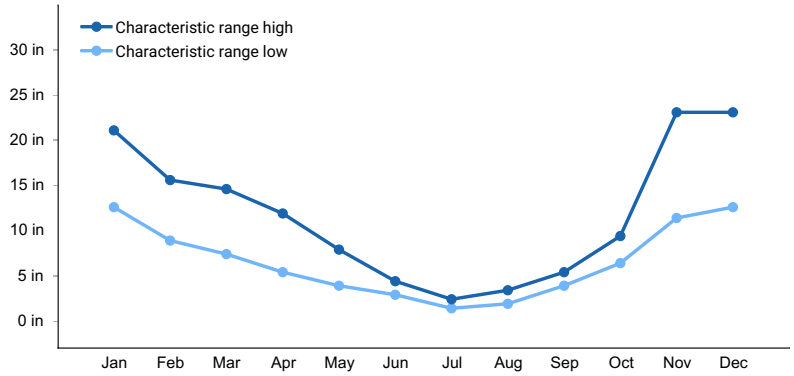


Figure 1. Monthly precipitation range

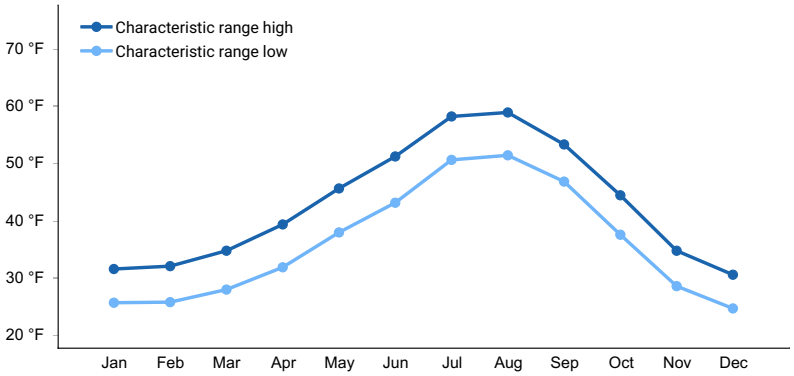


Figure 2. Monthly minimum temperature range

Influencing water features

This site is located in the middle to high elevations on the ridges, cirques, and glacial-valley walls in Mount Rainier National Park. This site does not experience ponding or flooding. The water table will typically rise during the spring and summer months and recede in the fall.

Soil features

Applicable Soils: Burroughs moist, Chenuis moist, Littletahoma moist, Mountwow moist, Sarvant moist, Tatoosh moist

Applicable Soil Map Units within Mt. Rainier National Park: 8250, 8251, 8252, 9250, 9251, 9252, 9253, 9254

Soils that support this ecological site occur in the cryic soil temperature regime and the udic soil moisture regime. Soils representative of this ecological site vary in drainage and depth, however the over-riding factor for this ecological site is the position on the landscape and the amount of time and duration of snowpack during the growing season. Burroughs, Chenuis, Littletahoma, Sarvant, and Tatoosh soils are well drained. Mountwow and Wahpenayo soils are somewhat poorly drained. Chenuis, Littletahoma, and Mountwow soils are very deep. Burroughs, Sarvant and Wahpenayo soils are moderately deep. Tatoosh soils are shallow. These soils are found on ridges, cirques and glacial valley walls and are formed from volcanic ash and andesite colluvium, with or without andesite bedrock. Mountwow and Wahpenayo soils have a seasonally high water table between 10 and 20 inches of the surface at some point during the growing season. Chenuis and Sarvant soils have greater than 35 percent rock fragments in the control section, while all others do not. Soil textures are coarse, primarily medial sandy loams and medial loamy sands. These soils exhibit 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 in most soils.
Soil moisture is not a limiting factor to forest growth on these soils owing to the abundance of precipitation and the inherent water holding properties of soils influenced by volcanic ash. Thin organic horizons consisting of decomposing litter are present on the soil surface of the Mountwow, Burroughs and Chenuis soils, serving to protect the soil from wind and water erosion.

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Colluvium–andesite (3) Residuum–andesite
Surface texture	(1) Sandy loam (2) Loamy sand
Drainage class	Well drained to somewhat poorly drained
Soil depth	18–60 in
Surface fragment cover <=3"	0–70%
Surface fragment cover >3"	0–50%
Available water capacity (Depth not specified)	2.5–9 in
Soil reaction (1:1 water) (Depth not specified)	4.5–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–70%
Subsurface fragment volume >3" (Depth not specified)	0–50%

Ecological dynamics

This ecological site is found in subalpine parklands at middle and high elevations of the Southern Washington Cascades. The site is predominantly comprised of low growing shrubs, forbs, and grass species. The site is often influenced by heavy snow loads which provide more soil moisture and insulation for plants during the dormant season. Plant production is directly correlated to the snow release date which can be highly variable from year to year (Canaday, 1974). The site is located on south and west slopes of Mount Rainier, but occurs on all aspects within that zone. In addition, it receives the highest amount of rainfall within the subalpine parklands located within Mount Rainier National Park, and has a wider degree of vegetative diversity and resilience as a result.

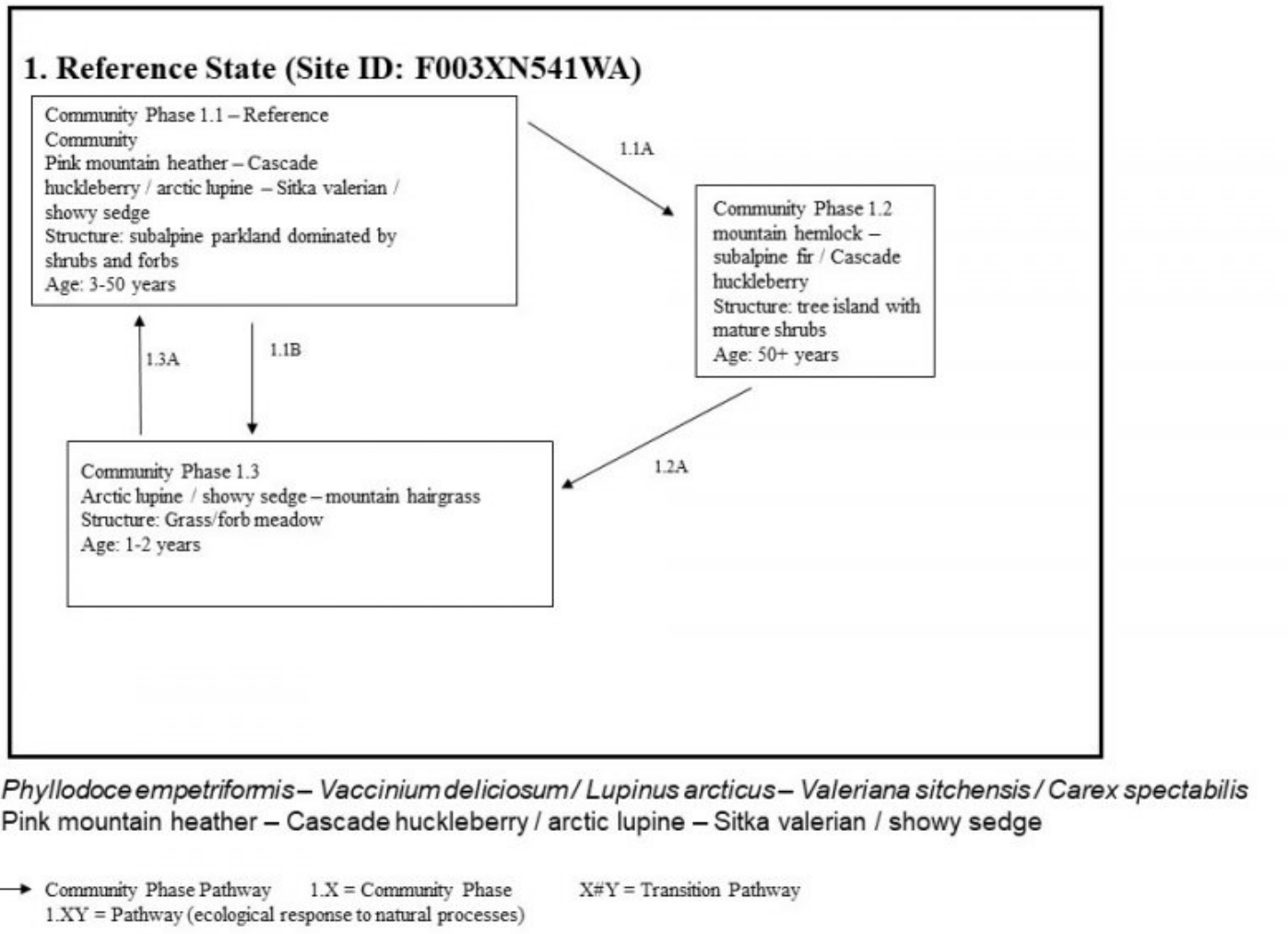
Soils that support this ecological site occur in the cryic soil temperature regime and the udic soil moisture regime. Soils representative of this ecological site vary in drainage and depth, however the over-riding factor for this ecological site is the position on the landscape and the amount of time and duration of snowpack during the growing season. Several of the soils have a water table between 10 and 20 inches of the surface at some point of the growing season. Usually, this combination of location, slope, and generally coarse soil textures would result in a site where lack of summer soil moisture could be a limitation for plant growth. However, soil moisture is not a limiting factor to plant growth on these soils owing to the abundance of precipitation and the inherent water holding properties of soils influenced by volcanic ash. Seasonal snowpack melts earlier on these sites and the lack of saturation in the soil profile allows soils to warm quickly with rising seasonal air temperature. In addition, prevailing winds from the south and west result in significant orographic precipitation and the resulting cloud cover provide a steady supply of moisture for plant growth throughout the summer.

The site is less susceptible to frequent natural disturbances, such as avalanches and soil movement. Historically, fire (anthropogenic and natural) was an important disturbance factor, suppressing the growth of heather and encroaching conifers (Hemstrom, 1982) while retaining a forb and grass dominated parkland ecosystem. Despite abundant precipitation and soil moisture, this site can be impacted by compaction and damage to vegetation which may have significant impacts on the ecological integrity and resilience of the site. If there is a long period without disturbance, the site is subject to conifer encroachment, including mountain hemlock (*Tsuga mertensiana*) and

subalpine fir (*Abies lasiocarpa*), creating tree islands.

The reference community may be most common, but it is likely that all community phases occur as a matrix across the landscape. Common plants include Cascade huckleberry (*Vaccinium deliciosum*), pink mountain-heather (*Phyllodoce empetriformis*), white mountain heather (*Cassiope mertensiana*), Sitka valerian (*Valeriana sitchensis*), false hellebore (*Veratrum viride*), American bistort (*Polygonum bistortoides*), western columbine (*Aquilegia formosa*), arctic lupine (*Lupinus arcticus*), spreading phlox (*Phlox diffusa*), arrow-leafed ragwort (*Senecio triangularis*), mountain hairgrass (*Vahlodea atropurpurea*), and showy sedge (*Carex spectabilis*).

State and transition model



Phyllodoce empetriformis – Vaccinium deliciosum / Lupinus arcticus – Valeriana sitchensis / Carex spectabilis
Pink mountain heather – Cascade huckleberry / arctic lupine – Sitka valerian / showy sedge

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

State 1

Community 1.1
pink mountain heather – Cascade huckleberry / arctic lupine – Sitka valerian / showy sedge

Structure: subalpine parkland of shrubs, forbs, grass, and grass-like species The reference community is a floristically rich mosaic of shrubs, forbs, and grass species that have been relatively undisturbed by natural and human influences. These subalpine ecosystems are located on aspects where snowmelt occurs in spring and early summer, providing for a longer growing season. These sites tend to receive adequate moisture throughout the growing season by additional snowmelt and runoff from higher elevations. Plant percent cover is variable but the reference community plants are common throughout the entire ecological site. Low-growing shrubs such as pink mountain-heather and Cascade huckleberry are most dominant, but white mountain heather and black huckleberry may be common and prolific in areas. Forbs including spreading phlox, American bistort, arctic lupine, and Sitka valerian cover the landscape with showy sedge interspersed. Dwarfed species of mountain hemlock, subalpine fir, and Alaska cedar are scattered throughout the ecosystem, forming tree islands in places. Small natural disturbances such as frost heaving, wind blasting, and variation in snowpack may have small scale, but significant impacts on alpine vegetation. Soil compaction and damage to vegetation may have significant impacts on the ecological site integrity. Herbivores such as marmots, pikas, elk, migratory birds, and mountain goats will forage on the vegetation which may create patches of open ground (Martin, 2001).

Dominant plant species

- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- Alaska cedar (*Callitropsis nootkatensis*), tree
- pink mountainheath (*Phyllodoce empetriformis*), shrub
- western moss heather (*Cassiope mertensiana*), shrub
- Cascade bilberry (*Vaccinium deliciosum*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- spreading phlox (*Phlox diffusa*), other herbaceous
- Sitka valerian (*Valeriana sitchensis*), other herbaceous
- arctic lupine (*Lupinus arcticus*), other herbaceous
- American bistort (*Polygonum bistortoides*), other herbaceous

Community 1.2
mountain hemlock – subalpine fir / Cascade huckleberry

Structure: tree islands Community phase 1.2 represents a community stage of tree islands that are developed over long periods of time without disturbance. The establishment of conifers such as subalpine fir (*Abies lasiocarpa*) and mountain hemlock (*Tsuga mertensiana*) are successful and have developed pockets of mature trees. Common understory species include black huckleberry, pink mountain heather, western moss heather, and Cascade huckleberry.

Dominant plant species

- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- pink mountainheath (*Phyllodoce empetriformis*), shrub
- Cascade bilberry (*Vaccinium deliciosum*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- western moss heather (*Cassiope mertensiana*), shrub

Community 1.3
Arctic lupine / showy Sedge – mountain hairgrass

Structure: Grass/Forb Meadow Early seral species of grasses and forbs will inhabit the landscape following disturbance. Common plants such as arctic lupine, Sitka valerian, American bistort, Idaho fescue, and showy sedge begin to dominate.

Dominant plant species

- Idaho fescue (*Festuca idahoensis*), grass
- showy sedge (*Carex spectabilis*), grass
- arctic lupine (*Lupinus arcticus*), other herbaceous
- Sitka valerian (*Valeriana sitchensis*), other herbaceous
- American bistort (*Polygonum bistortoides*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

pink mountain heather – Cascade huckleberry / arctic lupine – Sitka valerian / showy sedge

mountain hemlock – subalpine fir / Cascade huckleberry

This pathway represents an ongoing lack of disturbance which favors the establishment of pockets of trees over time.

Pathway 1.1B
Community 1.1 to 1.3

This pathway represents an extreme disturbance. The most typical disturbance is wildfire, however other extreme disturbances may include avalanche, landslide, or slower form of mass movement that removes the majority of the vegetation. Wildfire intensity will be elevation driven, and it is expected that lower elevations will be more devastated by higher intensity wildfires and the recovery time will be longer as a result.

Pathway 1.2A
Community 1.2 to 1.3

This pathway represents an extreme disturbance. The most typical disturbance is wildfire, however other extreme disturbances may include avalanche, landslide, or slower form of mass movement that removes the majority of the vegetation. Wildfire intensity will be elevation driven, and it is expected that lower elevations will be more devastated by higher intensity wildfires and the recovery time will be longer as a result.

Pathway 1.3A
Community 1.3 to 1.1

This pathway represents no further major disturbance and maturation of present species. Re-establishment of shrubs such as pink mountain heather and Cascade huckleberry occur as well as diversification of forb species.

Additional community tables

Table 5. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
showy sedge	CASP5	*Carex spectabilis*	Native	1–36	0–40
Forb/Herb					
arctic lupine	LUAR2	*Lupinus arcticus*	Native	1–36	0–25
bracted lousewort	PEBR	*Pedicularis bracteosa*	Native	1–24	0–20
spreading phlox	PHDI3	*Phlox diffusa*	Native	1–8	0–10
American bistort	POBI6	*Polygonum bistortoides*	Native	1–24	0–10
Sitka valerian	VASI	*Valeriana sitchensis*	Native	1–24	0–5
Shrub/Subshrub					
Cascade bilberry	VADE	*Vaccinium deliciosum*	Native	1–48	0–45
western moss heather	CAME7	*Cassiope mertensiana*	Native	1–36	0–40
pink mountainheath	PHEM	*Phyllodoce empetriformis*	Native	1–24	0–20
thinleaf huckleberry	VAME	*Vaccinium membranaceum*	Native	1–48	0–20

Table 6. 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
subalpine fir	*ABLA*	31	89	–	90	90	–	–	
mountain hemlock	*TSME*	36	56	–	25	70	–	–	

Inventory data references

Relationship to Other Established Classifications

This ecological site falls within the National Vegetation Classification Group- North Pacific Alpine-Subalpine Dwarf-shrubland and Heath

This ecological site includes the following USDI National Park Service Associations Groups:
PHYEMP-VACDEL-(CASMER)
PHYEMP-(VACDEL)/LUPARC

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T15N R08E S12
Latitude	46° 47′ 39″
Longitude	121° 43′ 52″

Other references

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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):**

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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:**
