USDA Natural Resources
Conservation Service

Ecological site R003XN640WA
Southern Washington Cascades Low Cryic Bog or Fen

Last updated: 1/29/2025
Accessed: 05/10/2025

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 nonforested bogs and fens at low to middle elevations (2,100 to 4,600 feet) of the Southern Washington Cascade Mountains. Because of the scale of mapping, this site concept includes both bogs and fens and they are not distinguished differently. The site is influenced by the pH of the soils, availability of nutrients, physiography, and hydrologic dynamics. The summers are cool and dry, and the winters are cold and wet.
The soils that support this ecological site are in the cryic soil temperature regime and the aquic soil moisture regime. The site typically is in poorly drained areas that are subject to residual ponding from overbank flooding, groundwater discharge from nearby slopes, or a seasonal high water table associated with meltwater. The water table commonly is at or near the surface during much of the growing season, and the rate of organic material decomposition is slow because of the anaerobic and acidic conditions. These conditions result in a nutrient-poor environment. The soils are mucky and formed in organic material and bands of volcanic ash.
The site supports vegetation that is tolerant of frequent ponding and periodic saturation. Common plants include mannagrass (Glyceria spp.), American skunkcabbage (*Lysichiton americanus*), water sedge (*Carex aquatilis*), bluejoint reedgrass (*Calamagrostis canadensis*), white marsh marigold (*Caltha leptosepala*), black alpine sedge (*Carex nigricans*), rush (Juncus), bog Labrador tea (*Ledum groenlandicum*), and water parsley (*Oenanthe sarmentosa*).

Associated sites

R003XN641WA	**Southern Washington Cascades High Cryic Bog or Fen** Ecological site R003XN640WA, Southern Washington Cascades Low Cryic Bog or Fen, has features that are associated to those of site R003XN641WA, Southern Washington High Cryic Bog or Fen. Both sites are influenced by ponding and similar disturbance patterns; however, elevation and the duration of ponding distinguish these ecosystems. Ecological site R003XN640WA is at an elevation of 2,100 to 4,600 feet, and site R003XN641WA is at an elevation of 3,600 to 6,500 feet. Both sites support similar plant species, but site R003XN640WA has a longer growing season and higher plant production.

Similar sites

R003XN641WA	**Southern Washington Cascades High Cryic Bog or Fen** Ecological site R003XN640WA, Southern Washington Cascades Low Cryic Bog or Fen, has features that are associated to those of site R003XN641WA, Southern Washington High Cryic Bog or Fen. Both sites are influenced by ponding and similar disturbance patterns; however, elevation and the duration of ponding distinguish these ecosystems. Ecological site R003XN640WA is at an elevation of 2,100 to 4,600 feet, and site R003XN641WA is at an elevation of 3,600 to 6,500 feet. Both sites support similar plant species, but site R003XN640WA has a longer growing season and higher plant production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Glyceria* (2) *Carex aquatilis*

Physiographic features

This ecological site is on debris aprons and in depressions in the Cascade Mountains (elevation 2,100 to 4,600 feet) of Mount Rainier National Park. The bogs commonly are in swales of depressions within closed hydrologic basins. The fens are on debris aprons that have hydrologic movement. The bogs and fens typically are small because they are limited by adjacent physiographic features. The steeper slopes impact the hydrology in the watershed (Chimner, 2010). Slope commonly is 0 to 5 percent.

Table 2. Representative physiographic features

Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	2,100–4,600 ft
Slope	0–5%
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 51 to 111 inches, and the mean annual air temperature is 36 to 53 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)	30-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	51-111 in

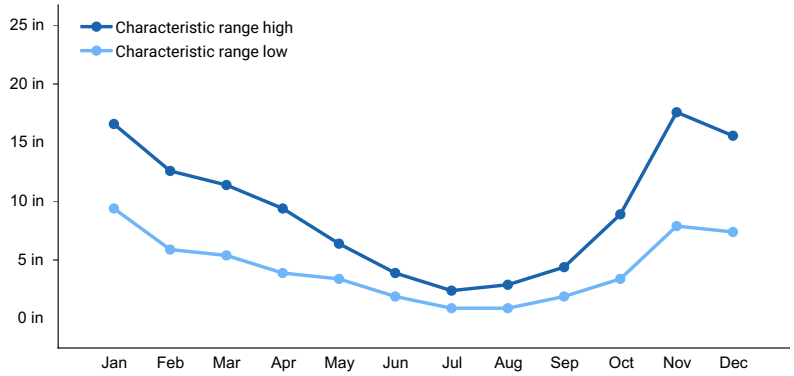


Figure 1. Monthly precipitation range

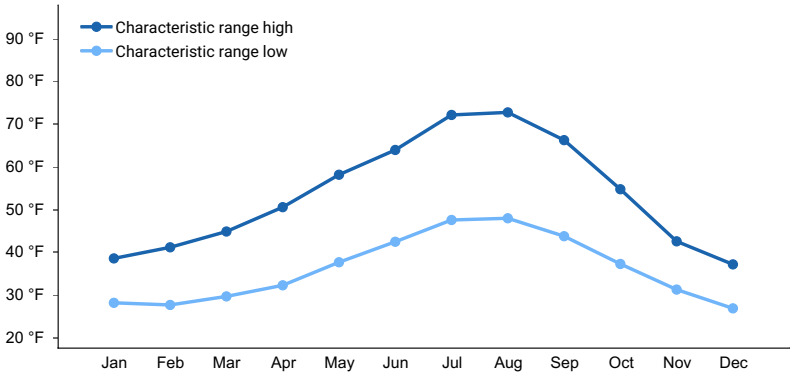


Figure 2. Monthly minimum temperature range

Influencing water features

This site is at low to middle elevations on debris aprons and in swales of depressions in Mount Rainier National Park. The site is subject to frequent, long periods of ponding in spring, which directly influence the plant community. The fens are continuously fed and filtered by hydrologic movement, and the bogs are in closed basins. The water table typically rises in spring and recedes in fall.

Soil features

Applicable soils: Ghost

Applicable soil map units in Mount Rainier National Park: 8110, 8150

The Ghost soils are in the cryic soil temperature regime and the aquic soil moisture regime. They are very poorly drained and very deep. The soils are on debris aprons and in depressions. They formed in organic material and volcanic ash. The Ghost soils have a seasonal high water table at the surface at some time during the growing season. The soils are subject to frequent periods of ponding in April, May, and June. They have less than 35 percent rock fragments in the particle-size control section. The soils consist dominantly of organic material, primarily muck. The dominant pedogenic process is the accumulation of organic matter as a result of the slow rate of decomposition in the saturated environment. Sapric soil material is in all of the organic horizons, and andic soil properties are in all of the mineral horizons. Soil moisture is a limiting factor to plant growth because of the frequent periods of ponding and the abundance of precipitation and snowmelt. The organic horizons consist of decomposing litter. These horizons help to protect the soils from wind and water erosion.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Volcanic ash
Surface texture	(1) Muck (2) Woody

Drainage class	Very poorly drained
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–20%
Available water capacity (Depth not specified)	16–33 in
Soil reaction (1:1 water) (Depth not specified)	4.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

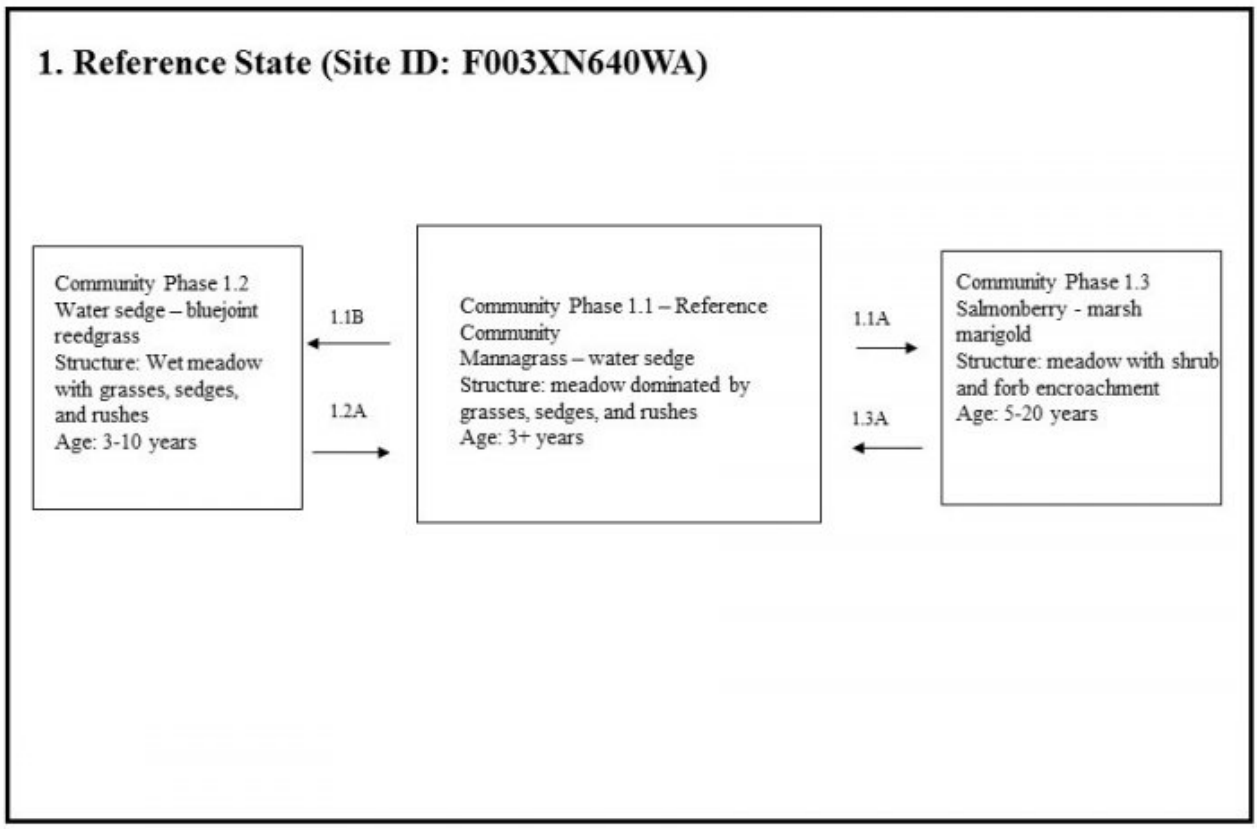
This ecological site is strongly influenced by physiography and hydrology. Mountain bogs and fens are unique ecosystems that impact carbon and hydrologic cycles. They host rare and unique plant and animal species that commonly are restricted to boreal and arctic regions (Chimner, 2010). Bogs are dominantly in depressions of closed hydrologic basins that are influenced primarily by snowpack and rainfall. They do not have an outlet for waterflow; therefore, they are more acidic. Fens are on debris aprons that are influenced by groundwater and aquifer recharge and discharge (Patterson, 2007).

This site is at the lower range in elevation for bogs and fens in Mount Rainier National Park. It has a longer growing season than do sites at higher elevations. This site commonly is shaded for at least part of the day because of the landscape position. Snow typically remains on the ground until late in spring or early in summer, which shortens the growing season.

The soils typically are very poorly drained and are subject to residual ponding from overbank flooding, groundwater discharge from nearby slopes, or a seasonal high water table associated with meltwater. The water table commonly is at or near the surface for much of the growing season, and the rate of organic material decomposition is slow because of the anaerobic and acidic conditions. These conditions result in a nutrient-poor environment. The soils are mucky and formed in organic material and bands of volcanic ash.

The duration and frequency of ponding directly influences the plant community. The vegetation is adapted to excessive soil moisture, ponding, and acidic conditions. Common plants include mannagrass (Glyceria spp.), American skunkcabbage (*Lysichiton americanus*), water sedge (*Carex aquatilis*), bluejoint reedgrass (*Calamagrostis canadensis*), white marsh marigold (*Caltha leptosepala*), black alpine sedge (*Carex nigricans*), rush (Juncus), bog Labrador tea (*Ledum groenlandicum*), and water parsley (*Oenanthe sarmentosa*). If the hydrological system is altered or restricted, this site will dry out over time and mature into a meadow ecosystem.

State and transition model



Glyceria spp. - Carex aquatilis
Mannagrass – water 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
Mannagrass and Water Sedge

Structure: Wet meadow consisting dominantly of grasses, sedges, and rushes The reference community is a meadow consisting dominantly of grasses, sedges, and rushes. The vegetation is influenced by a water table near or above the soil surface much of the growing season. The snow on this site melts in midsummer, restricting the growing season. Mannagrass, water sedge, and black alpine sedge are abundant. Water sedge and mannagrass are sod-forming species that create dense thickets as a result of the rhizomatous root system. They are intolerant of

shade, but they are at multiple stages of succession (Hauser, 2006). Shrubs such as salmonberry and forbs such as American skunkcabbage typically are near the edges of the site, which are drier, are at higher elevations, and have a contrasting ecotone.

Dominant plant species

- salmonberry (*Rubus spectabilis*), shrub
- mannagrass (*Glyceria*), grass
- water sedge (*Carex aquatilis*), other herbaceous
- black alpine sedge (*Carex nigricans*), other herbaceous
- American skunkcabbage (*Lysichiton americanus*), other herbaceous
- white marsh marigold (*Caltha leptosepala*), other herbaceous
- bog Labrador tea (*Ledum groenlandicum*), other herbaceous
- water parsely (*Oenanthe sarmentosa*), other herbaceous
- rush (*Juncus*), other herbaceous

Community 1.2
Water Sedge and Bluejoint Reedgrass

Structure: Wet meadow consisting of grasses, sedges, and rushes Community phase 1.2 is a wet meadow consisting of grasses, sedges, and rushes. The vegetation is influenced by a water table above the soil surface during the growing season. Late snowmelt and extended periods of ponding restrict the diversity of the plants to those adapted to water and peat, such as water sedge, bluejoint reedgrass, and rushes. Water sedge and bluejoint reedgrass are rhizomatous, and they can colonize in disturbed environments (Hauser, 2006). These species adapt to an increase in the level of the water table, and they are present in the early seral stage under excessively wet conditions (Tesky, 1992).

Dominant plant species

- mannagrass (*Glyceria*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- black alpine sedge (*Carex nigricans*), other herbaceous
- water sedge (*Carex aquatilis*), other herbaceous

Community 1.3
Salmonberry and Marsh Marigold

Structure: Dry meadow with shrub and forb encroachment Community phase 1.3 is a dry meadow consisting of shrubs, forbs, grasses, and sedges. The vegetation is influenced by a water table at or below the soil surface during the growing season. The plant community is influenced by below-average snowpack and precipitation during several consecutive years. The drier conditions restrict the regeneration of wetland species such as water sedge, black alpine sedge, and rushes. Species at the edges of the site and ecotone, such as salmonberry, ladyfern, and marsh marigold, encroach in the open meadow and become more dominant.

Dominant plant species

- salmonberry (*Rubus spectabilis*), shrub
- white marsh marigold (*Caltha leptosepala*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), other herbaceous

Pathway 1.1B
Community 1.1 to 1.2

This pathway represents a climatic change toward wetter conditions. If the site becomes wetter because of increased snowpack or precipitation, the duration of the periods of ponding will increase. This will decrease the length of the growing season and alter the plant community.

Pathway 1.1A

Community 1.1 to 1.3

This pathway represents a climatic change toward drier conditions. If the site becomes drier because of decreased snowpack, decreased precipitation, or hydrologic restriction, the duration of the periods of ponding will decrease. This will increase the length of the growing season and alter the plant community.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents a climatic change toward drier conditions. If the site becomes drier because of decreased snowpack or precipitation, the duration of the periods of ponding will decrease. This will impact the length of the growing season and alter the plant community.

Pathway 1.3A
Community 1.3 to 1.1

This pathway represents a climatic change toward wetter conditions. If the site becomes wetter because of increased snowpack or precipitation, the duration of the periods of ponding will increase. This will impact the length of the growing season and alter the plant community.

Additional community tables

Inventory data references

Other Established Classifications

National vegetation classification group: Vancouverian-Rocky Mountain Subalpine Snowbed, Wet Meadow

U.S. Department of the Interior, National Park Service, plant association: CARAQU-(CARNIG)-CALLEP, ALNRUB/GLYSTR, RUBPAR-RUBSPE

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T15N R07E S35
Latitude	46° 44′ 15″
Longitude	121° 52′ 44″

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.
Chimner, R., J. Lemly, and D. Cooper. 2010. Mountain fen distribution, types and restoration priorities, San Juan Mountains, Colorado, USA. Wetlands. Volume 30, pages 763-771.
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.
Hauser, A. Scott. 2006. *Carex aquatilis*. 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/graminoid/caraqu/all.html
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.
Patterson, L., and D. Cooper. 2007. The use of hydrologic and ecological indicators for the restoration of drainage ditches and water diversions in a mountain fen, Cascade Range, California. Wetlands. Volume 27, number 2, pages 290-304.
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.
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, Julie L. 1992. *Calamagrostis canadensis*. In Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory http://www.fs.fed.us/database/feis/plants/graminoid/calcan/all.html
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.
United States National Vegetation Classification. 2016. United States national vegetation classification database, V2.01. Federal Geographic Data Committee, Vegetation Subcommittee, Washington, D.C. Accessed November 28, 2016.
Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological systems of Washington State. A guide to identification.

Contributors

Erin Kreutz
Erik Dahlke
Philip Roberts
Marty Chaney

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:**

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:**