Ecological site F003XN927WA
Frigid/Xeric Coniferous

Accessed: 04/23/2024

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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Classification relationships

Related National Park Service Plant Alliances: *Pseudotsuga menziesii*-(*Pinus contorta* var. latifolia) Forest Alliance, *Pseudotsuga menziesii*-(*Pinus ponderosa*) Forest Alliance, *Pinus ponderosa*-(*Pseudotsuga menziesii*) Woodland and Savanna Alliance.

This ecological site includes the following USDA Forest Service Plant Association: Bigleaf Maple Series - ACMA community type HBM1 (Kovalchik 2004).

Associated sites

F003XN923WA	**Cryic/Xeric Coniferous**
F003XN928WA	**Frigid/Xeric Active Natural Disturbance**

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii* (2) *Pinus ponderosa*
Shrub	(1) *Paxistima myrsinites* (2) *Amelanchier alnifolia*

Herbaceous	(1) *Calamagrostis rubescens* (2) *Collomia linearis*

Physiographic features

This native plant community occurs across many landscape positions generally at lower elevations along the east slope of the North Cascades. Dominating the frigid/xeric soil temperature/moisture regime, this site extends across glacial valleys and mountain slopes to the ridge lines above.

This ecological site has only been mapped within the boundary of the North Cascades National Park Complex. This site, where mapped, ranged from 1000 to 5000 feet in elevation. The table below refers to the representative elevations of this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Valley side (3) Stream terrace
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	1,000–3,500 ft
Slope	5–100%
Water table depth	20 in
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation from October to April. The mean annual precipitation ranges from 20 to 65 inches and the mean annual temperature ranges from 33 to 49 degrees Fahrenheit. Generally this site occupies areas with warm dry summers and cool wet winters.

Precipitation and temperature data in the tables below was extracted from: PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created February 2004. Information from the Ross Dam weather station, was used by the PRISM Climate Group to generate climate data for the North Cascades region.

Table 3. Representative climatic features

Frost-free period (average)	100 days
Freeze-free period (average)	120 days
Precipitation total (average)	65 in

Influencing water features

In general, this ecological site is not influenced by wetland or riparian water features but may be found on stream terraces or adjacent to wetland and riparian areas. Occasionally and for brief amounts of time, the site may be flooded by adjacent rivers and streams but overall this has an insignificant influence on the plant community. Typically the Kettling or Torment soil series are present in the areas subject to flooding.

Soil features

Applicable soils: Despair, Farway, Goode, Kettling, Lyall, Sawtooth, Torment.

The soils that support this native plant community occur in the frigid soil temperature regime (average annual temperature less than 8 degrees C, with a greater than 5 degrees C summer-winter fluctuation) and xeric soil moisture regime (the rooting zone is usually moist throughout the winter with prominent summer drought). In the xeric soil moisture regime, the soil profile typically dries out during the summer months for longer stretches of time than the udic counterparts of the North Cascades west slope. These soils are moderately well to well drained and range from shallow bedrock controlled soils to very deep soils. Generally these soils have a mantle of material with significant volcanic ash influence overlying glacial till or colluvium. The upper mantle is characterized by a low bulk density and relatively high water holding capacity. Soil moisture can be a limiting factor to forest growth on these soils owing to the lower precipitation amounts within this zone and the resulting moisture deficit during the summer months. Typically the soils under this plant community are Andisols and Inceptisols and have weakly expressed soil morphology as compared to the frigid/udic west slope counterparts. In general, the distinguishing characteristic for Andisols is the thickness and quality of the volcanic ash influenced mantle. Andisols typically have a distinct volcanic ash mantle at least 36 cm thick. Inceptisols have either an ash mantle thinner than 36 cm or the volcanic ash is thoroughly mixed throughout the soil profile and there is no distinct zone where andic soil properties dominate. In addition, soil profiles under this plant community tend to have more distinct and thicker A horizons than west slope counterparts, likely due to differences in understory species and a less intense weathering regime.

A blank entry under soil depth column indicates no depth restriction within the soil profile.

For more information on soils and their terminology, please refer to Soil taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys (Soil Survey Staff, 1999; http://soils.usda.gov/technical/classification/taxonomy/).

Table 4. Representative soil features

Surface texture	(1) Ashy fine sandy loam (2) Ashy sandy loam (3) Sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to very rapid
Soil depth	10 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	4.2–15.99 in
Soil reaction (1:1 water) (0-40in)	4.5–6.5
Subsurface fragment volume <=3" (Depth not specified)	5–65%
Subsurface fragment volume >3" (Depth not specified)	5–50%

Ecological dynamics

These sites are found on cool, dry, low elevations just east of the Cascade Crest. Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) are the dominant overstory species with lodgepole pine (*Pinus contorta*), grand fir (*Abies grandis*), western white pine (*Pinus monticola*) and bigleaf maple (Acer macrophylla) present in varying amounts. The historic fire regime is one of high frequency (5-35 years) and low intensity. This type of fire is often patchy as it is not carried from tree crown to tree crown but instead relies on fairly unbroken ground cover; this is how some species with only moderate fire tolerance remain in this forest. An integral part of this forest, fire kept these sites more open and park-like than other forested sites by killing many of the young seedlings and shrubs as well as some of the less fire-resistant overstory species. All of the common understory species are adapted to this fire regime; pachistima (*Paxistima myrsinites*), serviceberry (*Amelanchier alnifolia*), tall Oregongrape (*Mahonia aquifolium*), birchleaf spirea (*Spiraea betulifolia* var. lucida), baldhip rose (*Rosa*

gymnocarpa), kinnikinnick (*Arctostaphylos uva-ursi*), snowbrush ceanothus (*Ceanothus velutinus*), pinegrass (*Calamagrostis rubescens*), narrow-leaved collomia (*Collomia linearis*) and fireweed (*Chamerion angustifolium*) are typical for this site. When fire is actively suppressed in these sites, the natural dynamics are fundamentally changed such that simply ceasing fire suppression is often not sufficient to return to the original state.

State and transition model

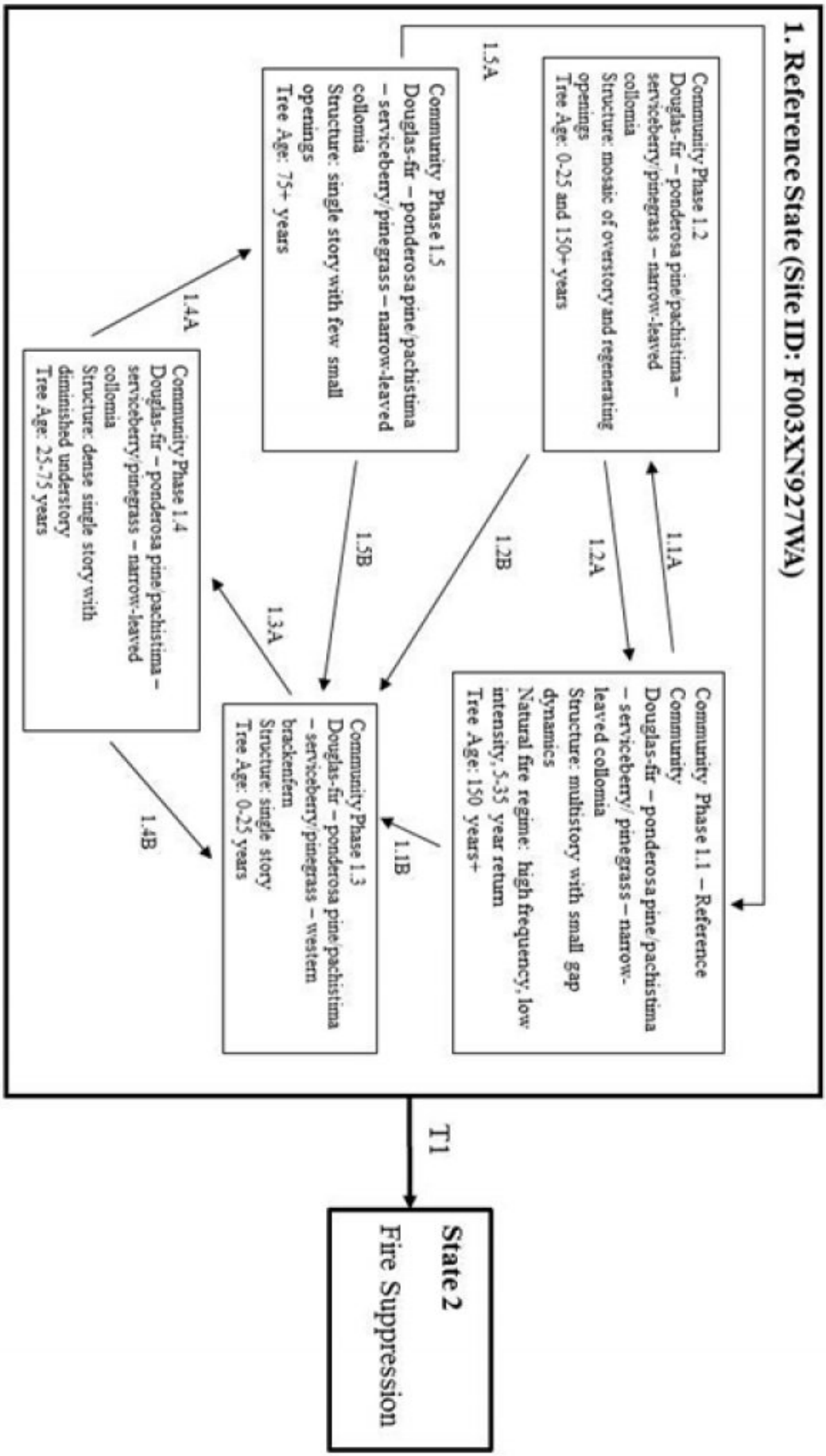

Figure 4. State and Transition Model

State 1

Reference

Community 1.1
Douglas-fir – ponderosa pine/pachistima – serviceberry/ pinegrass – narrow-leaved collomia

Figure 5. Reference Community (foreground)

Structure: two-storied – overstory with shrubs and scattered regeneration Douglas-fir and ponderosa pine are the codominant overstory species in the Reference Community. Both species are well adapted to the natural fire regime of high frequency/low intensity when mature, having thick bark which protects the cambium layer from overheating. Western white pine, lodgepole pine, and grand fir are considered moderately well adapted to low intensity fires and will be found scattered throughout these forests. Mature bigleaf maples may also survive a low intensity fire; if not it has the ability to resprout after top-kill allowing for its continued presence in this forest. All of the shrubs found in this ecological site are also adapted to fire, having the ability to resprout from root crowns or rhizomes left in the soil after the low-intensity fire kills the aboveground portion of the plants. Pinegrass and fireweed also have this ability while narrow-leaved collomia and fireweed both produce many windborne seeds that will recolonize sites from unburned areas.

Community 1.2
Douglas-fir – ponderosa pine/pachistima – serviceberry/pinegrass – narrow-leaved collomia

Structure: mosaic of overstory and regenerating openings. CP 1.2 retains some areas that resemble CP 1.1 but also contains moderate sized (2-5 acres) openings. Douglas-fir is susceptible to laminated root rot (Phellinus weirii) and this organism causes expanding pockets of mortality. These pockets would most likely be reforested by any of the pines and/or bigleaf maple which are not host species. Insect outbreaks such as western spruce budworm (Choristoneura occidentalis on Douglas-fir and grand fir) or Mountain pine beetle (Dendroctonus ponderosae on ponderosa pine) can also cause localized mortality. The shrub layer would also respond well to an increase in sunlight and may delay reforestation of the newly formed openings.

Community 1.3
Douglas-fir – ponderosa pine/pachistima – serviceberry/pinegrass – western brackenfern

Structure: single story/shrub CP 1.3 is forestland in regeneration, often with scattered remnant mature trees; species composition depends on the natural seed sources present and the intensity of disturbance. Successive low intensity fires will kill some areas of seedlings and saplings while other clusters will be missed, creating an ongoing patchwork of regeneration and open spaces (horizontal differentiation). When resulting from a severe fire event there is a possibility for resprouting shrubs to outcompete tree seedlings for a time, due to the energy reserves in their root system. Bigleaf maple will resprout after being top-killed, and these would also grow faster than newly sprouted seedlings. Disturbance loving species such as western brackenfern and fireweed will have a temporary spike in cover in this phase.

Community 1.4
Douglas-fir – ponderosa pine/pachistima – serviceberry/pinegrass – narrow-leaved collomia

Structure: patches of dense single story with a diminished understory, interspersed with more open, grass/shrub areas. CP 1.4 is a forest in the competitive exclusion stage, possibly with scattered remnant mature trees; the majority of Douglas-fir and ponderosa pine trees that reach this stage would now be resistant to fire due to thickening bark. Low intensity fires will have previously killed some areas of seedlings and saplings while other patches will have been missed – there is increasing competition among individual trees for the available water and nutrients in these unburned patches. Canopy closure can approach 100%, leading to a diminished understory in these areas. Over time these forests will begin to self-thin due to the elevated competition. Species composition depends on the original seed source(s) available; the forest could be single or mixed-species including Douglas-fir, ponderosa pine, lodgepole pine, bigleaf maple or grand fir.

Community 1.5
Douglas-fir – ponderosa pine/pachistima – serviceberry/pinegrass – narrow-leaved collomia

Structure: single story with more small openings CP 1.5 is a maturing forest which is starting to differentiate vertically as well as horizontally. Individual trees are dying (whether due to insects, disease or competition) allowing even more sunlight to reach the forest floor in these once-dense patches of forest. This allows for an increase in the understory as well as some pockets of overstory tree species regeneration.

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents a larger disturbance than is found in the Reference Community– an insect infestation or disease pocket affecting the overstory would create this forest structure. Areas of regeneration would range from approximately 2 to 5 acres.

Pathway 1.1B
Community 1.1 to 1.3

This pathway represents a less frequent, major stand-replacing disturbance such as a high-intensity fire, large-scale wind event or major insect infestation.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents growth over time with no further significant disturbance. The areas of regeneration pass through the typical stand phases – competitive exclusion, maturation, understory reinitiation – until they resemble the old-growth structure of the reference community. Given that low intensity fire is an integral part of this ecological site it is understood that fire would play a part in shaping the maturing forest.

Pathway 1.2B
Community 1.2 to 1.3

This pathway represents a major stand-replacing disturbance leading to the stand initiation phase of forest development.

Pathway 1.3A
Community 1.3 to 1.4

This pathway represents growth over time with no further major disturbance. Given that low intensity fire is an integral part of this ecological site it is understood that fire would play a part in shaping the maturing forest.

Pathway 1.4B
Community 1.4 to 1.3

This pathway represents a major stand-replacing disturbance leading to the stand initiation phase of forest development.

Pathway 1.4A
Community 1.4 to 1.5

This pathway represents continued growth over time with no further major disturbance. Given that low intensity fire is an integral part of this ecological site it is understood that fire would play a part in shaping the maturing forest.

Pathway 1.5A
Community 1.5 to 1.1

This pathway represents no further major disturbance. Continued growth over time, as well as ongoing mortality, leads to continued vertical diversification. The community begins to resemble the structure of the reference community, with small pockets of regeneration and a more diversified understory. Given that low intensity fire is an integral part of this ecological site it is understood that fire would play a part in shaping the maturing forest.

Pathway 1.5B
Community 1.5 to 1.3

This pathway represents a major stand-replacing disturbance leading to the stand initiation phase of forest development.

State 2
Fire Suppression

Actively suppressing the natural fire regime will fundamentally change the structure of these sites. The duration of suppression combined with the Community Phase when suppression began will dictate the amount of input necessary to regain a semblance of the natural communities.

Transition T1
State 1 to 2

Transition T1 to State 2 represents active and ongoing fire suppression in any native Plant 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							
ponderosa pine	PIPO	*Pinus ponderosa*	Native	–	–	–	–
Douglas-fir	PSME	*Pseudotsuga menziesii*	Native	–	–	–	–
grand fir	ABGR	*Abies grandis*	Native	–	–	–	–
bigleaf maple	ACMA3	*Acer macrophyllum*	Native	–	–	–	–
western white pine	PIMO3	*Pinus monticola*	Native	–	–	–	–
lodgepole pine	PICO	*Pinus contorta*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
pinegrass	CARU	*Calamagrostis rubescens*	Native	0.5–1	10–50
Forb/Herb					
fireweed	CHANA2	*Chamerion angustifolium ssp. angustifolium*	Native	1–3	1–30
tiny trumpet	COLI2	*Collomia linearis*	Native	0.5–1	1–10
Shrub/Subshrub					
Oregon boxleaf	PAMY	*Paxistima myrsinites*	Native	0.5–3	5–60
kinnikinnick	ARUV	*Arctostaphylos uva-ursi*	Native	0.5–1	1–50
Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	Native	1–5	5–35
snowbrush ceanothus	CEVE	*Ceanothus velutinus*	Native	1–5	0–25
hollyleaved barberry	MAAQ2	*Mahonia aquifolium*	Native	1–3	5–20
dwarf rose	ROGY	*Rosa gymnocarpa*	Native	1–4	1–15

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
Douglas-fir	*PSME*	80	110	98	154	90	795	–	
ponderosa pine	*PIPO*	75	115	62	132	43	600	–	
lodgepole pine	*PICO*	65	85	60	98	100	525	–	

Inventory data references

Type Locality Plot ID: 07-TMR-086

Type locality

Location 1: Chelan County, WA	
Township/Range/Section	T32N R18E S8
UTM zone	N
UTM northing	5350605
UTM easting	675523
Latitude	48° 17′ 4″
Longitude	120° 38′ 3″

Other references

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Covelo, CA: Island Press. 493 pages.

Burns, Russell M., and Barbara H. Honkala, technical coordinators. 1990. Silvics of North America. U.S. Department of Agriculture, Forest Service, Agriculture Handbook 654. http://www.na.fs.fed.us/pubs/silvics_manual/table_of_contents.shtm

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. 58 pages.

Fire Effects Information System, [Online].

U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
http://www.fs.fed.us/database/feis/

Kovalchik, Bernard L.; Clausnitzer, Rodrick R. 2004. Classification and management of aquatic, riparian, and wetland sites on the national forests of eastern Washington: series descripton. Gen. Tech. Rep. PNW-GTR-593. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 354 p. In cooperation with: Pacific Northwest Region, Colville, Okanogan, and Wenatchee National Forests.

Miller, Margaret M.; Miller, Joseph W. 1976. Succession after wildfire in the North Cascades National Park complex. In: Proceedings, annual Tall Timbers fire ecology conference: Pacific Northwest; 1974 October 16-17; Portland, OR. No. 15. Tallahassee, FL: Tall Timbers Research Station: 71-83. [6574]

Perry, D.A. Forest Ecosystems. Baltimore, MD: The Johns Hopkins University Press; 1994. 649 pages.

Pojar, J., and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine, Vancouver, British Columbia. 528 pages.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
http://soils.usda.gov/technical/classification/taxonomy/

Contributors

Kathryn Smith

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	
Approved by	
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:**