USDA Natural Resources Conservation Service

Ecological site F236XY201AK
Boreal Open Forest Wet Loamy Warm Mountain Slopes

Last updated: 2/13/2024
Accessed: 05/16/2024

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): 236X–Bristol Bay-Northern Alaska Peninsula Lowlands

The Bristol Bay-Northern Alaska Peninsula Lowland Major Land Resource Area (MLRA 236) is located in Western Alaska. This MLRA covers approximately 19,500 square miles and is defined by an expanse of nearly level to rolling lowlands, uplands and low to moderate hills bordered by long, mountain footslopes. Major rivers include the Egegik, Mulchatna, Naknek, Nushagak, and Wood River. MLRA 236 is in the zone of discontinuous permafrost. It is primarily in areas with finer textured soils on terraces, rolling uplands and footslopes. This MLRA was glaciated during the early to middle Pleistocene. Moraine and glaciofluvial deposits cover around sixty percent of the MLRA. Alluvium and coastal deposits make up a large portion of the remaining area (Kautz et al., 2012; USDA, 2006).

Climate patterns across this MLRA shift as one moves away from the coast. A maritime climate is prominent along the coast, while continental weather, commonly associated with Interior Alaska, is more influential inland. Across the MLRA, summers are general short and warm while winters are long and cold. Mean annual precipitation is 13 to 50 inches, with increased precipitation at higher elevations and areas away from the coast. Mean annual temperatures is between 30 and 36 degrees F (USDA, 2006).

The Bristol Bay-Northern Alaska Peninsula MLRA is principally undeveloped wilderness. Federally managed land includes parts of the Katmai and Aniakchak National Parks, and the Alaska Peninsula, Becharof, Togiak and Alaska Maritime National Wildlife Refuges. The MLRA is sparsely populated. Principal communities include Dillingham, Naknek, and King Salmon. Commercial fishing in Bristol Bay and the Bering Sea comprises a major part of economic activity in the MLRA. Other land uses include subsistence activities (fishing, hunting, and gathering) and sport hunting and fishing (USDA, 2006).

Classification relationships

Alaska Vegetation Classification:
Closed needleleaf forest (I.A.1 – level III) / Closed black spruce-white-spruce forest (I.A.1.l – level IV)
(Viereck et al., 1992)

Circumboreal Vegetation Map – Alaska-Yukon Region:
Southern Alaska Spruce-Birch-Herb Forests
(Jorgensen and Meidinger, 2015)

BioPhysical Settings: 7616011 – Western North American Boreal Treeline White Spruce Woodland - Boreal
(LANDFIRE biophysical settings, 2009)

Ecological site concept

This boreal ecological site is on warm glaciated mountain backslopes and footslopes. Site elevation is between 400 and 1,500 feet above sea level. Slopes are strongly sloped (5 – 15 percent). This site is found at warmer aspects

from the southeast to northwest. Soil hydrology and temperature and a fire regime shape the vegetation on this landform. Soils are poorly drained with a water table in May and June, which shapes the vegetation on this site. Soil temperatures are warmer here than on other slopes at similar elevations due to a predominantly southerly aspect and increased subsurface gravels. These conditions create a unique forested site.

The reference state supports three communities. The reference plant community is characterized as a closed black spruce-white spruce forest (Viereck et al., 1992). It is composed of a mix of black spruce and white spruce in the overstory with an open understory of tall, medium, and low shrubs. Post-fire communities are atypically absent an overstory and are comprised of fast-growing herbaceous species, extant shrubs (in particular willow and alder), and colonizing tree samplings.

Associated sites

F236XY115AK	**Boreal Forest Loamy Moist Slopes** F236XY115AK describes a mixed open forest on rounded mountain backslopes. It is associated with well drained soils, which is the primary driver of vegetation that separates it from F236XY201AK. F236XY201AK supports a mix of white and black spruce on poorly drained soils that are too warm to support permafrost.
R236XY107AK	**Western Alaska Maritime Scrub Gravelly Drainages** R236XY107AK describes swales on mountain backslopes and footslopes. It co-occurs with F236XY201AK on these landforms. R236Xy107AK is differentiated by the lack of trees and increased cover by hydrophilic shrubs such as willow.
F236XY202AK	**Boreal Forest Frozen Loamy Slopes** F236XY202AK describes black spruce woodlands on permafrost soils. These two ecological sites co-occur on mountain slopes and may blend together based on local conditions.
R236XY104AK	**Alpine Dwarf Scrub Gravelly Slopes** R236XY104AK is in the alpine and subalpine, upslope of R236XY104AK. Soil factors and temperature prevent a forest from developing on these landforms.

Similar sites

F236XY202AK	**Boreal Forest Frozen Loamy Slopes** Closed mixed spruce stands can appear similar to open and closed forests of just black or white spruce (Viereck et al., 1992). Both of these ecological sites are associated with poorly drained soils on mountain backslopes and footslopes. F236XY201AK is restricted to warmer soils, due to southerly aspects and greater than 50% subsurface rock fragments. It also does not support permafrost, which is present in the soils associated with F236XY202AK. Soil and site differences result in different forests in the reference plant community.

Table 1. Dominant plant species

Tree	(1) *Picea glauca* (2) *Picea mariana*
Shrub	(1) *Alnus* (2) *Salix*
Herbaceous	(1) *Equisetum*

Physiographic features

This site is on warmer backslopes and toeslopes of glaciated mountains. Elevation typically ranges from 400 to 1,500 feet above sea level, though it is present at a wider range based on local conditions. Slopes gradients are gentle to strong (5 – 15 percent). This site is restricted to south-facing, warmer aspects. A water table is present at the soil surface in May and June. There is no flooding or ponding associated with these slopes.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain

Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	122–457 m
Slope	5–15%
Water table depth	0–152 cm
Aspect	W, NW, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	9–671 m
Slope	4–30%
Water table depth	0–152 cm

Climatic features

The climate of this site reflects that of the MLRA, which is described as maritime polar (EPA, 2013). Temperatures are moderated by the nearby Bristol Bay and norther Pacific bodies of water. Annual precipitation ranges from 21 – 34 inches with approximately 40 percent occurring during the June-September growing season (PRISM, 2018).

Table 4. Representative climatic features

Frost-free period (characteristic range)	75-100 days
Freeze-free period (characteristic range)	65-90 days
Precipitation total (characteristic range)	533-864 mm
Frost-free period (actual range)	75-100 days
Freeze-free period (actual range)	65-90 days
Precipitation total (actual range)	381-1,041 mm
Frost-free period (average)	90 days
Freeze-free period (average)	75 days
Precipitation total (average)	737 mm

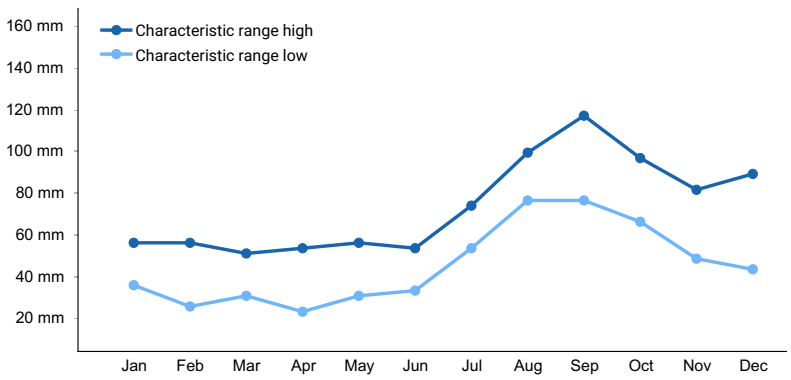


Figure 1. Monthly precipitation range

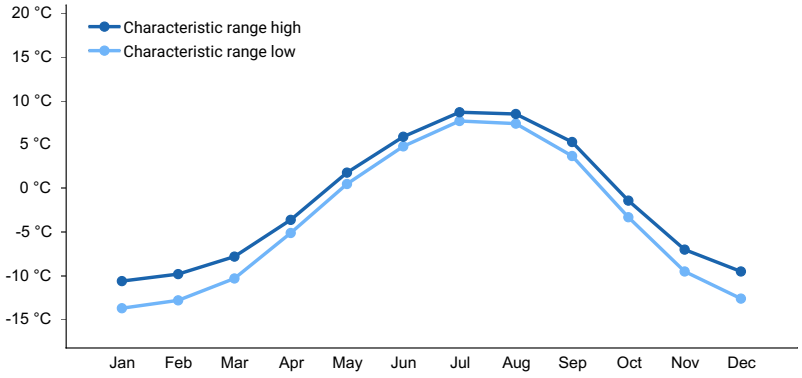


Figure 2. Monthly minimum temperature range

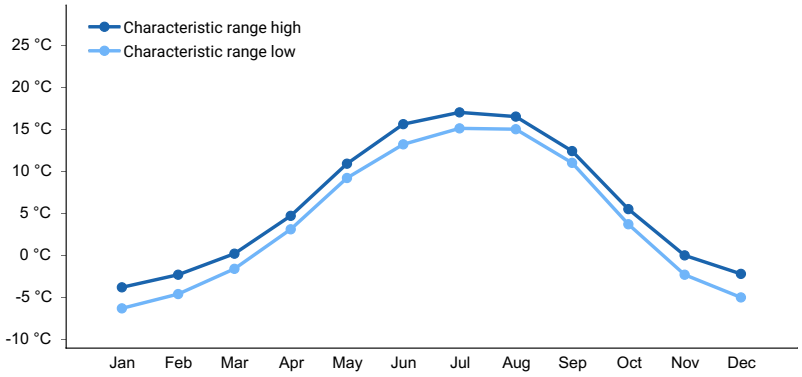


Figure 3. Monthly maximum temperature range

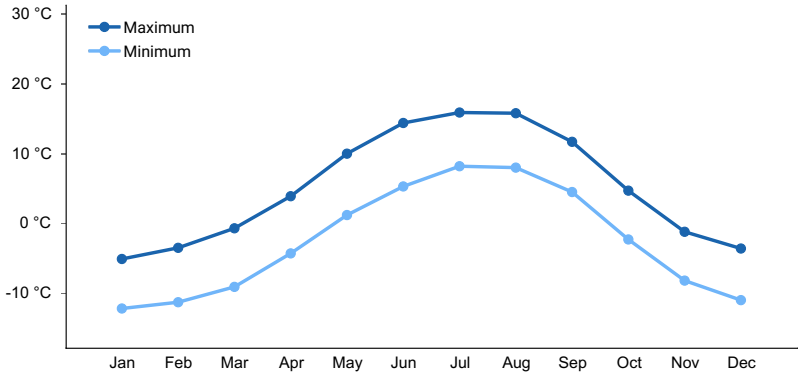


Figure 4. Monthly average minimum and maximum temperature

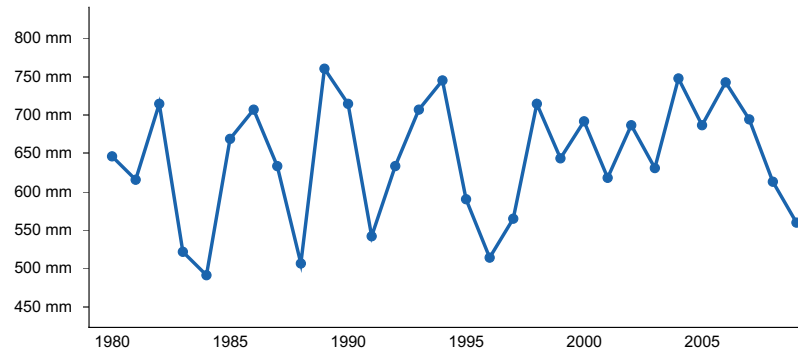


Figure 5. Annual precipitation pattern

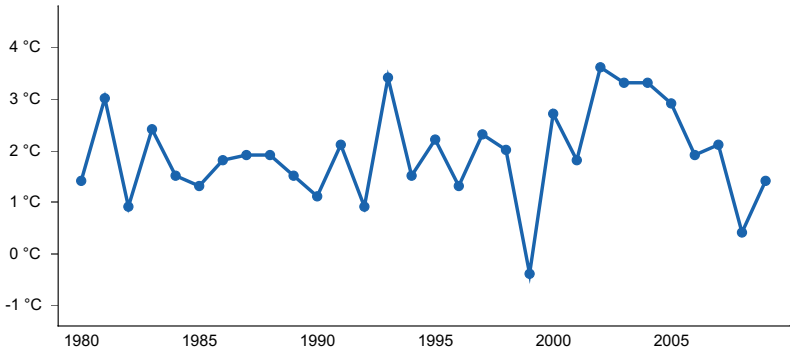


Figure 6. Annual average temperature pattern

Influencing water features

Due to its landscape position, this site is not influenced by wetland or riparian water features. Precipitation is the main source of water. Snow melt and seasonal ice melt contribute to a water table during the early months of the growing season.

Soil features

Soils are Inceptisols, which are young and weakly developed soils (Soil Survey Staff, 2013). Soils are very deep and poorly drained. They support a cryic temperature regime. Parent material is mossy organic material over silty eolian deposits over gravelly till.

Soil characteristics affecting vegetation include soil hydrology and temperature. A water table is present at the soil surface in May and June. Wet soils influence the vegetation by restricting the vegetation that can grow here during the important early growing season months. Soil temperatures are warmer than on other slopes at similar elevations due to a predominantly southerly aspect and increased subsurface gravels. Gravels store and transfer heat energy through the soil profile.

Correlated soil components in the Nulato Hills area, Alaska (AK630): E36-Boreal forest-silty wet till slopes

Table 5. Representative soil features

Parent material	(1) Till
Surface texture	(1) Silt loam
Drainage class	Poorly drained
Permeability class	Moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	9.91 cm
Soil reaction (1:1 water) (0-25.4cm)	4.9–6.2
Subsurface fragment volume <=3" (Depth not specified)	28%
Subsurface fragment volume >3" (Depth not specified)	20%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained

Permeability class	Moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	9.91 cm
Soil reaction (1:1 water) (0-25.4cm)	4.9–6.2
Subsurface fragment volume <=3" (Depth not specified)	28%
Subsurface fragment volume >3" (Depth not specified)	20%

Ecological dynamics

This boreal ecological site is on warm glaciated mountain backslopes and footslopes. Elevation ranges from 400 to 1,500 feet above sea level. Slope gradients are strong (5 – 15 percent). This site is restricted to warmer aspects, ranging from the southeast to northwest. Soil hydrology and temperature and a fire regime shape the vegetation. The reference plant community is a mix of black and white spruce, with a diverse but open understory of shrubs.

Fire is a major disturbance. Fire dynamics and successional pathways in Alaskan spruce forests are complex (Viereck et al., 1992; LANDFIRE Biophysical Settings, 2009). The fire cycle and post-fire communities are shaped by factors including existing vegetation, soil characteristics, climate, and fire characteristics such as frequency and severity. Fire is responsible for three documented communities in the reference state.

Windthrow likely occurs in the reference plant community. This disturbance may contribute to the large mix of shrubs in the understory.

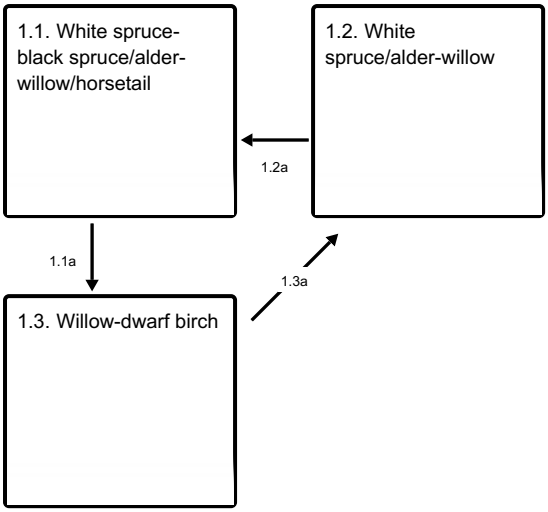
The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on professional experience and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities



1.1a - Fire

1.2a - Fire recovery

1.3a - Fire recovery

State 1
Reference State

The reference state supports three community phases grouped by the structure and dominance of the vegetation (e.g., trees, shrubs, forbs, and graminoids) and their ecological function and stability. The reference plant community is characterized by a mixed closed forest of white and black spruce. The presence of this and related communities are dictated temporally and spatially by a fire disturbance regime. All community phases in this report are characterized using the Alaska vegetation classification system (Viereck et al., 1992).

Dominant plant species

- white spruce (*Picea glauca*), tree
- black spruce (*Picea mariana*), tree
- alder (*Alnus*), shrub
- willow (*Salix*), shrub
- horsetail (*Equisetum*), other herbaceous

Community 1.1
White spruce-black spruce/alder-willow/horsetail

The reference plant community is a closed needleleaf forest (Viereck et al., 1992). The major plant groups are trees, medium shrubs, and low shrubs. The overstory is a mix of white and black spruce. The understory is usually weakly developed (Viereck et al., 1992) and may contain a mix of alder, willow, ericaceous shrubs, and other woody shrubs. Horsetails are common. Ground cover is usually a mix of mosses and lichens and is dependent on local site conditions.

Dominant plant species

- white spruce (*Picea glauca*), tree
- black spruce (*Picea mariana*), tree
- alder (*Alnus*), shrub
- willow (*Salix*), shrub
- horsetail (*Equisetum*), other herbaceous

Community 1.2
White spruce/alder-willow

Community 1.2 is an open forest (Viereck et al., 1992). White spruce is predominant, though black spruce, particularly seedlings, and paper birch (*Betula papyrifera* ssp. kenaica) can be present. The understory is usually denser than the reference plant community and contains a mix of tall, medium, and low shrubs. Species can include alder, willow, prickly rose, highbush cranberry, and various ericaceous shrubs.

Dominant plant species

- white spruce (*Picea glauca*), tree
- alder (*Alnus*), shrub
- willow (*Salix*), shrub
- prickly rose (*Rosa acicularis*), shrub
- squashberry (*Viburnum edule*), shrub

Community 1.3
Willow-dwarf birch

Community 1.3 is a post-fire open shrubland comprised of shrubs and herbaceous plants. Shrubs typically resprout from extant rootstock. Herbaceous species colonize via seeds in post-burn sites where competition for light and space is low. Tree saplings may be present during this time.

Dominant plant species

- willow (*Salix*), shrub
- dwarf birch (*Betula nana*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- sedge (*Carex*), grass
- horsetail (*Equisetum*), other herbaceous
- fireweed (*Chamerion angustifolium*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.3

Fire is the major disturbance in this ecological site. It is primarily caused by lightning strikes during summer storms. Black spruce are particularly susceptible to fire due to their dense growth and layering and highly resinous branches and needles (Fryer, 2014). Complete fire dynamics in this system are poorly understood and site-specific characteristics likely play a large role in determining fire frequency and community successional phases (LANDFIRE, 2009).

Pathway 1.2a
Community 1.2 to 1.1

Spruce colonization and growth continues, with slower growing species pushing into the canopy. The understory remains crowded with a patchy mix of tall and medium shrubs and mixed herbaceous species. Soil development continues.

Pathway 1.3a
Community 1.3 to 1.2

Trees saplings push into the overstory, creating a woodland or open story with a mixed understory. The understory is dominated by a mix of tall shrubs and a mix of shade tolerant and intolerant species. Soil development continues.

Additional community tables

Inventory data references

Vegetative communities and transitions are described using existing models and expert knowledge. There are no vegetation inventory data points in NASIS associated with this ecological site.

External data sources:
The Alaska Vegetation Classification (Viereck et al., 1992)
The Alaska-Yukon Region of the Circumboreal Vegetation Map (CBVM) (Jorgensen and Meidinger, 2015)
LANDFIRE Biophysical Settings Models (LANDFIRE Biophysical Settings, 2009)

References

Viereck, L.A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-286..

Other references

Fryer, Janet L. 2014. Picea mariana. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us /database/feis/plants/tree/picmar/all.html Accessed Dec 14, 2021.

Jorgensen, T., and D. Meidinger. 2015. The Alaska Yukon Region of the Circumboreal Vegetation Map (CBVM). CAFF Strategies Series Report. Conservation of Arctic Flora and Fauna, Akureyri, Iceland. ISBN: 978-9935-431-48-6.

Kautz, D.R., P. Taber, and S. Nield, editors. 2012. Land Resource Regions and Major Land Resource Areas of Alaska. United States Department of Agriculture, Natural Resources Conservation Service (USDA–NRCS).

LANDFIRE Biophysical Settings. 2009. Biophysical Setting 7616011 – Western North American Boreal Treeline White Spruce Woodland - Boreal. In: LANDFIRE Biophysical Setting Model: Map zone 76, [Online]. In: Vegetation Dynamics Models. In: LANDFIRE. Washington, DC: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory; U.S. Geological Survey; Arlington, VA: The Nature Conservancy (Producers). Available: https://www.landfire.gov/national_veg_models_op2.php. Accessed December 14, 2021.

PRISM Climate Group. (PRISM) Oregon State University. https://prism.oregonstate.edu. Date created October 2018. Accessed 3 Mar 2023.

Scenarios Network for Alaska and Arctic Planning (SNAP). Historical Monthly Temperature – 1km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. Accessed 20 Mar 2023.

Scenarios Network for Alaska and Arctic Planning (SNAP). Historical monthly and derived precipitation products downscaled from CRU TS data via the delta methods – 2km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. Accessed 20 Mar 2023.

Soil Survey Staff. 2013. Simplified Guide to Soil Taxonomy. USDA-Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

US Environmental Protection Agency (EPA). Level III Ecoregions of the Conterminous United States. UP ESP Office of Research and Development. Corvallis, OR. http://edg.epa.gov/. Created 16 Apr 2013. Accessed 20 Mar 2023.

Contributors

Phil Barber
Stephanie Schmit

Steff Shoemaker
Jamin Johanson

Approval

Kirt Walstad, 2/13/2024

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	05/16/2024
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:**