USDA Natural Resources Conservation Service

Ecological site R237XY220AK
Western Alaska Maritime Mosaic Loamy Hummocks

Last updated: 7/23/2020
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 237X–Ahklun Mountains

The Ahklun Mountains Major Land Resource Area (MLRA 237) is in western Alaska (fig. 3). This MLRA covers approximately 14,555 square miles, and it includes the mountains, hills, and valleys of the Kilbuck Mountains in the north and the Ahklun Mountains in the south. Except for the Kilbuck Mountains and the highest ridges of the Ahklun Mountains, the MLRA was extensively glaciated during the Pleistocene (Kautz et al., 2004). Today, a few small glaciers persist in mountainous cirques (Gallant et al., 1995). The present-day landscape and landforms reflect this glacial history; glacial moraines and glacial drift cover much of the area (USDA-NRCS, 2006). The landscape of the MLRA is primarily defined by low, steep, rugged mountains cut by narrow-to-broad valleys. Flood plains and terraces of varying sizes are common at the lower elevations in the valley bottoms. Glacially carved valleys host many lakes. Togiak Lake is one of the largest lakes in the region. It is 13 miles long and about 9,500 acres in size. Major rivers include the Goodnews, Togiak, Kanektok, Osviak, Eek, and Arolik Rivers. Where the Goodnews and Togiak Rivers reach the coast, the nearly level to rolling deltas support numerous small lakes.

This MLRA has two distinct climatic zones: subarctic continental and maritime continental (fig. 4). The high-elevation areas are in the subarctic continental zone. The mean annual precipitation is more than 75 inches, and the mean annual air temperature is below about 27 degrees F (-3 degrees C) in extreme locations. The warmer, drier areas at the lower elevations are in the maritime continental zone. The mean annual precipitation is 20 to 50 inches, and the mean annual air temperature is about 30 to 32 degrees F (-0.2 to 1.2 degrees C) (PRISM). This climatic zone is influenced by both maritime and continental factors. The temperatures in summer are moderated by the open waters of the Bering Sea, and the temperatures in winter are more continental due to the presence of ice in the sea (Western Regional Climate Center, 2017). The seasonal ice reaches its southernmost extent off the coast of Alaska in Bristol Bay (Alaska Climate Research Center, 2017). The western coast of Alaska is also influenced by high winds from strong storms and airmasses in the Interior Region of Alaska (Hartmann, 2002).

The Ahklun Mountains MLRA is principally undeveloped wilderness. Federally managed lands include the Togiak and Alaska Maritime National Wildlife Refuges. The MLRA is sparsely populated, but it has several communities, including Togiak, Manokotak, Twin Hills, and Goodnews Bay. Togiak is the largest village. It has a population of approximately 855, most of which are Yup'ik Alaska Natives (U.S. Census Bureau, 2016). Major land uses include subsistence activities (fishing, hunting, and gathering) and wildlife recreation (USDA-NRCS, 2006; Kautz et al., 2004).

Ecological site concept

Ecological site R237XY220AK is associated with moderately well drained soils. It is on earth hummocks in linear to slightly concave depressions of broad outwash plains in the southern part of the Ahklun Mountains area. The major disturbance is the formation of earth hummocks. The micro-topographic low areas are subject to ponding. The site does not support an alternate state.

This ecological site supports an earth hummock mosaic consisting of two communities distinguished by the micro-high and micro-low areas. Both of these areas support many low and dwarf shrubs, including bog blueberry (*Vaccinium uliginosum*), dwarf birch (*Betula nana*), and marsh Labrador tea (Ledum palustre ssp. decumbens). The micro-low positions typically are wet and support hydrophilic species, and the micro-high areas support dense concentrations of low and dwarf shrubs and many lichens.

Associated sites

R237XY222AK	**Western Alaska Maritime Scrubland Loamy Hummocks** Ecological sites R237XY220AK and R237XY222AK are on earth hummocks of outwash plains. The sites are differentiated by the height of the earth hummocks and reference state communities. Ecotonal plant communities that have characteristics from more than one ecological site are in areas where these sites abut.

Similar sites

R237XY222AK	**Western Alaska Maritime Scrubland Loamy Hummocks** Ecological sites R237XY220AK and R237XY222AK are on earth hummocks. Site R237XY220AK is in linear to slightly concave depressional areas of outwash plains, and site R237XY222AK is in linear to convex areas on talfs of plains and treads of terraces. The plant communities on the well drained, coarse textured soils associated with site R237XY222AK are on smaller earth hummocks and are similar in both the micro-high and micro-low areas.

Figure 1. The micro-high and micro-low areas of the rolling earth hummocks support many of the same plant species, but the micro-topographic areas support different indicator species.

Figure 2. Some of the earth hummocks support dense willow.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Vaccinium uliginosum* (2) *Betula nana*
Herbaceous	Not specified

Physiographic features

Site characteristics specifically relate to the reference plant community phase. Each ecological site has a specific set of site characteristics and disturbance dynamics that results in a unique plant community composition, structure, and function. Site characteristics (climate, geology, topography, and soil characteristics) are dynamic across a landscape. Subtle changes in site characteristics can result in a different plant community phase or ecological site. Definitions of site characteristics are provided in the United States Department of Agriculture Handbook 296 (USDA-NRCS, 2006), Geomorphic Description System (Schoeneberger and Wysocki, 2012), Field Book for Describing and Sampling Soils (Schoeneberger et al., 2012), and Soil Survey Manual (Soil Science Division Staff, 2017).

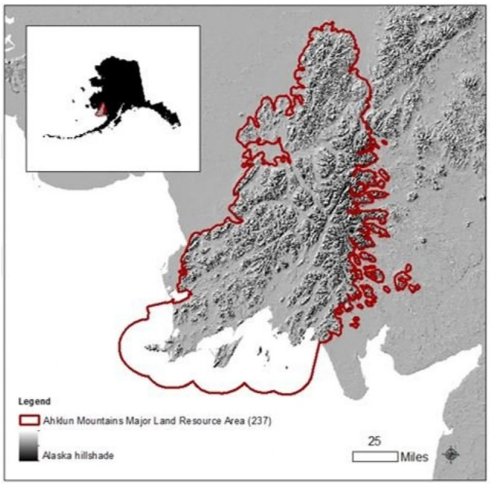

Figure 3. The Ahklun Mountains area (MLRA 237) is in western Alaska.

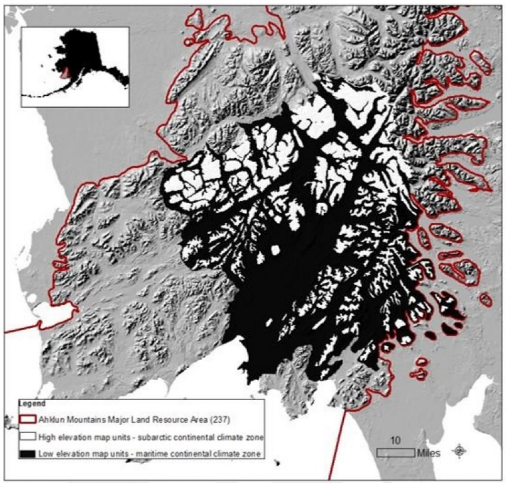

Figure 4. High-elevation and low-elevation map units in the area, which illustrate the primary climatic influence.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Concave (2) Linear
Landforms	(1) Plains > Outwash plain > Earth hummock
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours)

Ponding frequency	Occasional
Elevation	0–210 m
Slope	0–2%
Water table depth	3–150 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Climate of land resource region (LLR): Maritime continental (Western Regional Climate Center, 2017); short, warm summers and long, cold winters (USDA-NRCS, 2006)

Climate of major land resource area (MLRA): Maritime continental in the lowlands and subarctic continental at higher elevations. The mean annual precipitation is 20 to 30 inches in the lowlands, and it increases to more than 45 inches at the higher elevations. The mean annual air temperature along the coast is about 34 degrees F (1 degree C) (PRISM, 2014). Strong winds are common throughout the year.

Table 3. Representative climatic features

Frost-free period (characteristic range)	85-140 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	

Influencing water features

The mosaic of micro-high and micro-low areas results in ponding of the micro-low areas. Differences in soil moisture differentiate the vegetative communities in the micro-high and micro-low areas. The natural drainage class of the soils and the presence of a water table likely contribute to the formation of earth hummocks, because the content of moisture in the soil is a primary contributor to frost heave (Matsuoka, 1996). Many theories about the role of soil moisture in frost heave are tied to the formation of ice lenses and the movement of water through freezing zones (Grab, 2005; Michalowski and Zhu, 2006). These theories are supported by data from the Ahklun Mountains area. Smaller hummocks develop on soils that are similar in particle size and are in similar landform positions but have better drainage, and the vegetative communities are the same in both the micro-high and micro-low positions of these soils (site R237XY222AK).

Soil features

The Metervik soil is correlated to this ecological site. This soil is moderately well drained. The water table is higher in the micro-low positions than in the micro-high positions. The saturated hydraulic conductivity of the soil is moderately high throughout. Andic properties are in the upper part of the soil.

Table 4. Representative soil features

Drainage class	Moderately well drained

Ecological dynamics

Outwash plains and outwash terraces are throughout the Ahklun Mountains area. Positions on these landscapes include rises, talfs, treads, and depressions. The two ecological sites on these landscapes that support the formation of earth hummocks are differentiated by location, soil characteristics, and vegetation. Site R237XY220AK is associated with moderately well drained soils. It is in linear to slightly convex depressions of broad outwash plains in the southern half of the Ahklun Mountains. Site R237XY222AK is associated with well drained soils. It is on linear to slightly convex talfs and treads throughout the Ahklun Mountains. Differences in climate, slope shape, and soil characteristics create different vegetative communities in these sites.

Ecological site R237XY220AK supports a mosaic of two communities in a repeating pattern on earth hummocks (fig. 1). This is in depressions on outwash plains in the southern half of the Ahklun Mountains. The long length and slight concavity of the slopes result in soils that are fine textured and have a high content of moisture. Large earth hummocks form in these areas. Both the micro-high and micro-low areas support low and dwarf shrubs. The micro-low positions typically are wetter than the micro-high positions. The communities in the micro-low positions have a higher richness of species, including dense hydrophilic shrubs and forbs. The communities in the micro-high positions support dense low and dwarf shrubs and many lichens. In areas where the soil is saturated, dense communities of willow may grow in both the micro-high and micro-low areas (fig 2).

Disturbance Dynamics

Frost Heave
The formation of earth hummocks, likely from frost heave, is the major disturbance in this ecological site. The hummocks result in two micro-topographic communities--low areas that commonly support hydrophilic, shade-tolerant species and mosses and high areas that support low and dwarf shrubs and lichens.

Earth hummocks occur on a variety of landscapes, at different elevations, and under different climatic conditions. Further research is needed to understand the formation of earth hummocks (Grab, 2005). Soil texture, soil moisture, seasonal frost or permafrost, air temperature, and vegetation may contribute to their formation (Kade et al., 2005; Grab, 2005; Kokelj et al., 2007). Many theories have been proposed to explain the genesis of earth hummocks, including the 'cryoexpulsion' of clasts, hydrostatic and cryostatic pressure, cellular circulation, and differential frost heave (Grab, 2005). The differential frost heave model is possibly the most widely accepted theory for the formation of earth hummocks (Grab, 2005), including for those formed in this area. This model proposes that the unevenness in the surface of the ground and the vegetation cover lead to corresponding variations in soil temperature and moisture. As frost results in frozen ground that progresses to unfrozen pockets, the upward movement of the soil creates earth hummocks (Beskow, 1930). This model is compatible with the patchy growth of ericaceous scrubs in these open tundra communities.

Hydrological Influences
The mosaic of micro-high and micro-low areas results in ponding of the micro-low areas. Differences in soil moisture differentiate the vegetative communities in the micro-high and micro-low areas. Moderately well drained soils and the presence of a water table likely contribute to the formation of earth hummocks, because the content of moisture in the soil is a primary contributor to frost heave (Matsuoka, 1996). Many theories about the role of soil moisture in frost heave are tied to the formation of ice lenses and the movement of water through freezing zones (Grab, 2005; Michalowski and Zhu, 2006). These theories are supported by data from the Ahklun Mountains area. Smaller hummocks develop on soils that are similar in particle size and are in similar landform positions but have better drainage, and the vegetative communities on these soils are the same in both the micro-high and micro-low areas (site R237XY222AK).

Fire
No incidence or evidence of fire was recorded in situ for this ecological site; however, previous wildfires have been mapped in areas of the site. Historically, the main causes of wildfires in the Ahklun Mountains area are lightning strikes and human activity (AICC, 2017).

Other Observations
No evidence of browsing or grazing in this ecological site was observed. Some of the plants in this site produce edible berries, which likely are browsed in season.

No alternate states were observed in this ecological site.

State and transition model

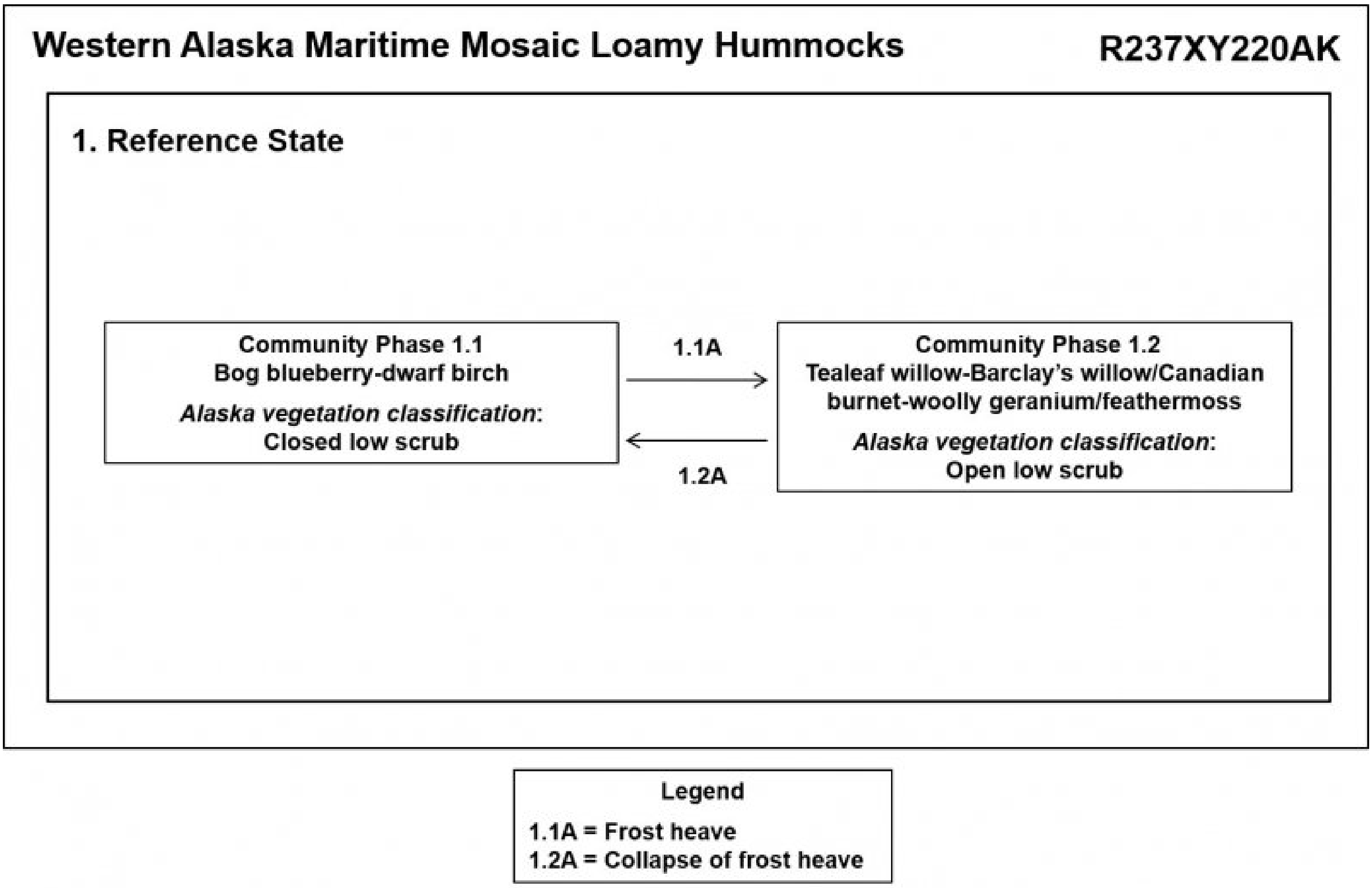

Figure 5. State-and-transition model.

State 1
Reference State

The reference state supports two communities that are in a mosaic and distinguished by the developed structure and dominance of the vegetation and the ecological function and stability of the community (fig. 5). The earth hummocks in this site support different communities in the micro-high and micro-low areas. This report provides baseline vegetation inventory data. Future data collection is needed to provide further information about existing plant communities and the disturbance regimes that would result in transitions from one community to another. Common and scientific names are from the USDA PLANTS database. All community phases are characterized by the Alaska Vegetation Classification System (Viereck et al., 1992).

Community 1.1
Bog blueberry-dwarf birch (Vaccinium uliginosum-Betula nana)

Figure 6. The micro-high areas of the hummocks support more lichens, less mosses, and fewer shrub species but more total shrub cover than do the micro-low areas.

Community Phase 1.1 Canopy Cover Table

Vegetation data are aggregated across modal sample plots for this community phase and are provided as a frequency (percent) and mean canopy cover (percent) of the dominant and most ecologically relevant species.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	100	40
S	Dwarf birch	*Betula nana*	BENA	100	15
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	10
S	Black crowberry	*Empetrum nigrum*	EMNI	100	7
B	Knight's plume moss	*Ptilium crista-castrensis*	PTCR70	100	20
B	Schreber's big red stem moss	*Pleurozium schreberi*	PLSC70	100	10
L	Greygreen reindeer lichen	*Cladina rangiferina*	CLRA60	100	7

This dataset includes data from one sample plot. Due to the limited data available for this plant community phase, personal field observations were used to aid in describing the community.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Canopy cover data are based on ocular estimates and rounded, except trace (0.1 percent) cover. Data ranging from 1 to 9 percent cover are rounded to the nearest integer. Data ranging from 10 to 100 percent cover are rounded to the nearest factor of 5.

Figure 7. Canopy cover and frequency of species in community 1.1.

The micro-topographic high areas of the earth hummock mosaic are characterized as closed low scrub (Viereck et al., 1992). The dominant functional groups are low shrubs (8 to 36 inches in height), mosses, and medium forbs (4 to 24 inches). Major shrubs include bog blueberry, dwarf birch, marsh Labrador tea, and black crowberry (*Empetrum nigrum*). Other shrubs may include Lapland cornel (*Cornus suecica*) and lingonberry (*Vaccinium vitis-idaea*). Forbs and graminoids in small amounts may include Canadian burnet (*Sanguisorba canadensis*), woolly geranium (*Geranium erianthum*), fireweed (*Chamerion angustifolium*), and smallawned sedge (*Carex microchaeta*). Lichens and mosses are in these micro-high areas, but the abundance of lichens is higher than in the micro-low areas and the abundance of mosses is lower.

Community 1.2
Tealeaf willow-Barclay's willow/Canadian burnet-woolly geranium/feathermoss (Salix pulchra-Salix barclayi/Sanguisorba canadensis-Geranium erianthum/Pleurozium schreberi)

Figure 8. The micro-low areas of hummocks support more mosses, less lichens, and more shrub species but less total shrub cover than do the micro-high areas.

Community Phase 1.2 Canopy Cover Table

Vegetation data are aggregated across modal sample plots for this community phase and are provided as a frequency (percent) and mean canopy cover (percent) of the dominant and most ecologically relevant species.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
S	Barclay's willow	*Salix barclayi*	SABA3	100	15
S	Tealeaf willow	*Salix pulchra*	SAPU15	100	10
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	100	6
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	4
F	Canadian burnet	*Sanguisorba canadensis*	SACA14	100	3
F	Woolly geranium	*Geranium erianthum*	GEER2	100	1
B	Schreber's big red stem moss	*Pleurozium schreberi*	PLSC70	100	30
B	Knight's plume moss	*Ptilium crista-castrensis*	PTCR70	100	30
B	Polytrichum moss	*Polytrichum spp.*	POLYT5	100	5

This dataset includes data from one sample plot. Due to the limited data available for this plant community phase, personal field observations were used to aid in describing the community.

Plant functional group classifications—T = trees, S = shrubs, G = graminoids, F = forbs, B = bryophytes, L = lichens

Canopy cover data are based on ocular estimates and rounded, except trace (0.1 percent) cover. Data ranging from 1 to 9 percent cover are rounded to the nearest integer. Data ranging from 10 to 100 percent cover are rounded to the nearest factor of 5.

Figure 9. Canopy cover and frequency of species in community 1.2.

The micro-topographic low areas are characterized as open low scrub (Viereck et al., 1992). The major plant strata are medium shrubs (3 to 10 feet in height), mosses, and low shrubs (8 to 36 inches). The low areas typically are wetter than the high areas, and they support more hydrophilic plants. Willows such as Barclay's willow (*Salix barclayi*) and tealeaf willow (*S. pulchra*) are common. Other shrubs may include bog blueberry and marsh Labrador tea. Forbs such as Canadian burnet and woolly geranium may be present. Few, if any, graminoids are present. Feathermosses commonly are more prevalent in the micro-low areas than in micro-high areas, and lichens are rare in the micro-low areas. The ground cover typically consists of mosses and herbaceous and woody litter.

Pathway 1.1A
Community 1.1 to 1.2

Bog blueberry-dwarf birch (Vaccinium uliginosum-Betula nana)

Tealeaf willow-Barclay's willow/Canadian burnet-woolly geranium/feathermoss (Salix pulchra-Salix barclayi/Sanguisorba canadensis-Geranium erianthum/Pleurozium schreberi)

Frost heave creates and shifts earth hummocks. This is an ongoing process that can change micro-high positions to micro-low positions and vice versa.

Pathway 1.2A
Community 1.2 to 1.1

Tealeaf willow-Barclay's willow/Canadian burnet-woolly geranium/feathermoss (Salix pulchra-Salix barclayi/Sanguisorba canadensis-Geranium erianthum/Pleurozium schreberi)

Bog blueberry-dwarf birch (Vaccinium uliginosum-Betula nana)

Frost heave creates and shifts earth hummocks. This is an ongoing process that can change micro-high positions to micro-low positions and vice versa.

Additional community tables

Other references

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Approval

Michael Margo, 7/23/2020

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	05/12/2025
Approved by	Michael Margo
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:**