Ecological site R237XY201AK
Western Alaska Maritime Scrubland Gravelly Slopes

Last updated: 7/23/2020
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): 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 R237XY201AK is in convex to linear areas of rolling, glaciated plains throughout the Ahklun Mountains area. The climate, landform, and soil characteristics create a unique ecological site. The associated soils are well drained or somewhat excessively drained. The reference state supports two community phases dictated by wind erosion and historically heavy use by caribou.

The reference plant community is characterized as an ericaceous dwarf scrubland (Viereck et al., 1992) that has

extensive lichen cover. Common shrubs include black crowberry (*Empetrum nigrum*), dwarf birch (*Betula nana*), marsh Labrador tea (Ledum palustre ssp. decumbens), and bog blueberry (Vaccinium uliginosum). Lichens include greygreen reindeer lichen (*Cladina rangiferina*), star reindeer lichen (*C. stellaris*), and snow lichens (Stereocaulon spp.).

Associated sites

R237XY204AK	**Western Alaska Maritime Scrubland Loamy Slopes** Ecological site R237XY201AK is in convex to linear areas of rolling, glaciated plains. Site R237XY204AK is in linear areas of the plains. Differences in landform, disturbance regimes, and associated soils create unique and easily distinguishable vegetative communities on these associated ecological sites. Ecotonal plant communities that have characteristics from more than one ecological site are in areas where these sites abut.
R237XY205AK	**Western Alaska Maritime Scrubland Loamy Swales** Ecological site R237XY201AK is in convex to linear areas of rolling, glaciated plains. Site R237XY205AK is in concave areas of the plains. Differences in landform, disturbance regimes, and associated soils create unique and easily distinguishable vegetative communities on these associated ecological sites. Ecotonal plant communities that have characteristics from more than one ecological site are in areas where these sites abut.

Similar sites

R237XY217AK	**Western Alaska Maritime Dwarf Scrubland Gravelly Slopes, High Elevation** Site R237XY217AK, which is on high-elevation summits and shoulders of mountains, has several site characteristics similar to those of site R237XY201AK. These include exposure to wind, well drained and somewhat excessively drained soils, and cool soil temperatures in winter. Separate ecological sites are needed because of differences in plant cover, species richness, and disturbance regimes.
R237XY204AK	**Western Alaska Maritime Scrubland Loamy Slopes** Several ecological sites in the Ahklun Mountains area support a reference community characterized as open low scrub. Although the plant communities may be similar, none of the reference plant communities are identical. Differences in landforms, reference state vegetation, soils, and disturbance regimes differentiate the sites.
R237XY205AK	**Western Alaska Maritime Scrubland Loamy Swales** Several ecological sites in the Ahklun Mountains area support a reference community characterized as open low scrub. Although the plant communities may be similar, none of the reference plant communities are identical. Differences in landforms, reference state vegetation, soils, and disturbance regimes differentiate the sites.
R237XY218AK	**Western Alaska Maritime Dwarf Scrubland Gravelly Slopes, Concave** Several ecological sites in the Ahklun Mountains area support a reference community characterized as open low scrub. Although the plant communities may be similar, none of the reference plant communities are identical. Differences in landforms, reference state vegetation, soils, and disturbance regimes differentiate the sites.
R237XY219AK	**Western Alaska Maritime Dwarf Scrubland Gravelly Slopes, Very Steep** Several ecological sites in the Ahklun Mountains area support a reference community characterized as open low scrub. Although the plant communities may be similar, none of the reference plant communities are identical. Differences in landforms, reference state vegetation, soils, and disturbance regimes differentiate the sites.
R237XY236AK	**Western Alaska Maritime Graminoid Peat Plains** Several ecological sites in the Ahklun Mountains area support a reference community characterized as open low scrub. Although the plant communities may be similar, none of the reference plant communities are identical. Differences in landforms, reference state vegetation, soils, and disturbance regimes differentiate the sites.

Figure 1. Area of reference plant community in foreground and early disturbance phase in mid background.

Figure 2. Reference plant community in a convex area.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Empetrum nigrum* (2) *Betula nana*
Herbaceous	(1) *Cladina stellaris* (2) *Cladina rangiferina*

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).

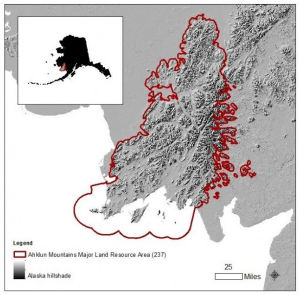

Figure 3. The Ahklun Mountains area (MLRA 237) is in western Alaska.

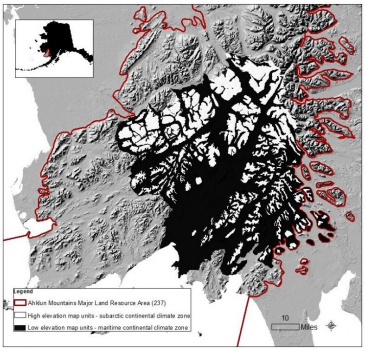

Figure 4. High-elevation and low-elevation map units in the area, which illustrate the primary climatic influence.

Table 2. Representative physiographic features

Slope shape across	(1) Convex
Slope shape up-down	(1) Convex (2) Linear
Geomorphic position, flats	(1) Rise
Landforms	(1) Plains > Plain
Flooding frequency	None
Ponding frequency	None
Elevation	15–2,690 ft
Slope	0–25%
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). Strong winds are common throughout the year.

Table 3. Representative climatic features

Frost-free period (characteristic range)	75-140 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	

Influencing water features

Soil features

The Goodnews and Kwethluk soils are correlated to this ecological site. These soils are well drained or somewhat excessively drained, have a thin (0 to 2 inches thick) organic layer, and do not have a water table. The Goodnews soil is shallow to lithic bedrock (10 to 20 inches). The saturated hydraulic conductivity of the Kwethluk soil is moderately high or high in the upper part and very high in the glacial underlying material, and the saturated hydraulic conductivity of the Goodnews soil is high or very high.

Table 4. Representative soil features

Drainage class	Well drained to somewhat excessively drained
Depth to restrictive layer	10–20 in

Ecological dynamics

Ecological site R237XY201AK is in convex to linear areas of rolling, glaciated plains (figs. 1 and 2). Site R237XY204AK is in linear areas of the plains, and site R237XY205AK is in concave areas. Differences in landform, soils, and site characteristics create unique and easily distinguishable vegetative communities in these sites.

The soils associated with site R237XY201AK have colder temperatures in winter and warmer temperatures in summer as compared to other soils at similar elevations. Wind in the exposed, convex positions decreases snowpack and insulation in winter, resulting in colder temperatures and less moisture infiltrating the ground during snowmelt in spring. Good exposure to sunlight and the gravelly substratum in the soils result in quick thawing in spring and warmer soil temperatures in summer.

Exposure to wind, the natural drainage class of the soils, and cool soil temperatures in winter are important factors that control the vegetation of the reference state. The plant communities are dominantly dwarf, hardy shrubs and diverse fruticose lichens. Shrubs that can reproduce in well drained soils are limited by the cold temperatures and exposure to wind (Hobbie and Chapin, 1998). Lichens thrive under these conditions because the dwarf, low-growing shrubs provide protection from wind and the limited soil moisture restricts growth of grasses and forbs.

Disturbance Dynamics

Cratering and Wind Scouring

Wind scouring after cratering by caribou is the major documented disturbance associated with this ecological site. Caribou grazing can lead to cratering, which exposes the mineral soil. Cratering is a result of caribou digging through snow to graze on lichen, which is limited from previous grazing. This disturbance results in an early plant community phase. Grazing can decrease the community biomass (Gilbert, 1974) and relative abundance of lichen (Helle and Aspi, 1983), and cratering can damage and shift individual and clumped lichen (Cooper et al., 2001). High winds in cratered areas can erode the exposed soils and produce unvegetated blowouts that consist dominantly of surface rock fragments and coarsely textured soils (Lyles and Tatarko, 1986) (See Schoeneberger and Wysocki, 2012, for a description of blowouts.). Revegetation of the exposed glacial underlying material is slow.

This disturbance is localized. It occurs on small rises or in other slightly elevated areas where the wind has limited the snow depth (fig. 1). Somewhat excessively drained and sandy soils are more susceptible to this wind erosion than are loamy or loamy-skeletal soils (U.S. Department of Agriculture, 2018). Thus, it is likely that the Kwethluk soils are more susceptible to this wind erosion than are the Goodnews soils. Further field observations are required

to document the full causes and effects of these disturbance dynamics. Natural variations in plant richness and cover may be evident among areas of this ecological site.

Fire

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

Other Observations

The lichens in this ecological site provide forage for caribou in winter. Shrubs may be browsed, but the normal level of browsing pressure typically does not decrease the shrub population.

This ecological site typically is far from established villages and towns, which limits direct anthropogenic influences.

No alternative states were observed in this ecological site.

State and transition model

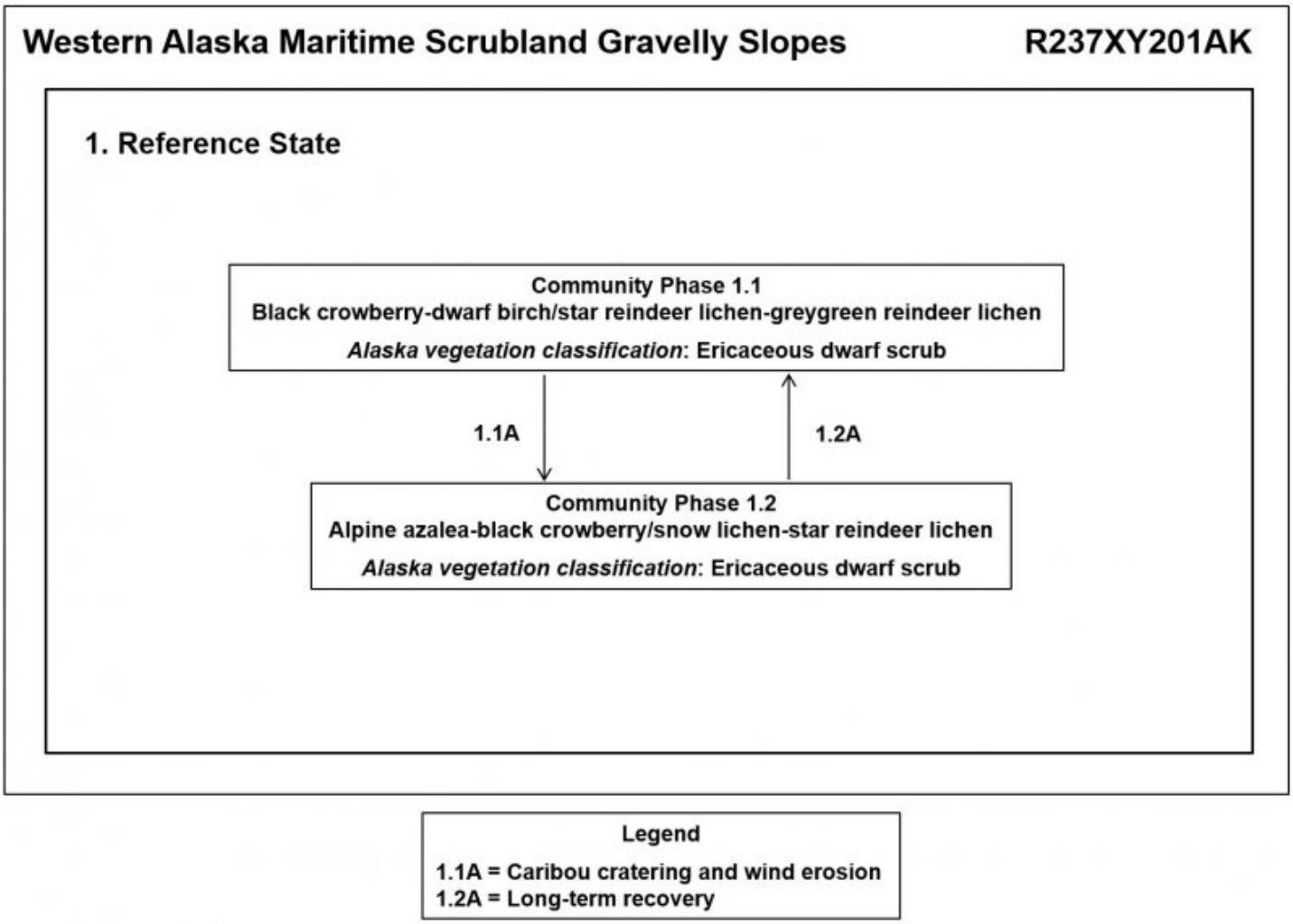

Figure 5. State-and-transition model.

State 1
Reference State

The reference state supports two community phases that are distinguished by the developed structure and dominance of the vegetation and the ecological function and stability of the community (fig. 5). The reference community phase is a tundra scrubland. The presence of each community is temporally dictated by a disturbance regime of cratering and wind erosion. This report provides baseline vegetation inventory data. Future data collection

is needed to provide further information about existing plant communities and the disturbance regime that results in transitions from one community to another. Common and scientific names are from the USDA PLANTS database. Community phases are characterized by the Alaska Vegetation Classification System (Viereck et al., 1992).

Community 1.1
Black crowberry-dwarf birch/star reindeer lichen-greygreen reindeer lichen (Empetrum nigrum-Betula nana/Cladina stellaris-Cladina rangiferina)

Figure 6. Typical area of community 1.1.

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. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
S	Black crowberry	*Empetrum nigrum*	EMNI	100	20 (2-35)
S	Marsh Labrador tea	*Ledum palustre* ssp. *decumbens*	LEPAD	100	10 (2-25)
S	Dwarf birch	*Betula nana*	BENA	90	15 (0-40)
S	Bog blueberry	*Vaccinium uliginosum*	VAUL	90	7 (0-20)
S	Lingonberry	*Vaccinium vitis-idaea*	VAVI	79	4 (0-15)
S	Red fruit bearberry	*Arctostaphylos rubra*	ARRU	53	3 (0-10)
L	Reindeer lichen^	*Cladina* spp.	CLADI3	100	25 (10-45)
L	Greygreen reindeer lichen	*Cladina rangiferina*	CLRA60	84	10 (0-25)
L	Snow lichen	*Stereocaulon* spp.	STERE2	84	4 (0-15)
L	Star reindeer lichen	*Cladina stellaris*	CLST60	74	15 (0-15)
L	Cup lichen	*Cladonia* spp.	CLADO3	68	4 (0-20)

^Reindeer lichen (*Cladina* spp.) includes all *Cladina* species.

This dataset includes data from 19 sample plots. The sample plots are distributed across the Ahklun Mountains area and are independent of one another.

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 reference plant community is characterized as ericaceous dwarf scrub (fig. 6) (Viereck et al., 1992). The vegetative strata are dwarf shrubs (less than 8 inches in height), low shrubs (8 to 36 inches), and lichens (fig. 7). Common shrubs include black crowberry, dwarf birch, marsh Labrador tea, bog blueberry, and lingonberry. Graminoids are sporadic, but common species are smallawned sedge (*Carex microchaeta*) and alpine sweetgrass (*Anthoxanthum monticola* ssp. alpinum). The ground cover is dominantly lichens, including star reindeer lichen, greygreen reindeer lichen, snow lichen, *Flavocetraria cucullata*, felt lichens (Peltigera spp.), and Cetraria spp. Other ground cover includes herbaceous litter, mosses, and rock fragments. Some areas are bare soil.

Community 1.2
Alpine azalea-black crowberry/snow lichen-star reindeer lichen (Loiseleuria procumbens-Empetrum nigrum/Stereocaulon spp.-Cladina stellaris)

Figure 8. Typical area of community 1.2.

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. Canopy cover is represented as a mean with the range in parentheses.

Plant group	Common name	Scientific name	USDA plant code	Frequency (percent)	Mean canopy cover (percent)
S	Alpine azalea	*Loiseleuria procumbens*	LOPR	100	5 (0.1-10)
S	Black crowberry	*Empetrum nigrum*	EMNI	100	3 (2-3)
G	Alpine sweetgrass	*Anthoxanthum monticola* ssp. *alpinum*	ANMOA3	50	1 (0-1)
F	Nodding arnica	*Arnica lessingii*	ARLE2	100	1 (0.1-1)
L	Snow lichen	*Stereocaulon* spp.	STERE2	100	5 (0.1-10)
L	Reindeer lichen^	*Cladina* spp.	CLADI3	100	3 (1-5)
L	Witch's hair lichen	*Alectoria* spp.	ALECT3	50	10 (0-20)

^Reindeer lichen (*Cladina spp.*) includes all species of *Cladina*.

This dataset includes data from two sample plots. The plots are distributed across the Ahklun Mountains area and are independent of one another. 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.

This community is the result of cratering by caribou followed by large-scale wind erosion (fig. 8). Most of the ground is covered by rock fragments or is bare soil. The vegetative strata that characterize this community are fruticose lichens and dwarf shrubs (less than 8 inches in height) (fig. 9). Plants typically include remnants of former resident species and colonizing species. Common species include black crowberry, alpine azalea (*Loiseleuria procumbens*), alpine sweetgrass, nodding arnica (*Arnica lessingii*), snow lichens, reindeer lichens, and witch's hair lichen (Alectoria spp.).

Pathway 1.1A
Community 1.1 to 1.2

Black crowberry-dwarf birch/star reindeer lichen-greygreen reindeer lichen (Empetrum nigrum-Betula nana/Cladina stellaris-Cladina rangiferina)

Alpine azalea-black crowberry/snow lichen-star reindeer lichen (Loiseleuria procumbens-Empetrum nigrum/Stereocaulon spp.-Cladina stellaris)

Caribou cratering and wind erosion. Cratering by caribou when browsing can make these exposed, convex landforms susceptible to wind erosion.

Pathway 1.2A
Community 1.2 to 1.1

Alpine azalea-black crowberry/snow lichen-star reindeer lichen (Loiseleuria procumbens-Empetrum nigrum/Stereocaulon spp.-Cladina stellaris)

Black crowberry-dwarf birch/star reindeer lichen-greygreen reindeer lichen (Empetrum nigrum-Betula nana/Cladina stellaris-Cladina rangiferina)

Natural succession: Normal time and growth without grazing pressure and wind erosion. For this community to return to the reference plant community, soil formation must be initiated in the area, which is hypothesized to occur via eolian processes and the accumulation of organic material. This process is expected to take several centuries to complete.

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	05/10/2025
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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
