Ecological site X2239X00Y070
Alpine Dwarf Scrub Gravelly Slopes

Last updated: 2/18/2025
Accessed: 05/21/2025

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): 239X–Northern Bering Sea Islands

The Northern Bering Sea Islands (MLRA 239X) occurs in Western Alaska and includes Saint Lawrence (1,792 square miles), Nunivak (1,632 square miles), and Saint Matthew (137 square miles) Islands and several smaller adjacent islands all of which are surrounded by the Bering Sea. This MLRA makes up 3,705 square miles. The terrain primarily consists of nearly level to rolling plains and highlands with mostly gentle slopes. Coastal lowlands dotted with numerous small- and medium-size lakes make up a significant part of St. Lawrence Island. Steep, low-relief volcanic cones, vents, and lava flows are common throughout Nunivak Island and less common on St. Lawrence and St. Matthew Islands. Narrow, discontinuous sea cliffs, sand dunes, and sand sheets are along many stretches of the coast. Elevation ranges from sea level along the coast to 2,207 feet at the summit of Atuk Mountain, on St. Lawrence Island. The area is mostly undeveloped wild land that is sparsely populated. Residents use this remote area primarily for subsistence hunting, fishing, and gathering. Reindeer and/or muskox herding provides meat and other products to residents on Nunivak Island and St. Lawrence Islands. The largest communities on the islands are Diomede, Gambell, Mekoryuk, and Savoonga.

Geology and Soils

Across the islands, most of the landscape is mantled with late Tertiary and Quaternary alluvial, marine, and eolian surficial deposits. While a small portion of the northwest coast of St. Lawrence Island was glaciated (Patton et al. 2011), the vast majority of the MLRA was unglaciated during the Pleistocene Epoch. St. Lawrence Island is the most geologically complex of the islands in this area. The St. Lawrence Island coastal plain is dotted with numerous small- and medium-size lakes with a mosaic primarily composed of surficial deposits and volcanic and sedimentary rock, including coal beds and limestone. The highlands on this island are primarily composed of Cretaceous granitic bedrock except for Atuk Mountain which is composed of young volcanic bedrock from the Quaternary to late Tertiary. Nunivak and St. Matthew Islands are made up almost exclusively of early and late Tertiary and Quaternary volcanic rocks.

These islands are in the zone of discontinuous permafrost. Frozen soils are common across the vast extents of rolling plains and gentle sloping highlands. In these areas, the layer of permafrost is generally thin or moderately thick and occurs primarily in fine textured deposits. Permafrost generally does not occur on flood plains, in coarse textured sediments on the slopes of volcanic cones and other highlands, along the coast, or near lakes and other bodies of water. Common periglacial features include solifluction lobes, frost boils, and palsen (Swanson et al. 1986, USDA 2022).

The majority of soils are acidic, and the dominant soil order is Gelisols. Except for some non-acidic uplands on St. Lawrence Island, the vast majority of soil substrate across the MLRA is acidic (pH less than 5.5) (CAVM Team 2023). The Gelisols are shallow or moderately deep to permafrost (10 to 40 inches) and are typically very poorly to poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have thick accumulations of surface organic material and primarily occur in very wet coastal plain depressions and low-gradient drainageways. The Orthels and Turbels have comparably thinner surface organic material and primarily occur on the coastal lowlands and other areas with gentle slopes. The MLRA also has small areas of Andisols, Entisols, Inceptisols, and Mollisols. Andisols and Inceptisols primarily occur on volcanic cones and other slopes with coarse textured, acidic soils. Mollisols occur on areas with limestone on St. Lawrence Island (USDA 2022). Entisols primarily occur on flood plains and estuaries. Miscellaneous (non-soil) areas make up about 10 percent of the area and are primarily water, lava flows, rubble composed of volcanic rock, and beach sediments.

Climate

The presence of sea ice in the Bering Sea strongly influences the climate across the islands in this area. Sea ice in the Bering Sea historically forms in early December, increases in thickness until late April, and breaks apart in June (Zuesler 1941). When sea ice is absent, the Bering Sea and North Pacific Ocean moderate diurnal and monthly temperatures resulting in a maritime climate. As sea ice forms around the islands, temperatures decrease significantly with the area shifting to a continental climate.

Vegetation

Tidal flats and estuaries support sedge dominant communities, while drier beach dune communities support American dunegrass and seacoast angelica communities (Swanson et al. 1986). The coastal lowlands and nearly level to rolling plains have a mosaic of sedge and moss dominant wetlands and various tundra. The tundra often has dwarf shrubs like crowberry; tussock forming and non-tussock forming sedges; and a variety of forbs, lichen, and mosses. Very wet drainages and the shores of lakes support wet sedge meadows. Drier soils on flood plains commonly support low to tall willow scrub with dense grasses and forbs in the understory. Shallow soils with coarse textured rocks common on volcanic cones, mountain slopes, and ridges commonly support alpine dwarf scrub dominated by ericaceous shrubs, Dryas, and dwarf willows. These communities commonly have a considerable amount of lichen and bare ground. Bedrock exposures and barrens with lichens and scattered shrubs and herbs in pockets of fine earth dominate the highest elevations, ridges, and other windblown sites.

Introduced ungulates

Introduced herds of reindeer and muskox provide a rich history of land use across the Northern Bering Sea Islands MLRA. Of the many islands in this MLRA, Nunivak was the only island historically grazed by ungulates. Inhabited by caribou until the late 1800’s, the caribou on Nunivak Island were extirpated with the introduction of rifles (Griffin 2001). Reindeer were introduced to St. Lawrence Island as early as 1901 (Jackson 1902), Nunivak Island in 1920, and St. Matthew Island in 1944 (Swanson and Barker 1991). Muskox were introduced to Nunivak Island in 1930 (ADFG 2024). Nunivak Island currently has managed herds of reindeer and muskox, St. Lawrence Island currently has managed herds of reindeer, and St. Matthew Island currently has no herds of reindeer. Some small islands in this MLRA are believed to have no history of natural or introduced ungulate herds (e.g. Pinnace Islands, Hall Island, and Punuk Islands).

LRU notes

There are two distinct bioclimates in this MLRA resulting in slight differences in vegetation. St. Lawrence Island is more than 200 miles North of Nunivak and St. Matthew Islands. As a result, St. Lawrence Island is significantly colder. Mean annual air temperatures on Nunivak and St. Matthew Islands typically range from 30 to 34 degrees Fahrenheit and are between 24 to 28 degrees Fahrenheit on St. Lawrence Islands (PRISM 2018). More southerly islands in this area fall into the Circumpolar Arctic Vegetation Mapping (CAVM) subzone E and more northerly islands fall into CAVM subzone D (CAVM 2022). Moist and dry tundra common to the near level to rolling plains across the islands are thought to support plant communities with similar species but have different plant community structures. Subzone E supports low shrub communities and subzone D erect dwarf shrub communities (CAVM 2022). At this time, these differences in community structure are recognized but unique ecological sites for each CAVM bioclimate subzone were not developed.

This area supports two life zones defined by the physiological limits of plant communities along an elevational gradient: arctic and alpine. In this MLRA, the arctic life zone occurs below 500 feet elevation on average (Swanson et al. 1986) and is the elevational band where lowland vegetation dominates. For this MLRA, certain vascular plant species are common in the lowlands and much less common in the alpine (i.e. Salix pulchra, Salix fuscescens, Betula nana, Ledum palustre ssp. decumbens, and Calamagrostis canadensis). Above the arctic band of elevation, alpine vegetation dominates. For this MLRA, certain vascular plant and lichen species are common in the alpine and much less common in the lowlands (i.e. Dryas octopetala ssp. octopetala, Diapensia lapponica var. obovata, Anthoxanthum monticola ssp. alpinum, Oxytropis nigrescens, Alectoria ochroleuca, and Flavocetraria nivalis). The lowlands also have much higher potential for lichen biomass yields compared to the alpine (Swanson et al. 1986). The transition between arctic and alpine vegetation can occur within a range of elevations, and is highly dependent on latitude, slope, aspect, and shading from adjacent mountains.

Classification relationships

Landfire BPS – 6716880 - Alaska Arctic Acidic Dryas Dwarf-Shrubland (Landfire 2009)
Dryas-Lichen Tundra (Viereck et al. 1992)
Dryas-Lichen (Ridges) (Swanson et al. 1986)

Ecological site concept

This ecological site occurs on alpine slopes with dry and gravelly soils that do not have permafrost. These alpine slopes occur on the summits, shoulders, and backslopes of mountains and volcanic cones at elevations typically above 500 feet. Associated soils do not pond or flood and are considered well drained. A typical soil profile has 1 to 2 inches of peat over colluvium and/or gravelly tephra.

The presence of introduced ungulate herds on Nunivak, St Lawrence, and St. Matthews Islands, in some places for over a century, plays an integral role in shaping vegetation across this MLRA. Islands in this MLRA without a history of introduced reindeer and muskox herds are associated with reference state vegetation, while islands with introduced herds are associated with grazing state vegetation.

Two plant communities have been documented within the grazing state for this ecological site and are based on the degree of ungulate use. Community 2.1 is considered the potential natural vegetation for the grazing state. This community is characterized as dryas-lichen tundra (Viereck et al. 1992) and has diverse vegetation. Common and dominant species include eightpetal mountain-avens, crowberry, small awned sedge, and various preferred lichen range species (e.g. Cladina sp., *Flavocetraria cucullata*, Cetraria sp., and Alectoria sp.). The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches height) and foliose and fruticose lichen.

Associated sites

R239XY043AK	**Alpine Dwarf Scrub Silty Slopes** Occurs on alpine mountain and hill slopes with silty soils prone to soil creep and solifluction.

Similar sites

R239XY043AK	**Alpine Dwarf Scrub Silty Slopes** Both ecological sites 43 and 70 support alpine dwarf shrub communities. When compared to ecological site 43, site 70 has different dominant dwarf shrubs and much less bryophyte biomass and cover.
R239XY063AK	**Arctic Dwarf Scrub Loamy Frozen Slopes** Both ecological sites 63 and 70 support dwarf shrub tundra. Ecological site 70 occurs in the alpine typically at elevations above 500 feet, while ecological site 63 occurs at lower elevations. These differences in life zone result in different kinds and amounts of vegetation.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Dryas octopetala ssp. octopetala* (2) *Empetrum nigrum*
Herbaceous	(1) *Flavocetraria cucullata* (2) *Cladina*

Legacy ID

R239XY070AK

Physiographic features

This ecological site occurs at high elevation in the alpine life zone. The site is associated with the backslopes of mountains and the shoulders, backslopes, and footslopes of volcanic cones. On Nunivak Island, additional associated landforms were identified as summits of hills and lava flows (Swanson et al. 1986). Slopes occur on all aspects and are typically moderately steep. Hill summits are gently sloping, while some volcanic cones are very steep. Elevation typically ranges between 500 and 1100 feet (Swanson et al.1986) but can go to much lower elevation on certain north-facing, windswept slopes. Flooding and ponding do not occur. These are dry soils with a water table occurring at deep to very deep depths.This site generates limited runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope (4) Footslope

Landforms	(1) Mountain system > Mountain (2) Plains > Volcanic cone (3) Plains > Hill (4) Plains > Lava flow
Runoff class	Low
Flooding frequency	None
Ponding frequency	None
Elevation	500–1,100 ft
Slope	12–25%
Water table depth	39–60 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Low to medium
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	100–2,170 ft
Slope	4–75%
Water table depth	Not specified

Climatic features

Sea ice strongly influences the climate of the islands in MLRA 239X. For the Northern Bering Sea Islands, sea ice starts forming in December and often persists through early June. In the absence of sea ice, the Bering Sea and North Pacific Ocean moderate diurnal and monthly temperatures resulting in a maritime climate. Summer temperatures (June through August) are relatively stable with mean maximum monthly temperatures ranging between 50 to 55 degrees Fahrenheit. As sea ice forms around the islands, temperatures decrease significantly with the area shifting to a continental climate. The coldest months (January through March) have mean monthly minimum temperatures ranging from 4 to 6 degrees Fahrenheit. The extent, thickness, and duration of the Bering Sea ice appears to be in flux resulting in southerly storms that can bring significantly warmer winter monthly temperatures (Stabeno et al. 2018, Gramling 2019).

The Northern Bering Sea Islands have summers that are short and cool and winters that are long and cold. Strong winds are common throughout the year. Mean annual air temperatures typically range from 26 to 32 degrees Fahrenheit with Saint Lawrence Island (mean annual air temperatures between 24 to 28 degrees Fahrenheit) being significantly colder compared to Nunivak and Saint Michael Islands (mean annual air temperatures between 30 to 34 degrees Fahrenheit) (PRISM 2018). The warmest months are June, July, and August. During these summer months, the typical freeze free period for the area ranges from 94 to 111 days. The coldest months are January, February, and March.

This area is semi-arid with mean annual precipitation typically ranging between 14 and 17 inches. The warmest months have overcast skies with frequent fog and precipitation while the coldest months have clear skies. The two wettest months are August and September where the islands typically receive a quarter of the annual precipitation. The rest of the months receive similar amounts of precipitation. Saint Michael Island receives greater mean annual precipitation (between 17 and 21 inches) compared to Nunivak and Saint Lawrence Islands (between 13 to 17 inches) (PRISM 2018). The average annual snowfall ranges from about 50 to 80 inches (USDA 2022) with the highest snowfall occurring during the months spanning November through March (USDA 1986).

Table 4. Representative climatic features

Frost-free period (characteristic range)	51-75 days
Freeze-free period (characteristic range)	94-111 days
Precipitation total (characteristic range)	14-17 in
Frost-free period (actual range)	50-85 days
Freeze-free period (actual range)	93-117 days
Precipitation total (actual range)	13-18 in
Frost-free period (average)	64 days
Freeze-free period (average)	103 days
Precipitation total (average)	15 in

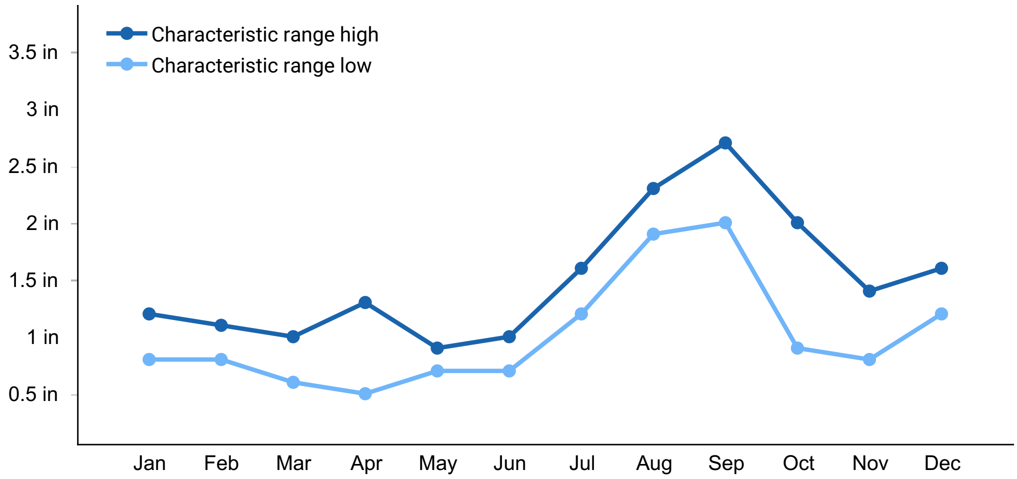


Figure 1. Monthly precipitation range

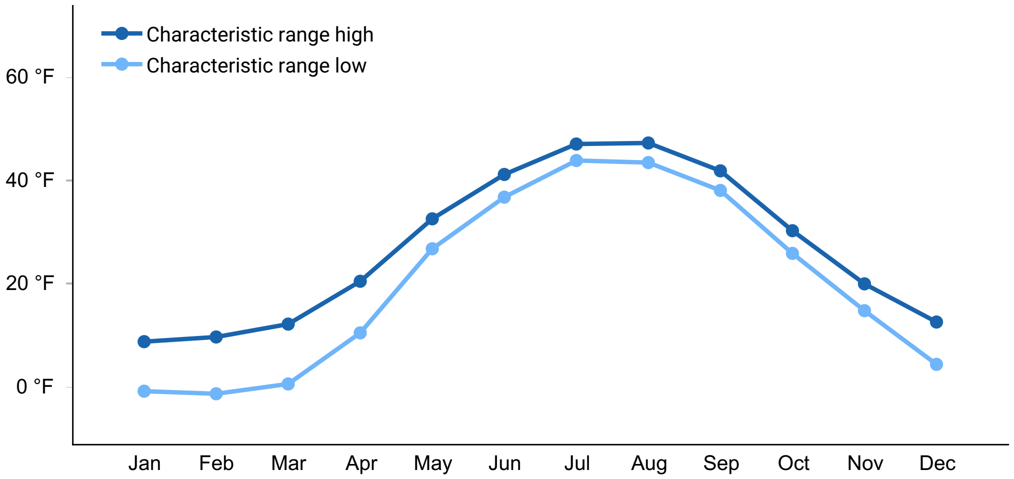


Figure 2. Monthly minimum temperature range

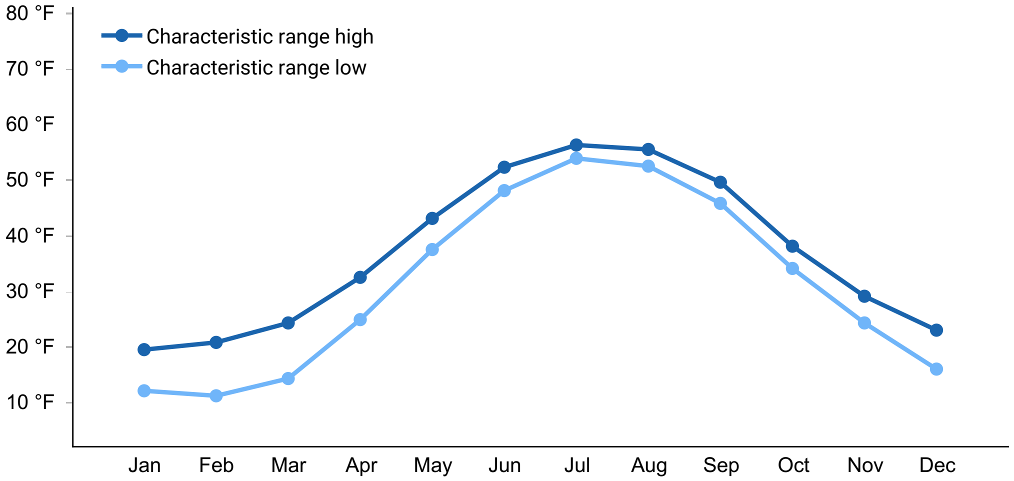


Figure 3. Monthly maximum temperature range

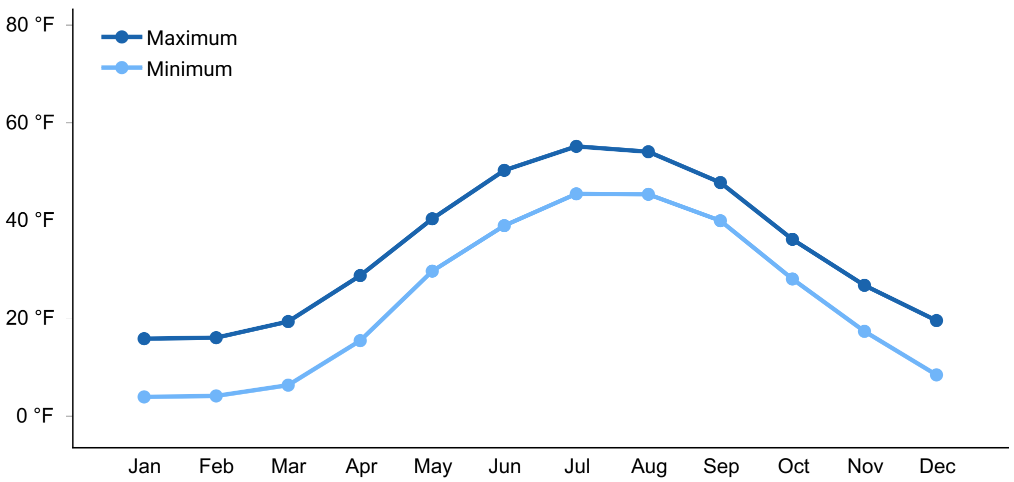


Figure 4. Monthly average minimum and maximum temperature

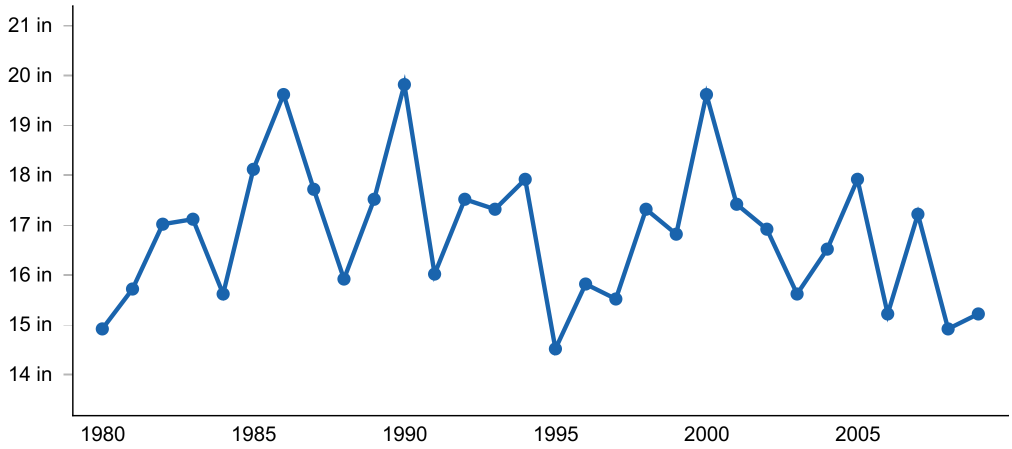


Figure 5. Annual precipitation pattern

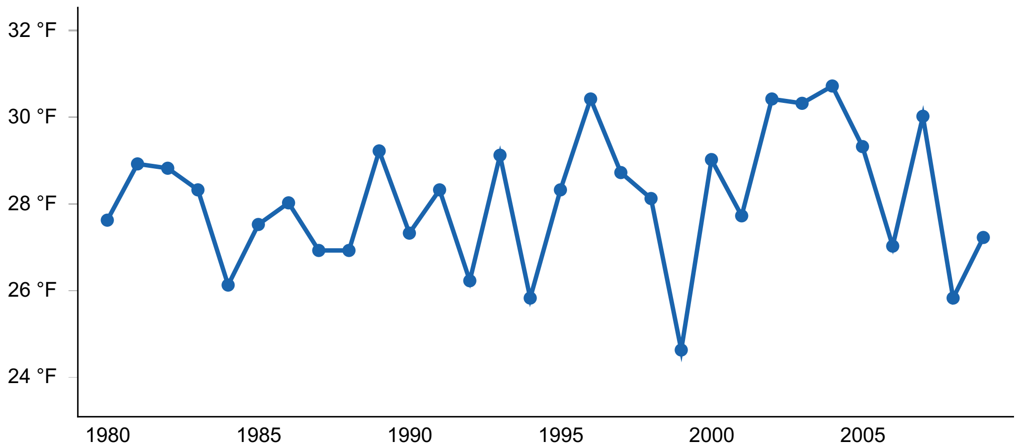


Figure 6. Annual average temperature pattern

Climate stations used

- (1) NOME MUNI AP [USW00026617], Nome, AK
- (2) WALES [USW00026618], Wales, AK
- (3) BETHEL AP [USW00026615], Bethel, AK

Influencing water features

Due to its landscape position, this site is neither associated with or influenced by streams or wetlands. Precipitation and throughflow are the main source of water for this ecological site. Surface runoff and throughflow contribute some water to downslope ecological sites.

Depth to the water table may decrease following summer storm events or spring snowmelt and increase during extended dry periods.

Wetland description

n/a

Soil features

Soils formed in gravelly parent material and do not have permafrost. Surface rock fragments are common and at the highest associated elevations can range up to 30 percent cover. These are mineral soils often capped with 1 to 2 inches of organic material. On mountain and hill slopes, the mineral soil below the organic material is a silt loam formed from wind-blown loess. The loess layer is up to 4 inches thick. Below the silty parent material is gravelly colluvium. On volcanic cones, the mineral soils are all ashy and very gravelly. Rock fragments in the soil profile range between 35 and 75 percent of the soil profile by volume. Mountain and hill slopes have very deep soils without restrictions. Volcanic cones have soils that contact bedrock at moderate depths (20 to 30 inches). The pH of the soil profile ranges from very strongly acidic to slightly acidic. The soils are dry for the growing season and are considered well drained.

Table 5. Representative soil features

Parent material	(1) Loess (2) Colluvium (3) Tephra
Surface texture	(1) Very cobbly silt loam (2) Silt loam
Family particle size	(1) Loamy-skeletal (2) Ashy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	24–60 in
Soil depth	24–60 in
Surface fragment cover <=3"	3–25%
Surface fragment cover >3"	1–8%
Available water capacity (0-40in)	1.5–3.5 in
Calcium carbonate equivalent (10-40in)	0%
Clay content (0-20in)	5–10%
Electrical conductivity (10-40in)	0 mmhos/cm
Sodium adsorption ratio (10-40in)	0
Soil reaction (1:1 water) (10-40in)	5–6.2

Subsurface fragment volume <=3" (0-60in)	20–30%
Subsurface fragment volume >3" (0-60in)	15–45%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	1.5–5.1 in
Calcium carbonate equivalent (10-40in)	Not specified
Clay content (0-20in)	Not specified
Electrical conductivity (10-40in)	Not specified
Sodium adsorption ratio (10-40in)	0–3
Soil reaction (1:1 water) (10-40in)	Not specified
Subsurface fragment volume <=3" (0-60in)	Not specified
Subsurface fragment volume >3" (0-60in)	Not specified

Ecological dynamics

The Northern Bering Sea Islands MLRA (MLRA 239X) occurs in the arctic where the harsh climate limits the composition and structure of plant communities. This area has cool and short summers and long and cold winters. Limited warmth during the short summer months, inhibits trees from occurring, and the expansive tundra is composed of a mosaic of low growing shrubs, sedges, moss, and lichen. The cold temperatures limit the vertical and horizontal structure of shrubs and other functional groups of the tundra (CAVM 2022). For instance, shrubs do not typically exceed 80 cm in height across these islands (Swanson et al. 1986; CAVM 2022).

This ecological site occurs in the alpine life zone within this arctic MLRA. The alpine life zone has a harsh climate that further limits growth of vegetation and prevents the establishment of many species common at lower elevations. In this area, alpine vegetation is characterized as either barrens or dwarf shrub communities with a diverse array of low-lying herbaceous plants, moss, and lichen (Swanson et al. 1986). These unique plant communities are the result of high winds, a short growing season, deep and persistent snow beds, and cold soils.

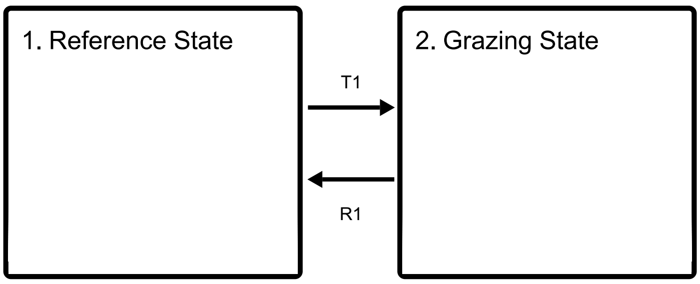
Ungulate History and Use

In this MLRA, the lack of predators paired with quality forage can lead to dramatic population growth of reindeer which in turn can lead to significant die-offs. Eighty-one reindeer were introduced to Nunivak Island in 1920. Due to a lack of predators and an abundance of high-quality forage, the reindeer population climbed to peaks of greater than 30 thousand in 1944 and 23 thousand in 1965 (Swanson and Barker 1991). After each peak in population, the reindeer herds experienced dramatic population die offs that resulted in less than 5 thousand animals (Swanson and Barker 1991). These die offs are largely attributed to lichen range depletion. Lichen forage makes up 47 percent of the March diet for reindeer herds on Nunivak Island (Swanson et al. 1986) so the depletion of lichen range can directly lead to stress and mortality of reindeer populations.

The presence of introduced ungulate herds on Nunivak, St Lawrence, and St. Matthews Islands, in some places for over a century, plays an integral role in shaping vegetation across this MLRA. Some small islands in this MLRA are believed to have no history of natural or introduced ungulate herds (e.g. Pinnace Islands, Hall Island, and Punuk Islands). On islands with introduced herds, grazing by reindeer and/or muskox has impacted the potential natural vegetation. For instance, continuous grazing of slow growing fruticose lichen can lead to changes in lichen species composition (Swanson and Barker 1991) and can lead to increases in shrub and bryophyte cover (Kautz et al. 1992). Because of the mixed history in grazing in this MLRA, the STM for this ecological site has two states. Islands in this MLRA without a history of ungulate herds are associated with reference state vegetation, while islands with introduced ungulate herds are associated with grazing state vegetation.

State and transition model

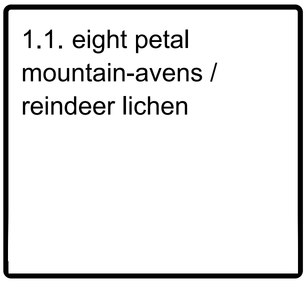
Ecosystem states



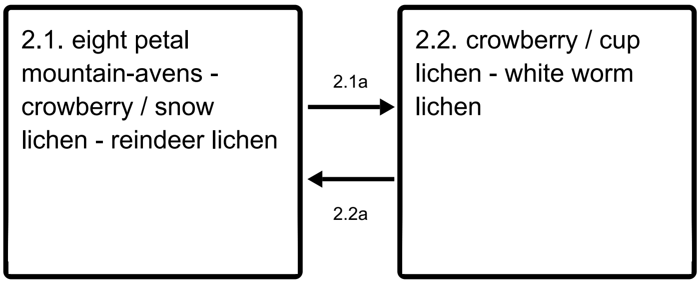
T1 - Human introduction of reindeer and/or muskox to islands.

R1 - Long periods of time after extirpation of human introduced ungulates.

State 1 submodel, plant communities



State 2 submodel, plant communities



2.1a - Continuous grazing by reindeer and/or muskox

2.2a - Time without continuous grazing by reindeer and/or muskox

State 1
Reference State

The historic and current use of introduced ungulates in this MLRA may have altered the potential natural vegetation on these islands. Islands in this MLRA without a history of introduced grazing have reference state vegetation, while islands with introduced herds of reindeer and/or muskox (Nunivak, St. Lawrence, and St. Matthews Islands) have grazing state vegetation. Currently no data has been collected in areas of this MLRA in reference condition. Future targeted data collection efforts can address whether range in excellent condition within the grazing state is similar to reference state vegetation and these results could dramatically alter this provisional state and transition model.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- (*Flavocetraria cucullata*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 1.1
eight petal mountain-avens / reindeer lichen

Community 1.1 is the potential natural vegetation for this state. It is characterized as dryas-lichen tundra (Viereck et al. 1992) with eight petal mountain-avens the dominant dwarf shrub. Other common and abundant species include crowberry, alpine sweetgrass, and an assortment of lichen.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- crowberry (*Empetrum*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- (*Flavocetraria cucullata*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous

State 2
Grazing State

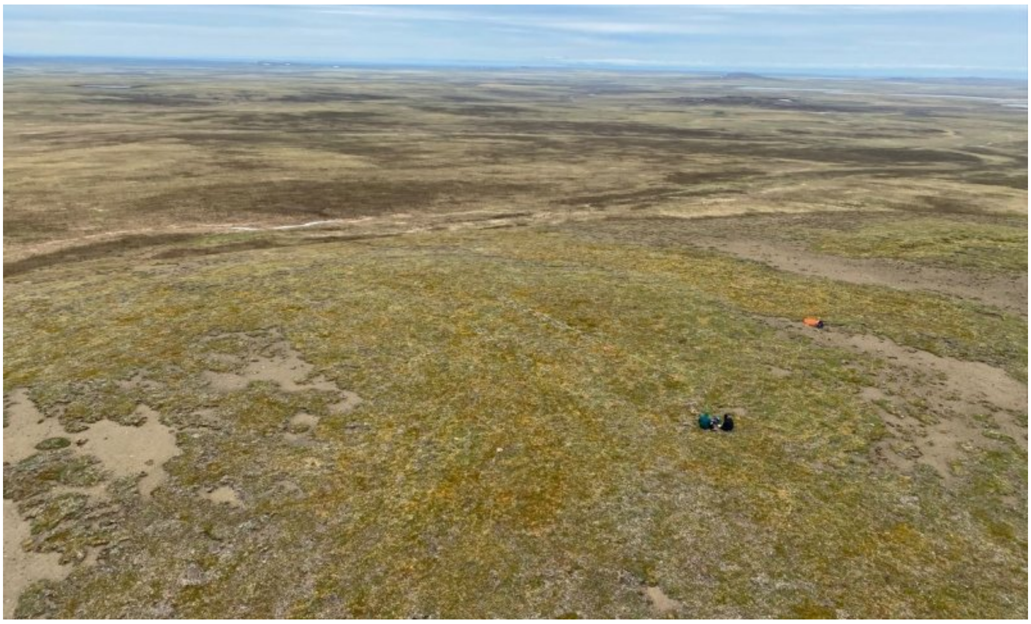


Figure 7. The summit of a low elevation mountain on Nunivak Island that supports this ecological site.

Two plant communities occur within the grazing state and the vegetation differs in large part due to the degree of ungulate use. The data for this state is based on a mixture of recent field work conducted on Nunivak Island (2022-2023) and historical range surveys conducted on Nunivak Island (Swanson et al. 1986, Kautz et al. 1992). Future work will be required to determine if the vegetation on Nunivak Island represent the vegetation across the grazed islands of this MLRA.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- (*Flavocetraria cucullata*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 2.1
eight petal mountain-avens - crowberry / snow lichen - reindeer lichen

Figure 8. A typical plant community on Nunivak Island associated with community 2.1.

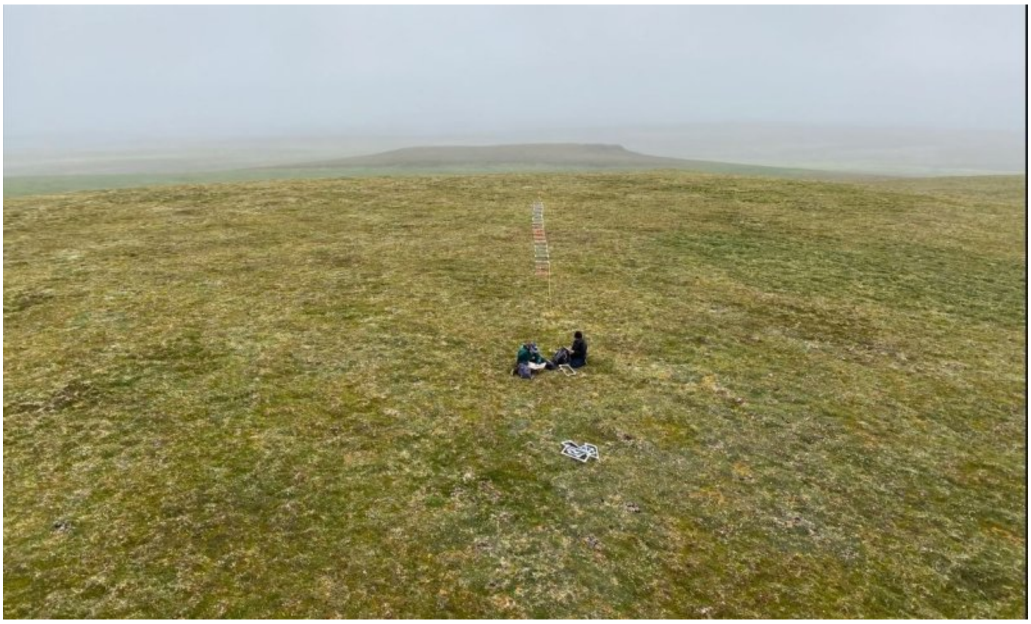


Figure 9. A hill summit on Nunivak Island associated with the grazing state.

Community 2.1 is considered the potential natural vegetation for the grazing state and is in excellent ecological condition. This community is characterized as dryas-lichen tundra (Viereck et al. 1992) and has diverse vegetation. Common and dominant species include eightpetal mountain-avens, crowberry, netleaf willow, alpine bearberry, small awned sedge, alpine sweetgrass, blackish oxytrope, and various preferred lichen range species (e.g. Cladina sp., *Flavocetraria cucullata*, Cetraria sp., and Alectoria sp.). The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches height) and foliose and fruticose lichen.

Forest understory. Live lichen and moss annual production cannot be measured accurately due to a lack of information on growth rates and/or slow annual growth rates. Lichen and moss biomass data below refers to total biomass, while vascular plants biomass refers to annual production.

The mountain-avens most commonly associated with this site is Dryas ajanensis (DROCO). The Flora of North America no longer recognizes eightpetal mountain-avens (Dryas octopetala) as occurring in Alaska and has split this species concept into several new species (Springer and Parfitt 2015).

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- netleaf willow (*Salix reticulata*), shrub
- alpine bearberry (*Arctostaphylos alpina*), shrub
- pincushion plant (*Diapensia lapponica var. obovata*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- smallawned sedge (*Carex microchaeta*), grass
- (*Flavocetraria cucullata*), other herbaceous
- reindeer lichen (*Cladina mitis*), other herbaceous
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- blackish oxytrope (*Oxytropis nigrescens*), other herbaceous
- island cetraria lichen (*Cetraria islandica*), other herbaceous
- witch's hair lichen (*Alectoria nigricans*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous
- globe ball lichen (*Sphaerophorus globosus*), other herbaceous
- whiteworm lichen (*Thamnolia vermicularis*), other herbaceous
- snow lichen (*Stereocaulon*), other herbaceous

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Lichen	400	800	1200
Shrub/Vine	170	320	465
Grass/Grasslike	20	40	55
Forb	10	20	30
Moss	0	0	2
Total	**600**	**1180**	**1752**

Table 8. Ground cover

Tree foliar cover	0%

Shrub/vine/liana foliar cover	25-50%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-5%
Non-vascular plants	30-55%
Biological crusts	0%
Litter	0-5%
Surface fragments >0.25" and <=3"	3-5%
Surface fragments >3"	3-7%
Bedrock	0%
Water	0%
Bare ground	0-5%

Table 9. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	25-50%	0-5%	0-5%
>0.5 <= 1	–	–	0-2%	0-2%
>1 <= 2	–	–	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
crowberry / cup lichen - white worm lichen

Community 2.2 has been continuously grazed. Cover and biomass of crowberry and less preferred lichen species increase, while cover and biomass of eightpetal mountain-avens and preferred lichen species decrease significantly. Lichen biomass goes from 800 pounds per acre on average for community 2.1 down to 100 pounds per acre on average for community 2.2. Preferred lichens for this community are reindeer lichen and Flavocetraria lichen. The less preferred lichens are globe ball lichen, and cup lichens.

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- smallawned sedge (*Carex microchaeta*), grass
- dicranum moss (*Dicranum*), other herbaceous
- polytrichum moss (*Polytrichum*), other herbaceous
- globe ball lichen (*Sphaerophorus globosus*), other herbaceous
- whiteworm lichen (*Thamnolia vermicularis*), other herbaceous
- cup lichen (*Cladonia*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- (*Flavocetraria cucullata*), other herbaceous

Pathway 2.1a
Community 2.1 to 2.2

Continuous grazing by reindeer and/or muskox. Continuous grazing reduces the cover and abundance of desirable forage lichen and increases the cover and abundance of dwarf shrubs, forbs, and less desirable forage lichen.

Pathway 2.2a
Community 2.2 to 2.1

Time without continuous grazing by reindeer and/or muskox. The cover and abundance of desirable forage lichen increases, competing and reducing the cover of dwarf shrubs, forbs, and less desirable forage lichen.

Transition T1
State 1 to 2

Human introduction of reindeer and/or muskox to islands.

Restoration pathway R1
State 2 to 1

Long periods of time after extirpation of human introduced ungulates.

Additional community tables

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
2	**Shrubs Annual Production**			170–465	
	eightpetal	DROCO	*Dryas octopetala ssp.*	60–275	–

	mountain-avens		*octopetala*		
	black crowberry	EMNI	*Empetrum nigrum*	15–80	–
	netleaf willow	SARE2	*Salix reticulata*	20–80	–
	alpine bearberry	ARAL2	*Arctostaphylos alpina*	5–45	–
	least willow	SARO2	*Salix rotundifolia*	4–35	–
	pincushion plant	DILAO2	*Diapensia lapponica var. obovata*	2–30	–
	marsh Labrador tea	LEPAD	*Ledum palustre ssp. decumbens*	2–15	–
	lingonberry	VAVI	*Vaccinium vitis-idaea*	2–10	–
	polar willow	SAPO	*Salix polaris*	0–5	–
	bog blueberry	VAUL	*Vaccinium uliginosum*	0–5	–
Grass/Grasslike					
3	**Grass/Grasslike Annual Production**			20–55	
	shortstalk sedge	CAPO	*Carex podocarpa*	8–45	–
	smallawned sedge	CAMI4	*Carex microchaeta*	4–35	–
	smallflowered woodrush	LUPA4	*Luzula parviflora*	0–5	–
Forb					
4	**Fob Annual Production**			10–30	
	blackish oxytrope	OXNI	*Oxytropis nigrescens*	2–10	–
	lousewort	PEDIC	*Pedicularis*	2–10	–
	woolly lousewort	PELA14	*Pedicularis lanata*	0–5	–
	larkspurleaf monkshood	ACDE2	*Aconitum delphiniifolium*	0–5	–
Moss					
5	**Total Bryophyte Biomass**			0–2	
	dicranum moss	DICRA8	*Dicranum*	1	–
	polytrichum moss	POLYT5	*Polytrichum*	0–1	–
Lichen					
6	**Total Lichen Biomass**			400–1200	
		FLCU	*Flavocetraria cucullata*	40–240	–
	greygreen reindeer lichen	CLRA60	*Cladina rangiferina*	40–240	–
	reindeer lichen	CLMI60	*Cladina mitis*	40–180	–
	island cetraria lichen	CEIS60	*Cetraria islandica*	20–120	–

	lichen				
	witch's hair lichen	ALNI60	*Alectoria nigricans*	8–95	–
	witch's hair lichen	ALOC60	*Alectoria ochroleuca*	24–95	–
	whiteworm lichen	THVE60	*Thamnolia vermicularis*	8–85	–
	globe ball lichen	SPGL60	*Sphaerophorus globosus*	8–60	–
	snow lichen	STERE2	*Stereocaulon*	8–60	–
	felt lichen	PELTI2	*Peltigera*	4–50	–
	cetraria lichen	CENI60	*Cetraria nigricans*	8–50	–
	cup lichen	CLGR13	*Cladonia gracilis*	4–50	–
	cup lichen	CLADO3	*Cladonia*	0–10	–

Animal community

Strong frequent winds and soil characteristics, such as low mineral content, coarse fragments, etc., prevent all but a few low-growing plants from surviving on these sites. Muskoxen and ptarmigan are among the few wildlife species hardy enough to feed on the sparse vegetation. Natural cavities formed by large boulders and rock outcrops may provide sufficient cover for some small mammals, such as voles, and as a result, small rodents may use some of the more protected and productive of these sites.

Hydrological functions

N/A

Recreational uses

The varied seascapes and landscapes present scenic views of high aesthetic value. Opportunities for photography are excellent.

Wood products

No wood products available from this site.

Other products

Reindeer Grazing

This site is best suited for winter range. This site should be avoided during dry periods of the year due to the fragility of lichens when they are dry and brittle and therefore easily trampled. This site is usually exposed to winds and is snow free during most of the winter allowing reindeer and muskoxen easy access to the lichens.

Other information

These interpretive narratives were all developed in a report for range sites on Nunivak Island (Swanson et al. 1986).

Inventory data references

Tier 2 sampling plots used to develop the grazing state. Plot numbers as recorded in NASIS with associated community phase.

Community 2.1

897005, 907009

Plant species and production information are based on a historic range survey on Nunivak Island (Swanson et al. 1986).

References

Alaska Department of Fish and Game Staff. 2024 (Date accessed). Muskox (Ovibos moschatus). https://www.adfg.alaska.gov/index.cfm?adfg=muskox.main.

CAVM Team. 2023. Raster Circumpolar Arctic Vegetation Map. Scale 1:7,000,000. Conservation of Arctic Flora and Fauna, Akureyri.

Gramling, C. 2019. What happens when the Bering Sea's ice disappears?.

Griffin, D. 2001. Nunivak Island, Alaska: A history of contact and trade.

Jackson, S. 1902. Eleventh Annual Report on Introduction of Domestic Reindeer into Alaska, with Map and Illustrations, 1901. Senate of the United States, 54th Congress, 1st Session. Document No. 98..

Kautz RD, Swanson JD, Barker M, and Morgart J. 1992. Nunivak Island Trend Study, 1989-1990 Nunivak Island, AK. USDA NRCS.

Landfire. 2009. Biophysical Setting. LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior, Washington, DC..

Patton Jr, W., F. Wilson, and T. Taylor. 2011. Geologic Map of Saint Lawrence Island.

Smith, R.D., A.P. Ammann, C.C. Bartoldus, and M.M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices.

Springer, J. and B. Parfitt. 2015. Dryas. in Flora of North America.

Stabeno, P.J., C.A. Ladd, C. Mordy, and R.M. McCabe. 2018. How the Absence of Sea Ice Altered the Physical Oceanography of the Northern Bering Sea. AGU Fall Meeting Abstracts 2018:OS53B–04.

Swanson, J.D., D. Lehner, J. Zimmerman, and D. Pauling. 1986. Range survey of Nunivak Island, Alaska.

Swanson, J. and M. Barker. 1992. Assessment of Alaska reindeer populations and range conditions. Rangifer 12:33–43.

United States Department of Agriculture, . 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.

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..

Wald, E.J. 2009. Nunivak Island Reindeer and Muskoxen Survey, 2009. US Fish & Wildlife Service, Yukon Delta National Wildlife Refuge.

Zeusler, F. 2009. Ice in the Bering Sea and Arctic Ocean.

Other references

PRISM Climate Group. 2018. Alaska – average monthly and annual precipitation and minimum, maximum, and mean temperature for the period 1981-2010. Oregon State University, Corvallis, Oregon. https://prism.oregonstate.edu/projects/alaska.php. (Accessed 4 September 2019).

Scenarios network for Alaska and arctic planning (SNAP). Historical Monthly Temperature – 1km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. (Accessed 5 May 2021).

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 5 May 2021).

Contributors

Blaine Spellman

Approval

Marji Patz, 2/18/2025

Acknowledgments

Phillip Barber, Stephanie Schmit, Michael Singer, Jamin Johanson and Marji Patz are acknowledged for their feedback on the ecological sites of this MLRA and suggestion on soil component correlation. Karin Sonnen is acknowledged for her excellent technical review to make this ecological site description report a much better product.

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	05/21/2025
Approved by	Marji Patz
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:**
