USDA Natural Resources Conservation Service

Ecological site R246XY051AK
Arctic Shrub Loamy Frozen Tidal Marsh

Last updated: 5/22/2025
Accessed: 04/10/2026

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): 246X–Arctic Coastal Plain

The Arctic Coastal Plain MLRA (MLRA 246X) consists of level to gently rolling plains along the coast of the Arctic Ocean. This area makes up 22,235 square miles. It is mostly remote, sparsely populated wildland. Numerous rivers, mostly originating in the Brooks Range, drain to the Arctic Ocean. The largest being the Canning, Colville, Jago, Kongakut, Kuk, Utukok, and Sagavanirktok Rivers. Narrow, nearly level flood plains and stream terraces parallel the many rivers. The area is dotted by thousands of small and medium-size lakes and interconnecting wetlands. Many of the lakes are elongated thaw lakes, which are consistently oriented from north to northwest. Small sand dunes occur along the coastline, rivers, and plains. Elevation ranges from sea level to about 655 feet.

Permanent settlements include Point Lay, Wainwright, Utqiagvik, Nuigsut, and Kaktovik. The Prudhoe Bay oil fields and the northern terminus of the Trans-Alaska Pipeline are in the central part of the MLRA. The Dalton Highway and the Trans-Alaska Pipeline bisect the area west of the Sagavanirktok River, terminating at Deadhorse. The community of Deadhorse provides much of the industrial infrastructure and many of the residential facilities associated with the oil fields and pipeline. Parts of the National Petroleum Reserve and Arctic National Wildlife Refuge are in this MLRA.

Geology and Soils

This area was never glaciated (NRCS 2022). The bedrock geology consists of Cretaceous and Tertiary stratified sedimentary rocks and uplifted continental deposits. The modern landscape is mantled with Quaternary deposits of alluvial, eolian, or glaciofluvial origin.

This MLRA is in the zone of continuous permafrost. Areas without permafrost in the soil profile are limited to tidal flats, large sand dunes, and soils directly adjacent to large rivers. Thick layers of permafrost occur in both fine textured and coarse textured deposits across the area. Depth to the base of the permafrost layer ranges between 500 and 2000 feet. Periglacial features, such as beaded drainages, patterned ground (ice-wedge polygons, thaw gullies, pingos, and frost boils) occur throughout the MLRA.

The dominant soil order in this MLRA is Gelisols. Most have an aquic soil moisture regime. The Gelisols are shallow or moderately deep to permafrost, occur on fine and coarse textured sediments, and are generally poorly drained or very poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have a glacic layer and/or thick accumulations of surface organic material and are associated with ice-wedge troughs of polygons, vegetated lake basins, swales, and low-gradient drainageways. The Orthels and Turbels have comparably thinner surface organic material and occur on flood plains, stream terraces, plains, and the centers of low- and high-center polygons. Miscellaneous (non-soil) areas make up about 20 percent of this MLRA. The most common are water, riverwash, and beaches.

Climate
The average annual precipitation in this area is 4 to 8 inches. Brief, cool summers and long, very cold winters characterize the arctic climate. The average annual snowfall is about 20 to 40 inches. The average annual temperature ranges from 11 to 14 degrees Fahrenheit. The average freeze-free period is between 43 and 76 days but freezing temperatures can occur in any month.

Vegetation
The wet soils prevalent across this MLRA support extensive swaths of tussock tundra and wet sedge meadow tundra (Viereck et al. 1992). The drier sites and low uplands support dwarf scrub dominated by various ericaceous shrubs and dwarf willow. On shallow, rocky soils and exposed sites, lichens and scattered herbs dominate the ground layer. Flood plains support a mixture of low willow scrub and scattered herbs. Fire is not common in this MLRA (AICC 2022).

LRU notes

The bulk of the MLRA is associated with the Circumpolar Arctic Vegetation Mapping (CAVM) subzone D with a small portion of the Northern most lands falling into subzone C (CAVM 2022). Arctic subzone D is associated with vegetation that have herbaceous and dwarf shrub communities that are commonly 4 to 15 inches tall, while subzone C has an herbaceous and dwarf shrub layer that are typically less than 6 inches tall (CAVM 2022). At this time, these differences in community structure are recognized with large differences in annual production expected; but unique ecological sites for each CAVM bioclimate subzone were not developed.

Classification relationships

Landfire BPS – 17010 - Alaska Arctic Coastal Sedge-Dwarf-Shrubland (Landfire 2009)

Ecological site concept

- Occurs on backshores and the highest levels of tidal marsh that are occasionally to rarely inundated from strong tidal surges or extreme high tides.
- Soils formed in organic material and marine deposits. Soils are capped with eight inches of mucky peat, and the surface mineral texture is cryoturbated muck and fine sandy loam.
- Soils have a water table at very shallow depth throughout the growing season and are considered very poorly drained.
- Soils are very deep but have permafrost at very shallow to moderate depths.
- The reference plant community is open low scrub (Viereck et al. 1992) commonly with crowberry, oval-leaf willow, water sedge, looseflower alpine sedge, and Sphagnum. One plant community was identified within the reference state.

Associated sites

R246XY004AK	**Arctic Shrub Sandy Flood Plains** Occurs upstream of estuaries on large floodplains. Associated with open and closed low scrub willow vegetation.
R246XY008AK	**Arctic Sedge Peat Frozen Drainageways** Occurs upstream of estuaries on low-gradient drainageway and streams. Associated with closed willow and wet sedge meadow plant communities.
R246XY050AK	**Arctic Sedge Loamy Tidal Marsh** Occurs on the same landforms but in lower positions that are much more commonly inundated by tides. Soils have thinner organic caps, lack permafrost, and support sedge and grass dominant communities.

Similar sites

R239XY051AK	**Arctic Shrub Loamy Frozen Tidal Marsh** Ecological site R239XY051AK occurs on the same landforms with similar soils and vegetation but occurs to the West in the Northern Bering Sea Islands MLRA.

Figure 1. Periodically flooded tidal marsh on arctic coastal plain associated with ecological site 50 (in Macander et al. 2020).

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Salix ovalifolia* (2) *Empetrum nigrum*
Herbaceous	(1) *Carex aquatilis* (2) *Carex rariflora*

Physiographic features

- Occurs on shore complex. Associated landforms have occasional to rare tidal flooding (Landfire 2009) and include backshores and the highest levels of tidal marsh.
- Elevation typically ranges between 10 and 20 feet. In areas with strong tidal surges, elevation can reach 30 feet or more.
- Slopes are nearly level. Given the low relief, aspect is not relevant for this ecological site concept.
- Soils do not pond. During the growing season, a water table commonly occurs at very shallow depth.
- This site generates negligible runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Landforms	(1) Shore complex > Coastal plain (2) Shore complex > Backshore (3) Shore complex > Tidal flat
Runoff class	Negligible
Flooding duration	Brief (2 to 7 days)

Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	3–6 m
Slope	0–1%
Water table depth	0–25 cm
Aspect	Aspect is not a significant factor

Climatic features

Very short, cool summers and long, very cold winters characterize the arctic climate associated with this ecological site. Given its far North latitude, this Arctic Coastal Plains MLRA experiences long-periods of continuous light in the summer (85 days in Utqiagvik) and continuous darkness in the winter (65 days in Utqiagvik). Mean annual temperature for the Arctic Coastal Plains MLRA typically ranges from 11 to 14 degrees Fahrenheit. The warmest months span June through August with mean normal temperatures ranging from 40 to 47 degrees Fahrenheit (PRISM 2008). The coldest months span December through March with mean normal temperatures ranging from -19 to -9 degrees Fahrenheit (PRISM 2008). This MLRA is arid with mean annual precipitation ranging from 4 to 8 inches. Approximately half of the annual precipitation occurs during the months of July through September. The average annual snowfall ranges from 20 to 40 inches (USDA 2022). The ground is consistently covered with snow from October through May March.

Table 3. Representative climatic features

Frost-free period (characteristic range)	10-28 days
Freeze-free period (characteristic range)	43-76 days
Precipitation total (characteristic range)	102-203 mm
Frost-free period (actual range)	3-48 days
Freeze-free period (actual range)	23-94 days
Precipitation total (actual range)	76-229 mm
Frost-free period (average)	17 days
Freeze-free period (average)	61 days
Precipitation total (average)	152 mm

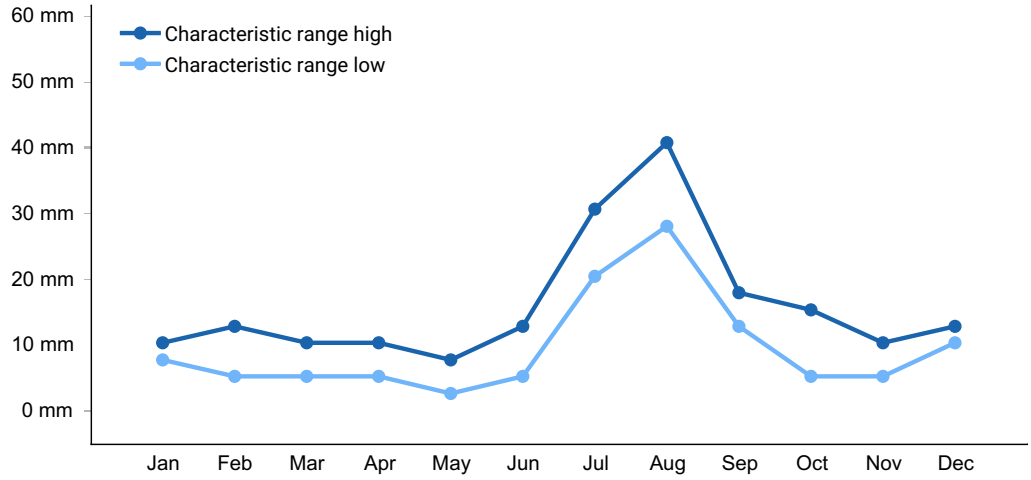

Figure 2. Monthly precipitation range

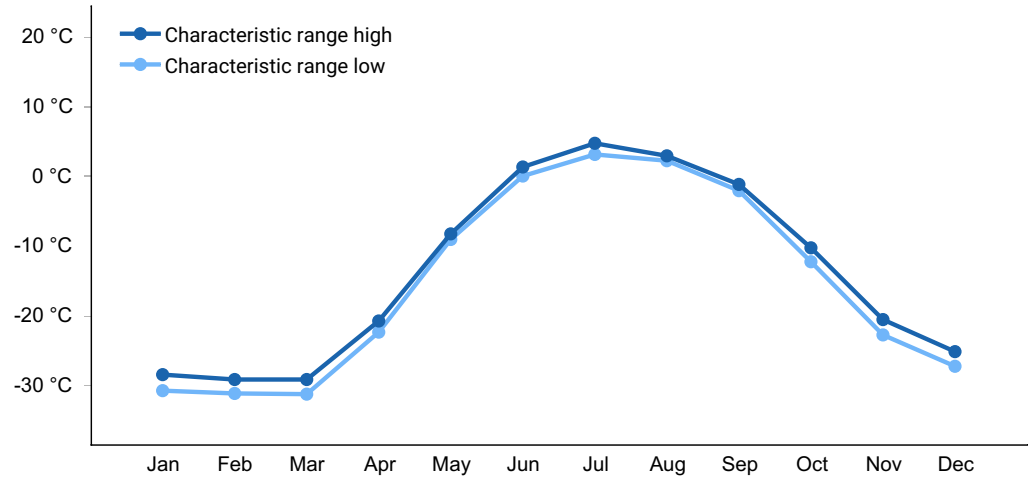

Figure 3. Monthly minimum temperature range

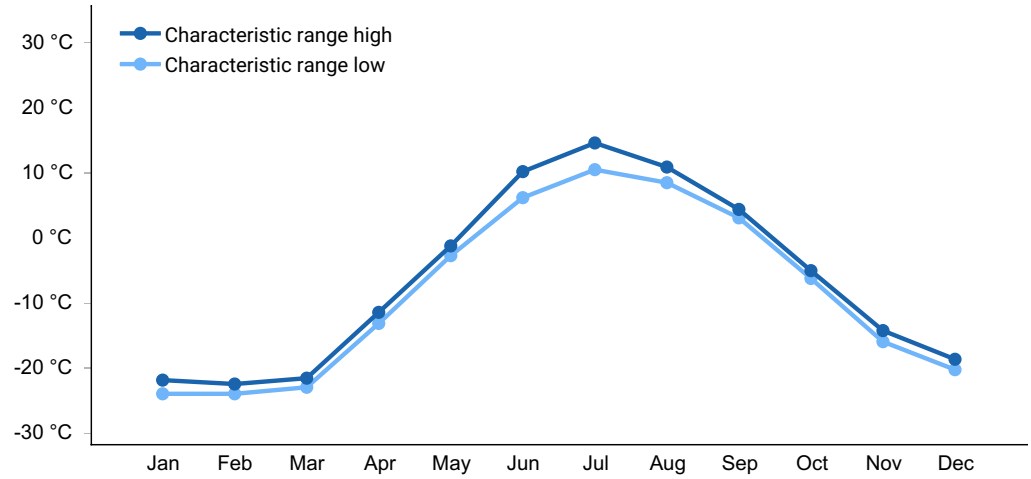

Figure 4. Monthly maximum temperature range

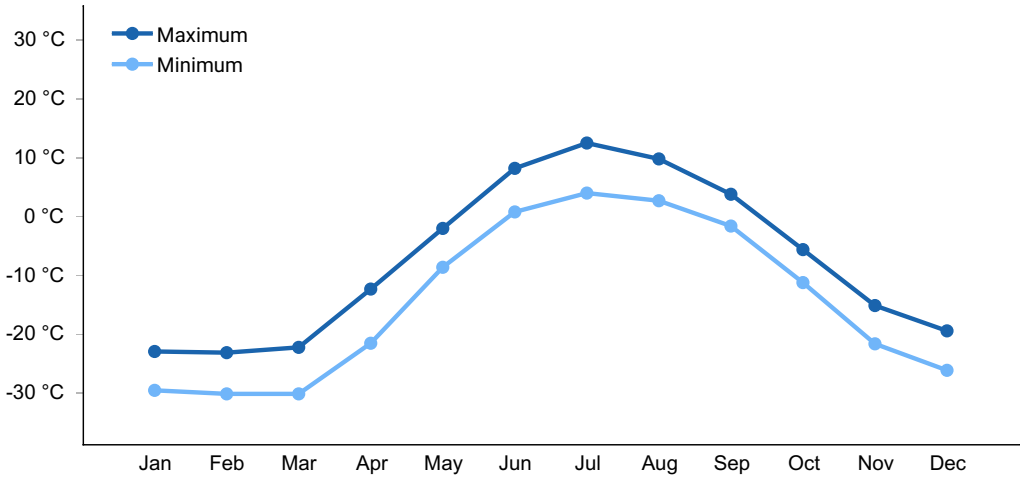

Figure 5. Monthly average minimum and maximum temperature

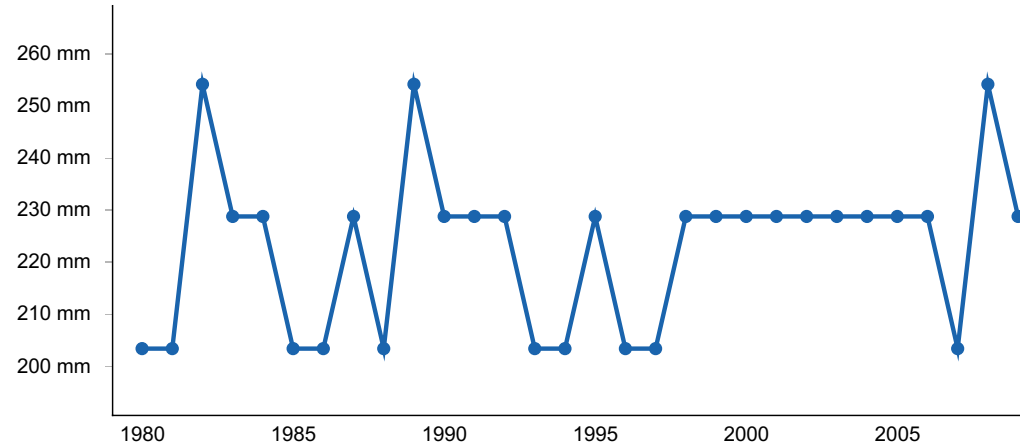

Figure 6. Annual precipitation pattern

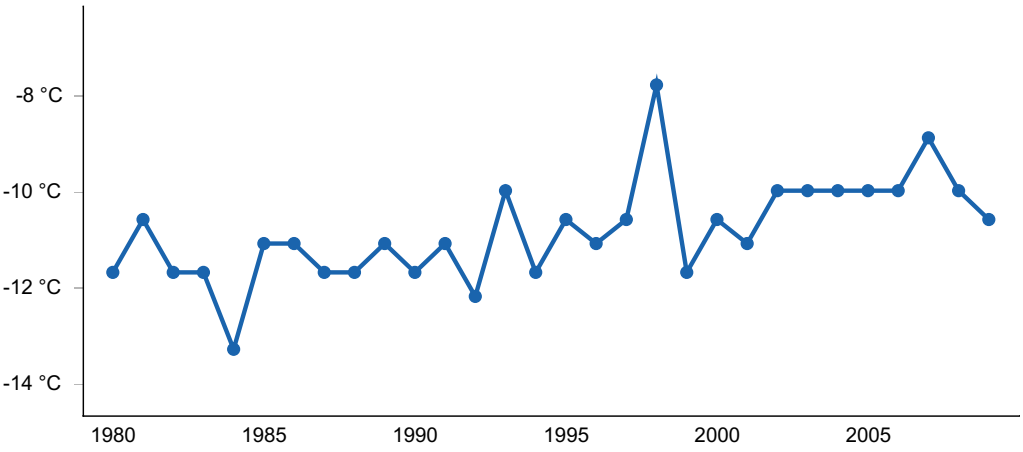

Figure 7. Annual average temperature pattern

Climate stations used

- (1) BARROW POST ROGERS AP [USW00027502], Barrow, AK
- (2) KUPARUK [USC00505136], Prudhoe Bay, AK
- (3) PRUDHOE BAY [USC00507780], Prudhoe Bay, AK

Influencing water features

In the associated shore complex, periodic tidal flooding, precipitation, and groundwater discharge are the main sources of water (Smith et al. 1995; USDA-NRCS 2008).

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

Wetland description

This ecological site is classified as an estuarine fringe wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008).

Soil features

- Soils formed in organic matter and marine deposits.
- Rock fragments do not occur on the soil surface.
- Mineral soils are capped with eight inches of mucky peat. Surface mineral horizons are cryoturbated muck and fine sandy loam.
- While soils are considered very deep, permafrost is a restriction that occurs at very shallow to moderate depths (9 to 33 inches).
- Subsurface rock fragments are not typical in the soil profile. On occasion, rocks range between 0 and 10 percent of the soil profile by volume.
- The pH of the soil profile ranges from slightly acidic to neutral.
- Soils are considered very poorly drained.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Marine deposits
Surface texture	(1) Mucky fine sandy loam
Family particle size	(1) Coarse-loamy
Drainage class	Very poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	23–84 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	6.1–11.94 cm
Calcium carbonate equivalent (25.4-101.6cm)	0%

Clay content (0-50.8cm)	4–6%
Electrical conductivity (25.4-101.6cm)	0–1 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0–3
Soil reaction (1:1 water) (25.4-101.6cm)	6.1–7.2
Subsurface fragment volume <=3" (0-152.4cm)	0%
Subsurface fragment volume >3" (0-152.4cm)	0%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Moderately rapid to rapid
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 (0-101.6cm)	Not specified
Calcium carbonate equivalent (25.4-101.6cm)	Not specified
Clay content (0-50.8cm)	Not specified
Electrical conductivity (25.4-101.6cm)	Not specified
Sodium adsorption ratio (25.4-101.6cm)	Not specified
Soil reaction (1:1 water) (25.4-101.6cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	0–5%
Subsurface fragment volume >3" (0-152.4cm)	0–5%

Ecological dynamics

Saltwater Influences and vegetative succession

Within the shore complex, there are multiple landforms such as tidal flats, foredunes, estuaries, tidal marshes, and backshores each with unique tidal influences. Tidal flats, foredunes, lower levels of tidal marshes, and estuaries are all proximal to the ocean and receive frequent salt spray and/or routine tidal flooding. Backshores and upper levels of tidal marshes are comparatively distal landforms that receive tidal flooding only during exceptionally severe storms. Based on the associated soils and vegetation, this ecological site occurs on distal landforms within the shore complex.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. crowberry - oval-leaf willow / looseflower alpine sedge - water sedge / Sphagnum - Schreber's big red stem moss

State 1
Reference State

Figure 8. Photo of reference state vegetation (in Macander et al. 2020).

The reference plant community is open low scrub (Viereck et al. 1992). One plant community was identified within the reference state and is occasionally to rarely inundated from strong tidal surges or extreme high tides. The vegetation modeled for this ecological site has limited data and is considered provisional.

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- oval-leaf willow (*Salix ovalifolia*), shrub
- Alaska bog willow (*Salix fuscescens*), shrub
- water sedge (*Carex aquatilis*), grass
- looseflower alpine sedge (*Carex rariflora*), grass
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous

Community 1.1
crowberry - oval-leaf willow / looseflower alpine sedge - water sedge / Sphagnum - Schreber's big red stem moss

Community 1.1 is characterized as open low scrub (Viereck et al. 1992). Common and abundant understory species include crowberry, oval-leaf willow, Alaska bog willow, looseflower alpine sedge, Sphagnum moss, and Schreber's big red stem moss (Landfire 2009; Viereck et al. 1992). The binomial name of these and other associated plants can be found in the below dominant plant species table.

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- oval-leaf willow (*Salix ovalifolia*), shrub
- Alaska bog willow (*Salix fuscescens*), shrub
- dwarf birch (*Betula nana*), shrub
- looseflower alpine sedge (*Carex rariflora*), grass
- water sedge (*Carex aquatilis*), grass
- circumpolar reedgrass (*Calamagrostis deschampsioides*), grass
- Anderson's alkaligrass (*Puccinellia andersonii*), grass
- sphagnum (*Sphagnum*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Additional community tables

Animal community

Not available

Hydrological functions

Not available

Recreational uses

Not available

Wood products

Not available

Other information

Not available

Inventory data references

The vegetation modeled for this site has limited data and is considered provisional. The associated model was largely developed from NRCS staff with working knowledge of the area and literature review.

Other references

Alaska Interagency Coordination Center (AICC). 2022. http://fire.ak.blm.gov/.
CAVM 2022.

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

Macander, M.J. Well, A.F., McNown R.W., Christopherson T. 2020. Land cover mapping, north slope of the arctic national wildlife refuge, Alaska, 2019. ABR, Inc. – Environmental Research and Services, Fairbanks, AK.

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).

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

Contributors

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Acknowledgments

Thanks to Marji Patz for her quality control review of these provisional ecological sites in this MLRA.

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	04/10/2026
Approved by	Blaine Spellman
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**