

Ecological site R243XY401AK

Arctic scrub peat polygons

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Accessed: 03/26/2026

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): 243X–Western Brooks Range Mountains, Foothills, and Valleys

Boundaries and important features:

The Western Brooks Range Mountains, Foothills, and Valleys MLRA (MLRA 243X) encompasses the southern slopes of the De Long Mountains, the Baird Mountains, the Noatak River drainage, and the lower Kobuk River drainage. The southern limit of the area includes the western Lockwood Hills, Sheklukshuk and Waring Mountains, and Kiana and Igichuk Hills. MLRA 243 makes up 22,705 square miles. This MLRA shares boundaries with MLRAs 242X, 244X, and 245X. MLRA 242X (Northern Seward Peninsula-Selawik Lowlands) has nearly level to rolling plains, river deltas, and extended mountain footslopes. MLRA 244X (Northern Brooks Range Mountains) has steep, rugged, high mountains and narrow valleys. MLRA 245X (Arctic Foothills) has broad, rounded hills and nearly level uplands at the base of the Brooks Range. MLRA 243X shares a less apparent boundary with MLRAs 233 (Upper Kobuk and Koyukuk Hills and Valleys) and 234X (Interior Brooks Range Mountains), where a continental subarctic climate prevails.

Kobuk Valley National Park is located in the south-central portion of MLRA 243X, along the Kobuk River. Kobuk Valley National Park has an area of around 1.75 million acres and was designated to preserve the 100 ft high Great Kobuk Sand Dunes and the surrounding area which includes the Onion Portage caribou migration route. The Noatak National Preserve is located in the north-central portion of the MLRA, along the Noatak River corridor. The Noatak River is the nation's largest unaltered river basin, and the preserve is around 6.5 million acres. 5.7 million acres of the preserve are designated as wilderness. The Noatak River is also a designated National Wild and Scenic River.

The Red Dog Mine is located in the northwestern portion of the MLRA. The Red Dog Mine is the world's largest producer of zinc and has the world's largest zinc reserves. The mine is the primary economic driver of the Northwest Arctic Borough. The Northwest Arctic Borough was formed in 1986 on the economic basis of taxing the mine.

Geology:

The entire area was glaciated during the Early and Middle Pleistocene, except for possibly small portions of the Baird Mountains. By the Late Pleistocene, glaciers had retreated from most of the area, except for the central, upper-elevation portions of the De Long Mountains in the northern part of the MLRA. The valley of the upper Noatak River was likely covered by extensive proglacial lakes during parts of the Pleistocene Epoch. In the mountains, glacial deposits have eroded away or been buried by mountain colluvium and alluvium, which accumulated during the Holocene Epoch across about 60 percent of the present landscape.

Glacial moraines, drift, and outwash deposits are extensive on the lower mountain slopes and in valleys at the mid and lower elevations. These deposits cover about 18 percent of the MLRA. Flood plains, stream terraces, and alluvial fans have recent and Pleistocene fluvial deposits. The underlying bedrock geology consists almost entirely of stratified sedimentary rocks of Paleozoic and Precambrian age and, in some cases, Cretaceous age.

This area is in the zone of continuous permafrost. In the mountains, permafrost is most evident in unconsolidated materials. In the valleys, thick layers of permafrost occur in both fine textured and coarse textured materials. Depth to the base of the permafrost layer may be 1,000 feet (305 meters) or more. In close proximity to water bodies, it may be 600 feet (185 meters) or more. Periglacial features, such as pingos, thermokarst pits, thaw lakes, solifluction lobes, and high- and low-center polygons, are common on-stream terraces, on the lower mountain slopes, and in swales on foothills.

Soils:

The dominant soil orders in this MLRA are Gelisols, Entisols, Inceptisols, and Mollisols. The soils in the area have a gelic soil temperature regime and an aquic or udic soil moisture regime. The Gelisols are shallow or moderately deep to permafrost, occur on fine to gravelly textured sediments, and are very poorly to moderately well drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have thick accumulations of surface organic material and occur in depressions, lake margins, and shallow basins. The Orthels and Turbels have comparably thinner surface organic material with the Turbels being cryoturbated. These widespread soils occur on slopes of mountains, hills, and plains across the MLRA. Inceptisols (suborder Gelepts), Mollisols (suborder Gelolls), and Entisols (suborder Gelents) occur on upper mountain slopes and ridges formed in loamy to stony colluvium and residuum. These soils are shallow to deep and are generally

well drained. Entisols (suborder Cryofluvents) on flood plains formed in stratified loamy, sandy, and gravelly alluvium and are somewhat poorly to well drained.

Vegetation Dynamics:

The mountain slopes and ridges in this area generally support dwarf scrub dominated by *Dryas*, ericaceous shrubs including crowberry, and dwarf willow. Lichens and scattered herbs dominate the ground layer on shallow, rocky soils and exposed sites. There are extensive areas of bare soil and bedrock. On the more mesic sites, sedges, forbs, and mosses cover most of the surface. Areas at the lower elevations and areas of the deeper soils on nearly level uplands, terraces, and basins generally support low willow and ericaceous shrub scrub and mesic graminoid herbaceous communities, commonly with extensive areas of tussock-forming sedges. Saturated sites support wet sedge meadows and wet sedge-moss meadows. Flood plains support a mixture of tall and low scrub dominated by various willows, shrub birch, and alder.

Climate:

Short, generally cool summers and long, very cold winters characterize the continental arctic climate of the area. The average annual precipitation ranges from about 10 to 15 inches (255 to 380 millimeters) at the lower elevations in the western part of this MLRA and along the central Noatak River and from about 20 to 40 inches (510 to 1,015 millimeters) in the mountains. The average annual snowfall is about 35 to 100 inches (90 to 255 centimeters). The average annual temperature ranges from about 8 to 16 degrees F (-13 to -9 degrees C). Snow and freezing temperatures can occur in any month of the year, particularly at the higher elevations.

LRU notes

This area supports two life zones defined by the physiological limits of plant communities along an elevational gradient: arctic lowlands and alpine. In this MLRA, the arctic lowland life zone typically occurs below 1000 feet elevation on average 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. *Betula nana*, *Salix pulchra*, *Ledum palustre*). Above the arctic lowlands 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*, *Saxifraga oppositifolia*, *Empetrum nigrum*). 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 Biophysical Settings – 6817080 – Alaska Arctic Polygonal Ground Shrub-Tussock Tundra (Landfire 2009)

Viereck Communities:

Mixed shrub-sedge tussock tundra– II.C.2.A (Viereck et al. 1992)

Wet sedge meadow tundra - III.A.3.a. (Viereck et al. 1992)

Ecological site concept

- Associated with ice-wedge, high-center polygons on the slopes of plains. These high-center polygons have two distinct microtopographic positions being the domed center and ice-wedge trough. These microtopographic positions have unique site and soil properties that result in a mosaic of vegetation.
- Occurs in the arctic lowland life zone. Elevation ranges between 20 and 1000 feet. Slopes are nearly level to gently sloping and occur on all aspects.
- Soils are derived from organic material and silty loess.
- Soils are very deep but permafrost restriction occur at shallow to moderate depths.
- Soils are wet. The domed centers have poorly drained soils that do not pond. The ice-wedge trough have very poorly drained soils that pond frequently for very long durations.
- The domed centers support mixed shrub-sedge tussock tundra (Viereck et al. 1992), while the ice-wedge troughs support a wet graminoid herbaceous community (Viereck et al. 1992) dominated by sedges.

Associated sites

R243XY201AK	Arctic tussock gravelly frozen slopes Occurs on same hills and plains but on soils that pond and support tussock dominant plant communities.
R243XY402AK	Arctic scrub gravelly frozen slopes Occurs on the same hills and plains but is not associated with ice-wedge, high-center polygons.

Similar sites

R243XY201AK	Arctic tussock gravelly frozen slopes Ecological site 201 shares similar soils but is not associated with ice wedge polygons. Tussock dominant polygon domes have similar plant communities as ecological site 201.
R243XY402AK	Arctic scrub gravelly frozen slopes Ecological site 402 is not associated with ice wedge polygons. Shrub dominant polygon domes have similar plant communities as ecological site 402.

Table 1. Dominant plant species

Tree	Not specified
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Shrub	(1) <i>Betula nana</i> (2) <i>Salix pulchra</i>
Herbaceous	(1) <i>Eriophorum vaginatum</i> (2) <i>Carex bigelowii</i>

Physiographic features

This arctic scrub lowland ecological site (R243XY401AK) is associated with high-center, ice-wedge polygons on the slopes of plains. A well expressed high-center, ice-wedge polygon has a raised center relative to its boundary and has two distinct microtopographic positions: domed center and ice-wedge trough. Representative elevation ranges between 20 and 1000 feet with this ecological site occasionally occurring up to 1550 feet. Slope are nearly level to gently sloping and shows no preference for north-facing or south-facing aspects. Soils do not flood. Associated with negligible to limited amounts of runoff to adjacent, downslope ecological sites.

Domed center:

Soils do not pond. A seasonal water table occurs at very shallow depth (0 to 10 inches).

Ice-wedge trough:

Soils pond frequently for very long durations. A water table occurs at very shallow depth throughout the growing season.



Figure 1. Aerial image of ice-wedge polygons on the arctic coastal plain (MLRA 246X). Notice the two distinct microtopographic positions: domed centers and ice-wedge trough.

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Talf
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Landforms	(1) Alluvial plain > Plain > High-center polygon
Runoff class	Negligible to low
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	6–305 m
Slope	0–8%
Ponding depth	30 cm
Water table depth	0–25 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	6–472 m
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

MLRA 243X is characterized by an arctic continental climate having short, warm summers and long, cold, dark winters. The average annual mean temperature is 20.1 degrees Fahrenheit. The warmest months span June through August, with normal maximum temperature ranging from 57 to 61 degrees Fahrenheit. The coldest months are December through February, with normal minimum temperature ranging from -15 to -10 degrees Fahrenheit. This MLRA receives high annual precipitation with the summer months being the wettest. Average annual precipitation ranges from 9 to 32 inches. Approximately 40 percent of the annual precipitation occurs during the months of July through September.

Snow persists in the alpine and arctic lowland life zones throughout much of the year. A lack of trees and tall shrubs also means that this site is subject to strong winds, further exacerbating cold temperatures. This site has a much shorter growing season than sites in lower elevation areas and the growing season is significantly colder for associated vegetation.

Table 4. Representative climatic features

Frost-free period (characteristic range)	55-85 days
Freeze-free period (characteristic range)	40-70 days
Precipitation total (characteristic range)	356-660 mm
Frost-free period (actual range)	45-90 days
Freeze-free period (actual range)	30-75 days
Precipitation total (actual range)	229-813 mm
Frost-free period (average)	69 days
Freeze-free period (average)	54 days
Precipitation total (average)	508 mm

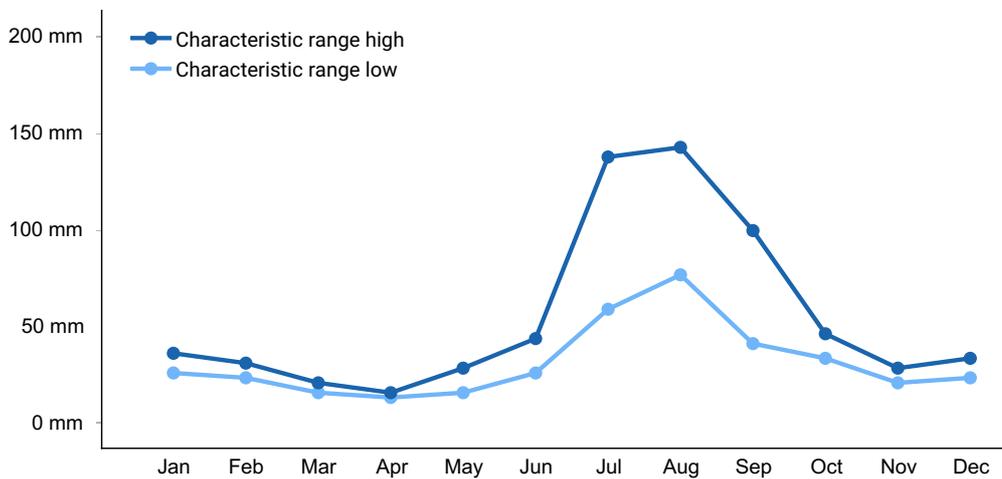


Figure 2. Monthly precipitation range

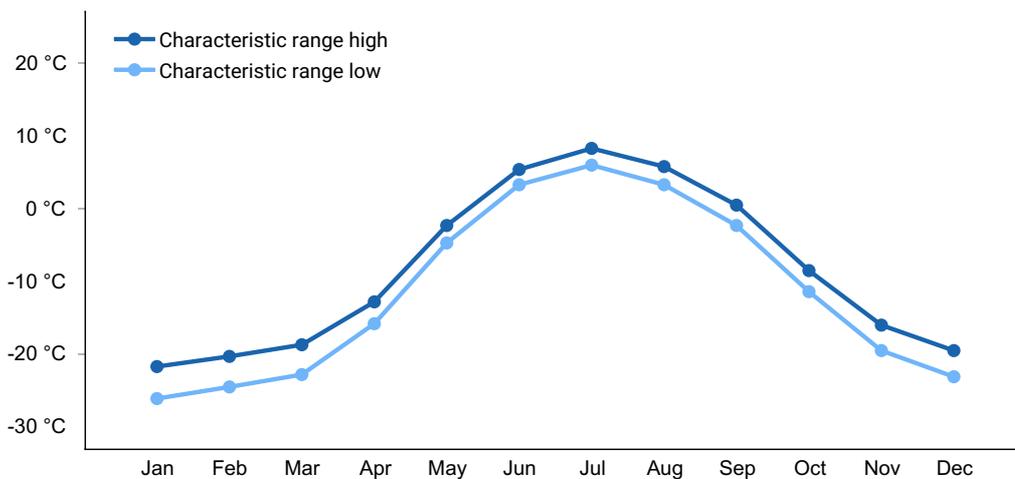


Figure 3. Monthly minimum temperature range

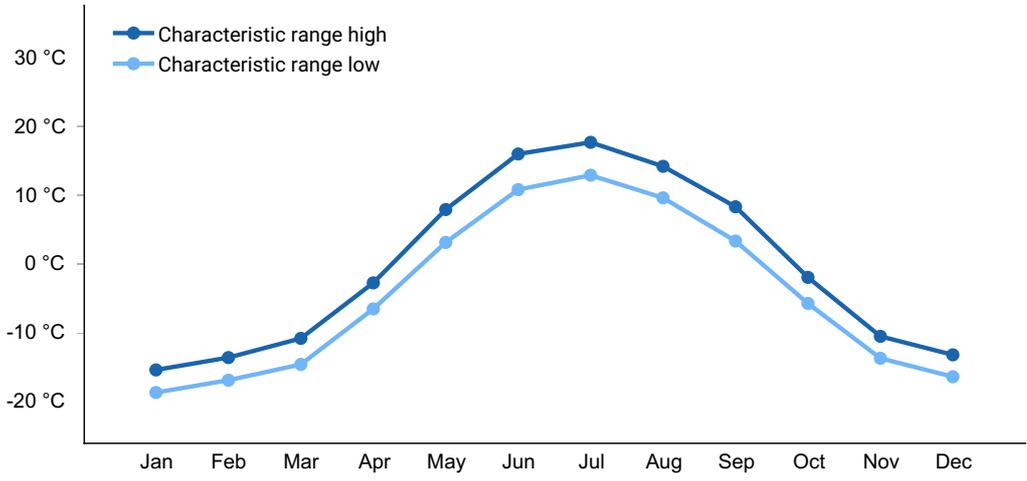


Figure 4. Monthly maximum temperature range

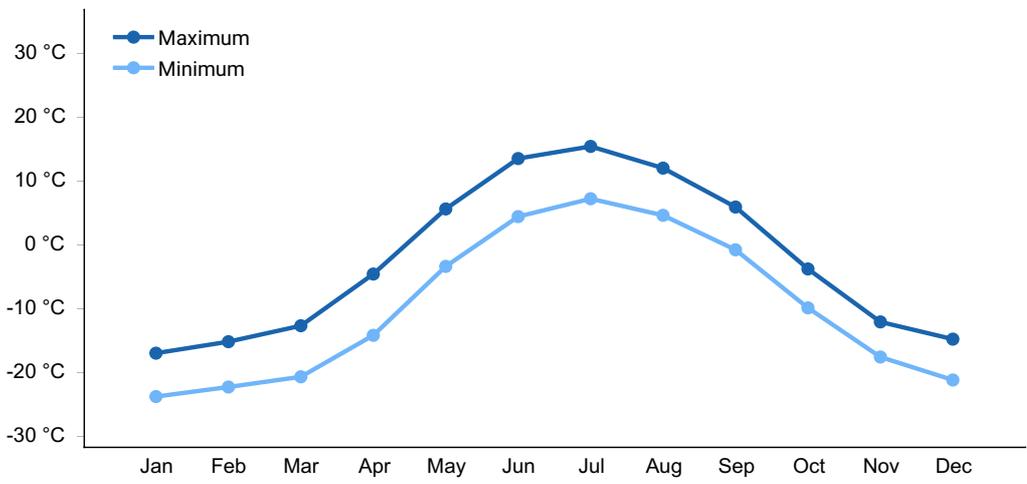


Figure 5. Monthly average minimum and maximum temperature

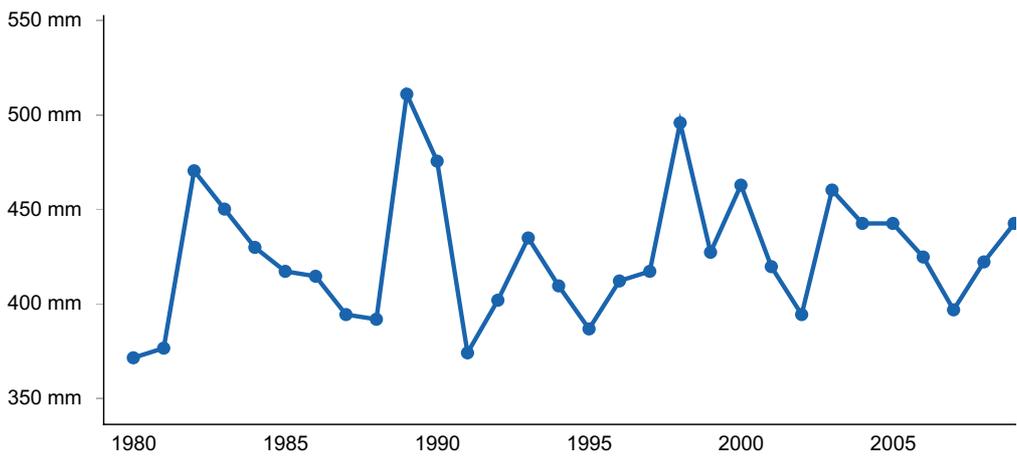


Figure 6. Annual precipitation pattern

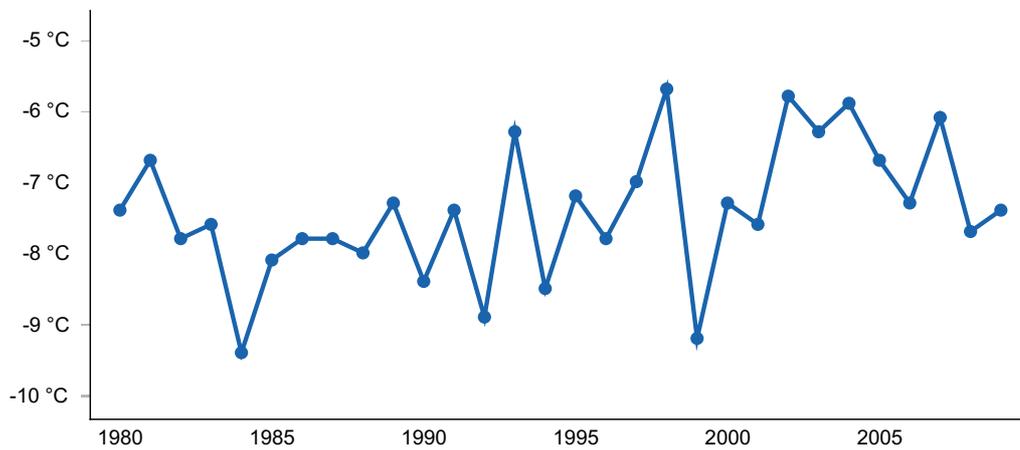


Figure 7. Annual average temperature pattern

Influencing water features

Organic soil flats, or extensive peatlands, differ from mineral soil flats, in part because their elevation and topography are controlled by vertical accretion of organic matter. They occur commonly on flat interfluvies but may also be located where depressions have become filled with peat to form a relatively large flat surface. Water source is dominated by precipitation, while water loss is by saturation overland flow and seepage to underlying ground water.

Wetland description

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

Soil features

- Soils formed in organic material and loess.
- Rock fragments do not occur on the soil surface.
- Capped with up to 32 inches of organic material.
- The surface mineral horizon occurs at moderate depths and is a mucky silt loam derived from silty loess. This silty layer is thick, extending to very deep depths.
- These organic-rich soils do not have subsurface rock fragments.
- Soils are very deep. Permafrost restrictions occur at moderate depth (26 to 39 inches).
- Soils range from extremely acidic to strongly acidic.
- Soils are wet. The domed center of the ice-wedge polygons are considered poorly drained and the ice-wedge troughs very poorly drained.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Loess
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Surface texture	(1) Mucky peat
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Rapid
Depth to restrictive layer	66–99 cm
Soil depth	152 cm
Surface fragment cover ≤3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.19–40.39 cm
Calcium carbonate equivalent (25.4-101.6cm)	0%
Clay content (0-50.8cm)	0%
Electrical conductivity (25.4-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0
Soil reaction (1:1 water) (25.4-101.6cm)	3.6–4.9
Subsurface fragment volume ≤3" (0-152.4cm)	0%
Subsurface fragment volume >3" (0-152.4cm)	0%

Table 6. Representative soil features (actual values)

Drainage class	Very poorly drained to poorly drained
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 (0-101.6cm)	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)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

The Western Brooks Range MLRA (MLRA243X) occurs in the arctic biome this site is exposed to a variety of harsh environmental conditions. This area has cool, short summers and long 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. Sites with greater than 25 percent lichen cover tend to be exposed to the wind and accumulate little winter snow (Viereck et al. 1992).

Eriophorum vaginatum (Tussock cottongrass) is the primary tussock-former at this site. Tussock cottongrass is found in acidic, nutrient-poor, poorly drained soils. Tussock cottongrass dominates tussock tundra and tussock-shrub tundra in the Arctic. Ericaceous shrubs, birches, willows, and alders will often grow in tussock cottongrass communities.

Low- to moderate-severity fire generally top-kills large tussock cottongrass plants. However, some moderate and severe fire may kill tussock cottongrass plants. Young tussocks may be most susceptible to fire-caused mortality, seeds are unlikely to survive fire if burned. The mean fire -return interval for tussock cottongrass tundra and tussock cottongrass-shrub tundra range from 50 to greater than 1,000 years (FEIS 2024).

Ice-wedge polygons genesis and transitions

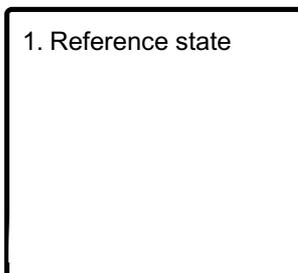
Soil contraction at extremely cold temperature results in incredible stress that is relieved through cracking of the soil profile. During spring snowmelt, these soil cracks fill with water that immediately freeze which mark the start of an ice wedge. Continued ground contraction and cracking and snowmelt filling and freezing within these cracks results in the growth of ice wedges. The growth of these ice wedges can result in formation of low-center polygons. Low-center polygons are associated with actively growing or stable ice-wedges. Erosion, deposition, or thawing of ice-wedges lead to development of high-center polygons (Landfire 2009). The formation of ice-wedges and the natural transition from low-

to high-center polygons occurs on time scales exceeding several hundreds of years.

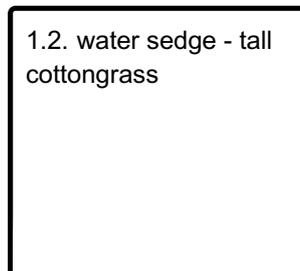
This ecological site relates to low-relief, high-center polygons, which are polygon with relatively flat centers that are raised relative to its boundary. There are two associated plant communities related to polygon microtopography: domed center of the polygon (community 1.1) and ice wedge trough (community 1.2). The troughs are up to 6 feet wide, perennially ponded with shallow water, and support a wet graminoid herbaceous community (Vioreck et al. 1992) dominated by various sedges. The polygon dome range between 10 and 100 feet wide, have comparatively drier soils, and support mixed shrub-sedge tussock tundra (Vioreck et al. 1992).

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1

Reference state

The reference state describes two plants communities associated with ice-wedge, high-center polygons. All plant communities associated with this ecological site have limited data, so the state-and-transition model is provisional.

Dominant plant species

- dwarf birch (*Betula nana*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- water sedge (*Carex aquatilis*), grass
- tall cottongrass (*Eriophorum angustifolium*), grass

Community 1.1

dwarf birch - tealeaf willow / tussock cottongrass / Sphagnum - turgid Aulacomnium moss

Plant community 1.1. occurs on the domes of high-center polygons and is characterized as mixed shrub-sedge tussock tundra (Viereck et al. 1992). Dominant plants include tealeaf willow, dwarf birch, tussock cottongrass, Sphagnum, Polytrichum moss, splendid feathermoss, and turgid Aulacomnium moss (Landfire 2009),

Dominant plant species

- dwarf birch (*Betula nana*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- white arctic mountain heather (*Cassiope tetragona*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- wideleaf polargrass (*Arctagrostis latifolia*), grass
- sphagnum (*Sphagnum*), other herbaceous
- polytrichum moss (*Polytrichum strictum*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- turgid aulacomnium moss (*Aulacomnium turgidum*), other herbaceous

Community 1.2

water sedge - tall cottongrass

Plant community 1.2 occurs in the ice-wedge troughs of high-center polygons and is characterized as wet sedge meadow tundra (Viereck et al. 1992). Dominant plants include water sedge and tall cottongrass.

Dominant plant species

- water sedge (*Carex aquatilis*), grass
- tall cottongrass (*Eriophorum angustifolium*), grass

Additional community tables

Animal community

Mammals common to MLRA 243 include brown bear, caribou, moose, musk ox, black bear, wolf, red fox, and rodents. Many species of migratory waterfowl and shore birds nest in the abundant ponds and wetlands. Raptors include gyrfalcon, peregrine falcon, golden

eagle, hawks, and owls. Arctic char and Arctic grayling are in most of the rivers. Lake trout and northern pike are common in many lakes.

Hydrological functions

N/A

Recreational uses

This remote area of Alaska is mostly undeveloped wildland and is sparsely populated. The area provides excellent opportunities for hunting and other kinds of wildland recreation. Most visitors are served by air taxi, guiding, and outfitting companies operating out of the major Alaska communities. Most of the communities are along the major rivers or lakes or on the coast. Kobuk Valley National Park is located within the Western Brooks Range MLRA. Visitors to Kobuk Valley NP typically fly in and camp / backpack in the park (USDA Agriculture Handbook 296).

Local residents use this area primarily for subsistence hunting, fishing, and gathering. In the Noatak Valley, many families leave their homes in villages in the spring and spend the summers at subsistence camps gathering salmon, caribou, and various wild greens and berries on the tundra.

Wood products

N/A

Other products

N/A

Other information

N/A

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.

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Contributors

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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	03/26/2026
Approved by	Blaine Spellman
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):**
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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:**
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