

Ecological site R245XY402AK

Arctic scrub gravelly frozen slopes

Last updated: 5/28/2025
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General information

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

MLRA notes

Major Land Resource Area (MLRA): 245X–Arctic Foothills

The Arctic Foothills MLRA (MLRA 245X) includes the broad, rounded hills and nearly level uplands at the northern base of the Brooks Range from Point Hope, in the west, to Demarcation Point, in the east. It makes up about 45,565 square miles. Periglacial features occur throughout the area. The area is entirely undeveloped wildland and is sparsely populated. It is in the zone of continuous permafrost. MLRA 245X has boundaries based on physiography with MLRAs 242X, 243X, 244X, and 246X. MLRA 242X (Northern Seward Peninsula-Selawik Lowlands), near Kivalina Lagoon, is distinguishable by nearly level to rolling plains, river deltas, and extended mountain footslopes. MLRA 243X (Western Brooks Range Mountains), encompasses the southern slopes of the De Long Mountains, the Baird Mountains, the Noatak River drainage, and the lower Kobuk River drainage. MLRA 244X (Northern Brooks Range Mountains) has steep, rugged, high mountains and narrow valleys. MLRA 246X (Arctic Coastal Plain) has a level to gently rolling plain along the coast of the Arctic Ocean. MLRA 245 also is bordered by the Chukchi Sea. Land ownership: MLRA 245X encompasses the northernmost portions of the Noatak National Preserve, Gates of the Arctic National Park, and the Arctic National Wildlife Refuge (ANWR). The Noatak National Preserve is located 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 is designated as wilderness. The Noatak River is also a designated National Wild and Scenic River. Gates of the Arctic National Park is the northernmost national park in the United States, situated entirely north of the Arctic Circle. The area of the park and preserve is the second largest in the US at 8,472,506 acres, second only to Wrangell-St. Elias National Park and Preserve. The park features six Wild and Scenic Rivers. The Arctic National Wildlife Refuge (ANWR) is a 19,286,772-acre wildlife refuge located in northeastern Alaska. It is the largest wildlife refuge in the country. The ANWR is home to a diverse range of endemic mammal species and hundreds of species of migratory birds. The majority of MLRA 245 is managed by the BLM, USFWS, and the State of Alaska. The BLM manages 17,027,543 acres, around 58 percent of the MLRA. The USFWS manages 4,650,388 acres, around 16 percent of the MLRA, and the State of Alaska has a patent on 10,375,908 acres of the MLRA, around 36 percent of the MLRA. Climate: Brief, cool summers and long, very cold winters characterize the arctic climate of the Arctic Foothills MLRA. The average annual precipitation ranges 11.9 and 12.8 inches. Average annual snowfall ranges from about 40 to 60 inches. The average annual temperature ranges from 12 to 29 degrees Fahrenheit. The average freeze-free period is between 10 and 55 days. Geology: This MLRA remained unglaciated during the Pleistocene Epoch, except possibly for the upper areas along the edge of the Northern Brooks Range Mountains MLRA. Bedrock and coarse to fine rubble cover the surface of convex uplands. Elsewhere, Quaternary surface deposits include various alluvial, eolian, or glaciofluvial materials. Slightly modified to highly modified moraines and drift occur in areas adjacent to the Brooks Range. The bedrock geology consists primarily of Cretaceous and Late Paleozoic to Lower Mesozoic stratified sedimentary rocks or uplifted Cretaceous and Tertiary continental deposits. Soils: The dominant soil order within this MLRA is Gelisols with Inceptisols covering a comparatively minor extent. These Gelisols are shallow or moderately deep to permafrost and are typically poorly to very poorly drained. Miscellaneous (nonsoil) areas make up about 6 percent of this area and are primarily rock outcrop, talus, and ice. Gelisols are soils that have permafrost within 100 cm of the soil surface and/or have gelic materials within 100 cm of the soil surface and have permafrost within 200 cm. Gelic materials are mineral or organic soil materials that have evidence of cryoturbation (frost churning) and/or ice segregation in the active layer (seasonal thaw layer) and/or the upper part of the permafrost (NRCS 2024). The common suborders of Gelisols within this MLRA are Turbels, Histels, and Orthels. The Histels have thick accumulations of surface organic material and are associated with high-center polygons. The Orthels and Turbels have comparably thinner surface organic material and occur on high floodplains, stream terraces, low-center polygons, and the slopes of hills and plains. Turbels show signs of cryoturbation while Orthels do not. Inceptisols lack permafrost and are soils that have altered horizons that have lost bases or iron and aluminum but retain some weatherable minerals. They do not have an illuvial horizon enriched with either silicate clay or with an amorphous mixture of aluminum and organic carbon (NRCS 2024). The common suborder of Inceptisols in this MLRA are Gelepts, which are associated with dry and gravelly soils on the slopes of hills and plains. Vegetation dynamics: The hills and plains in this MLRA support dwarf scrub vegetation dominated by Dryas, black crowberry, and dwarf willow communities. On shallow, rocky soils and exposed landforms, lichens and scattered herbs dominate the ground layer. On more mesic soils, sedges, forbs, and mosses cover most of the surface. The mesic and deeper soils in valleys and basins and on terraces generally support low and dwarf willow and ericaceous shrub scrub and mesic graminoid herbaceous communities, commonly with extensive areas of tussock-forming sedges. Depressions, drainageways, and other

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 some alder.

Classification relationships

Landfire Biophysical Settings – 7606821 – Alaska Arctic Scrub Birch-Ericaceous Shrubland – Infrequent Fire (Landfire 2009) Viereck Communities: Open Low Mesic Shrub Birch-Ericaceous Shrub – II.C.2.c (Viereck et al. 1994)

Ecological site concept

• Arctic climate • Associated landforms are glaciated plains and hills. • Soils are derived from gravelly cryoturbate • Soils are somewhat poorly to poorly drained, there is no flooding or ponding at this site. • Soils have permafrost at 47 inches. • The reference plant community is characterized as an open low mesic shrub birch-ericaceous shrub (Viereck et al 1994) with the dominant plants being dwarf birch, lingonberry, and wideleaf polargrass.

Associated sites

R245XY201AK	Arctic tussock gravelly frozen slopes Ecological sites 201 and 402 occur on the same slopes of hills and plains across this MLRA. Ecological site 201 ponds frequently, while ecological site 402 does not pond. These differences result in ecological site 402 have much less common and abundant tussock sedge cover.
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Similar sites

R245XY403AK	Arctic scrub gravelly slopes Ecological site 403 is a dryas dwarf-shrubland, while site 402 is a shrub-birch ericaceous shrubland. Both are dominated by shrubs as opposed to tussock forming grasses, but their dominant species are different.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Betula nana</i> (2) <i>Vaccinium uliginosum</i>
Herbaceous	(1) <i>Arctagrostis latifolia</i> (2) <i>Poa arctica</i>

Physiographic features

The arctic scrub gravelly frozen slopes ecological site occurs on glaciated plains and small hills. Elevation ranges between 20 up to 4750 feet. Slope is nearly level on plains, and ranges from gently to strongly sloping on hills. This site occurs on all aspects and shows no preference for north-facing or south-facing slopes. This ecological site has a water table at the soil surface for short periods of the growing season, neither flooding nor ponding occurs at this site.

Table 2. Representative physiographic features

Landforms	(1) Plains > Hill
Runoff class	Medium

Flooding frequency	None
Ponding frequency	None
Elevation	70 – 630 m
Slope	10 – 20 %
Water table depth	0 – 30 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 frequency	Not specified
Elevation	10 – 1,450 m
Slope	0 – 20 %
Water table depth	Not specified

Climatic features

The arctic climate of MLRA 245X is characterized by brief, cool summers and long, very cold winters. The average annual precipitation ranges between 7 and 19 inches . The average annual snowfall ranges from about 40 to 60 inches. The average annual temperature ranges from 10 to 20 degrees Fahrenheit. The average freeze-free period ranges between 39 and 82 days.

Table 4 Representative climatic features

Frost-free period (characteristic range)	20-40 days
Freeze-free period (characteristic range)	40-80 days
Precipitation total (characteristic range)	310-330 mm
Frost-free period (actual range)	0-70 days

Freeze-free period (actual range)	20-100 days
Precipitation total (actual range)	180-480 mm
Frost-free period (average)	30 days
Freeze-free period (average)	60 days
Precipitation total (average)	310 mm

Influencing water features

Organic soil flats or extensive peatlands occur commonly on flat interfluves 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. Raised bogs share many of these characteristics but may be considered a separate class because of their convex upward form and distinct edaphic conditions for plants. Portions of the Everglades and northern Minnesota peatlands are common examples of organic soil flat wetlands.

Wetland description

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

Soil features

- Soils formed in loess and gravelly cryoturbate.
- Surface rock fragments cover up to 15 percent of the soil surface
- The surface mineral horizon is a mucky silt loam that lacks rock fragments. This horizon is 5 inches thick.
- Soils are very deep.
- Permafrost is a restriction that occurs at shallow to deep depths (12 to 47 inches).
- The pH of the soil profile ranges from strongly acidic to slightly acidic.
- These are wet soils that are considered somewhat poorly to poorly drained.

Table 5. Representative soil features

Parent material	(1) Eolian deposits (2) Cryoturbate
Surface texture	(1) Silt loam (2) Peat
Family particle size	(1) Coarse-loamy (2) Loamy-skeletal
Drainage class	Poorly drained to somewhat poorly drained

Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	30 – 120 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	0 – 20 %
Available water capacity (0-101.6cm)	9.91 – 11.94 cm
Clay content (0-50.8cm)	0 – 10 %
Electrical conductivity (25.4-101.6cm)	Not specified
Sodium adsorption ratio (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	20 – 40 %
Subsurface fragment volume >3" (0-152.4cm)	0 – 20 %

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 (0-101.6cm)	7.62 – 19.81 cm
Clay content (0-50.8cm)	0 – 10 %
Electrical conductivity (25.4-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	0 – 40 %
Subsurface fragment volume >3" (0-152.4cm)	0 – 20 %

Ecological dynamics

The Arctic Foothills MLRA has a harsh climate and cold soils and occurs in the zone of continuous permafrost. This MLRA occurs in the arctic biome and has a growing season that is both short and cold. As a result, the vertical and horizontal structure of vegetation is severely limited. Vegetation within the arctic biome is typically restricted to dwarf shrubs, mosses, and lichens.

This ecological site (R245Y402AK) can be described as a mesic shrub birch-ericaceous shrub community. These communities occupy extensive areas of mesic slopes in the Alaska Range, alpine areas of interior and south-central Alaska, and in northern and Western Alaska (Vioreck et al. 1994).

Betula nana (dwarf birch) is the dominate shrub and is a common arctic species with a circumpolar distribution, it is characteristic of low, open, mixed-shrub and tussock tundra communities. It is also found in black and white spruce communities, including black spruce-birch, which is the most widespread ecosystem type in Alaska (FEIS 2024). *Betula nana* regenerates after low and moderate severity fire events by sprouting from the root crown and rhizomes (FEIS 2024). The samaras are dispersed by wind and can invade burned areas from off site. Successful establishment from seed is rare in *Betula nana* (FEIS 2024).

Arctagrostis latifolia (wideleaf polargrass) is a dominant graminoid at this site. Wideleaf polargrass is a circumboreal species, it grows in wet meadows, along rivers, on tundra, and in freshwater marshes. It is best adapted to cold, boggy soils and mesic upland soils (FEIS 2024). Its associated species include *Betula nana*, *Cornus canadensis*, *Ledum groenlandicum*, and *Empetrum nigrum*. Wideleaf polargrass is top killed by fire and survives fire by sprouting from rhizomes. It is a prolific colonizer in post-fire areas.

Fire Dynamics and Succession

Reported fire history in this MLRA spans 1974 to 2021. During this time period, there were 41 recorded fires. The mean fire size was

approximately ten thousand acres. The largest fire was the 2007 Anaktuvuk River fire, burning 256,733 acres (AICC 2024).

The number of fires that burn in tundra systems are limited by ignitions, prevalence of atmospheric moisture, and fuel moisture content or fuel availability. Fires in the tundra happen less often than in boreal systems (NPS 2024). Fires can be sporadic and widely distributed. The fire return intervals vary widely in tundra systems, from 30 years to over 1,000 years. In the past, fires have burned more frequently on the Seward Peninsula and in the Noatak Valley than in other tundra regions. This is due to slightly warmer and drier conditions and higher amounts of plants and shrubs above ground such as tussock cottongrass (NPS 2024).

Vascular and non-vascular plant succession dynamics vary in post-fire environments. Data collected in the footprint of the abnormally severe Anaktuvuk River fire (ARF) shows that four years after the burn, above-ground net primary productivity of vascular plants was equal in burned and unburned areas, though total live biomass was less (Bret-Harte et al 2013). Graminoid biomass had recovered to unburned levels, but shrubs had not. Most of the vascular plant biomass had resprouted from surviving underground parts. Much greater changes were observed in the biomass and composition of the non-vascular plant community (Bret-Harte et al 2013). Lichen biomass appears to take decades to centuries to recover from the disturbances of fires, particularly under a warming climate (Racine et al 2004).

Tussock cottongrass is the primary tussock forming plant species in arctic tundra. Tussock cottongrass burns easily yet is very hardy. It grows quickly and is very productive, forming a tussock made of fine dead fuels from the previous year. These fine fuels burn quickly and easily. Tundra fires are usually wind driven and move rapidly, burning through years of accumulated tussock grass thatch. The tussock growth protects the cottongrass roots and plant tissues from fire. These plants and shrubs recover and grow vigorously after fire, benefitting from released nutrients and warmer soils (NPS 2024).

Fire impacts soil composition and structure (Li et al 2021). Fires will often partially or completely consume the organic material layer, depending on the severity of the fire. Fire can also impact permafrost. On average, forest fires reduce the permafrost extent by up to 9-16 percent and accelerate permafrost thaw by five years. The effects of wildfire on permafrost are much larger in forested areas than in tundra, bogs, and fens (Li et al 2021).

There are over 143 million acres of arctic and subarctic tundra in Alaska, most of which is designated in a limited fire management option. A limited fire management option is one of four fire management options outlined in the Alaska Interagency Wildland Fire Management Plan (AICC 2024). A 'limited' approach is the most hands-off management option, meaning the fire will be left to behave naturally and fill its natural ecological role (AICC 2024).

Arctic tundra areas are experiencing warmer temperatures and an increase in fire activity over the past twenty years. Climate model forecasts show more warming in the future, particularly in the high northern areas. This could affect the length of the growing season, how well plants and shrubs grow, and rain and snowfall. A longer and more robust growing season could likely impact trends regarding number and intensity of fires in the arctic tundra.

State and transition model

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Mammals common to the area include brown bear, wolf, wolverine, caribou, Arctic fox, snowshoe hare, tundra hare, hoary marmot, brown lemming, and northern bog lemming. Musk oxen, which were decimated by hunting in the late 1800s, are becoming more common in many places. Common birds include willow ptarmigan, rough-legged hawk, American golden plover, short-eared owl, and snowy owl. Arctic char and Arctic grayling are in most of the rivers.

Recreational uses

Local residents use this area primarily for subsistence hunting, fishing, and gathering. Sport hunting, fishing, and gathering. Sport hunting and other kinds of wildland recreation are becoming increasingly important. Most visitors are served by air taxi, guiding, and outfitting companies' operation out of the major Alaska communities. Most of the communities in the area are along the major rivers at the lower elevations or are on the coast. Gates of the Arctic National Park, the Arctic National Wildlife Reserve, and the Noatak National Preserve are all partially located in MLRA 245. Gates of the Arctic National Park is the least visited national park in the United States and has no formal infrastructure or trails.

Other products

Some limited extraction of minerals, including oil and gas, occurs only locally.

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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Approval

Blaine Spellman, 5/28/2025

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	10/02/2026
Approved by	
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:
