Ecological site R245XY201AK
Arctic tussock 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 – 6716942 – Alaska Arctic Tussock Tundra – Infrequent Fire Viereck Communities: Tussock tundra – III.A.2.D (Viereck et al. 1992)

Ecological site concept

• Arctic climate • Associated landforms are stream terraces and slopes of plains • Soils are derived from organic material, silty eolian deposits, and gravelly colluvium • Soils are considered very poorly drained and ponds frequently for very long durations. • Soils have permafrost at 12 inches • The reference plant community is characterized as a tussock tundra (Viereck et al 1992) with the dominant plants being tussock cottongrass, Bigelow's sedge, dwarf birch, and tealeaf willow.

Associated sites

R245XY402AK	**Arctic scrub 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.

Similar sites

R245XY401AK	**Arctic polygon complex** Ecological site 401 is a complex of ecological sites with a mosaic of vegetation that is associated with low- and high-center polygonal ground. While the center of high-center polygons share similar tussock dominated vegetation, ecological site 201 is not associated with ice-wedge polygons and lacks a similar mosaic of vegetation and soils.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Betula nana* (2) *Salix pulchra*
Herbaceous	(1) *Eriophorum vaginatum* (2) *Carex bigelowii*

Physiographic features

The arctic tussock gravelly frozen slopes ecological site occurs on turf hummocks of plains and stream terraces. Turf hummocks consist of vegetation and organic matter with or without a core of mineral soil or stones. Elevation ranges between 20 and 4750 feet. Slope is nearly level on stream terraces and ranges from gentle to strongly sloping on plains and hills. This ecological site occurs on all aspects, showing no preference for north-facing or south-facing aspects. Flooding does not occur at this site. This ecological site has a water table at the soil surface for long periods of the growing season and ponds frequently for long durations of time. The ponding depth ranges from two to eight inches above the soil surface.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Plain > Turf hummock

Runoff class	Medium
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	Frequent
Elevation	80 – 630 m
Slope	0 – 10 %
Ponding depth	10 – 20 cm
Water table depth	0 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	10 – 1,450 m
Slope	0 – 10 %
Ponding depth	Not specified
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

Slope wetlands are found where there is a discharge of ground water to the land surface and occur on sloping land; elevation gradients may range from steep hillsides to slight slopes. Slope wetlands are usually incapable of depressional storage because they lack the necessary closed contours. Principal water sources are ground water return flow and interflow from surrounding uplands, as well as precipitation. Hydrodynamics are dominated by downslope unidirectional water flow. Slope wetlands can occur in nearly flat landscapes if ground water discharge is a dominant source to the wetland surface. Slope wetlands lose water primarily by subsurface and surface flows and by evapo-transpiration. Slope wetlands may develop channels, but the channels serve only to convey water away from the slope wetland.

Wetland description

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

Soil features

- Soils formed in loess and gravelly colluvium
- Rock fragments do not occur on the soil surface.
- The surface mineral horizon is a mucky silt loam formed from loess or silty colluvium that lacks rock fragments. This silty soil horizon is thin.
- Soils are very deep.
- Permafrost is a restriction that occurs at shallow to moderate depths (12 to 28 inches).
- The pH of the soil profile ranges from strongly acidic to slightly acidic.
- These are wet soils that are considered very poorly to poorly drained.

Table 5. Representative soil features

Parent material	(1) Eolian deposits (2) Colluvium
Family particle size	(1) Coarse-silty (2) Loamy-skeletal
Drainage class	Very poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	30 – 70 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	13.97 – 20.57 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)	0 – 40 %
Subsurface fragment volume >3" (0-152.4cm)	Not specified

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)	12.19 – 21.08 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)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

The Arctic Foothills MLRA has a harsh climate with 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 (R245XY201AK) is associated with tussock tundra, which is widespread in northern and western Alaska on poorly drained, acidic soils over permafrost on flats and gentle slopes. Tussock tundra exhibits ecological stability and may represent climax vegetation on topographically subdued terrain types, including flats, plateaus, benches, and gentle slopes. The vegetative community may originate from wet sedge meadows through enhanced drainage conditions (Viereck et al 1992). Alternatively, tussock tundra may form from dwarf-birch ericaceous shrub associations when drainage becomes constrained, or the permafrost table rises. In scenarios where sphagnum or lichen successfully colonizes and accumulates sufficiently to overtop sedge tussocks, the structure will undergo mortality, potentially facilitating conversion to an ericaceous shrub-forb/sphagnum dominated site. Tussock senescence is additionally induced when the permafrost table rises into the organic material layer of the soil (Viereck et al 1992).

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).

Fires in the tundra happen less often than in boreal systems (NPS 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 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 the increased nutrient availability 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 9 to 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, as well as rain and snow fall. 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 (%)

Table 8. Community 1.2 plant community composition

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

Table 9. Community 1.3 plant community composition

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

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 ANWR, and the Noatak National Preserve are all partially located in MLRA 245. Gates of the Arctic NP 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

No data present, used literature to support development.

Other references

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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	09/23/2026
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:**