Ecological site R243XY201AK
Arctic tussock gravelly frozen slopes

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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): 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 bedrock controlled soils are shallow to deep and are 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 – 7616942 – Alaska Arctic Tussock Tundra - Infrequent Fire (Landfire 2009) Viereck Communities: Tussock tundra – III.A.2.D (Viereck et al. 1994)

Ecological site concept

• Occurs on the slopes of hills and plains. Turf hummocks are common periglacial features. • Associated with the arctic lowland life zone. Elevation ranges between 20 and 1000 feet. Slopes are nearly level to strongly sloping and occur on all aspects. • Soils are derived from silty loess over colluvium and/or till and a considered silty or gravelly. • Soils are very deep but permafrost restrictions occur at shallow to moderate depths. • These wet soils are considered very poorly to poorly drained and pond frequently for very long durations. • The reference plant community is characterized as tussock tundra (Viereck et al. 1994). Multiple plant communities occur within the reference state related to wildfire.

Associated sites

R243XY401AK	**Arctic scrub peat polygons** Occurs on the same hills and plains but associated with ice-wedge, high-center polygons.
R243XY402AK	**Arctic scrub gravelly frozen slopes** Occurs on same hills and plains but on soils that do not pond and support shrubby plant communities. Commonly associated with nonsorted circles.

Similar sites

R243XY401AK	**Arctic scrub peat polygons** Ecological site 401 occupies a similar ecological niche as 201, but occurs on polygonal ground that support a mosaic of plant communities

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 site (R243XY201AK) is an arctic lowland site that occurs on glaciated hills and plains. Turf hummocks are common periglacial microfeatures. Turf hummocks consist of vegetation and organic matter with or without a core of mineral soil or stones that are 8 to 20 inches in height and 8 to 35 inches in diameter. Representative elevation ranges between 20 and 1000 feet with this ecological site occasionally occurring up to 1550 feet. Slopes are nearly level to strongly sloping and show no preference for north-facing or south-facing aspects. Flooding does not occur. Ponding occurs frequently for very long durations. In May and June, a water table is present at 0 to 10 inches. There is negligible to low amounts of runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Plain > Turf hummock (2) Alluvial plain > Hill > Turf hummock
Runoff class	Negligible to low
Ponding duration	Very long (more than 30 days)
Ponding frequency	Frequent
Elevation	10 – 310 m
Slope	0 – 20 %
Ponding depth	0 – 30 cm
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
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	10 – 470 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 14 to 26 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)	60-90 days
Freeze-free period (characteristic range)	40-70 days
Precipitation total (characteristic range)	360-660 mm
Frost-free period (actual range)	50-90 days
Freeze-free period (actual range)	30-80 days
Precipitation total (actual range)	230-810 mm
Frost-free period (average)	70 days
Freeze-free period (average)	50 days
Precipitation total (average)	510 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 over colluvium and/or till
• Rock fragments do not occur on the soil surface.
• Capped with 9 to 11 inches of peat.
• The surface mineral horizon is a mucky silt loam formed from silty loess or colluvium. This silty layer is variable ranging from very thin to very thick.
• Soils are considered silty or gravelly with subsurface rock fragments ranging between 0 and 50 percent of the soil profile by volume.
• Soils are very deep. Soils restrictions include strongly contrasting textural stratification (between 12 and 17 inches) and permafrost (between 12 and 24 inches).
• These wet soils are considered very poorly to poorly drained.
• Soils range from moderately acidic to neutral.

Table 5. Representative soil features

Parent material	(1) Loess (2) Colluvium (3) Till
Surface texture	(1) Peat
Family particle size	(1) Loamy-skeletal (2) Coarse-silty
Drainage class	Very poorly drained to 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 (0-25.4cm)	12.7 – 26.16 cm

Calcium carbonate equivalent (0-152.4cm)	Not specified
Electrical conductivity (0-152.4cm)	Not specified
Soil reaction (1:1 water) (25.4-101.6cm)	5.9 – 6.8
Subsurface fragment volume <=3" (0-152.4cm)	0 – 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"	0 %
Surface fragment cover >3"	Not specified
Available water capacity (0-25.4cm)	7.11 – 26.16 cm
Calcium carbonate equivalent (0-152.4cm)	Not specified

Electrical conductivity (0-152.4cm)	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 (MLRA 243X) occurs in the arctic biome and 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).

Fire patterns in MLRA243X

Within this MLRA, fire is considered a natural and common event that typically is unmanaged. Fire suppression is limited, and generally occurs in the southern part of the MLRA and along the Kobuk and Noatak River valleys. Most fires are caused by lightning strikes.

Reported fire history in this MLRA spans 1946 to 2021 and there were 262 fires totaling 1.4 million acres burned. Of those 262 fires, 154 were between 1 and 1000 acres, with the largest being approximately 210,000 acres.

Tundra fire regimes, like the ones found in MLRA 243X, are poorly understood and rapidly changing. Tundra burning impacts vegetation composition, nutrient cycling, and permafrost dynamics (Racine et al 1987, 2004). Increasing evidence suggests that Arctic warming is affecting tundra fire regimes. In 2010, 37 fires burned 106,000 acres in the Noatak National Preserve, located within MLRA 243X. This was the largest number of fires that have occurred in the area since record keeping began in 1950 (Jones et al 2009).

Changes in fuel characteristics associated with increased shrub growth and/or density due to warming over the past several decades (Racine et al 1987, 2004) may have contributed to the intensity of recent burns. There is also evidence to suggest that Betula shrubs have contributed to high levels of tundra burning in the past. This suggestion, in combination with studies documenting increased birch (Betula spp) abundance in early stage post-fire plant communities raises the possibility of a positive feedback loop between increased shrub density and increased tundra burning (Joly et al 2010).

Fire Dynamics for this ecological site

Tussock cottongrass, Eriophorum vaginatum, is the primary tussock-former for this ecological site. This sedge typically occurs in acidic, nutrient-poor, poorly drained soils that are underlain by permafrost. Tussock cottongrass dominates tussock tundra and tussock-shrub tundra in the Arctic. It is common in bog and fens. Ericaceous shrubs, birches, willows, and alders often grow in tussock cottongrass communities, frequently with mosses and lichens. There is little information about fire regimes in the arctic region of Alaska, and mean fire return interval estimates for tussock tundra ecosystems varies broadly (Landfire 2009).

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 MLRA 243X 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

Not available.

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

Not available

Other 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.

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Contributors

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Approval

Blaine Spellman, 5/29/2025

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.

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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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:**
