Ecological site R240XY720AK
Arctic Tussock Tundra Frozen Plains

Last updated: 6/05/2025
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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): 240X–Nulato Hills-Southern Seward Peninsula Highlands

The Nulato Hills-Southern Seward Peninsula Highlands (MLRA 240X) is in Western Alaska, which describes the mostly treeless zone of discontinuous permafrost in the arctic. This MLRA is approximately 18,500 square miles in size. The terrain is defined by rolling hills, low mountains and river valleys. Flood plains systems are common but generally narrow. This watershed drains into Norton Sound and Bering Sea. Major rivers include the Unalakleet, Koyuk, and Fish Rivers. The area is mostly undeveloped wild land that is sparsely populated. Residents use this remote area primarily for subsistence hunting, fishing, and gathering. Villages are primarily located along the coast and include the two larger municipalities of Nome and Unalakleet, and various other villages such as Koyuk and Saint Michael. Geology and Soils This MLRA was mostly unglaciated during the late Pleistocene. Glaciers were limited to upper elevations on the Seward Peninsula. Coastal lowlands are filled with Holocene deposits. Silty eolian deposits mantle coastal areas and the slopes of lower elevation hills and mountains. Flood plains and terraces are built on fluvial deposits. Modified glacial moraines are evident in areas of past glacial activity. Bedrock material is primarily a mix of sedimentary and volcanic rock (USDA, 2022). This MLRA is in the zone of discontinuous permafrost. Shallow permafrost is most common on coastal plains, gentle footslopes, and organic swales. Permafrost constitutes a root- restrictive layer that perches water and creates poorly drained or poorly drained soils. Common soil orders include Gelisols that support permafrost and Entisols and Inceptisols which are marked by little to no development. The Gelisols are typically shallow or moderately deep to permafrost, occur on finer to gravelly textured sediments, and are poorly or very poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have thick accumulations of surface organic material and commonly occur on mounds of plains. The Orthels and Turbels have comparably thinner surface organic material. Turbels show signs of cryoturbation while Orthels do not. Entisols and Inceptisols are common on shallow rocky soils of the alpine and subalpine, as well as scoured flood plain soils. Non-soil areas (rock outcrop, rubble land and beaches) make up approximately five percent of the MLRA surface. Climate The climate is a mix of maritime in the summer and continental in the winter, which is a result of sea ice in Norton Sound. Summers are brief and cool summers and winters are long and cold. Mean annual precipitation is 15 to 20 inches at lower elevations, increasing to 20 to 40 inches at higher elevations (USDA, 2022). Mean annual temperatures ranges from 23 to 31 degrees F (SNAP, 2014a). Vegetation Vegetation is mainly influenced by site and soil characteristics such as temperature-degree days, exposure to wind, soil depth, and soil hydrology. Dwarf scrublands are present across much of the uplands. Lower elevations generally support more developed soils. Well drained soils support tall shrubs. Organic soils support mosses, graminoids and low shrubs. Forests occur on some low mountain slopes and river valleys but are associated with the Yukon-Kuskokwim Highlands (MLRA 230X). Tussock tundra is ubiquitous across much of the poorly drained, low gradient slopes and coastal plains (USDA, 2022).

LRU notes

There are two life zones delineated by plant communities along a temperature gradient driven by elevation. The predominant climate across MLRA 240X is arctic lowlands. Low mean annual air temperatures and a short growing season shape the vegetation across the landscape. The alpine climate zone is generally reserved for elevations above 1,200 feet. Decreased mean annual temperatures at these higher elevations support unique soils and vegetation.

Classification relationships

Alaska Vegetation Classification: Mesic graminoid herbaceous (III.A.2. - level III) / Tussock tundra (III.A.2.d - level IV) (Viereck et al., 1992) BioPhysical Settings: 6816942 – Alaska Arctic Tussock Tundra – Infrequent Fire (Landfire, 2009)

Ecological site concept

Ecological Site characteristics: • Occurs on gently sloping arctic hill and plain slopes • Soils are capped by a thick organic layer and underlain with eolian or till material • Soils have permafrost at moderate depths and are considered poorly drained • Associated with a tussock tundra reference plant community. Two plant communities have been identified within the reference state related to fire. • One alternate state is identified in this ecological site and is defined by peat mound formations.

Associated sites

R240XY710AK	**Arctic Scrub Wet Drainages** R240XY710AK describes boreal tall scrub drainages that bisect the tussock tundra. This ecological site surrounds these drainages.
R240XY731AK	**Subalpine Ericaceous Scrub Loamy Slopes** R240XY731AK describes the birch-ericaceous shrub tundra on better drained soils. It is generally located upslope on steeper slopes.
R240XY732AK	**Subalpine Tall Scrub Gravelly Slopes** R240XY732AK describes the alder scrubland on slopes with gravelly soils. It is generally located upslope on steep slopes.

Similar sites

F230XY611AK	**Boreal Forest Loamy Frozen Slopes** F230XY611AK shares similar site and soil properties but occurs to the east in the Yukon-Kuskokwim Highlands MLRA 230X. This ecological site supports open forests of black spruce with tussock tundra understories.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ledum palustre ssp. decumbens* (2) *Betula nana*
Herbaceous	(1) *Eriophorum angustifolium* (2) *Carex*

Physiographic features

This ecological site occurs in the alpine and lowland life zones. Elevation ranges from 100 to 1500 feet above sea level. Slope gradients are nearly level to strongly sloping (0 to 10 percent) and occur on all aspects. While soils do not pond, a shallow water table occurs at very shallow depth throughout the growing season.

Peat mounds are a distinct microfeature of this ecological site. Drainage is improved on the raised landforms. Ponding can occur in inter-mound areas.

Table 2. Representative physiographic features

Slope shape across	(1) Linear (2) Convex

Slope shape up-down	(1) Linear
Hillslope profile	(1) Backslope (2) Footslope
Landforms	(1) Plains > Plain (2) Plains > Plain > Mound (3) Plains > Hill (4) Hills > Hill
Runoff class	Negligible
Flooding frequency	None
Ponding frequency	None
Elevation	30 – 460 m
Slope	0 – 10 %
Water table depth	0 – 10 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	20 – 610 m
Slope	Not specified
Water table depth	Not specified

Climatic features

The mixed maritime/continental climate in MLRA 240X includes short, cool summers and long, cold winters. Mean annual temperature ranges from 23 to 31 degrees Fahrenheit, with temperatures typically below freezing from November through March. Approximately 40 percent of total precipitation occurs during the June – August growing season (PRISM, 2018; SNAP, 2014a; SNAP, 2014b). Across the MLRA, snowfall ranges from 40 to 100 inches (USDA-NRCS, 2022).

Table 4 Representative climatic features

Frost-free period (characteristic range)	80-110 days
Freeze-free period (characteristic range)	100-130 days
Precipitation total (characteristic range)	330-510 mm
Frost-free period (actual range)	30-120 days
Freeze-free period (actual range)	90-140 days
Precipitation total (actual range)	250-580 mm
Frost-free period (average)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	360 mm

Influencing water features

Precipitation, seasonal ice melt, and snow melt are the main sources of water for this ecological site.

Wetland description

This ecological site is a slope wetland under the Hydrogeomorphic (HGM) classification system (Brinson, 1993; USDA-NRCS, 2008). A shallow water table is present in the reference state throughout the year.

Soil features

Soils are wet Gelisols formed in organic material over cryoturbated eolian deposits. Rock fragments do not occur on the soil surface. Soils have a thick, 9 to 35-inch organic cap. These silty and organic soils typically lack rock fragments at depth. Soils are very deep but have permafrost at moderate depths. This restriction perches water and influences plant community composition. Soil pH is extremely to slightly acidic. Soils are poorly drained with a shallow water table throughout the year.

Peat mounds in the alternate state support different soils. The organic cap is much thicker, which allows the ice lenses and frozen cores to develop. Permafrost is shallower under the thick insulating organic layer. However, soil drainage is improved on mounds as they rise above the existing water table. Inter-mound areas maintain a poorly drained soil classification.

Table 5. Representative soil features

Parent material	(1) Mossy organic material (2) Cryoturbate (3) Eolian deposits
Surface texture	(1) Mucky peat (2) Peat
Drainage class	Poorly drained
Permeability class	Moderate
Depth to restrictive layer	50 – 90 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	21.08 – 35.81 cm
Soil reaction (1:1 water) (0-25.4cm)	3.6 – 5.5
Subsurface fragment volume <=3" (0-152.4cm)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

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)	11.94 – 50.8 cm
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	0 – 40 %
Subsurface fragment volume >3" (0-152.4cm)	0 – 10 %

Ecological dynamics

The Nulato Hills-Southern Seward Peninsula Highlands MLRA (MLRA 240X) occurs in Western Alaska with arctic vegetation and has a harsh climate that limits the composition and structure of plant communities. This area has cool, short summers and long, cold winters. Trees are restricted to warmer slopes in mountain valleys and flood plains. The expansive tundra is comprised of a mosaic of shrubs, sedges, moss, and lichen.

This ecological site describes the tussock tundra on plains and hills. Vegetation is restricted by cold temperature and permafrost-influenced hydrology. Vegetation is typically comprised of species labeled as facultative and facultative wet species.

Fire is the major natural disturbance on this ecological site. The fire cycle may range from 50 to 600 years (Landfire, 2009). Fire dynamics in this subarctic region are poorly understood and are likely to vary within and between areas across the landscape (Landfire, 2009). Fire disturbance is responsible for one unique post-disturbance community. Post-fire community composition depends on fire factors such as frequency and severity. Slight to moderate fires may only burn surface vegetation, leaving the wet organic horizon intact. A severe fire burns the insulating organic layer, causing permafrost to drop in the soil profile. Soil drainage improves and less hydric species colonize. As the organic horizon thickens, permafrost rises, the soil becomes wetter, and the community shifts back to community 1.1.

Peat mounds are described as an alternate state in this ecological site. Peat mound formation requires an insulating organic horizon, cold temperatures, and free available water. Mound formation starts in areas of the tundra where there are significant differences in the thickness of peat, which may result from Sphagnum moss colonization of sedge meadows (Pielou, 1995). This peat is saturated as soils freeze in the fall. A frozen core of soil develops as the peat draws in available water and the near-surface permafrost resting below the thick organic layer continually freezes the water. The insulating peat protects the soil core from melting the next summer, and the process repeats the following fall, creating subsequent ice lenses.

The mounds rise due to the combination of frost heave, continually stacking ice lenses, and the buoyancy of the frozen core (Seppala 1986). Soil drainage improves and the vegetation shifts from wet sedge meadow tundra to an ericaceous shrubland. If these landforms raise high enough above the water table, soil temperature increases, ice-lens melt, and these landforms can collapse. Fire can also remove the insulating layer and cause mounds to collapse.

The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

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 2.1 plant community composition

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

Table 10. Community 2.2 plant community composition

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

Inventory data references

Vegetative communities and transitions are described using existing models and expert knowledge. There are no vegetation inventory data points in NASIS associated with this ecological site. External model data sources: The Alaska-Yukon Region of the Circumboreal Vegetation Map (CBVM) (Jorgensen and Meidinger, 2015) Circumpolar Arctic Vegetation Mapping Project (CAVM Team, 2003). LANDFIRE Biophysical Settings Models (Landfire, 2009) Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 p.

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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	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:**