USDA Natural Resources Conservation Service

Ecological site R230XY620AK
Boreal Peat Frozen Flats Complex

Last updated: 6/11/2025
Accessed: 04/11/2026

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): 230X–Yukon-Kuskokwim Highlands

The Yukon-Kuskokwim Highlands (MLRA 230X) include the most western parts of Interior Alaska (Land Resource Region X2) and have a continental climate. MLRA 230X is approximately 42,300 square miles spread across mountain, hills, and valleys. Flood plain systems are common. The watershed drains into the Bering Sea to the west and Bristol Bay to the southwest. Major rivers include the Yukon, Innoko, Kuskokwim, Mulchatna, and Nushagak Rivers. This sparsely populated area is mostly undeveloped wildland. Residents use this remote area primarily for subsistence hunting, fishing, and gathering. Villages are primarily located along rivers along the MLRA 230X boundary and include Greyling, Nulato, and Koyukuk. Federally managed lands in the MLRA include parts of Innoko, Nowitna, and Koyukuk National Wildlife Refuges.

Geology and Soils

The Yukon-Kuskokwim Highlands MLRA was mostly unglaciated during the Pleistocene. Glaciers were limited to the Lime Hills in the southeast. Glacial moraines and drift are evident in areas of past glacial activity. Unglaciated upland areas are covered with colluvium and slope alluvium originating from bedrock. Loess deposits cover gentle sloping hills and footslopes of mountains near major rivers. Bedrock material is primarily sedimentary rocks with intrusive volcanic rock (USDA, 2022).

This MLRA is in the zone of discontinuous permafrost. Permafrost is most common in finely textured soils on terraces, gently sloping hills, and cold mountain footslopes. It is typically absent from flood plains and mountain backslopes. Across the MLRA, permafrost presence decreases as proximity to the Yukon-Kuskokwim delta increases.

The dominant soil orders are Gelisols, Entisols, Inceptisols, and Spodosols. Gelisols support shallow to deep permafrost and often have a perched water table for at least part of the growing season. Inceptisols, Spodosols, and Entisols lack permafrost. Two important factors that prevent permafrost aggradation are groundwater connectivity and thick bands of sandy and/or gravelly soil horizons. Inceptisols have minimal development and are common on alpine scrublands and high flood plains. Entisols are common on mountain backslopes and scoured flood plains. Spodosols support a spodic soil horizon and are common in the acidic soils underlying spruce forests and ericaceous shrublands. Non-soil areas such as rock outcrops, rubble lands and beaches make up approximately ten percent of the MLRA surface.

Climate

The Yukon-Kuskokwim Highlands MLRA has short, warm summers and cold, long winters. Mean annual precipitation is 10 to 15 inches at low elevations and increases to 20 to 40 inches at higher elevations (USDA, 2022). Annual snowfall is between 80 and 100 inches. Mean annual temperatures ranges from 25 to 32 degrees F (SNAP, 2014a; SNAP, 2014b).

Vegetation

Vegetation is mainly influenced by site and soil characteristics such as temperature-degree days, exposure, soil depth, and soil hydrology. Dwarf scrublands are prevalent on shallow soils on convex slopes and in the alpine. Mesic, lowland slopes are a mix of forests and shrublands of alder, willow, and ericaceous shrubs. Cold slopes generally support black spruce, while warm slopes support white spruce. Valley bottoms and steep slopes support a deciduous forest. Tussock tundra is associated with wet soils underlain by shallow permafrost and is ubiquitous across the lower footslopes of mountains and the coastal plain (USDA, 2022).

Fire

Fire is a major disturbance across the Yukon-Kuskokwim Highlands. Low severity fires destroy the canopy but leave the organic mat and rootstock mostly undisturbed. The vegetative community progresses directly back to a forest. Severe forest fires are stand replacement events. Post-first communities typically pass through an herbaceous meadow community before ericaceous shrubs, birch, and willows colonize. Drier soils may support a deciduous aspen or birch forest, while moist soils support cottonwoods and spruce. On all forest and woodland ecological sites, post-fire succession leads to a relatively rapid accumulation of organic matter and mosses on the surface. This accumulation results in decreases in soil temperature, biologic activity, and nutrient availability and a gradual decrease in site productivity.

LRU notes

MLRA 230X contains three life zones defined by the physiological limits of plant communities along an elevational gradient. The boreal life zone is the elevational band where forest communities dominate. Non-forested areas in the boreal life zone are often hydrologically driven, and are either too wet (i.e., bogs) or too dry (i.e., river bluffs) to support forest communities. Subalpine and alpine vegetation dominates at higher elevations. The subalpine zone is a transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. Shrub height can be over four feet. Trees are absent from the alpine, and all shrubs are dwarf or prostrate. In general, the boreal life zone occurs below 1,200 feet; the subalpine life zone occurs between 1,200 and 1,600 feet; and the alpine life zone occurs above 1,600 feet.

Within each life zone, there are plant assemblages associated with cold and warm slopes. Slope temperature is a factor of slope steepness, aspect, and shading from surrounding ridges and mountains. Warm slopes occur on southeast to west aspects that are moderate to very steep and are not shaded by the surrounding landscape. Cold slopes occur on northwest to east facing slopes, occur in shaded slope positions, or occur in low-lying areas that are cold air sinks. Examples of shaded positions include head slopes, low relief backslopes of hills, and the base of hills and mountains shaded by adjacent mountain peaks. Warm boreal slopes have a cryic soil temperature regime and lack permafrost. White spruce forests are an indicator of warm boreal slopes. Cold boreal slope soils have a gelic soil temperature regime and commonly have permafrost. In this area, black spruce forests and woodlands are an indicator of cold boreal slopes.

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:
7316290 – Western North American Boreal Tussock Tundra
(Landfire, 2009)

Ecological site concept

Ecological Site characteristics:
• Occurs in the boreal life zone on terraces and nearly level to gentle slopes of hills and mountains.
• While soils are very deep, permafrost occurs at moderate depths. Permafrost is a root restrictive and water perching layer
• Soils formed in organic material and silty alluvium and/or colluvium that are cryoturbated. These soils are often capped with 16-inchs of organic material
• Soils pond frequently for long durations. These very poorly drained soils have a water

table at the surface throughout the growing season
• The reference plant community is a scrub-tussock tundra
• Fire is the major disturbance in this ecological site and is responsible for two communities.
• Peat mounds and peat plateau are represented as an unmanaged alternate state

Associated sites

R230XY606AK	**Boreal Sedge Peat Depressions** R230XY606AK occurs in adjacent drainages and swales that have wet soils and support willows and sedges.
F230XY611AK	**Boreal Forest Loamy Frozen Slopes** F230XY611AK describes black spruce forests on poorly drained, thick organic soils. F230XY611AK occurs on footslopes, while R230XY620 occurs downslope on toeslopes.
R230XY601AK	**Boreal Forest Flood Plain Complex** F230XY601AK occurs in flood plains. Flood plains bisect the tussock tundra and are hydrologically linked.

Similar sites

F230XY611AK	**Boreal Forest Loamy Frozen Slopes** F230XY611AK describes the black spruce forest on wetland, permafrost soil. Similar tussocks and scrubs are in the understory. No trees are present on the tussock tundra described by R230XY620AK.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ledum palustre ssp. decumbens*
Herbaceous	(1) *Eriophorum vaginatum* (2) *Carex bigelowii*

Physiographic features

• This ecological site occurs on stream terraces and the slopes of plains, hills, and mountains.
• Elevation typically ranges between 100 and 1,200 feet above sea level.
• Slopes are nearly level to gently sloping and occur on all slope aspects.
• Ponding occurs frequently lasting for long durations of time. A water table is present at the soil surface throughout the growing season. The peat plateau alternate state does not pond.

Table 2. Representative physiographic features

Slope shape across	(1) Linear (2) Convex (3) Convex
Slope shape up-down	(1) Linear
Hillslope profile	(1) Footslope
Geomorphic position, flats	(1) Talf
Landforms	(1) Plains > Plain (2) Plains > Peat plateau (3) Hills > Hillslope (4) Hills > Peat plateau (5) Valley > Stream terrace (6) Mountains > Mountain
Runoff class	Negligible to low
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	30–366 m
Slope	0–3%
Ponding depth	5–20 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	30–610 m
Slope	0–12%
Ponding depth	Not specified

Climatic features

The Yukon-Kuskokwim Highlands MLRA has short, warm summers and long, cold winters. Mean annual temperature ranges from 25 to 32 degrees Fahrenheit, with temperatures typically below freezing from October through April. June through August are the warmest months of the year and constitute the heart of the growing season. Approximately 60 percent of total annual precipitation occurs from June through September (PRISM, 2018; SNAP, 2014a). Across the MLRA, snowfall ranges from 80 to 100 inches (USDA, 2022).

Table 4. Representative climatic features

Frost-free period (characteristic range)	75-95 days
Freeze-free period (characteristic range)	65-85 days
Precipitation total (characteristic range)	330-508 mm
Frost-free period (actual range)	60-110 days
Freeze-free period (actual range)	50-100 days
Precipitation total (actual range)	254-1,016 mm
Frost-free period (average)	80 days
Freeze-free period (average)	70 days
Precipitation total (average)	381 mm

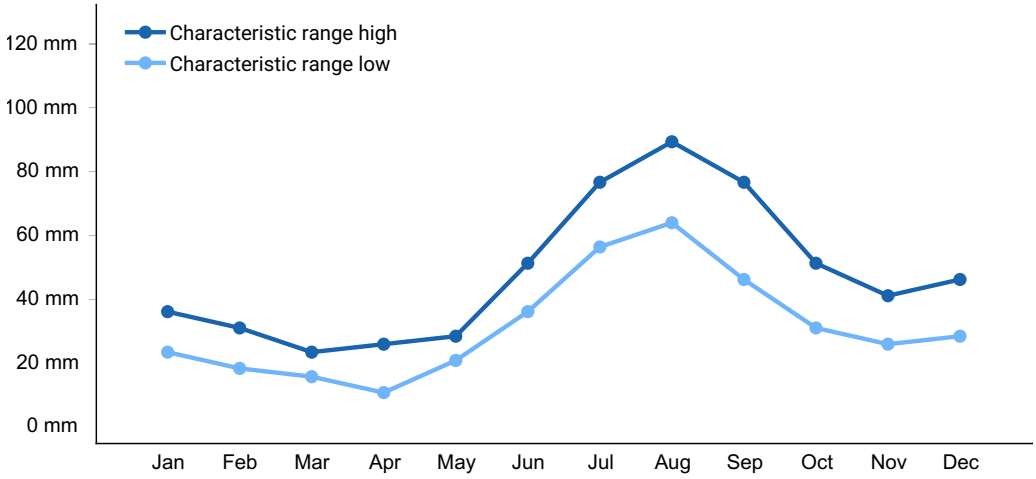


Figure 1. Monthly precipitation range

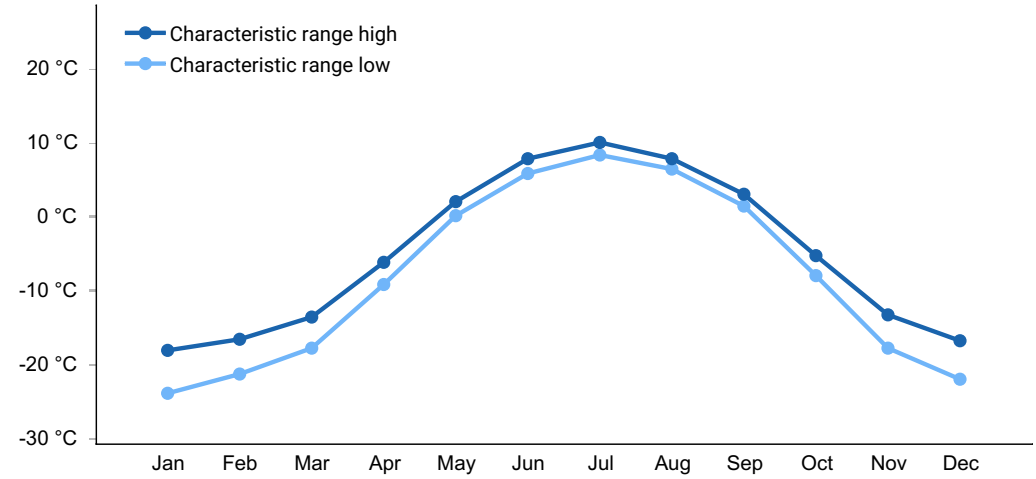


Figure 2. Monthly minimum temperature range

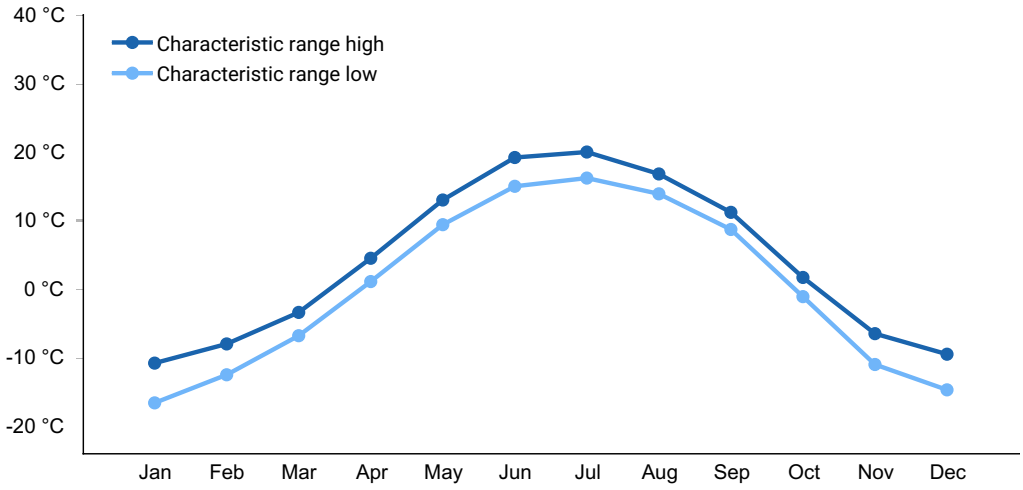


Figure 3. Monthly maximum temperature range

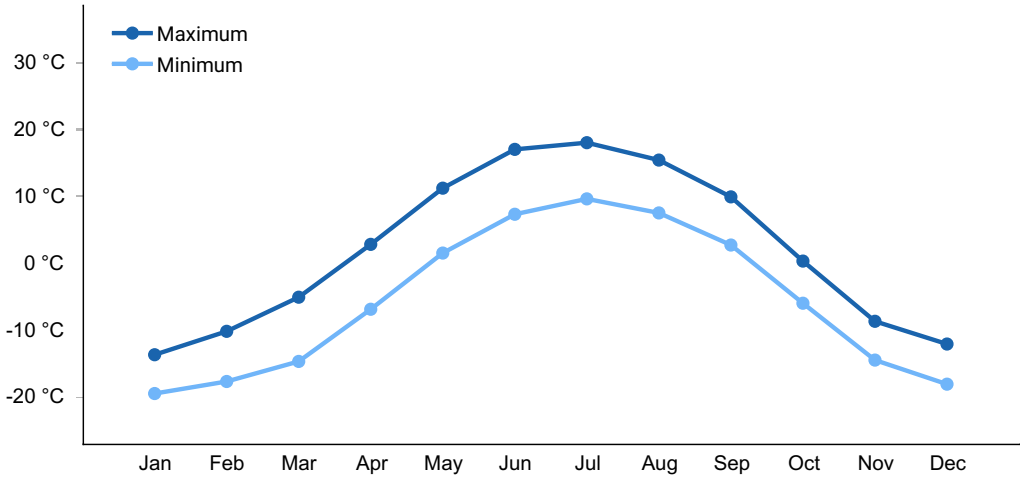


Figure 4. Monthly average minimum and maximum temperature

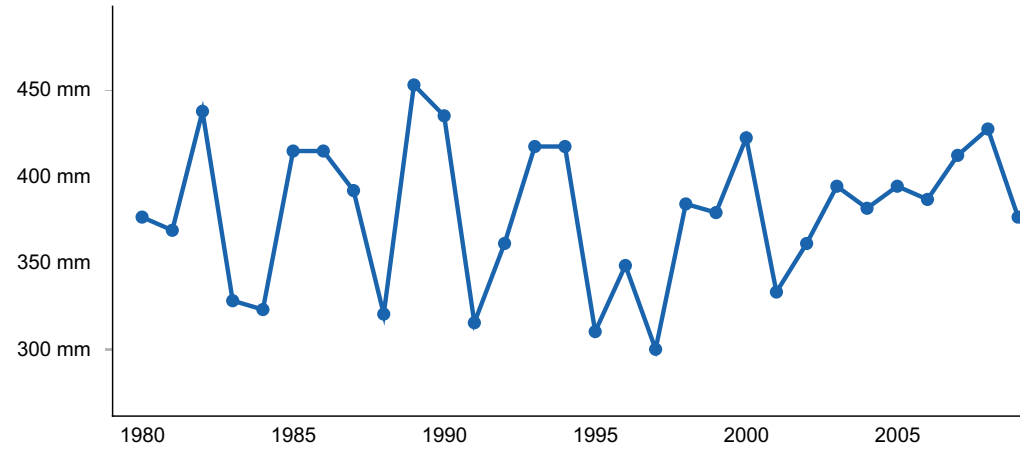


Figure 5. Annual precipitation pattern

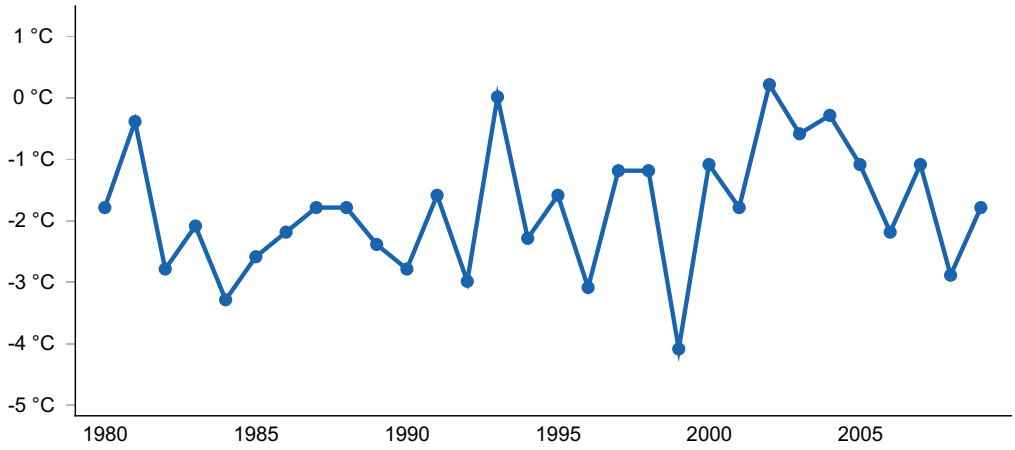


Figure 6. Annual average temperature pattern

Influencing water features

This site is not associated with or influenced by streams. Precipitation, throughflow, and seasonal ice melt are the main sources of water. Surface runoff and throughflow contribute water to downslope ecological sites.

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

• Common Gelisol great groups are Histoturbels (Soil Survey Staff, 2013).
• Soils formed in cryoturbated organic material over colluvium or alluvium
• Soil surface texture is peat or stratified peat - silt loam
• Rock fragments do not occur on the soil surface.
• Soils have a thick, 16-in thick organic cap
• While soils are very deep, permafrost occurs at moderate depths (20 to 32 inches)
• Subsurface rock fragments do not typically occur in the soil profile
• Soil pH is extremely to moderately acidic.
• Soils are considered very poorly drained
• Peat mounds in the alternate state support a thicker organic cap. Permafrost is generally shallower under the thick insulating organic layer. Soils are comparatively drier to reference state soils.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Colluvium (3) Alluvium
Surface texture	(1) Peat (2) Peat (3) Silt loam
Drainage class	Very poorly drained
Permeability class	Moderate
Depth to restrictive layer	51–81 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	24.13–35.81 cm
Soil reaction (1:1 water) (0-25.4cm)	4–5.6
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 somewhat poorly drained
Permeability class	Slow to moderate
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
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	0–18%
Subsurface fragment volume >3" (0-152.4cm)	0–9%

Ecological dynamics

Fire

Fire has a major influence on vegetation across the Yukon-Kuskokwim Highlands MLRA. Wildland fire is a common and natural event that is unmanaged except near towns and villages. Fires are patchy and different locations within a single burn experience different levels of fire intensity, or no fire at all. In general, cooler and wetter areas experience low-severity fires, while warmer and drier areas experience high-severity fires. Other factors such as fire load and recent weather also affect fire characteristics. A typical fire event considerably alters vegetation, above ground biomass, and the organic soil cap.

Fire is the major natural disturbance for this ecological site. The typical fire return interval is 50 to over 600 years (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. Low-severity fires have modest impacts on soil organic matter thickness, depth to permafrost, and soil drainage. A low-severity fire can consume the bulk of above ground vegetation, while leaving most of the organic mat intact. Organic matter continues to insulate these cold soils. 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.

Alternate State

The peat plateau is described as an alternate state in this ecological site. Peat plateau formation requires an insulating organic horizon, cold temperatures, and free available water. 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.

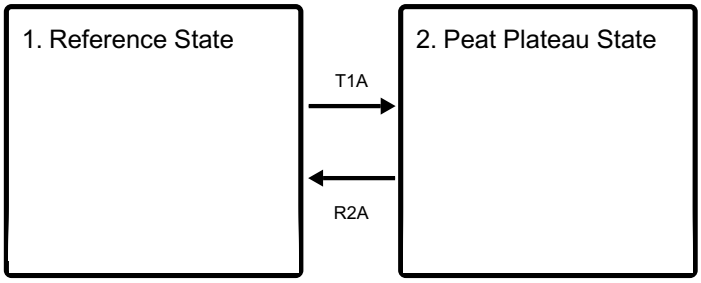
The peat plateau rises due to the combination of frost heave, continually stacking ice lenses, and the buoyancy of the frozen core (Seppala, 1986; Seppala, 2011). Soil drainage improves and the vegetation shifts from wet sedge meadow tundra to an ericaceous shrubland. If these landforms raise high enough above the water table, soil temperature increases, ice-lens melt, and these landforms can collapse. Fire can also remove the insulating layer and cause the peat plateau 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

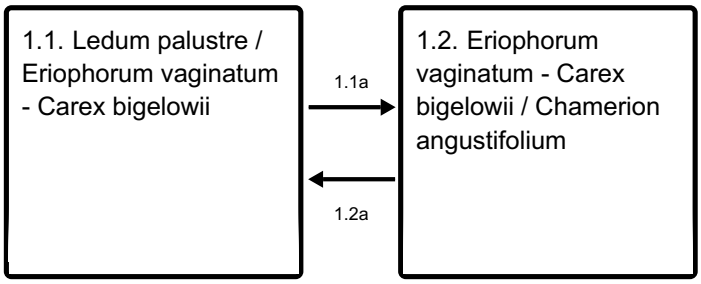
Ecosystem states



T1A - Peat Mound Formation

R2A - Soil ice melts; Soil collapse

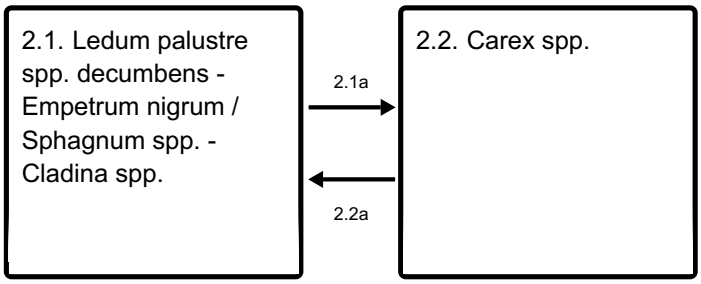
State 1 submodel, plant communities



1.1a - Fire; develops immediately after fire

1.2a - Fire recovery; develops after 10 years

State 2 submodel, plant communities



2.1a - Peat mound formation (microlow)

2.2a - Peat mound formation (microhigh)

State 1
Reference State

The reference state describes two distinct vegetative communities grouped by the

structure and dominance of the vegetation (e.g., shrubs, forbs, and graminoids) and their ecological function and stability. Fire is the major disturbance on this ecological site. Vegetation in the reference plant community (1.1) is shaped by very poorly drained, cold soils. The reference state is developed and characterized using available vegetation models, including Landfire BpS and the Alaska vegetation classification system (Landfire, 2009; Viereck et al., 1992).

Dominant plant species

- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- dwarf birch (*Betula nana*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- sedge (*Carex*), grass
- Bigelow's sedge (*Carex bigelowii*), grass

Community 1.1
Ledum palustre / Eriophorum vaginatum - Carex bigelowii

This community is a tussock tundra (Viereck et al., 1992). Major plant groups are tall and medium graminoids, and low and dwarf shrubs. Shrubs grow on and in-between tussocks. Moss is prevalent throughout the spaces between tussocks. Lichens grow on moss and tussocks. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- dwarf birch (*Betula nana*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- water sedge (*Carex aquatilis*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- sphagnum (*Sphagnum*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- arctic sweet coltsfoot (*Petasites frigidus*), other herbaceous

Community 1.2
Eriophorum vaginatum - Carex bigelowii / Chamerion angustifolium

This community is a mesic graminoid herbaceous meadow (Viereck et al., 1992). The composition of this community depends largely on fire severity and the time since fire disturbance. In general, the major plant groups are tall graminoids, medium forbs, and low forbs. Fast growing, seed dispersed species such as fireweed may be prevalent in the immediate aftermath of severely burned areas. Ground cover is mostly herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant

species table.

Dominant plant species

- tussock cottongrass (*Eriophorum vaginatum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.2

Fire is a major but infrequent disturbance on this site. Lightning strike is the most common cause of fire. Mean fire return intervals vary and range from 50 years to greater than 600 years (Landfire, 2009). Fire typically burns the insulating layer of herbaceous litter, mosses and lichens. Soils thaw and create conditions where quickly growing forbs and graminoids colonize and intermix with surviving plants.

Pathway 1.2a
Community 1.2 to 1.1

Fire recovery occurs quickly following low intensity fires. Recovery after high-intensity fires takes longer, as these fires burn the insulating layer of herbaceous litter, mosses and lichens. Cottongrass and sedges return almost immediately after a fire, while it can take the shrub community up to 25 years to recover (Innes, 2013).

State 2
Peat Plateau State

The peat plateau develops from the wet meadows in the reference state. Peat mounds are present. A peat mound is an elliptical dome-like permafrost mound containing alternating layers of ice lenses and peat or mineral soil, which are typically less than 10 feet in height. The edges of these raised features are strongly sloping. Peat mounds can raise significantly above the water table and soil drainage can improve. If these landforms raise high enough above the water table, soil temperature increases, and the ice lens melt.

Dominant plant species

- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- sedge (*Carex*), grass
- sphagnum (*Sphagnum*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 2.1

Ledum palustre spp. decumbens - Empetrum nigrum / Sphagnum spp. - Cladina spp.

This community describes the vegetation atop the peat mound. It is an ericaceous shrub bog (Viereck et al. 1992). Common vegetative strata include low and dwarf shrubs, medium graminoids, mosses, and lichens. Ground cover mostly mosses and lichens with areas of herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- dwarf birch (*Betula nana*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- sedge (*Carex*), grass
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- (*Flavocetraria*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- cup lichen (*Cladonia*), other herbaceous

Community 2.2
Carex spp.

This community is located in the low areas between mounds. It is a wet sedge meadow tundra (Viereck et al. 1992). Common vegetative strata include low shrubs, medium and tall graminoids, and moss. Ground cover is primarily comprised of mosses, herbaceous litter, and surface water. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- willow (*Salix*), shrub
- sedge (*Carex*), grass
- cottongrass (*Eriophorum*), grass
- sphagnum (*Sphagnum*), other herbaceous

Pathway 2.1a
Community 2.1 to 2.2

Peat mounds or palsa formation. This process coincides with pathway 2.2a, as a rising peat mound always coincides with the formation of inter-mound wet areas.

Pathway 2.2a
Community 2.2 to 2.1

Peat mounds or palsa raise from the wet sedge meadow tundra. Soil drainage improves and vegetation shifts to ericaceous shrub bog. This process coincides with pathway 2.1a, as a rising peat mound always coincides with the formation of inter-mound wet areas.

Transition T1A
State 1 to 2

A peat plateau forms from raised soils with underlying permafrost. Peat mounds are generally present. This raised feature supports different vegetation than the reference state.

Restoration pathway R2A
State 2 to 1

The ice core melts, causing the peat plateau and associated mounds to collapse. This generally occurs when the ice lenses melt as a result of the loss of the insulating cover. This may be due to natural dieback of the living organic horizon or from fire.

Additional community tables

Animal community

not available

Hydrological functions

not available

Recreational uses

not available

Wood products

not available

Other products

not available

Other information

not available

Inventory data references

External model data sources:

The Alaska-Yukon Region of the Circumboreal Vegetation Map (CBVM) (Jorgensen and Meidinger, 2015)

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. (Viereck et al., 1992)

References

Viereck, L.A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-286..

Other references

Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands. Technical Report WRP-DE-4, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Jorgensen, T., and D. Meidinger. 2015. The Alaska Yukon Region of the Circumboreal Vegetation Map (CBVM). CAFF Strategies Series Report. Conservation of Arctic Flora and Fauna, Akureyri, Iceland. ISBN: 978-9935-431-48-6.

Landfire. 2009. Biophysical Setting 7316290 – Western North American Boreal Tussock Tundra. In: LANDFIRE Biophysical Setting Model: Map zone 73, [Online]. In: Vegetation Dynamics Models. In: LANDFIRE. Washington, DC: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory; U.S. Geological Survey; Arlington, VA: The Nature Conservancy (Producers). Available: https://www.landfire.gov/vegetation/bps. Accessed March 18, 2025

Pielou, E.C. 2012. A naturalist's guide to the Arctic. University of Chicago Press.

PRISM Climate Group (PRISM). 2018. “Alaska – average monthly and annual precipitation and minimum, maximum, and mean temperature for the period 1981-2010.” Oregon State

University, Corvallis, Oregon. https://prism.oregonstate.edu/projects/alaska.php. Accessed Sept 17, 2024.

Scenarios network for Alaska and arctic planning (SNAP). 2014. “Historical Monthly Temperature – 1km, 1901-2009”. http://ckan.snap.uaf.edu/dataset/. Accessed Sept 17, 2024.

Scenarios network for Alaska and arctic planning (SNAP). 2014. “Historical monthly and derived precipitation products downscaled from CRU TS data via the delta methods – 2km, 1901-2009”. http://ckan.snap.uaf.edu/dataset/. Accessed Sept 17, 2024.

Seppälä, M. 1986. The origin of palsas. Geografiska Annaler: Series A, Physical Geography 68:141–147.

Seppälä, M. 2011. Synthesis of studies of palsa formation underlining the importance of local environmental and physical characteristics. Quaternary Research 75:366–370.

Soil Survey Staff. 2013. Simplified Guide to Soil Taxonomy. USDA-Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Western Regional Climate Center (WRCC). 2021. Climate of Alaska. Retrieved from https://wrcc.dri.edu/Climate/narrative_ak.php. Accessed November 15, 2024.

Western Regional Climate Center (WRCC). 2025. “McGrath WB Airport, Alaska ‘Freeze Free’ Season Probabilities.” https://wrcc.dri.edu/cgi-bin/cliTFrezD.pl?akmcgr. Accessed Mar 6, 2025.

Contributors

Phil Barber
Blaine Spellman
Marji Patz
Michael Singer

Acknowledgments

This ecological site description (ESD) fulfills the requirements of the Provisional Ecological Site (PES) national initiative. This ESD is published to fit current site-soil correlations as they are currently mapped and understood. Further data collection may provide the information to update this ESD from the provisional level to the approved level.

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	04/11/2026
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):**

---

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:**
