USDA Natural Resources
Conservation Service

Ecological site F234XY713AK
Boreal forest loamy frozen slopes

Last updated: 6/09/2025
Accessed: 03/20/2026

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): 234X–Interior Brooks Range Mountains

Geography
The Interior Brooks Range mountains area consists of predominantly steep, jagged mountains and narrow valleys that drain the southern side of the Brooks Range. This area is bordered by the Northern Brooks Range Mountains (Major Land Resource Area (MLRA) 244) to the north, the Western Brooks Range Mountains Foothills and Valleys (MLRA 243) to the west, and the Upper Kobuk and Koyukuk Hills and Valleys (MLRA 233) and the Interior Alaska Highlands (MLRA 231) to the south. The Brooks Range represents a drainage divide that is also the dividing line between MLRA 234 and MLRA 244. Rivers draining to the north wind their way along the North Slope until they reach the Arctic Ocean, while rivers that drain to the south reach the northern Pacific Ocean via the Bering Sea. MLRA 234 covers an area of 22,479 miles and is sparsely populated (USDA, 2022).

Geology
The Brooks Range is the northernmost extension of the Rocky Mountains and the highest range within the Arctic Circle, with high peaks in the eastern part of the range reaching elevations of nearly 9,000 feet. This area falls within the zone of discontinuous permafrost, with the continuous permafrost zone primarily occurring north of the Brooks Range. Wide, U-shaped valleys are evidence of extensive glaciation in the Early and Mid-Pleistocene, with most glaciers retreating to their current, high-elevation positions by the Late Pleistocene. The characteristically sharp upper peaks give way to lower mountain slopes comprised of alluvial and colluvial fans before reaching the gently sloping flood plains and terraces of the valley bottoms. While Paleozoic and Jurassic igneous and volcanic rocks can be found in the eastern part of the range, most of the lower slopes of this area are comprised of modified glacial material, alluvial, and colluvial deposits. Many rivers and

streams, such as the Koyukuk, have their headwaters in the Brooks Range and drain to the Bering Sea and North Pacific Ocean via the Yukon River.

Soils
The dominant soils orders in this MLRA are Gelisols, Entisols, and Inceptisols. Soils in the area have a gelic (subgelic) or cryic temperature regime, a udic or aquic moisture regime, and mixed minerology. Gelisols are common on soils that are shallow or moderately deep to permafrost and are somewhat poorly to very poorly drained. Gelisols are more common on cold slopes and stream terraces. In some cases, higher-intensity wildfires lead to loss of insulation when the surface organic layer is burned. This can lead to permafrost loss or active layer expansion and ultimately alter hydrology and taxonomic classification. Entisols and Inceptisols lacking in permafrost range from excessively-well to poorly drained. Entisols and inceptisols are more common on rocky terrain, warm boreal slopes, and flood plains. Miscellaneous areas such as glaciers, riverwash, rock outcrop, and rubble land make up 63 percent of the MLRA.

Vegetation
The continental subarctic climate of the Brooks Range in conjunction with shallow, rocky soils leads to a sparsely forested landscape in this MLRA. Spruce-hardwood forests and woodlands tend to be relegated to lower elevations where deeper soils form on footslopes and terraces. This is contrasted by the ericaceous dwarf shrub communities that are abundant on shallow, rocky slopes and ridges. Exposed sites are predominantly covered in lichen and sporadic forbs. Black spruce (*Picea mariana*) woodlands and tussock-forming sedge communities are on high stream terraces and footslopes where permafrost occurs, as are wet sedge meadows. Floodplains tend to be dominated by low to tall willow scrub communities.

Land use
Except for areas along the Dalton Highway, access to most of this MLRA is extremely limited, lending itself to intact natural vegetation communities. For this reason, land use primarily takes the form of subsistence hunting, gathering, and fishing by local communities. In additions to subsistence activity, the Brooks Range is also a popular recreation destination, with many users utilizing air taxi and guiding services to access remote parts of the area. As is the case with much of interior Alaska, major resource concerns involve the persistence of permafrost, the degradation of which can lead to various changes in hydrology and nutrient cycling.

LRU notes

This area supports three life zones defined by the physiological limits of plant communities along an elevational gradient: boreal, subalpine, and alpine. The boreal life zone is the elevational band where forest communities dominate. Not all areas in the boreal life zone are forest communities, however, particularly in places where soil is too wet or dry to support tree growth (e.g., bogs or river bluffs). Above the boreal band of elevation, subalpine and alpine vegetation dominate. The subalpine zone is typically a narrow

transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. In the subalpine, certain types of birch and willow shrub species grow at taller than one meter in height (commonly Betula glandulosa and Salix pulchra). In the alpine, trees no longer occur, and all shrubs are dwarf or lay prostrate on the ground. In this area, the boreal life zone occurs below 2,500 feet elevation on average. The transition between boreal and alpine vegetation can occur within a range of elevations, and is highly dependent on slope, aspect, and shading from adjacent mountains.

Within each life zone, there are plant assemblages that are typically associated with cold slopes and warms slopes. Cold slopes and warm slopes are created by the combination of the steepness of the slope, the aspect, and shading from surrounding ridges and mountains. Warm slope positions typically occur on southeast to west facing slopes that are moderate to very steep (greater than ten percent slope) and are not shaded by the surrounding landscape. Cold slopes typically 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 slope soils have a cryic soil temperature regime and lack permafrost. In this area, white spruce (Picea glauca) forests are an indicator of warm boreal slopes. Cold boreal slope soils typically 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. The boreal life zone can occur at higher elevations on warm slopes, and lower elevations on cold slopes.

Classification relationships

Alaska Vegetation Classification
Dwarf tree scrub woodland (II.A.1.3. - level IV)
(Viereck et al. 1992)

LANDFIRE Biophysical Settings
7416211 – Western North American Boreal Black Spruce Dwarf-tree Peatland – Boreal Complex
(LANDFIRE biophysical settings, 2009)

Ecological site concept

Key soil and site characteristics
• Occurs in the boreal life zone typically at elevations below 2500 feet
• Cold slopes (northwest to east facing)
• Coarse-silty to loamy-skeletal, poorly drained permafrost soils
• Shallow seasonal water table
• Moderate slopes (2 to 30 percent)

Associated sites

R234XY701AK	**Boreal tussock frozen hummocks** Commonly occurs on the summits of the same hills as ecological site 118 supporting a sedge tussock community.
F234XY714AK	**Boreal forest gravelly slopes** Occurs upslope of ecological site R234XY714AK, on warmer slopes that support stands of white spruce.

Similar sites

R234XY701AK	**Boreal tussock frozen hummocks** Both ecological sites occur on the same boreal hills and occasionally on the same footslopes. Mixed shrub-sedge tussock bog is the vegetation associated with ecological site R234XY701AK

Table 1. Dominant plant species

Tree	(1) *Picea mariana*
Shrub	(1) *Vaccinium vitis-idaea* (2) *Ledum palustre ssp. decumbens*
Herbaceous	(1) *Eriophorum vaginatum* (2) *Carex bigelowii*

Physiographic features

This site occurs on moderately sloping cold mountain backslopes, foot slopes, and toe slopes in the boreal zone. The boreal zone typically occurs below 2500 feet but can occur on warmer slopes up to 3000 feet or more. This ecological site occurs on slopes ranging from 2 to 30 percent. Ponding and flooding are not known to occur, but a shallow water table persists throughout the growing season.

Table 2. Representative physiographic features

Geomorphic position, mountains	(1) Lower third of mountainflank
Landforms	(1) Mountains > Mountain slope
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	280–762 m
Slope	2–30%
Water table depth	0 cm

Aspect	NW, N, NE, E

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	280–914 m
Slope	Not specified
Water table depth	Not specified

Climatic features

Characterized by a continental subarctic climate, cool, short summers interspace long, cool winters in this Major Land Resource Area (MLRA). Average annual temperatures range from 8 to 16 degrees, with freezing temperatures possible throughout the year. Precipitation ranges from 10 inches at low elevations up to 30 inches in the high elevations, with average snowfall ranging from 60 to 100 inches, annually. On average, there are only four frost free days per year at lower elevations, with frost possible throughout the year at higher elevations. The average high temperature in July (the warmest month, on average) is 65 degrees F, while the average high temperature in January is -1 degrees F. Extreme lows are common throughout interior Alaska. The lowest temperature recorded in Bettles Field, the location of one of the weather stations below, reached -69 degrees F.

Table 4. Representative climatic features

Frost-free period (characteristic range)	3-4 days
Freeze-free period (characteristic range)	48-59 days
Precipitation total (characteristic range)	254-356 mm
Frost-free period (actual range)	3-4 days
Freeze-free period (actual range)	46-61 days
Precipitation total (actual range)	229-356 mm
Frost-free period (average)	4 days
Freeze-free period (average)	54 days
Precipitation total (average)	305 mm

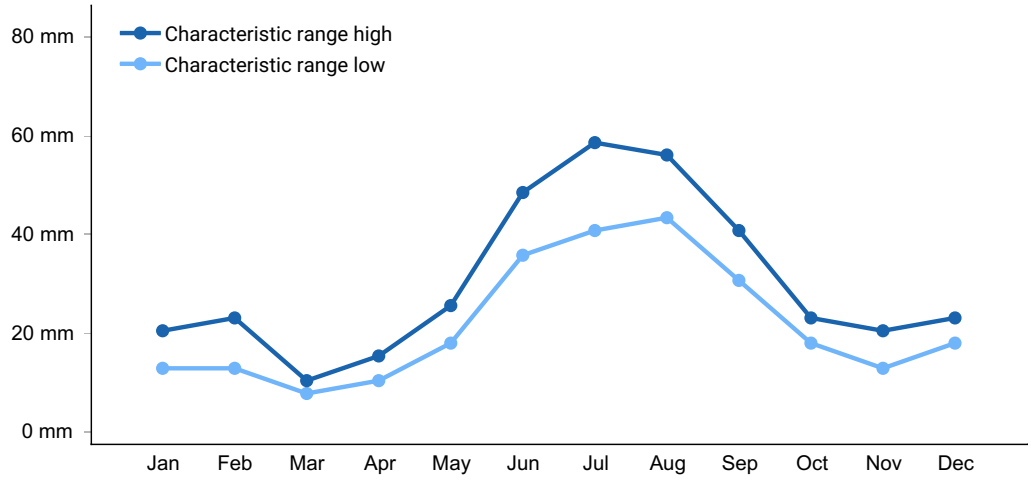


Figure 1. Monthly precipitation range

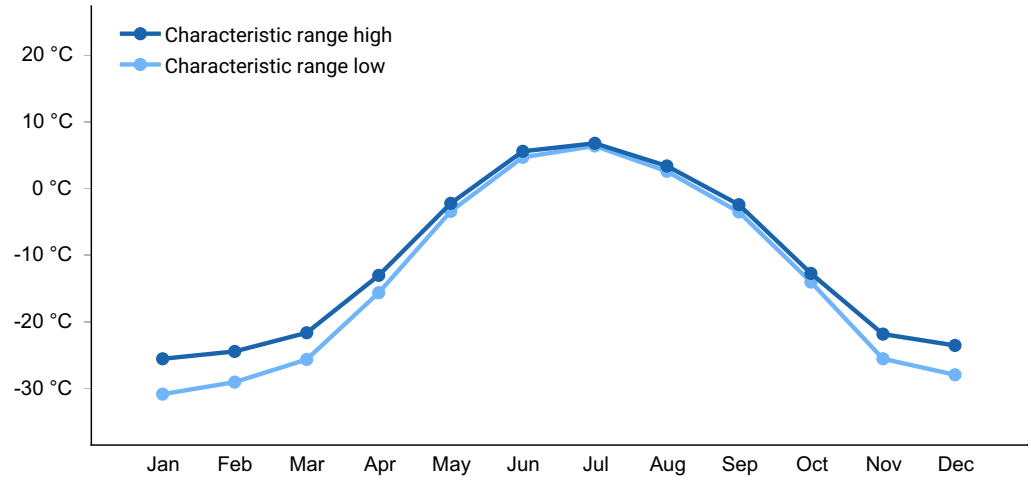


Figure 2. Monthly minimum temperature range

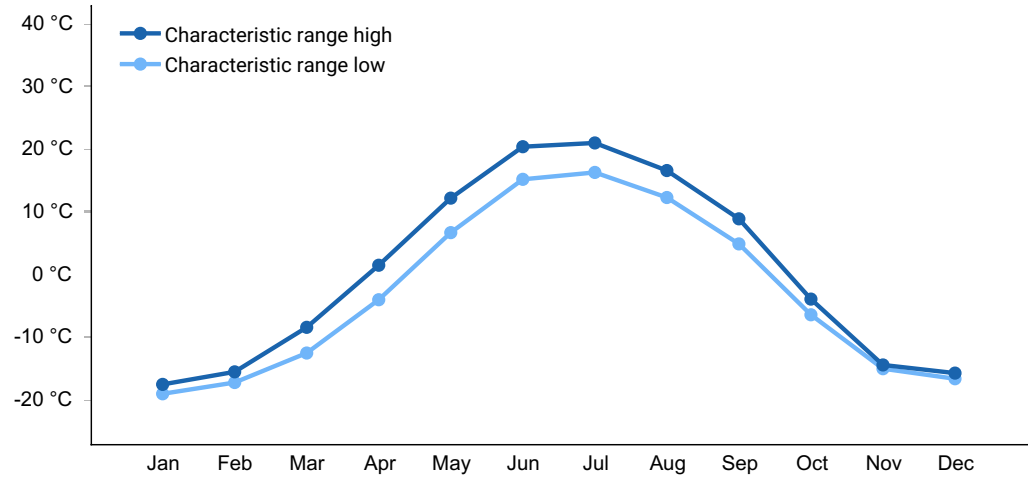


Figure 3. Monthly maximum temperature range

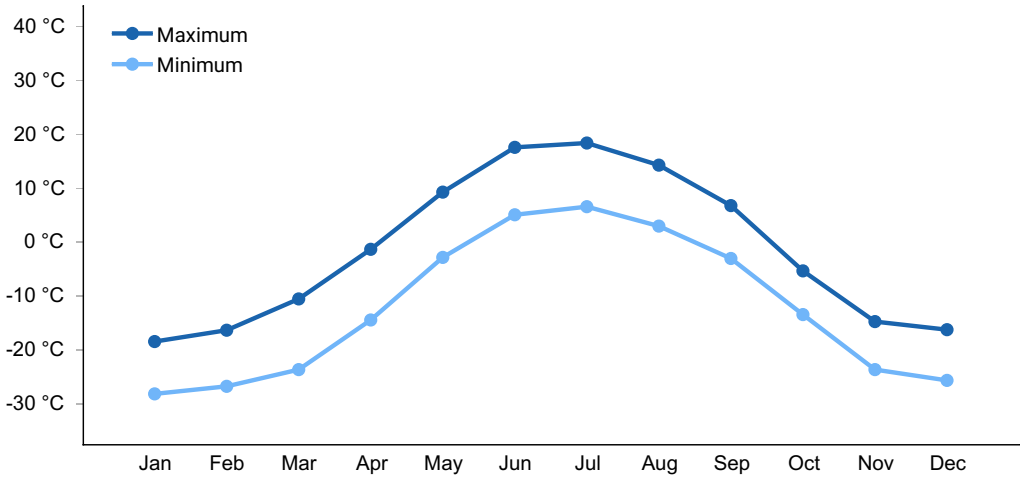


Figure 4. Monthly average minimum and maximum temperature

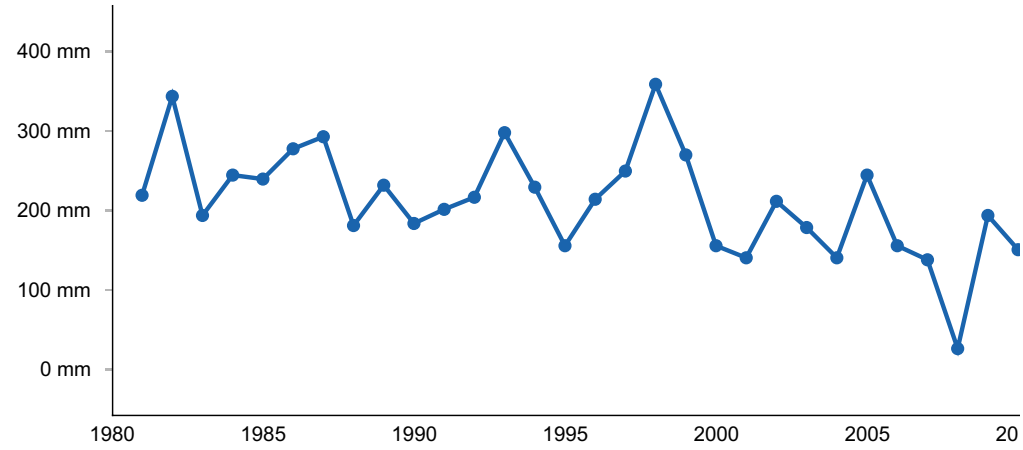


Figure 5. Annual precipitation pattern

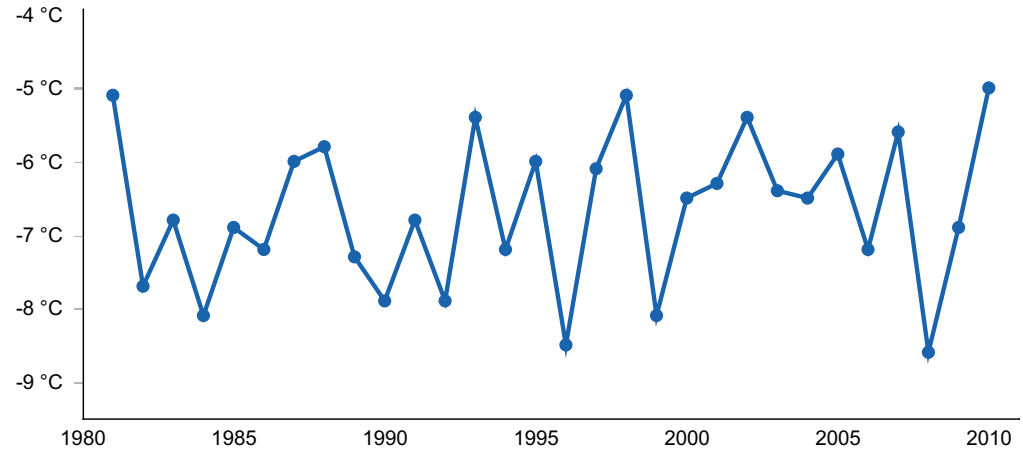


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WISEMAN [USC00509869], Bettles Field, AK
- (2) CHANDALAR SHELF DOT [USC00501497], Southerly North Slope Bo, AK
- (3) CHANDALAR LAKE [USC00501492], Yukon Flats Nat Wildlife, AK

Influencing water features

This site is associated with a shallow water table near the soil surface that persists through the growing season. Precipitation and groundwater are the main sources of water.

Soil features

The soils of this ecological site form in windblown silts and silty colluvium and have permafrost. Rock fragments do not occur on the soil surface and mineral soil is capped with 13 inches of saturated organic material. The mineral soil below the organic material is coarse-silty to loamy-skeletal derived from colluvium and windblow silts and has moderate rock fragments and high-water holding capacity. The soils of this site are considered very deep, but permafrost commonly occurs between 13 to 26 inches. Soils are extremely acidic to strongly acidic and are poorly drained with a shallow water table persisting throughout the growing season.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Colluvium
Surface texture	(1) Peat
Family particle size	(1) Coarse-silty (2) Loamy-skeletal
Drainage class	Poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	33–66 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.16–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	3.5–5.4
Subsurface fragment volume <=3" (0-152.4cm)	0–17%

Subsurface fragment volume >3" (0-152.4cm)	0–14%

Ecological dynamics

Fire
In interior Alaska, fire is a common and natural event that has a significant control on the vegetation dynamics across the landscape. A typical fire event in the lands associated with this ecological site will reset plant succession and alter dynamic soil properties (e.g., soil organic matter and depth of permafrost). For this ecological site to progress from the earliest stages of post-fire succession to the oldest stages of succession, data suggest that 70-100 years or more must elapse without another fire event (Johnstone et al. 2010a).

Within this area, fire is considered a natural and common event that typically is unmanaged. Fire suppression is limited and generally occurs adjacent to the various villages spread throughout the area or on allotments with known structures, all of which have a relatively limited acre footprint. Most fires are caused by lightning strikes. Fire-related disturbances are highly patchy and can leave undisturbed areas within the burn perimeter.

The fire regime within interior Alaska follows two general scenarios—low-severity burns, and high-severity burns. It should be noted, however, that the fire regime in interior Alaska is generally thought to be much more complex (Johnstone et al. 2008). Burn severity refers to the proportion of the vegetative canopy and organic material consumed in a fire event (Chapin et al. 2006). Fires in cool and moist habitat tend to result in low-severity burns, while fires in warm and dry habitat tend to result in high-severity burns. Because the soils have a thick organic cap and are poorly drained, the typical fire scenario for this ecological site is considered to result in a low severity burn.

Reference State Soil and Vegetation Dynamics
The low severity fire regime associated with this ecological site has modest impacts to soil organic matter thickness, depth of permafrost, and soil drainage. While a low severity fire can consume the bulk of above ground vegetation, minimal proportions of the organic mat are typically removed. Organic matter continues to insulate these cold soils. Field data support that each plant community has permafrost and that the associated low severity fire event had a negligible impact on the depth of permafrost. If permafrost remains at similar depths after a fire event, then soil drainage is unlikely to improve post-fire.

In areas prone to low severity fire events, the pre-fire vegetative community generally reestablishes quickly and there is minimal long-term alteration to community composition (Johnstone et al. 2010; Bernhardt et al. 2011). When minimal proportions of the organic mat are consumed, many species regenerate asexually using below ground root systems and rhizomes. Species known to regenerate after low severity fire events include various graminoids (e.g., sedges (Carex spp.) and cottongrass (Eriophorum spp.)), forbs (e.g., horsetail (Equisetum sp.)), and shrubs (e.g., labrador tea (*Ledum groenlandicum*), bog

blueberry (*Vaccinium uliginosum*), willow (Salix spp.)) (Johnstone et al. 2010). Black spruce (*Picea mariana*) is the Interior Alaska tree species best adapted to a low severity fire regime. Black spruce has semi-serotinous cones, and a low-severity fire often results in a flush of black spruce seedlings at the burned location.

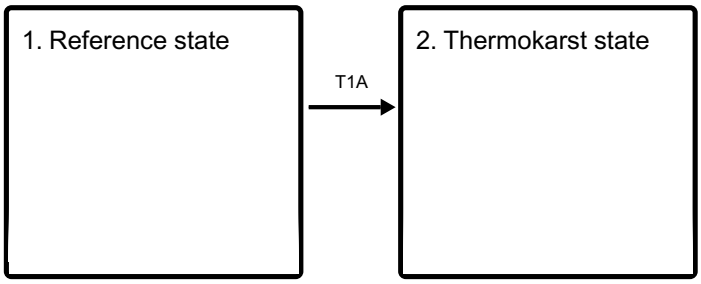
The latter stages of succession have an overstory that is a mix of broadleaf and immature needleleaf trees (community 1.2) or mature needleleaf trees (community 1.1). The recruitment of trees species during the early stages of post-fire succession largely controls the composition of the stand of trees in the later stages of post-fire succession (Johnstone et al. 2010a). During these later stages of succession, the slower growing black spruce seedlings mature and eventually replace the shade-intolerant broadleaf tree species. The typical fire return interval for black spruce stands in the boreal forest is 70-130 years (Johnstone et al. 2010a).

Lands associated with this site may be burning more frequently than in the past, which may result in alternative pathways of succession. The historic fire return interval for black spruce stands in Interior Alaska occurs approximately once per century. Due to global climate change, stands of spruce in certain portions of the Alaskan boreal forest are burning more frequently than these historic averages (Kelly et al. 2013). Increases to burn frequency favors forested stands dominated by quick growing deciduous trees. A major reason being that increased fire frequency decreases the presence and abundance of mature, cone-bearing trees. Less mature trees result in less spruce seedlings post-fire and an overall decreased abundance of spruce in the developing forest canopy. Increased burn frequency in the boreal forest may result in alternative pathways of post-fire succession with stands of deciduous trees persisting for longer than normal durations of time (Johnstone et al. 2010b).

Thermokarst State
Thermokarst occurs due to the thaw of ice-rich permafrost in soil after disturbances such as fire events or land clearing. For this site, thermokarst pits and gulleys that cut up slopes are common landforms associated with toe slopes and foot slopes in the area. From 2008 to 2009, four field observation were collected in areas that had undergone various degrees of thermokarst. When compared to reference state soils, all four observations had comparatively wetter soils that pond for longer durations of time. Two of these observations no longer had permafrost in the soil profile (0 to 60 inches).

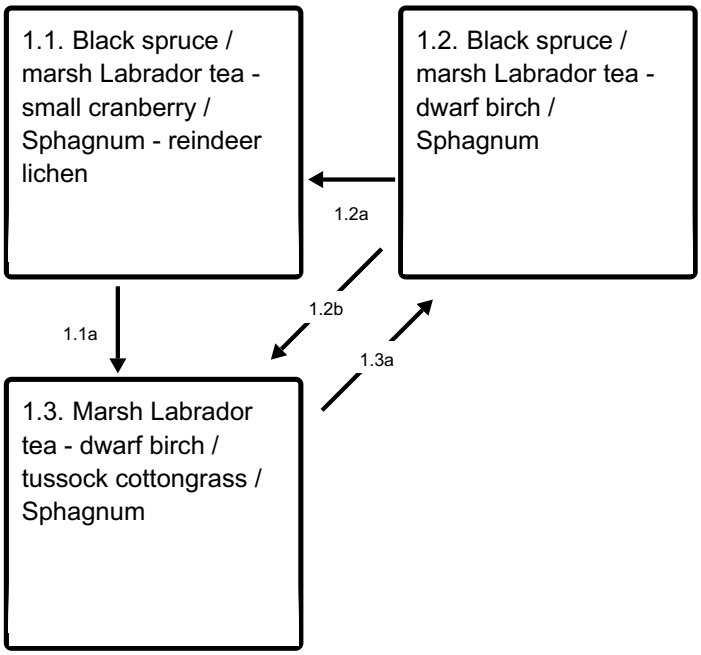
State and transition model

Ecosystem states



T1A - Permafrost thaw

State 1 submodel, plant communities



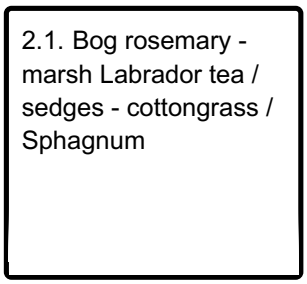
1.1a - Fire

1.2a - Time without fire

1.2b - Fire

1.3a - Time without fire

State 2 submodel, plant communities



State 1
Reference state

The reference plant community is dwarf tree scrub woodland (Viereck et al. 1992) dominated by black spruce (*Picea mariana*). There are three plant communities within the reference state related to fire.

Dominant plant species

- black spruce (*Picea mariana*), tree
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub

- sphagnum (*Sphagnum*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 1.1
Black spruce / marsh Labrador tea - small cranberry / Sphagnum - reindeer lichen

The reference plant community is characterized as dwarf tree scrub woodland (Viereck et al. 1992) with black spruce (*Picea mariana*) as the dominant tree. Black spruce tree cover primarily occurs in the stunted tree stratum (greater than 50 years of age and less than 15 feet). Live deciduous trees, primarily birch (Betula spp.), occasionally occur in the tree canopy. The soil surface is primarily covered with moss and lichen. Common understory species include marsh Labrador tea (*Ledum palustre* ssp. decumbens), bog blueberry (*Vaccinium uliginosum*), small cranberry (*Vaccinium oxycoccos*), lingonberry (*Vaccinium vitis-idaea*), tussock cottongrass (*Eriophorum vaginatum*), cloudberry (*Rubus chamaemorus*), various reindeer lichen (Cladina spp.), curled snow lichen (*Flavocetraria cucullata*), and various Sphagnum mosses (Sphagnum spp.). The understory vegetative strata that characterize this community are low shrubs (between 8 and 36 inches), mosses, and lichens.

Dominant plant species

- black spruce (*Picea mariana*), tree
- resin birch (*Betula neoalaskana*), tree
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- sphagnum (*Sphagnum*), other herbaceous
- (*Flavocetraria cucullata*), other herbaceous
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- reindeer lichen (*Cladina mitis*), other herbaceous

Community 1.2
Black spruce / marsh Labrador tea - dwarf birch / Sphagnum

Community 1.2. is in the late stage of fire-induced secondary succession for this ecological site. It is characterized as dwarf tree scrub woodland (Viereck et al. 1992). Black spruce (*Picea mariana*) seedlings are abundant, and tree cover primarily occurs in regenerative tree stratum. The soil surface is primarily covered with herbaceous litter and mosses. Common understory species include marsh Labrador tea (*Ledum palustre* ssp decumbens), lingonberry (*Vaccinium vitis-idaea*), dwarf birch (*Betula nana*), bog blueberry (*Vaccinium uliginosum*), tussock cottongrass (*Eriophorum vaginatum*), Bigelow's sedge

(*Carex bigelowii*), cloudberry (*Rubus chamaemorus*), curled snow lichen (*Flavocetraria cucullata*), various Sphagnum mosses (Sphagnum spp.), splendid feathermoss (*Hylocomium splendens*), and Schreber's big redstem moss (*Pleurozium schreberi*). The understory vegetative strata that characterize this community are tree regeneration, low shrubs (between 8 and 36 inches), dwarf shrubs (less than eight inches), and mosses.

Dominant plant species

- black spruce (*Picea mariana*), tree
- resin birch (*Betula neoalaskana*), tree
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- dwarf birch (*Betula nana*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub
- willow (*Salix*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- sphagnum (*Sphagnum*), other herbaceous
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- reindeer lichen (*Cladina mitis*), other herbaceous
- (*Flavocetraria cucullata*), other herbaceous
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous
- peppermint drop lichen (*Icmadophila ericetorum*), other herbaceous
- polytrichum moss (*Polytrichum*), other herbaceous

Community 1.3
Marsh Labrador tea - dwarf birch / tussock cottongrass / Sphagnum

Community 1.3 is in the early stage of fire-induced secondary succession for this ecological site. This community is characterized as open low scrub (Viereck et al. 1992). Seedlings of black spruce (*Picea mariana*) are common but have limited cover. Common species include marsh Labrador tea (*Ledum palustre* ssp. decumbens), dwarf birch (*Betula nana*), lingonberry (*Vaccinium vitis-idaea*), bog blueberry (*Vaccinium uliginosum*), small cranberry (*Vaccinium oxycoccos*), tussock cottongrass (*Eriophorum vaginatum*), Bigelow's sedge (*Carex bigelowii*), cloudberry (*Rubus chamaemorus*), various Sphagnum (Sphagnum spp.), and juniper polytrichum moss (*Polytrichum juniperinum*). The strata that characterize this community are low shrubs (between 8 and 36 inches), medium graminoids (between 4 and 24 inches), and mosses.

Dominant plant species

- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- dwarf birch (*Betula nana*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub

- black crowberry (*Empetrum nigrum*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- slimstem reedgrass (*Calamagrostis stricta*), grass
- sphagnum (*Sphagnum*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous
- (*Flavocetraria cucullata*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.3

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated cold and wet soils, this ecological site commonly experiences low-severity fires. Minimal proportions of the organic mat are typically removed. The pre-fire vegetation generally reestablishes quickly from below ground root systems and rhizomes.

Pathway 1.2a
Community 1.2 to 1.1

Time without fire. Black spruce (*Picea mariana*) seedlings and saplings mature into a stunted woodland.

Pathway 1.2b
Community 1.2 to 1.3

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated cold and wet soils, this ecological site commonly experiences low-severity fires. Minimal proportions of the organic mat are typically removed. The pre-fire vegetation generally reestablishes quickly from below ground root systems and rhizomes.

Pathway 1.3a
Community 1.3 to 1.2

Time without fire. Black spruce (*Picea mariana*) seedlings and sapling start to become a characteristic component of the plant community.

State 2
Thermokarst state

Thermokarst occurs due to the thermal erosion of ice-rich permafrost in soil after

disturbances such as fire events or land clearing. For this ecological site, pits and gulleys that cut up a foot slope are common landforms associated with thermokarst. While thermokarst can be readily observed, details related to thermokarst succession are poorly understood. After an unknown timeframe, thermokarst depressions could theoretically revert back to plant communities associated with the reference state (Myers-Smith et al. 2008). However, the timeframe for recovery is likely outside the scope of typical land management priorities. At this time, restoration back to reference conditions is not considered within the state-and-transition model. Thermokarst vegetation is commonly characterized as open low scrub (Viereck et al. 1992). Associated soils pond and have a persistent high-water table. The thermokarst state has one documented plant community. Future data collection efforts and research would likely enhance information about existing plant communities within this state and allow for better understanding of the potential transitions from one community or state to another.

Dominant plant species

- bog rosemary (*Andromeda polifolia*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- sedge (*Carex*), grass
- cottongrass (*Eriophorum*), grass
- sphagnum (*Sphagnum*), other herbaceous

Community 2.1
Bog rosemary - marsh Labrador tea / sedges - cottongrass / Sphagnum

Community 2.1 develops after thermokarst for this ecological site. This community is characterized as open low scrub (Viereck et al. 1992). Seedlings of black spruce (*Picea mariana*) occasionally occur but with limited cover. Common species include bog rosemary (*Andromeda polifolia*), marsh Labrador tea (*Ledum palustre* ssp. decumbens), dwarf birch (*Betula nana*), leatherleaf (*Chamaedaphne calyculata*), small cranberry (*Vaccinium oxycoccos*), lingonberry (*Vaccinium vitis-idaea*), tussock cottongrass (*Eriophorum vaginatum*), red cottongrass (*Eriophorum russeolum*), mud sedge (*Carex limosa*), and Sphagnum mosses (Sphagnum spp.). The vegetative strata that characterize this community are low shrubs (between 8 and 36 inches), medium graminoids (between 4 and 24 inches), and mosses.

Dominant plant species

- bog rosemary (*Andromeda polifolia*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- dwarf birch (*Betula nana*), shrub
- leatherleaf (*Chamaedaphne calyculata*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- tussock cottongrass (*Eriophorum vaginatum*), grass

- mud sedge (*Carex limosa*), grass
- red cottongrass (*Eriophorum russeolum*), grass
- sphagnum (*Sphagnum*), other herbaceous
- peppermint drop lichen (*Icmadophila ericetorum*), other herbaceous

Transition T1A
State 1 to 2

Land clearing or fire can thaw permafrost and the thermal erosion of ground ice results in the settling of soil, which is thermokarst. Subsidence can be significant with collapsed pits going down and spanning across several feet.

Additional community tables

Inventory data references

The vegetation modeled for this ecological site has limited data and is considered provisional. The associated model was largely developed from NRCS (Natural Resources Conservation Service) staff with working knowledge of the area and literature review.

Plant community composition is largely based on ecological sites from Major Land Resource Area (MLRA) 231X: Interior Alaska Highlands.

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

Bernhardt, E.L., T.N. Hollingsworth, and S. Chapin. 2011. Fire severity mediates climate-driven shifts in understory community composition of black spruce stands of interior Alaska. Journal of Vegetation Science 22:32–44.

Chapin, F.S., L.A. Viereck, P.C. Adams, K.V. Cleve, C.L. Fastie, R.A. Ott, D. Mann, and J.F. Johnstone. 2006. Successional processes in the Alaskan boreal forest. Page 100 in Alaska’s changing boreal forest. Oxford University Press.

Hinzman, L.D., L.A. Viereck, P.C. Adams, V.E. Romanovsky, and K. Yoshikawa. 2006. Climate and permafrost dynamics of the Alaskan boreal forest. Alaska’s changing boreal forest 39–61.

I. H. Myers-Smith, J. W. Harden, M. Wilmking, C. C. Fuller, A. D. McGuire, and F. S. Chapin III. 2008. Wetland succession in a permafrost collapse: interactions between fire and thermokarst. Biogeosciences 5:1273–1286.

Johnstone, J.F., T.N. Hollingsworth, F.S. CHAPIN III, and M.C. Mack. 2010. Changes in fire regime break the legacy lock on successional trajectories in Alaskan boreal forest. Global change biology 16:1281–1295.

Johnstone, J.F., F.S. Chapin, T.N. Hollingsworth, M.C. Mack, V. Romanovsky, and M. Turetsky. 2010. Fire, climate change, and forest resilience in interior Alaska. Canadian Journal of Forest Research 40:1302–1312.

Johnstone, J.F. 2008. A key for predicting postfire successional trajectories in black spruce stands of interior Alaska. US Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Kelly, R., M.L. Chipman, P.E. Higuera, I. Stefanova, L.B. Brubaker, and F.S. Hu. 2013. Recent burning of boreal forests exceeds fire regime limits of the past 10,000 years. Proceedings of the National Academy of Sciences 110:13055–13060.

LANDFIRE. 2009. Western North American Boreal Black Spruce Dwarf-tree Peatland – Boreal Complex. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

Schoeneberger, P.J. and D.A. Wysocki. 2012. Geomorphic Description System. Natural Resources Conservation Service, 4.2 edition. National Soil Survey Center, Lincoln, NE.

Smith, R.D., A.P. Ammann, C.C. Bartoldus, and M.M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices.

United States Department of Agriculture, . 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.

Contributors

Tyler Annetts
Phil Barber

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	03/20/2026
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:**
