Ecological site F230XY612AK
Boreal Forest Loamy Slopes

Last updated: 6/11/2025
Accessed: 03/25/2026

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:
Needleleaf open forest (I.A.2 - level III) / Open white spruce forest (I.A.2.e - level IV)
(Viereck et al., 1992)

BioPhysical Settings:
7316030 – Western North American Boreal White Spruce-Hardwood Forest
(Landfire, 2009)

Circumboreal Vegetation Map:
Yukon Spruce-Birch-Aspen Forests
(Jorgensen and Meidinger, 2015)

Ecological site concept

Ecological Site characteristics:
• Occurs in the boreal life zone on warm slopes of hill and mountains.
• Soils are very deep and lack root restrictions like permafrost
• Soils formed in loess and gravelly colluvium and have organic horizons less than six

inches thick
• Soils do not pond or flood. These well drained soils do not have a water table in the soil profile.
• The reference plant community is an open white spruce forest with medium shrubs, graminoids and mosses dominating the understory.
• Fire is the major disturbance in this ecological site and is responsible for four plant communities.

Associated sites

F230XY614AK	**Boreal Black Spruce Unfrozen Well Drained Slopes** Ecological site F230XY614AK occurs on the same hills and mountains but on colder slope positions with thicker organic mats. Ecological site 614 is associated with black spruce forests.
F230XY615AK	**Boreal Deciduous Forest Loamy Steep Slopes** Ecological site F230XY615AK occurs on adjacent slopes that are much steeper and are associated with paper birch forests.
R230XY606AK	**Boreal Sedge Peat Depressions** Ecological site R230XY606AK occurs in adjacent drainages and swales that have wet soils and support willows and sedges.

Similar sites

F230XY615AK	**Boreal Deciduous Forest Loamy Steep Slopes** F230XY615AK and F230XY612AK share similar hardwood successional plant communities. However, white spruce stands do not occur on the steep slopes associated with F230XY615AK.

Table 1. Dominant plant species

Tree	(1) *Picea glauca*
Shrub	(1) *Rosa acicularis* (2) *Viburnum edule*
Herbaceous	(1) *Hylocomium splendens*

Physiographic features

• This boreal ecological site occurs on the summits, shoulders, and backslopes of hills and on mountain bases and mountain flanks.
• Elevation typically ranges between 100 and 1200 feet
• Slope gradients are strongly sloping to moderately steep (4 to 25 percent).
• This site occurs on warm slopes. These slopes are on all aspects of lower elevation hills and become restricted to southern and western aspects on mountains.
• Flooding and ponding do not occur. A water table typically does not occur in the soil

profile.

Table 2. Representative physiographic features

Slope shape across	(1) Linear (2) Convex
Slope shape up-down	(1) Linear (2) Convex
Hillslope profile	(1) Backslope (2) Shoulder (3) Summit
Landforms	(1) Mountains > Mountain (2) Hills > Hill
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	30–366 m
Slope	4–25%
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	30–655 m
Slope	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

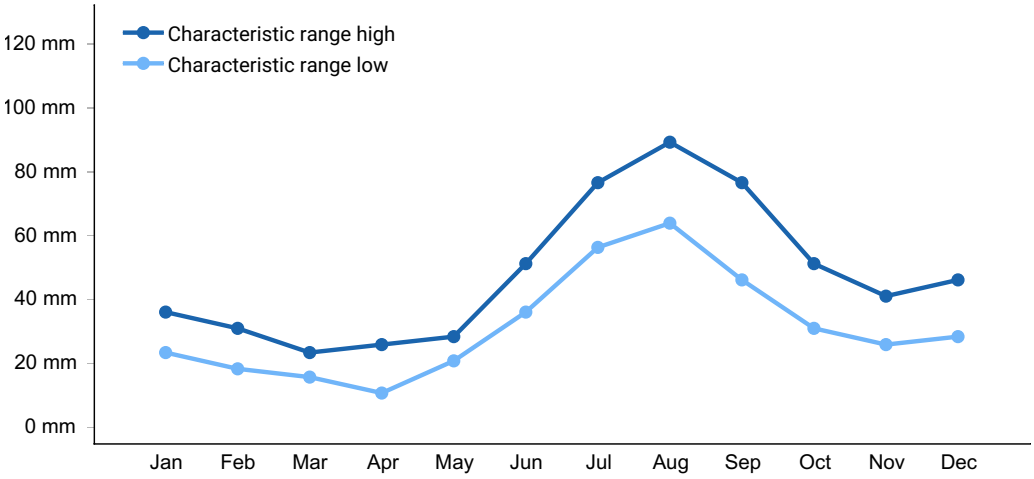


Figure 1. Monthly precipitation range

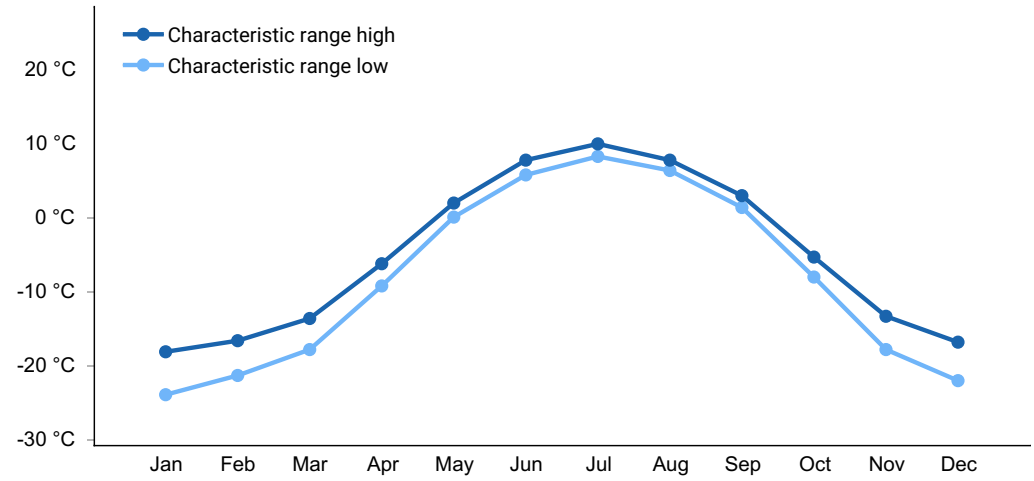


Figure 2. Monthly minimum temperature range

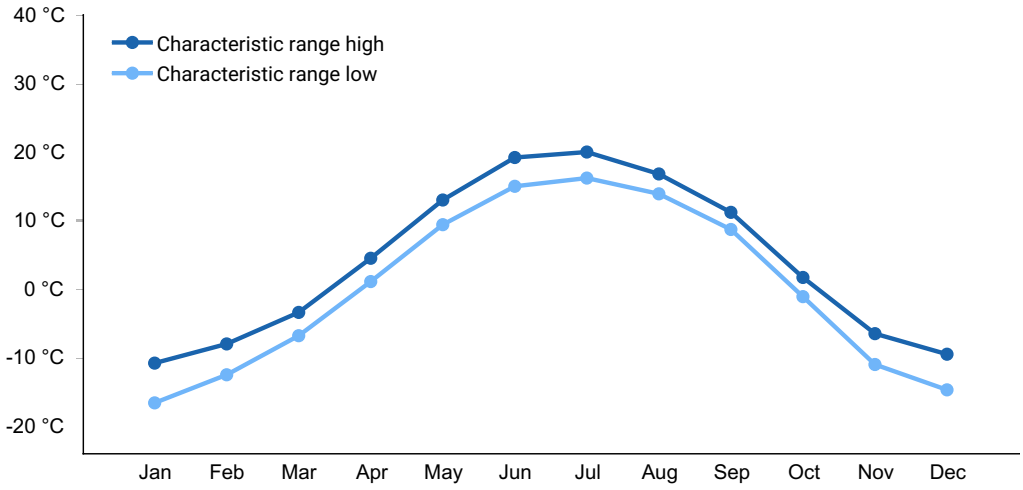


Figure 3. Monthly maximum temperature range

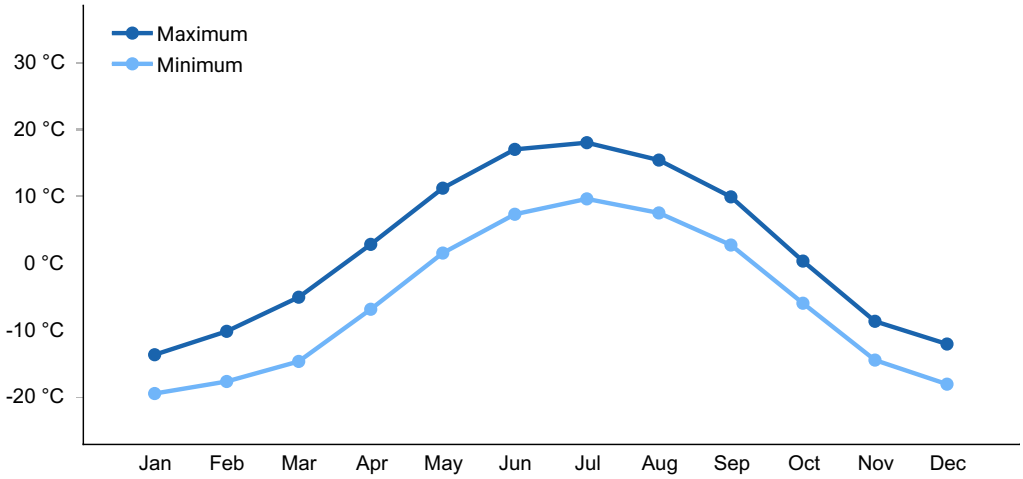


Figure 4. Monthly average minimum and maximum temperature

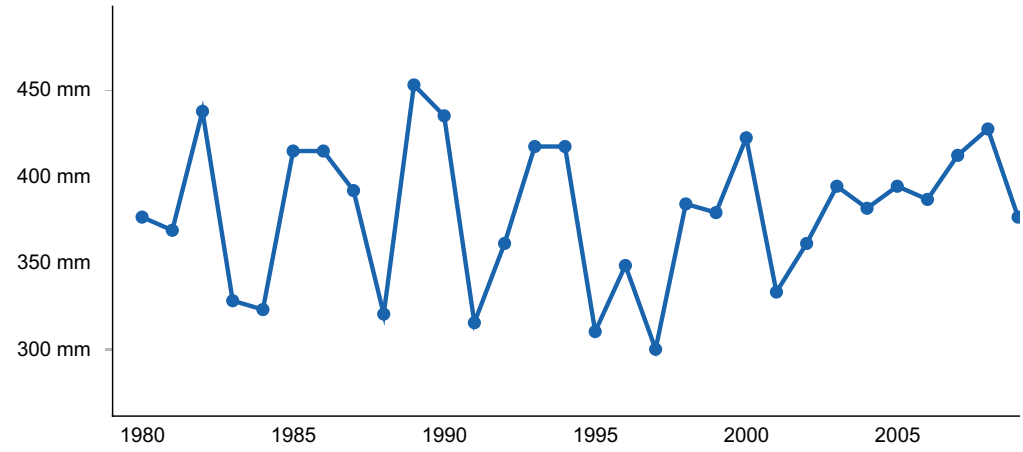


Figure 5. Annual precipitation pattern

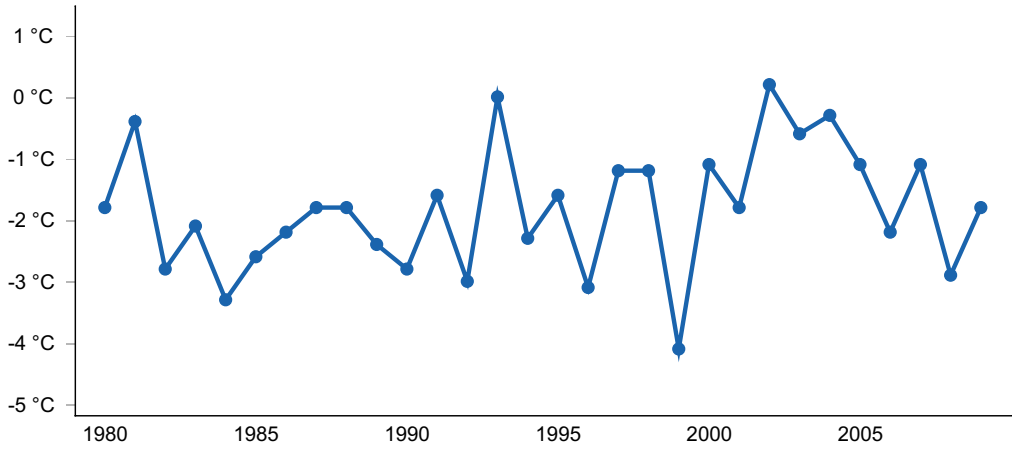


Figure 6. Annual average temperature pattern

Influencing water features

This site is not associated with or influenced by streams or wetlands. Precipitation and throughflow are the main source of water for this ecological site. Surface runoff and throughflow contribute water to downslope ecological sites.

Wetland description

This ecological site is not a wetland.

Soil features

• Common Inceptisol great groups are Haplocryepts, while common Spodosol great groups are Haplocryods (Soil Survey Staff, 2013).
• Soils formed in loess over gravelly colluvium.
• Rock fragments do not occur on the soil surface.
• Soils have a thin, 2- to 4-inch-thick organic cap. The texture of the top mineral horizon is silt loam or silt.
• Soils are typically very deep but on occasion bedrock contact occurs at moderate to deep depths (35 to 59 inches).
• Subsurface rock fragments vary from zero to thirty percent volume
• Soil pH is extremely to moderately acidic.
• Soils are well drained.

Table 5. Representative soil features

Parent material	(1) Eolian deposits (2) Loess (3) Colluvium
Surface texture	(1) Silt loam (2) Silt

Family particle size	(1) Coarse-silty (2) Coarse-loamy (3) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	Not specified
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.19–17.78 cm
Soil reaction (1:1 water) (0-25.4cm)	4.1–6
Subsurface fragment volume <=3" (0-152.4cm)	0–24%
Subsurface fragment volume >3" (0-152.4cm)	0–8%

Table 6. Representative soil features (actual values)

Drainage class	Moderately well drained to well drained
Permeability class	Not specified
Depth to restrictive layer	89–150 cm
Soil depth	89–152 cm
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)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

Fire

Fire has a major influence on vegetation across the Yukon-Kuskokwim Highlands MLRA. It is a common and natural event that is generally unmanaged except near towns and villages. Fires are patchy and different locations within a single burn area may experience different levels of fire intensity, or no fire at all. Fires may present as low-severity or high-severity, and the vegetative response may differ based on fire type. In general, cooler and wetter areas experience low severity fires, while dry, warm landforms experience higher severity fires. Other factors such as fire load and recent weather also affect a fire's characteristics. A typical fire event is a vegetative replacement event that damages or destroys above ground biomass and the organic soil cap.

Fire is the major natural disturbance on this ecological site. The typical fire return interval for this ecological site is 50 to over 200 years (Landfire, 2009). Crown fires are the dominant fire type, though more severe ground fires also occur. The typical post-fire successional pathway normally begins with an herbaceous meadow before progressing through a shrubland, a hardwood forest and, ending back at the pre-fire white spruce reference plant community. However, fire dynamics across the MLRA and within this provisional ecological site are variable.

Windthrow is a disturbance in this ecological site. It is a regular occurrence and keeps the canopy open. The light provided by canopy gaps contributes to higher shrub and forb diversity in the understory than might be found under a closed canopy.

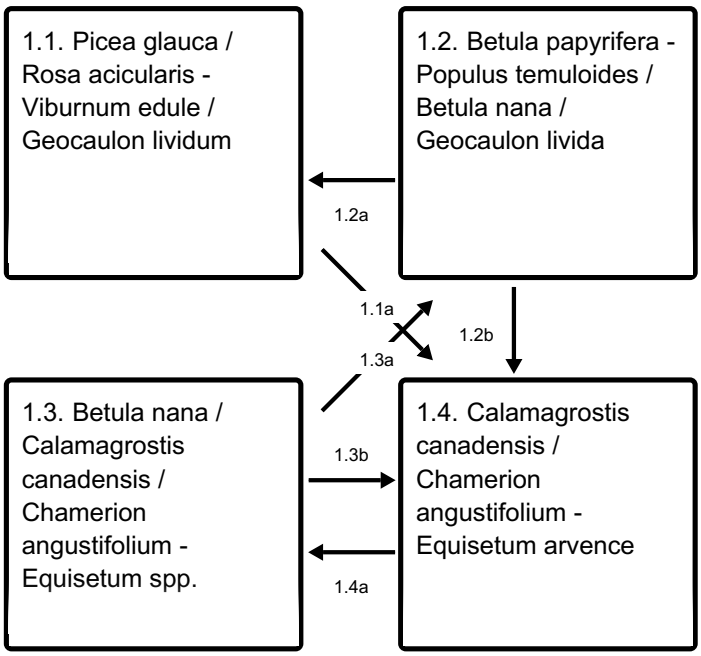
The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant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

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities



1.1a - Fire; occurs 0 - 4 years post-fire

1.2a - Fire recovery; develops 130+ years post-fire

1.2b - Fire

1.3a - Fire recovery; develops 30 - 120 years post-fire

1.3b - Fire

1.4a - Fire recovery; develops 5 - 30 years post-fire

State 1
Reference State

Figure 7. The white spruce reference plant community is common downslope of alder stands, as seen here.

The reference state describes four distinct vegetative communities on warm boreal slopes

with relatively thin (six inches or less) organic horizons. Fire is the major disturbance. Factors such as a cyclical fire regime, soil temperature, and soil drainage contribute to the community composition and dynamics of this ecological site. 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

- white spruce (*Picea glauca*), tree
- prickly rose (*Rosa acicularis*), shrub
- squashberry (*Viburnum edule*), shrub
- red fruit bearberry (*Arctostaphylos rubra*), shrub
- false toadflax (*Geocaulon lividum*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous

Community 1.1
Picea glauca / Rosa acicularis - Viburnum edule / Geocaulon lividum

The reference plant community is an open or closed forest (Viereck et al. 1992). White spruce is the dominant tree in this community. Other species, such as black spruce, paper birch, and quaking aspen may be present. Their presence is often dictated by site-specific climate and soil factors, as well as previous fire intensity. Tree cover is primarily in the tall stratum (greater than 40 feet). The dominant vegetative strata are tall trees, medium shrubs, medium graminoids, and medium forbs. Ground cover includes mosses, lichens, woody litter, and herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), tree
- black spruce (*Picea mariana*), tree

- dwarf birch (*Betula nana*), shrub
- prickly rose (*Rosa acicularis*), shrub
- red fruit bearberry (*Arctostaphylos rubra*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- squashberry (*Viburnum edule*), shrub
- russet buffaloberry (*Shepherdia canadensis*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- false toadflax (*Geocaulon lividum*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Community 1.2
Betula papyrifera - Populus temuloides / Betula nana / Geocaulon livida

Figure 8. Paper birch is more common on moister soils.

Figure 9. Aspen is more common on warmer, drier slopes.

This community is an open deciduous forest (Viereck et al. 1992). The forest canopy supports paper birch and/or quaking aspen, which is often dependent on current soil conditions created by previous fire severity. White spruce and black spruce may be present. The dominant vegetative strata are tall trees, medium shrubs, low shrubs, and medium forbs. Ground cover is primarily mosses, lichens, and herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- paper birch (*Betula papyrifera*), tree
- quaking aspen (*Populus tremuloides*), tree
- white spruce (*Picea glauca*), tree
- dwarf birch (*Betula nana*), shrub
- prickly rose (*Rosa acicularis*), shrub
- squashberry (*Viburnum edule*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- false toadflax (*Geocaulon lividum*), other herbaceous
- twinflower (*Linnaea borealis*), other herbaceous
- horsetail (*Equisetum*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 1.3
Betula nana / Calamagrostis canadensis / Chamerion angustifolium - Equisetum spp.

This community is an open low scrubland (Viereck et al. 1992). The dominant vegetative strata are low shrubs, and tall and medium graminoids and forbs. This community supports a mix of birch and ericaceous shrubs along with a variety of fast-growing, often seed-dispersed species capable of reproducing on the recently burned substrate. Tree seedlings and saplings are often present. Ground cover is primarily fresh and burned herbaceous litter, woody litter, and bare soil. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- dwarf birch (*Betula nana*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- manzanita (*Arctostaphylos*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- horsetail (*Equisetum*), other herbaceous

Community 1.4
Calamagrostis canadensis / Chamerion angustifolium - Equisetum arvence

This community is an herbaceous meadow (Viereck et al. 1992). The dominant vegetative strata are medium and tall graminoids and forbs (Landfire, 2009). Fast-growing herbaceous species with high seeding rates are the fastest to colonize the exposed mineral soil and burned organic layer. Ground cover is primarily herbaceous litter, woody litter, and bare soil. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.4

Crown fires are the major fire disturbance (Landfire, 2009). A fire sweeps through and incinerates much of the above ground vegetation. The organic mat is partially or fully removed. Post-fire species include surviving individuals from the pre-fire community, as well as fast-growing, seed-dispersing herbaceous species. The typical fire cycle on this ecological site ranges from 50 to 200 years (Landfire, 2009).

Pathway 1.2a

Community 1.2 to 1.1

Betula papyrifera - Populus temuloides / Betula nana / Geocaulon livida

Picea glauca / Rosa acicularis - Viburnum edule / Geocaulon lividum

Regenerative white spruce matures into a forest. Total herbaceous cover drops as competition from spruce and shrubs increases. The organic moss mat grows and thickens.

Pathway 1.2b
Community 1.2 to 1.4

A fire sweeps through and incinerates much of the above ground vegetation. The organic mat is partially or fully removed. Post-fire species include surviving individuals from the pre-fire community, as well as fast-growing, seed-dispersing herbaceous species.

Pathway 1.3a
Community 1.3 to 1.2

Shrubs colonize the community either via rootstock or seeding. White spruce seedlings and saplings begin to establish. Quaking aspen and/or paper birch may also colonize, depending on fire severity and available soil moisture.

Pathway 1.3b
Community 1.3 to 1.4

A fire sweeps through and incinerates much of the above ground vegetation. The organic mat is partially or fully removed. Post-fire species include surviving individuals from the pre-fire community, as well as fast-growing, seed-dispersing herbaceous species.

Pathway 1.4a
Community 1.4 to 1.3

Shrubs colonize from surviving rootstock and seeds. The low shrub canopy begins to shade out herbaceous species and populations of those plant types decrease. Tree saplings develop.

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

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)

LANDFIRE Biophysical Settings Models (Landfire, 2009)

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Contributors

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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	03/25/2026
Approved by	Blaine Spellman
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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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:**
