

Ecological site F233XY131AK

Boreal Forest Gravelly Floodplain

Last updated: 6/10/2025

Accessed: 03/28/2026

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): 233X–Upper Kobuk and Koyukuk Hills and Valleys

The Upper Kobuk and Koyukuk Hills and Valleys MLRA (herein called area) occurs in Interior Alaska. This area makes up 8,405 square miles. The largest tributaries are the Kobuk and the Koyukuk Rivers. Major tributaries of the Kobuk are the Reed, Beaver, Mauneluk, and Pau Rivers. Major tributaries of the Koyukuk River are the Alatna, John, and Kanuti Rivers. This area is primarily undeveloped wildland and sparsely populated. The communities within or near this area are Bettles, Kobuk, and Shungnak.

The terrain of this area consists of broad, nearly level river valleys and basins and rolling uplands separated by isolated hills and low rounded mountains. In the river valleys, nearly level flood plains and stream terraces gradually transition to gently sloping to moderately steep slopes leading to the hills and mountains. Basins are on the Pau River Flats between the eastern Zane and Lockwood Hills, on the Kanuti Flats between the Kanuti and Koyukuk Rivers, and along the middle reaches of the Hogatza River. Basins and stream terraces are dotted with hundreds of lakes and interconnecting wetlands. Elevation ranges from about 150 feet in the western part of the area, at the confluence of the Kobuk and Mauneluk Rivers, to 4,765 feet at the summit of Fritts Mountain, in the Angaycuham Mountains.

Geology and Soils

The northern part of the area was covered repeatedly by Pleistocene glaciers originating in the Brooks Range to the north. Slightly modified to highly modified moraines and drift cover many of the rolling uplands. Glacial ice flowed over most of the hills and low mountains, removing existing deposits and leaving a thin layer of glacial deposits. Today,

the lower mountain slopes, hills, and valley bottoms are covered with a variety of material, including glacial drift, colluvium, slope alluvium, fluvial deposits, and silty loess. In the southern part of the area, basins and valleys are filled with Quaternary glaciofluvial and fluvial deposits. Hills and upland slopes are covered with bedrock colluvium and slope alluvium, which are mantled with loess in places. The bedrock geology underlying much of the area consists dominantly of Permian through Lower Cretaceous stratified sedimentary and volcanic rocks.

This area is in the zone of discontinuous permafrost. Permafrost is close to the surface in lands with finer textured sediments throughout the area. Isolated masses of ground ice occur on terraces and the lower side slopes of hills. Permafrost does not occur on flood plains, on steep south-facing slopes, or other lands with very gravelly soils. Periglacial features, such as thermokarst pits, peat plateaus, and earth hummocks, are on the lower hill and mountain slopes and in upland valleys.

The dominant soil orders in this area are Gelisols, Inceptisols, and Entisols. The Gelisols are shallow or moderately deep to permafrost, occur on finer textured sediments, and are poorly drained or very poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have thick accumulations of surface organic material and occur in depressions, lake margins, and peat plateau. The Orthels and Turbels have comparably thinner surface organic material and occur on stream terraces and hill and upland slopes. The Inceptisols and Entisols are typically associated with gravelly soils that do not have permafrost within their profile, are deep, and are somewhat poorly drained to well drained. The common Inceptisol suborders are Cryepts and Gelepts both of which occur on upland and mountain slopes. Cryepts occur under forested soils at lower elevations and Gelepts on alpine tundra at higher elevations. Common Entisol suborders are Cryofluvents and Cryorthents both of which occur on alluvium on flood plains. Miscellaneous (non-soil) areas make up about 8 percent of this MLRA. The most common are rock outcrop, rubble land, and water.

Wildfires disturb the insulating organic material at the soil surface and can change the presence and/or depth of permafrost in the soil profile. These fire related changes to permafrost can also change the depth and presence of perched water tables. Gelisols that burn in this area can change soil taxonomic classification. For instance, depending on fire-severity, Histels may change to Orthels and Orthels may change to Inceptisols. Depending on the frequency and intensity of fires, landform position, and soil texture, the soils may or may not revert back to their original taxonomic classification.

Climate

Short, warm summers and long, cold winters characterize the continental subarctic climate of the area. The average annual precipitation ranges from 15 to 19 inches on valley bottoms and basins and from 19 to 26 inches at the higher elevations in the hills and mountains (PRISM 2018). Most of the precipitation falls as rain between May and September. The average annual snowfall ranges from 65 to 80 inches. The average

annual temperature is 22 to 24 degrees Fahrenheit (PRISM 2018). The temperature normally remains above freezing from mid-June through August in river valleys and basins with a freeze-free period ranging from 109 to 125 days. The freeze-free period is significantly shorter on higher elevation mountain slopes.

Vegetation

Most of this area is forested below an elevation of 1600 feet. Dominant tree species on slopes are white spruce and black spruce. Black spruce stands dominate on north-facing slopes, stream terraces, and other sites with poor drainage and permafrost. White spruce stands dominate on steep, south-facing slopes with dry soils. At lower elevations, lightning-caused wildfires are common, often burning many thousands of acres during a single fire event. Following wildfires, forbs, grasses, willow, ericaceous shrubs, paper birch, and quacking aspen communities are common until they are eventually replaced by stands of spruce. Tall willow and alder scrub is extensive on low flood plains. White spruce and balsam poplar are common on high flood plains.

With increasing elevation, the forests and woodlands give way to subalpine communities dominated by krummholz spruce, shrub birch, willow, and ericaceous shrubs. At even higher elevations, alpine communities prevail which are characterized by diverse forbs, dwarf ericaceous shrubs, and eightpetal mountain-avens. Many of these high elevation communities have a considerable amount of lichen cover and bare ground.

LRU notes

In this area, we refer to three life zones that are 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 with too wet or dry soil 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 a narrow transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees that can be considered tree line. In the subalpine, certain types of birch and willow shrub species grow at greater than or equal to 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 1600 feet elevation on average. The transition between boreal and subalpine vegetation can occur within a range of approximately 350 feet of elevation, and is highly dependent on slope, aspect, and shading from adjacent mountains.

Within each life zone, there are plant assemblages that are associated with cold slopes and warm 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 occur on southeast to west facing slopes that are moderate to very steep (greater than 10 percent slope) 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 slope soils have a cryic soil temperature regime and lack permafrost. In this area, 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. The boreal life zone can occur at higher elevations on warm slopes, and lower elevations on cold slopes.

Classification relationships

Landfire BPS – 6916141 – Western North American Boreal Montane Floodplain Forest and Shrubland – Boreal

Landfire BPS – 7416150 – Western North American Boreal Lowland Large River Floodplain Forest and Shrubland (Landfire 2009)

Ecological site concept

- Occurs in the boreal life zone on high floodplains that flood occasionally to rarely.
- Flooding occurs occasionally to rarely for brief durations. Ponding does not occur.
- Soils are considered well drained.
- Soils formed in alluvium.
- Soils are very deep. Permafrost does not occur in the soil profile.
- The reference plant community is closed needleleaf forest with white spruce the dominant tree. Multiple plant communities occur within the reference state related to wildfire and flooding.

Associated sites

| | |
|-------------|--|
| F233XY171AK | Boreal Woodland Loamy Frozen Terraces Occurs on stream terraces with stands of black spruce. |
| R233XY130AK | Boreal Scrubland Gravelly Floodplain Occurs on low flood plains with willow and alder dominant plant communities. |
| R233XY207AK | Boreal Sedge Peat Depressions Occurs on depressions of flood plains and stream terraces with sedge dominant plant communities. |

Similar sites

| | |
|-------------|---|
| F231XY131AK | Boreal Forest Gravelly Floodplain Occurs in an adjacent area (MLRA 231X) on similar soils and is provisionally thought to have similar vegetation and disturbance dynamics. |
|-------------|---|

Table 1. Dominant plant species

| | |
|------------|--|
| Tree | (1) <i>Picea glauca</i> |
| Shrub | (1) <i>Rosa acicularis</i> (2) <i>Linnaea borealis</i> |
| Herbaceous | (1) <i>Hylocomium splendens</i> (2) <i>Pleurozium schreberi</i> |

Physiographic features

- Occurs on high flood plains.
- Associated with the boreal life zone. Representative elevation occurs between 150 and 1300 feet.
- Slopes are nearly level and occur on all aspects.
- Ponding does not occur.
- Flooding occurs occasionally to rarely for brief durations.
- During the growing season, these moist soils have a water table occurring between 40 and 60 inches.
- Associated with negligible amounts of runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

| | |
|--------------------|----------------------------------|
| Landforms | (1) Alluvial plain > Flood plain |
| Runoff class | Negligible |
| Flooding duration | Brief (2 to 7 days) |
| Flooding frequency | Rare to occasional |
| Ponding frequency | None |
| Elevation | 46–396 m |
| Slope | 0–2% |
| Water table depth | 102–152 cm |
| Aspect | W, NW, N, NE, E, SE, S, SW |

Table 3. Representative physiographic features (actual ranges)

| | |
|--------------------|---------------|
| Runoff class | Not specified |
| Flooding duration | Not specified |
| Flooding frequency | Not specified |
| Ponding frequency | Not specified |
| Elevation | 46–488 m |
| Slope | Not specified |

| | |
|-------------------|---------------|
| Water table depth | Not specified |
|-------------------|---------------|

Climatic features

Short, warm summers and long, cold winters characterize the subarctic continental climate associated with this boreal forest gravelly slopes ecological site. The mean annual temperature for MLRA 233X ranges from 22 to 24 degrees Fahrenheit (PRISM 2008). The warmest months span May through August with mean normal maximum monthly temperatures ranging from 51 to 64 degrees Fahrenheit. The coldest months span December through March with mean normal minimum temperatures ranging from -2 to 3 degrees Fahrenheit. The freeze-free period for this boreal ecological site ranges from 105 to 129 days, and the temperature generally remains above freezing from late May through early-September.

The area receives minimal annual precipitation with July through September being the wettest. Average annual precipitation across MLRA 233X ranges between 17 to 21 inches (PRISM 2008). Approximately half of the annual precipitation occurs during the months of July through September with seasonal thunderstorms. The average annual snowfall ranges from 65 to 80 inches (USDA 2022). The ground is consistently covered with snow from November through March.

Table 4. Representative climatic features

| | |
|--|--------------|
| Frost-free period (characteristic range) | 73-105 days |
| Freeze-free period (characteristic range) | 105-129 days |
| Precipitation total (characteristic range) | 432-533 mm |
| Frost-free period (actual range) | 26-111 days |
| Freeze-free period (actual range) | 98-133 days |
| Precipitation total (actual range) | 356-610 mm |
| Frost-free period (average) | 90 days |
| Freeze-free period (average) | 115 days |
| Precipitation total (average) | 457 mm |

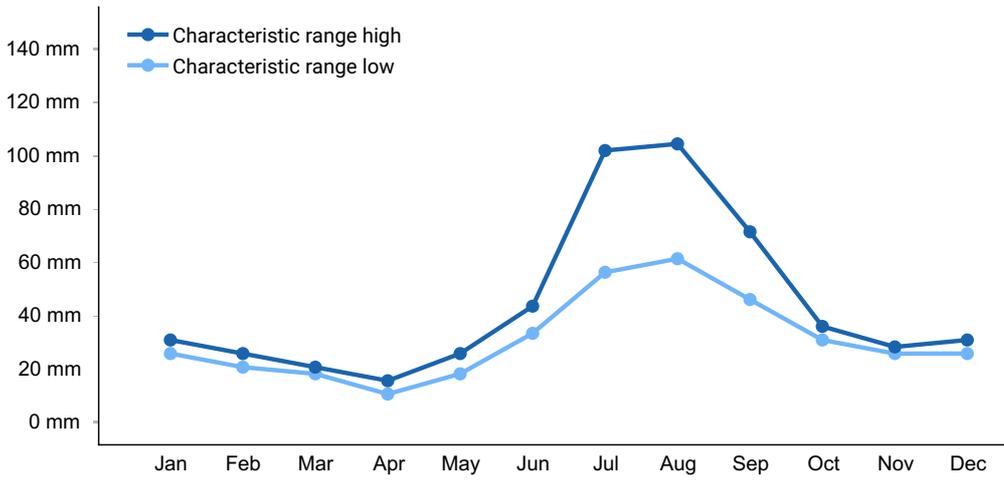


Figure 1. Monthly precipitation range

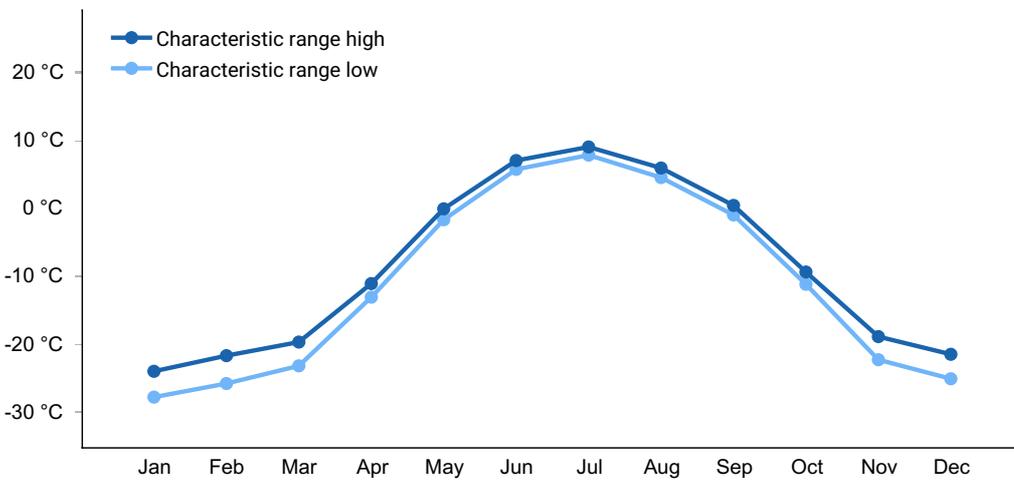


Figure 2. Monthly minimum temperature range

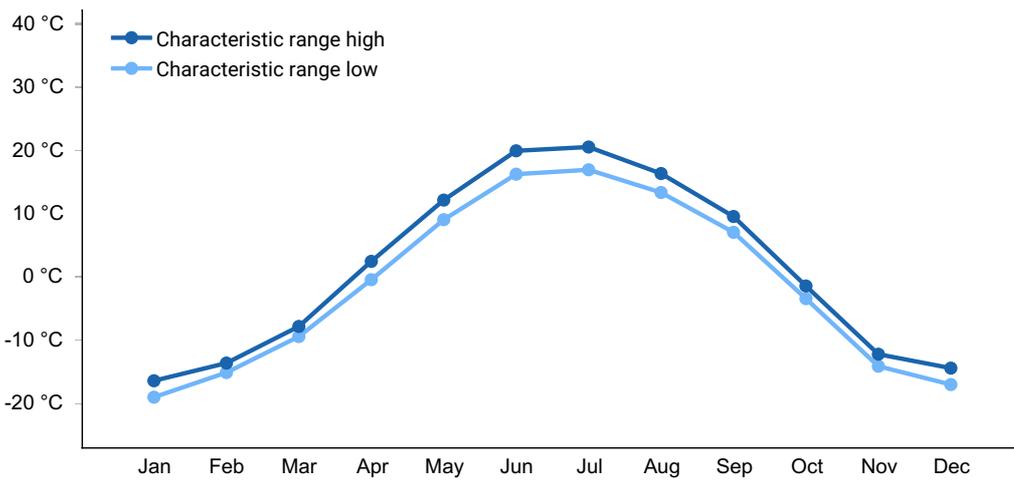


Figure 3. Monthly maximum temperature range

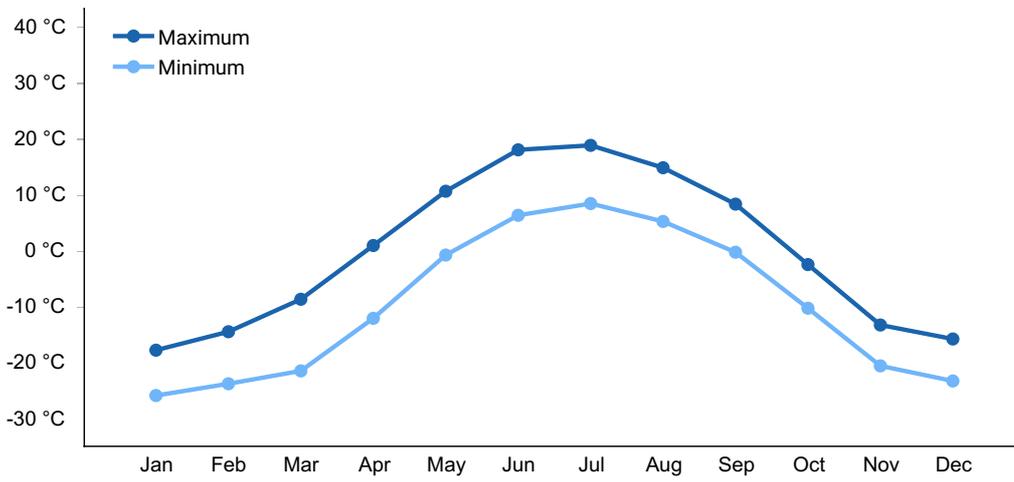


Figure 4. Monthly average minimum and maximum temperature

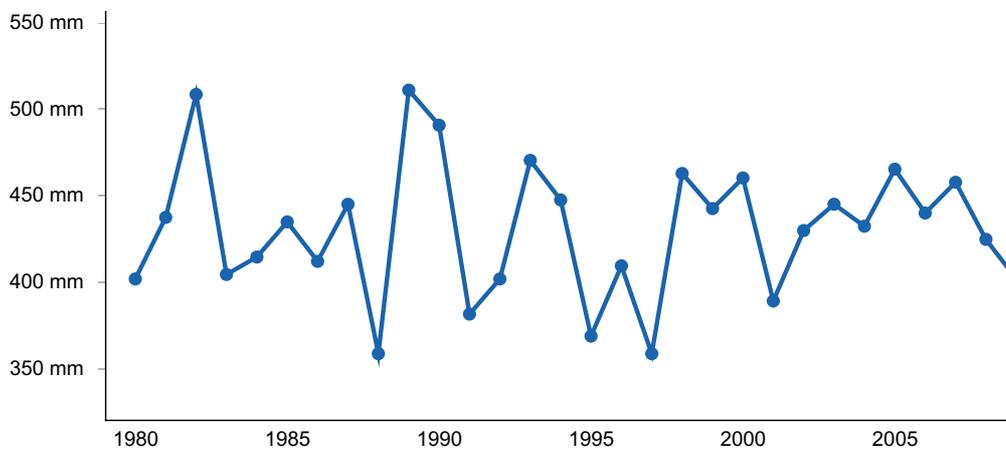


Figure 5. Annual precipitation pattern

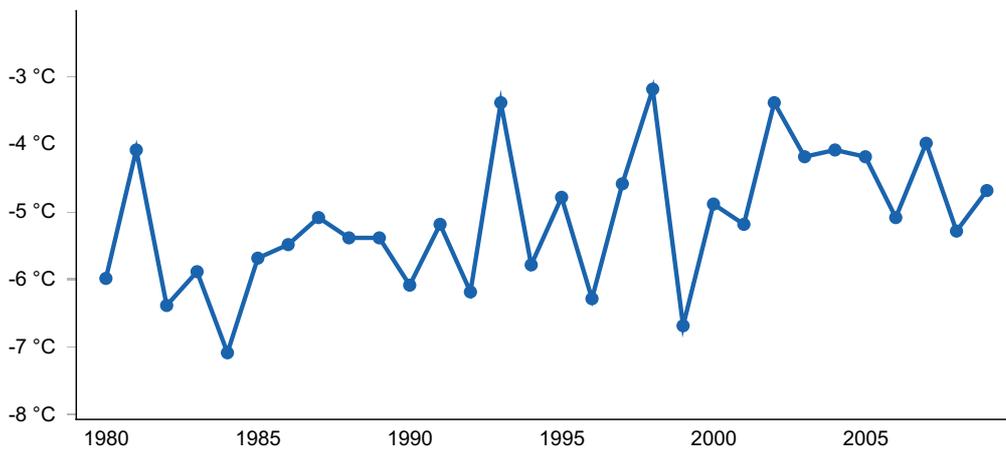


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BETTLES AP [USW00026533], Bettles Field, AK

Influencing water features

In the associated flood plains, overbank flow from the channel and subsurface hydraulic connections between the stream and adjacent wetlands are the main sources of water (Smith et al. 1995).

Depth to the water table may decrease following summer storm events or spring snowmelt and increase during extended dry periods.

Wetland description

This ecological site is classified as a riverine wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008).

Soil features

- Soils formed in alluvium.
- Rock fragments do not occur on the soil surface.
- Capped with up to three inches of organic material.
- The surface mineral horizon is stratified silts and fine sands. The thickness of these finer sediment horizons is highly variable and occur over bands of sandy and gravelly alluvium.
- These soils have subsurface rock fragments ranging between 0 and 40 percent of the soil profile by volume.
- While soils are very deep, soils have strong contrasting textural stratification resulting in restrictions at shallow to moderate depths (13 to 35 inches). This restriction can affect the movement and retention of water and/or nutrients.
- The pH of the soil profile ranges from strongly acidic to slightly alkaline.
- These are moist soils that are considered well drained.
- Soils are classified as Entisols in the great group Cryofluvents.

Table 5. Representative soil features

| | |
|----------------------------|---|
| Parent material | (1) Alluvium |
| Surface texture | (1) Silt (2) Fine sand |
| Family particle size | (1) Coarse-loamy over sandy or sandy-skeletal |
| Drainage class | Well drained |
| Permeability class | Moderately rapid to rapid |
| Depth to restrictive layer | 33–89 cm |
| Soil depth | 152 cm |
| Surface fragment cover ≤3" | 0% |
| Surface fragment cover >3" | 0% |

| | |
|--|--------------|
| Available water capacity (0-101.6cm) | 4.32–22.1 cm |
| Calcium carbonate equivalent (25.4-101.6cm) | 0% |
| Clay content (0-50.8cm) | 3–6% |
| Electrical conductivity (25.4-101.6cm) | 0–1 mmhos/cm |
| Sodium adsorption ratio (25.4-101.6cm) | 0 |
| Soil reaction (1:1 water) (25.4-101.6cm) | 5.2–7.4 |
| Subsurface fragment volume ≤3" (0-152.4cm) | 0–5% |
| Subsurface fragment volume >3" (0-152.4cm) | 0–35% |

Table 6. Representative soil features (actual values)

| | |
|--|---------------|
| Drainage class | Not specified |
| Permeability class | Not specified |
| Depth to restrictive layer | Not specified |
| Soil depth | Not specified |
| Surface fragment cover ≤3" | Not specified |
| Surface fragment cover >3" | Not specified |
| Available water capacity (0-101.6cm) | 0.51–22.1 cm |
| Calcium carbonate equivalent (25.4-101.6cm) | Not specified |
| Clay content (0-50.8cm) | Not specified |
| Electrical conductivity (25.4-101.6cm) | Not specified |
| Sodium adsorption ratio (25.4-101.6cm) | 0–3 |
| Soil reaction (1:1 water) (25.4-101.6cm) | 5.2–7.8 |
| Subsurface fragment volume ≤3" (0-152.4cm) | Not specified |

| | |
|---|---------------|
| Subsurface fragment volume >3" (0-152.4cm) | Not specified |
|---|---------------|

Ecological dynamics

Flood plain Dynamics

All montane streams and rivers in the Upper Kobuk and Koyukuk Hills and Valley MLRA (herein called area) have low and/or high flood plain ecological sites. These flood plain ecological sites represent major breaks in the flood regime and dominant vegetative type on associated tributaries. The low flood plain ecological site is thought to flood frequently (>50 times in 100 years) for brief to long durations of time (2 to 30 days) and supports shrub dominant communities. The high flood plain ecological site floods occasionally to rarely (1 to 50 times in 100 years) for brief durations of time (2 to 7 days) and supports forested plant communities.

The shift of vegetative type from shrubland to forest represents riparian primary succession along major streams in the area. On other Interior Alaska flood plains, this successional process is thought to take between 200 and 300 years (Chapin et al. 2006). The flood regime, growth traits of vegetation, biotic competition, and a slew of other factors contribute to the dynamic nature of boreal flood plain succession. For more detailed information on boreal flood plain succession and successional drivers, refer to Walker et al. (1986) and Chapin et al. (2006).

Data indicates that differences in flood frequency and duration result in different plant communities for this ecological site. High floodplains positions thought to flood more frequently have smaller white spruce, greater balsam poplar and shrub cover, and less bryophyte cover. High floodplain positions thought to flood less frequently have larger white spruce and greater white spruce and bryophyte cover. Given this observation, a more frequently and severely flooded plant community was incorporated into the reference state (community 1.6).

These montane streams and rivers have a stream terrace ecological site (see F231XY171AK). When compared to montane flood plains, stream terraces occur on higher landform positions that are often further away from the active stream channel. These montane stream terraces no longer flood. Stream terraces have thick peat layers, contact permafrost at shallow to moderate depths, commonly pond, and have wetter soils. Stream terraces support much less productive stands of black spruce (*Picea mariana*).

Fire

In the Upper Kobuk and Koyukuk Hills and Valleys MLRA (herein called area), 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 boreal forest gravelly flood plain ecological site will reset plant succession and alter dynamic soil

properties (e.g., thickness of the organic material). For this ecological site to progress from the earliest stages of post-fire succession dominated by grasses and forbs to the oldest stages of succession dominated by white spruce forests, data suggest that 130 to 150 years or more must elapse without another fire event (Foot 1982; Chapin et al. 2006; Landfire 2009).

Within this area, wildfire is considered a natural and common event that typically goes unmanaged. Fire suppression is limited and occurs adjacent to the small 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. From 2000 to 2020, 124 known fire events occurred in this area and the burn perimeter of the fires totaled approximately one million acres (AICC 2022). Fire-related disturbances are highly patchy and can leave undisturbed areas within the burn perimeter. During this time frame, 90 percent of the fire events were smaller than 20,000 acres but three fire events were greater than 100,000 acres in size (AICC 2022). Over this period of 20 years, these burn perimeters cover approximately 20 percent of this area.

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 can be considered 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 thin organic cap and are well drained, the typical fire scenario for this ecological site is considered to result in a high severity burn.

Large portions of the organic mat are consumed during a high-severity fire event, commonly exposing pockets of mineral soil. The loss of this organic mat, which insulates the mineral soil, and the decrease in site albedo results in higher summertime temperatures and overall soil temperatures to increase (Hinzman et al. 2006). These alterations to soil temperature may result in increased depths to seasonally frozen soil where it persists into the growing season, better soil drainage earlier in the season, and dryer overall conditions. High-severity fire events also destroy a majority of the vascular and nonvascular biomass above ground.

Field data suggest that each of the forested communities burn and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community 1.5) is a mix of species that either regenerate in place (e.g., subterranean root crowns for willow and rhizomes for graminoids) and/or from wind-dispersed seed or spores that colonize exposed mineral soil (e.g., quaking aspen [*Populus tremuloides*] and *Ceratodon* moss [*Ceratodon purpureus*]). The pioneering stage of fire succession is primarily composed of tree seedlings, forbs, grasses, and weedy bryophytes. This stage of succession is thought to persist for up to 4 years post-fire (Landfire 2009). Willow (*Salix* spp.) and quick growing deciduous tree seedlings continue to colonize and grow in stature on recently burned sites until they become dominant in the overstory, which marks the transition to the early stage

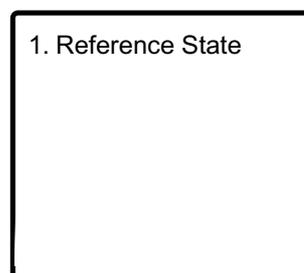
of fire succession (community 1.4). This early stage of fire succession is thought to persist 25 to 45 years post-fire (Landfire 2009). In the absence of fire, tree species continue to become more dominant in the stand and eventually develop into forests.

The latter stages of succession have an overstory that is dominantly deciduous trees (community 1.3), a mix of broadleaf and needleleaf trees (community 1.2), or needleleaf trees (community 1.1). The recruitment of trees species during the pioneering and 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 white spruce seedlings mature and eventually replace the shade-intolerant broadleaf tree species. The typical fire return interval for white spruce stands in Interior Alaska is 150 years (Landfire 2009; Abrahamson 2014).

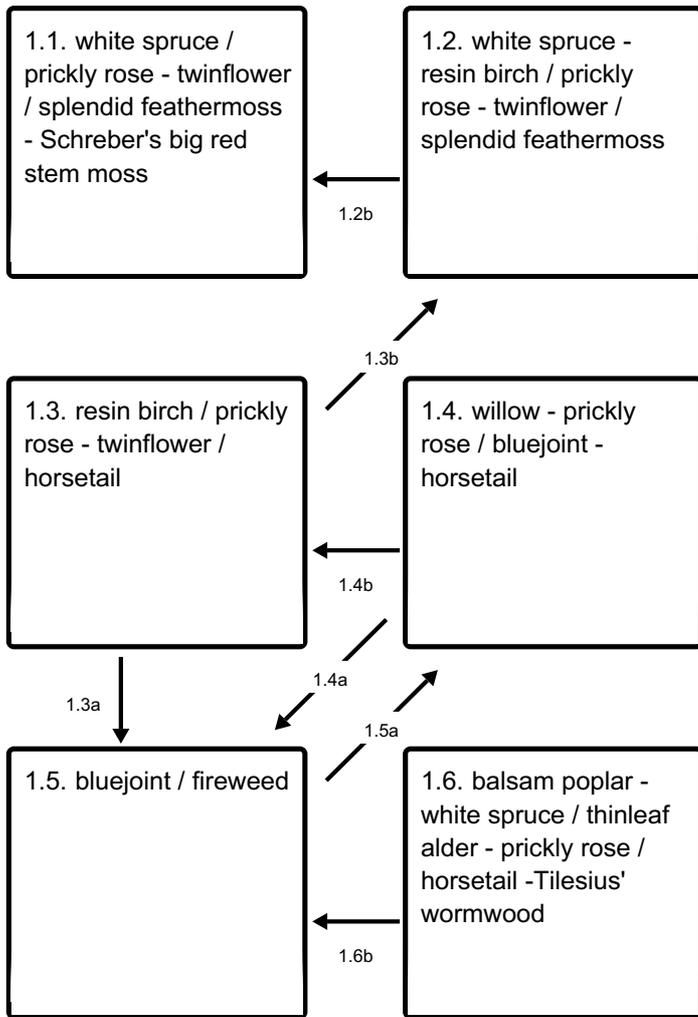
Lands in Interior Alaska are burning more frequently than in the past, which may result in alternative states of succession. The historic fire return interval for white spruce stands in Interior Alaska occurs approximately once every 150 years (Landfire 2009; Abrahamson 2014). Global climate change is warming the boreal forest and causing a longer growing season. As a result, stands of spruce in the Alaskan boreal forest are burning more frequently and intensely than their historic averages (Kelly et al. 2013). Increases to burn frequency favors forested stands dominated by quick growing deciduous trees (community 1.3). 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 fire frequency paired with decreased spruce propagules lowers the chances for the site to progress to post-fire successional communities 1.2 and 1.1. Increased burn frequency in the boreal forest may result in alternative states of post-fire succession with stands of deciduous trees persisting for longer than normal durations of time (Johnstone et al. 2010b).

State and transition model

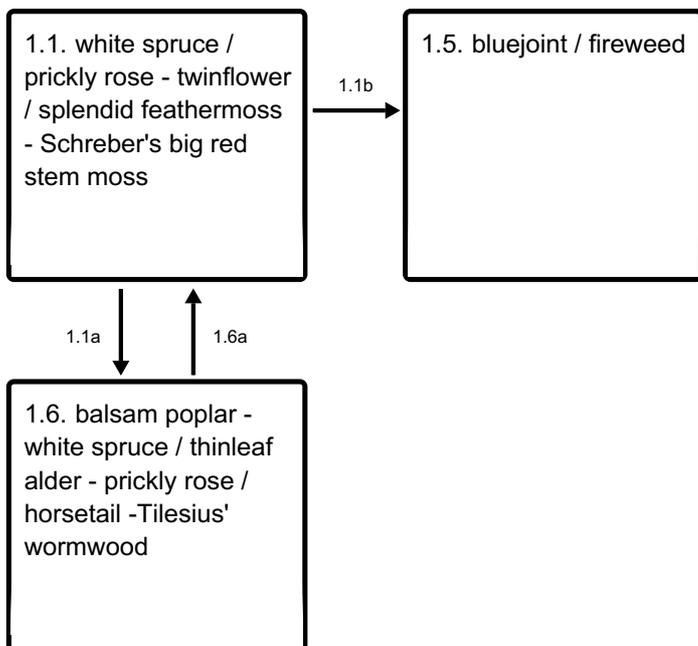
Ecosystem states



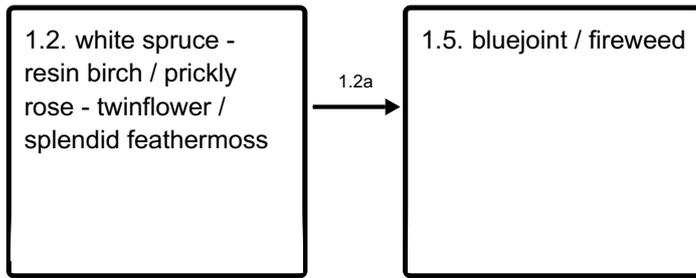
State 1 submodel, plant communities



Communities 1, 5 and 6 (additional pathways)



Communities 2 and 5 (additional pathways)



1.1b - A high-severity fire sweeps through and incinerates much of the above ground vegetation.

1.1a - More frequent and intense flooding

1.2b - 130 to 150 years without wildfire

1.2a - A high-severity fire sweeps through and incinerates much of the above ground vegetation.

1.3b - 80 to 100 years without wildfire

1.3a - A high-severity fire sweeps through and incinerates much of the above ground vegetation.

1.4b - 30 to 50 years without wildfire

1.4a - A high-severity fire sweeps through and incinerates much of the above ground vegetation.

1.5a - 4 to 6 years without wildfire

1.6a - Less frequent and intense flooding

1.6b - A high-severity fire sweeps through and incinerates much of the above ground vegetation.

State 1

Reference State

The reference plant community is closed needleleaf forest (Viereck et al. 1992) with the dominant tree being white spruce. There are five plant communities within the reference state related to fire and one community related to flooding. The vegetation modeled for this site has limited data and is considered provisional.

Dominant plant species

- white spruce (*Picea glauca*), tree
- prickly rose (*Rosa acicularis*), shrub
- twinflower (*Linnaea borealis*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Community 1.1

white spruce / prickly rose - twinflower / splendid feathermoss - Schreber's big red stem moss

The reference plant community is characterized as closed needleleaf forest (Viereck et al. 1992) composed primarily of mature white spruce. White spruce tree cover is primarily in the tall tree stratum (greater than 40 feet in height). Gaps occur in the tree canopy, but they are limited in size and extent and are likely the result of occasional windthrow. Live

deciduous trees, primarily resin birch and balsam poplar, occasionally occur in the tree canopy, but most have been replaced by white spruce. The soil surface is primarily covered with herbaceous litter and bryophytes. Common understory species include Siberian alder, prickly rose, squashberry, twinflower, lingonberry, bluejoint, field horsetail, northern bedstraw, false toadflax, tall bluebells, splendid feathermoss, and Schreber's big red stem moss. The understory vegetative strata that characterize this community are dwarf shrubs (less than 8 inches), medium forbs (between 4 and 24 inches), and mosses.

Dominant plant species

- white spruce (*Picea glauca*), tree
- resin birch (*Betula neoalaskana*), tree
- balsam poplar (*Populus balsamifera*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- prickly rose (*Rosa acicularis*), shrub
- squashberry (*Viburnum edule*), shrub
- twinflower (*Linnaea borealis*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- field horsetail (*Equisetum arvense*), other herbaceous
- northern bedstraw (*Galium boreale*), other herbaceous
- false toadflax (*Geocaulon lividum*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Community 1.2

white spruce - resin birch / prickly rose - twinflower / splendid feathermoss

Community 1.2 is in the late stage of fire-induced secondary succession for this ecological site. It is characterized as a closed mixed forest (Viereck et al. 1992). Deciduous trees, primarily mature resin birch, are starting to be replaced by white spruce in the tree canopy. Tree cover is generally split between immature medium-sized spruce trees (15 to 40 feet in height) and mature tall resin birch and spruce trees (greater than 40 feet in height). The soil surface is primarily covered with herbaceous litter and mosses. Commonly observed understory species include thinleaf alder, prickly rose, red currant, lingonberry, twinflower, grayleaf willow, squashberry, bluejoint, and field horsetail. The understory vegetative strata that characterize this community are medium shrubs (between 3 and 10 feet), dwarf shrub (less than 8 inches), and mosses.

Dominant plant species

- white spruce (*Picea glauca*), tree
- resin birch (*Betula neoalaskana*), tree
- prickly rose (*Rosa acicularis*), shrub

- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- twinflower (*Linnaea borealis*), shrub
- red currant (*Ribes triste*), shrub
- grayleaf willow (*Salix glauca*), shrub
- squashberry (*Viburnum edule*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- field horsetail (*Equisetum arvense*), other herbaceous
- Tilesius' wormwood (*Artemisia tilesii*), other herbaceous
- northern bedstraw (*Galium boreale*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Community 1.3

resin birch / prickly rose - twinflower / horsetail

Community 1.3 is in the middle stage of fire-induced secondary succession for this ecological site. It is characterized as closed deciduous forest (Viereck et al. 1992) with mature stands of resin birch. Immature white spruce are a common subdominant tree in the canopy.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- white spruce (*Picea glauca*), tree
- prickly rose (*Rosa acicularis*), shrub
- willow (*Salix*), shrub
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- meadow horsetail (*Equisetum pratense*), other herbaceous

Community 1.4

willow - prickly rose / bluejoint - horsetail

Community 1.4 is in the early stage of fire-induced secondary succession for this ecological site. It is characterized as open tall scrubland (Viereck et al. 1992) with an overstory primarily composed of a mixture of willow. White spruce and resin birch seedlings and saplings are common and cover primarily occurs in the regenerative tree stratum. Common understory species from a similar site in the Yukon Flats Lowlands area are prickly rose, a mixture of willow, redosier dogwood, bluejoint, fireweed, and a mixture of horsetail.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- prickly rose (*Rosa acicularis*), shrub
- willow (*Salix*), shrub
- redosier dogwood (*Cornus sericea*), shrub
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous

Community 1.5

bluejoint / fireweed

Community 1.5 is in the pioneering stage stage of fire-induced secondary succession for this ecological site. It is commonly characterized as either mesic graminoid herbaceous or mesic forb herbaceous (Vioreck et al. 1992) with the dominant plants being bluejoint and fireweed. White spruce and resin birch seedlings are common but cover is limited. Other common species include prickly rose, and assortment of willow, various horsetail, and various weedy mosses.

Dominant plant species

- prickly rose (*Rosa acicularis*), shrub
- willow (*Salix*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- wideleaf polargrass (*Arctagrostis latifolia*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- meadow horsetail (*Equisetum pratense*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous
- pohlia moss (*Pohlia*), other herbaceous
- ceratodon moss (*Ceratodon purpureus*), other herbaceous
- (*Marchantia polymorpha*), other herbaceous

Community 1.6

balsam poplar - white spruce / thinleaf alder - prickly rose / horsetail - Tilesius' wormwood

Community 1.6 is more frequently flooded than reference community 1.1. It is characterized as closed mixed forest (Vioreck et al. 1992). Deciduous trees, primarily mature balsam poplar, are dominant in the canopy but are actively being replaced by white spruce. White spruce cover is generally split between immature medium-sized trees

(15 to 40 feet in height) and mature tall trees (greater than 40 feet in height). The soil surface is primarily covered with a mixture of herbaceous litter and woody debris but large patches of exposed bare soil and surface rock fragments can occur (as much as 70 percent of the plot). Common understory species include Siberian alder, thinleaf alder, prickly rose, various willow, twinflower, squashberry, bluejoint, Tilesius' wormwood, tall bluebells, field horsetail, alpine sweetvetch, northern bedstraw, and false toadflax. The understory vegetative strata that characterize this community are tall shrubs (greater than 10 feet), medium shrubs (between 3 and 10 feet), and medium forbs (between 4 and 24 inches).

Dominant plant species

- balsam poplar (*Populus balsamifera*), tree
- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- thinleaf alder (*Alnus incana ssp. tenuifolia*), shrub
- false mountain willow (*Salix pseudomonticola*), shrub
- Bebb willow (*Salix bebbiana*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- prickly rose (*Rosa acicularis*), shrub
- twinflower (*Linnaea borealis*), shrub
- squashberry (*Viburnum edule*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- field horsetail (*Equisetum arvense*), other herbaceous
- dwarf scouringrush (*Equisetum scirpoides*), other herbaceous
- Tilesius' wormwood (*Artemisia tilesii*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- alpine sweetvetch (*Hedysarum alpinum*), other herbaceous
- northern bedstraw (*Galium boreale*), other herbaceous
- false toadflax (*Geocaulon lividum*), other herbaceous

Pathway 1.1b

Community 1.1 to 1.5

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated dry soils, this site commonly experiences high-severity fires. A significant proportion of organic matter is consumed, leaving exposed mineral soil. Vegetation usually resprouts from surviving individuals or is recruited from nearby areas via seed or seedbank.

Pathway 1.1a

Community 1.1 to 1.6

More frequent and intense flooding. The reference state for this ecological site floods rarely for brief periods of time. Areas that are thought to flood less frequently are

represented by community 1.1 and areas that are thought to flood more frequently are represented by community 1.6. When comparing the two plant communities, the more frequently flooded plant community has younger and smaller white spruce trees, more balsam poplar cover, and less bryophyte cover.

Pathway 1.2b

Community 1.2 to 1.1

Community pathway 1.2b occurs 130 to 150 years after wildfire disturbance (Foot 1982; Landfire 2009). Time without fire results in the continued growth and increased abundance of white spruce, which overtop and remove the shade intolerant deciduous tree species from the forest canopy.

Pathway 1.2a

Community 1.2 to 1.5

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated dry soils, this site commonly experiences high-severity fires. A significant proportion of organic matter is consumed, leaving exposed mineral soil. Vegetation usually resprouts from surviving individuals or is recruited from nearby areas via seed or seedbank.

Pathway 1.3b

Community 1.3 to 1.2

Community pathway 1.3b is thought to occur 80 to 100 years after wildfire disturbance. Time without fire results in the continued growth and increased abundance of white spruce, which overtop and remove the shade intolerant deciduous tree species from the forest canopy.

Pathway 1.3a

Community 1.3 to 1.5

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated dry soils, this site commonly experiences high-severity fires. A significant proportion of organic matter is consumed, leaving exposed mineral soil. Vegetation usually resprouts from surviving individuals or is recruited from nearby areas via seed or seedbank.

Pathway 1.4b

Community 1.4 to 1.3

Community pathway 1.4b is thought to occur 30 to 50 years after wildfire disturbance. Time without fire results in the continued development of a forest canopy dominated by

resin birch.

Pathway 1.4a

Community 1.4 to 1.5

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated dry soils, this site commonly experiences high-severity fires. A significant proportion of organic matter is consumed, leaving exposed mineral soil. Vegetation usually resprouts from surviving individuals or is recruited from nearby areas via seed or seedbank.

Pathway 1.5a

Community 1.5 to 1.4

Community pathway 1.5a is thought to occur 4 to 6 years after disturbance. Time without fire results in the herbaceous community being overtopped by willow and deciduous tree seedlings.

Pathway 1.6a

Community 1.6 to 1.1

Less frequent and intense flooding. The reference state for this ecological site floods rarely for brief periods of time. Areas that are thought to flood less frequently are represented by community 1.1 and areas that are thought to flood more frequently are represented by community 1.6. When comparing the two plant communities, the more frequently flooded plant community has younger and smaller white spruce trees, more balsam poplar cover, and less bryophyte cover.

Pathway 1.6b

Community 1.6 to 1.5

A fire sweeps through and incinerates much of the above ground vegetation. Because of the associated dry soils, this site commonly experiences high-severity fires. A significant proportion of organic matter is consumed, leaving exposed mineral soil. Vegetation usually resprouts from surviving individuals or is recruited from nearby areas via seed or seedbank.

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

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

References

Abrahamson, I.L. 2014. Fire Regimes of Alaskan White Spruce Communities .

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.

Foote, M.J. 1983. Classification, description, and dynamics of plant communities after fire in the taiga of interior Alaska. US Department of Agriculture, Forest Service, Pacific Northwest Forest and

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.

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. Biophysical Setting. LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior, Washington, DC..
- Schoeneberger, P.J. and D.A. Wysocki. 2017. Geomorphic Description System, Version 5.0..
- United States Department of Agriculture, . 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.
- 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..
- Walker, L.R., J.C. Zasada, and F.S. Chapin III. 1986. The role of life history processes in primary succession on an Alaskan floodplain. *Ecology* 67:1243–1253.

Other references

- Alaska Interagency Coordination Center (AICC). 2022. Alaska Fire History Perimeters. <http://fire.ak.blm.gov/>
- PRISM Climate Group. 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 4 September 2019).
- Scenarios network for Alaska and arctic planning (SNAP). Historical Monthly Temperature

– 1km, 1901-2009. <http://ckan.snap.uaf.edu/dataset/>. (Accessed 5 May 2021).

SNAP. 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 5 May 2021).

Contributors

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

| | |
|---|-------------------|
| Author(s)/participant(s) | |
| Contact for lead author | |
| Date | 03/28/2026 |
| 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:**
