USDA Natural Resources Conservation Service

Ecological site F231XY131AK
Boreal Forest Gravelly Floodplain

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 231X–Interior Alaska Highlands

The Interior Alaska Uplands (MLRA 231X) is in the Interior Region of Alaska and includes the extensive hills, mountains, and valleys between the Tanana River to the south and the Brooks Range to the north. These hills and mountains surround the Yukon Flats Lowlands (MLRA 232X). MLRA 231X makes up about 69,175 square miles. The hills and mountains of the area tend to be moderately steep to steep resulting in high-relief slopes. The mountains are generally rounded at lower elevations and sharp-ridged at higher elevations. Elevation ranges from about 400 feet in the west, along the boundary with the Interior Alaska Lowlands (MLRA 229X), to 6,583 feet at the summit of Mt. Harper, in the southeast. Major tributaries include large sections of the Yukon, Koyukuk, Kanuti, Charley, Coleen, and Chatanika Rivers. This area is traversed by several major roads, including the Taylor Highway in the east and the Steese, Elliott, and Dalton Highways north of Fairbanks. The area is mostly undeveloped wild land that is sparsely populated. The largest community along the road system is Fairbanks with smaller communities like Alatna, Allakaket, Chicken, Eagle, Eagle Village, Hughes, and Rampart occurring along the previously mentioned rivers and highways.

The vast majority of this MLRA was unglaciated during the Pleistocene epoch with the exceptions being the highest mountains and where glaciers extended into the area from the Brooks Range. For the most part, glacial moraines and drift are limited to the upper elevations of the highest mountains. Most of the landscape is mantled with bedrock colluvium originating from the underlying bedrock. Valley bottoms are filled with Holocene fluvial deposits and colluvium from the adjacent mountain slopes. Silty loess, which originated from unvegetated flood plains in and adjacent to this area, covers much of the surface. On hill and mountain slopes proximal to major river valleys (e.g., Tanana and Yukon Rivers), the loess is many feet thick. As elevation and distance from major river valleys increases, loess thickness decreases significantly. Bedrock is commonly exposed on the highest ridges.

This area is in the zone of discontinuous permafrost. Permafrost commonly is close to the surface in areas of the finer textured sediments throughout the MLRA. Isolated masses of ground ice occur in thick deposits of loess on terraces and the lower side slopes of hills. Solifluction lobes, frost boils, and circles and stripes are periglacial features common on mountain slopes in this area. Pingos, thermokarst pits and mounds, ice-wedge polygons, and earth hummocks are periglacial features common on terraces, lower slopes of hills and mountains, and in upland valleys in the area.

The dominant soil orders in this area are Gelisols, Inceptisols, Spodosols, and Entisols. The soils in the area have a subgelic or cryic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. Gelisols are common on north facing slopes, south facing footslopes, valley bottoms, and stream terraces. Gelisols are typically shallow or moderately deep to permafrost (10 to 40 inches) and are poorly or very poorly drained. Wildfires can disturb the insulating organic material at the surface, lowering the permafrost layer, eliminating perched water tables from Gelisols, and thus changing the soil classification. Inceptisols and Spodosols commonly form on south facing hill and mountain slopes. Entisols are common on flood plains and high elevation mountain slopes. Miscellaneous (non-soil) areas make up about 2 percent of this MLRA. The most common miscellaneous areas are rock outcrop and rubble land. In many valleys placer mine tailings are common.

Short, warm summers and long, cold winters characterize the subarctic continental climate of the area. The mean annual temperature of the area ranges from 22 to 27 degrees F. The mean annual temperature of the southern half of the area is approximately 3 degrees warmer compared to the northern half (PRISM 2018). The warmest months span June through August with mean monthly temperatures ranging from 50 to 56 degrees F. The coldest months span November through February with mean monthly temperatures ranging from -5 to 3 degrees F. When compared to the high-elevation alpine and subalpine life zones, the lower elevation boreal life zone tends to be 2-3 degrees F colder during the coldest months and 1-2 degrees F warmer during the warmest months (PRISM 2018). The freeze-free period at the lower elevations averages about 60 to 100 days, and the temperature usually remains above freezing from June through mid-September.

Precipitation is limited across this area, with the average annual precipitation ranging from 12 to 19 inches. The southern half of the areas receives approximately 2.5 inches more annual precipitation then the northern half (PRISM 2018). The lower elevation boreal life zone receives approximately 2.5 inches less annual precipitation than the high-elevation alpine and subalpine life zones (PRISM 2018). Approximately 3/5th of the annual precipitation occurs during the months of June through September with thunderstorms being common. The average annual snowfall ranges from about 45 to 100 inches. The ground is consistently covered with snow from November through March.

Most of this area is forested below an elevation of about 2500 feet. Dominant tree species on slopes are white spruce and black spruce. Black spruce stands are most common on north-facing slopes, stream terraces, and other sites with poor drainage and permafrost. White spruce stands are most common on warm slopes with dry soils. At lower elevations, lightning-caused wildfires are common, often burning many thousands of acres during a single fire. 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

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 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 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 ≥ 1 m 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 2500 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 (>10% 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 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

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

Ecological site concept

This site occurs on the high flood plain of montane streams and rivers with gravelly soils that lack permafrost. In this area, the flood plain of montane streams have been divided into low and high flood plain positions. When compared to the low flood plain, the high flood plain has less frequent and shorter duration flood events. Flooding occurs occasionally to rarely (1 to 50 times in 100 years) for brief durations of time (between 2 and 7 days). These differences in the flood regime result in the low flood plain supporting shrub dominant communities and the high flood plain supporting forested communities. For this site, soils range from somewhat poorly to well drained and lack permafrost. The typical soil profile has a thin layer of organic material over a very thick layer of loamy, sandy, and gravelly alluvium.

Field work indicates that certain sampled communities within the reference state flood more frequently and/or severely then other communities. As flooding frequency and duration increases, balsam poplar cover increases and bryophyte cover decreases. Given this observation, a more frequently and severely flooded plant community was incorporated into the reference state. This flooded community is typically characterized as closed mixed forest (Viereck et al. 1992) with balsam poplar and white spruce as the dominant trees.

Multiple plant communities occur within the reference state related to fire. When the reference state vegetation burns, the post-fire plant community is dominantly tree seedlings, forbs, grasses, and weedy bryophytes. With time and lack of another fire event, the post-fire vegetation goes through multiple stages of succession. For this site, the reference plant community is the most stable with the longest time since the vegetation was burned. This community is typically characterized as closed needleleaf forest (Viereck et al. 1992) with white spruce as the dominant tree. For this ecological site to progress from the earliest stages of post-fire succession to the oldest stages of succession, data suggest that 150 years or more must elapse without another fire event (Foot 1982; Chapin et al. 2006; Landfire 2009).

For the reference community, resin birch and balsam poplar occasionally occur as subdominant species in the canopy. 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.

An alternative state accounts for the unique vegetation observed after mining. The flood plains of these montane streams were commonly mined for gold

Associated sites

R231XY130AK	**Boreal Scrubland Gravelly Floodplain** Occurs on the low flood plain of the same montane streams supporting shrubby vegetation.
R231XY138AK	**Boreal Sedge Loamy Flood Plain Depressions** Occurs on flood plain depressions supporting sedge dominant communities.
F231XY151AK	**Boreal Forest Loamy Frozen Floodplain Moist** Occurs between site 131 and stream terrace sites with wetter soils and less productive stands of trees.
F231XY169AK	**Boreal Woodland Peat Frozen Flats** Occurs on adjacent stream terraces that no longer flood. Soils have permafrost and support black spruce woodlands.
F231XY171AK	**Boreal Woodland Loamy Frozen Terraces** Occurs on adjacent stream terraces that no longer flood. Soils have permafrost and support black spruce woodlands.

Similar sites

F231XY151AK	**Boreal Forest Loamy Frozen Floodplain Moist** Site 151 typically occurs between site 131 and site 171. Site 151 has wetter soils that commonly have permafrost, which results in less productive trees and different kinds and amounts of vegetation.
F231XY196AK	**Boreal Forest Loamy Frozen Flood Plain** Occurs on the high flood plain of very large streams like the Yukon River. The soils and flood regime are different between these two types of river systems, which result in different kinds and amounts of vegetation.

Table 1. Dominant plant species

Tree	(1) *Picea glauca*
Shrub	(1) *Rosa acicularis* (2) *Linnaea borealis*
Herbaceous	(1) *Hylocomium splendens* (2) *Pleurozium schreberi*

Physiographic features

This boreal site occurs on high flood plains of montane streams and rivers. The boreal life zone typically occurs below 2500 feet with this site occasionally occurring as high as 2875 feet. Slope is negligible on these floodplains ranging from 0 to 3 percent with the site occurring on all slope aspects. This site does not typically pond. Flooding occurs rarely to occasionally often for brief durations of time. Areas with more frequent flooding support different vegetation compared to areas that flood less frequently. During high-water and flooding, the water table is commonly at the soil surface. After the high-water recedes, the water table goes to deep or greater depths. This site provides very low runoff to adjacent sites.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Flood plain
Runoff class	Negligible to very low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding duration	Not specified
Ponding frequency	None
Elevation	91–762 m
Slope	0–3%
Ponding depth	Not specified
Water table depth	36–102 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	Not specified
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	67–876 m
Slope	0–12%
Ponding depth	10 cm

Water table depth	0 cm

Climatic features

Short, warm summers and long, cold winters characterize the subarctic continental climate associated with this boreal site. The mean annual temperature of the site ranges from 22 to 27 degrees F. The warmest months span June through August with mean normal maximum monthly temperatures ranging from 60 to 66 degrees F. The coldest months span November through February with mean normal minimum temperatures ranging from -3 to -12 degrees F. The freeze-free period for the site ranges from 80 to 120 days, and the temperature usually remains above freezing from late May through mid-September.

The area receives minimal annual precipitation with the summer months being the wettest. Average annual precipitation across the area typically ranges between 12 to 18 inches. Approximately 3/5th of the annual precipitation occurs during the months of June through September with thunderstorms common. The average annual snowfall ranges from about 45 to 100 inches. The ground is consistently covered with snow from November through March.

Table 4. Representative climatic features

Frost-free period (characteristic range)	16-78 days
Freeze-free period (characteristic range)	76-114 days
Precipitation total (characteristic range)	305-457 mm
Frost-free period (actual range)	4-87 days
Freeze-free period (actual range)	48-120 days
Precipitation total (actual range)	229-508 mm
Frost-free period (average)	53 days
Freeze-free period (average)	90 days
Precipitation total (average)	381 mm

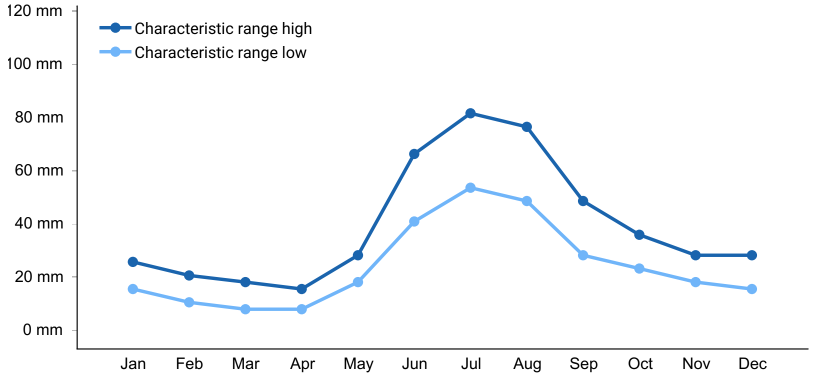


Figure 1. Monthly precipitation range

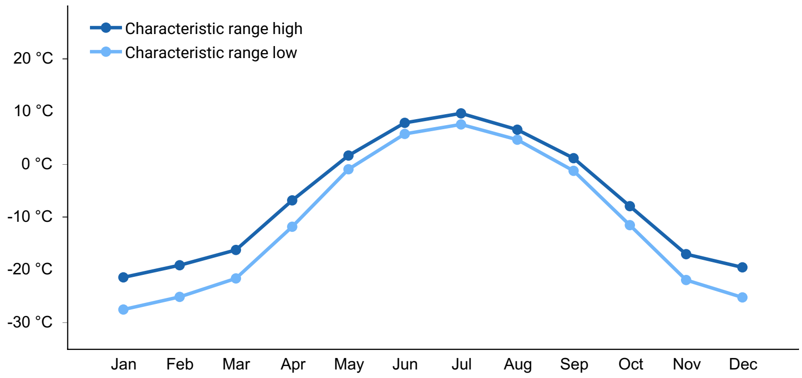


Figure 2. Monthly minimum temperature range

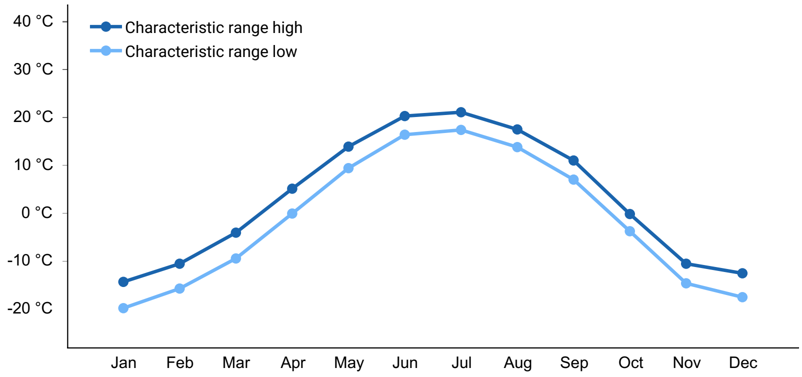


Figure 3. Monthly maximum temperature range

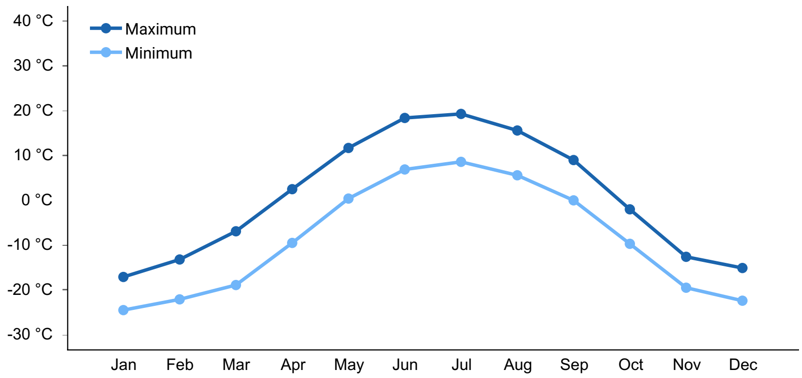


Figure 4. Monthly average minimum and maximum temperature

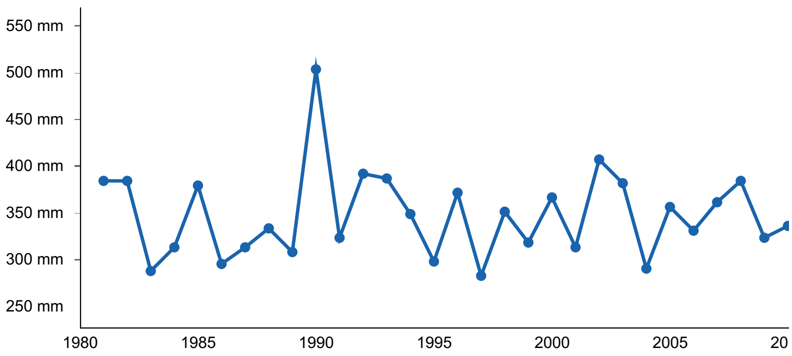


Figure 5. Annual precipitation pattern

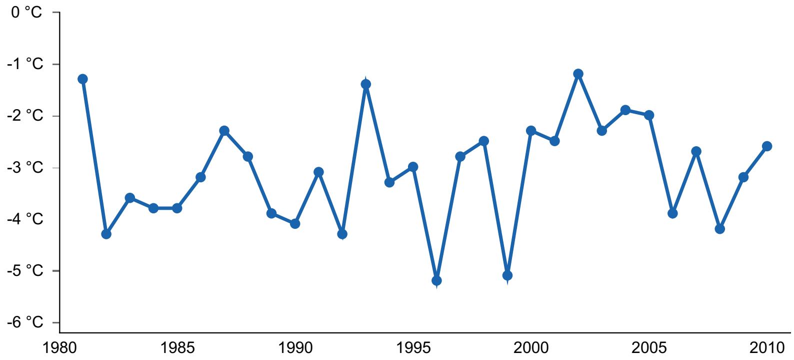


Figure 6. Annual average temperature pattern

Climate stations used

- (1) EAGLE AP [USW00026422], Tok, AK
- (2) CHICKEN [USC00501684], Tok, AK
- (3) MILE 42 STEESE [USC00505880], Fairbanks, AK
- (4) BETTLES AP [USW00026533], Bettles Field, AK
- (5) CIRCLE HOT SPRINGS [USC00501987], Central, AK
- (6) FT KNOX MINE [USC00503160], Fairbanks, AK
- (7) GILMORE CREEK [USC00503275], Fairbanks, AK
- (8) FOX 2SE [USC00503181], Fairbanks, AK
- (9) ESTER DOME [USC00502868], Fairbanks, AK
- (10) ESTER 5NE [USC00502871], Fairbanks, AK
- (11) COLLEGE 5 NW [USC00502112], Fairbanks, AK
- (12) COLLEGE OBSY [USC00502107], Fairbanks, AK
- (13) KEYSTONE RIDGE [USC00504621], Fairbanks, AK

Influencing water features

In the associated high 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

n/a

Soil features

Soils generally formed in loamy over sandy and gravelly alluvium and do not have permafrost. Rock fragments on the soil surface are typically absent. These are mineral soils commonly capped with 1 to 5 inches of organic material. The mineral soil below the organic material is often stratified layers of silt loam and/or sandy loam, which typically have minimal rock fragments and high-water holding capacity. This surface mineral horizon is highly variable ranging in thickness from 6 to 40 inches or more. Below this horizon are thick layers of sands and gravelly sands with rock fragments ranging between 5 and 25 percent of the soil profile by volume. At times, there is an abrupt change between the loamy and sandy gravelly alluvium resulting in restrictions at shallow to moderate depth (20 to 40 inches). Soils with these restrictions tend to be somewhat poorly drained while soils without these restrictions tend to be moderately to well drained. While some soils have restrictions, these are considered very deep soils. The pH of the soil profile is typically neutral.

Figure 7. A typical soil profile associated with this site. These high flood plain soils are commonly coarse loamy over sandy or sandy-skeletal. Notice the sandy-skeletal alluvium at 50 cm depth.

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Sandy loam (3) Very fine sandy loam
Family particle size	(1) Coarse-loamy (2) Coarse-loamy over sandy or sandy-skeletal (3) Sandy or sandy-skeletal (4) Sandy-skeletal
Drainage class	Somewhat poorly drained to well drained
Permeability class	Moderately rapid
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)	4.57–22.1 cm
Calcium carbonate equivalent (25.4-101.6cm)	0–1%
Clay content (0-50.8cm)	4–8%
Electrical conductivity (25.4-101.6cm)	0–5 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0
Soil reaction (1:1 water) (25.4-101.6cm)	7–7.3
Subsurface fragment volume <=3" (0-152.4cm)	5–25%
Subsurface fragment volume >3" (0-152.4cm)	0–2%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	51 cm
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	1.02–26.67 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)	Not specified
Soil reaction (1:1 water) (25.4-101.6cm)	6.5–7.3
Subsurface fragment volume <=3" (0-152.4cm)	0–70%
Subsurface fragment volume >3" (0-152.4cm)	0–20%

Ecological dynamics

Flooding

All montane streams and rivers in this area have low and/or high flood plain sites. These flood plain sites represent major breaks in the flood regime and dominant vegetative type on associated tributaries. The low flood plain 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 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).

Field work indicates that differences in flood frequency and duration result in different plant communities for this site. Sample plots thought to flood more frequently have smaller white spruce, greater balsam poplar and shrub cover, and less bryophyte cover. Sample plots 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 typically have terrace sites (see F231XY169AK and 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 Interior Alaska Uplands 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 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 150 years or more must elapse without another fire event (Foot 1982; Chapin et al. 2006; Landfire 2009).

Within this area, fire is considered a natural and common event that typically is unmanaged. Fire suppression is limited, and generally occurs adjacent to Fairbanks and 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. From 2000 to 2020, 596 known fire events occurred in the Interior Alaska Uplands area and the burn perimeter of the fires totaled about 13.8 million acres (AICC 2022). Fire-related disturbances are highly patchy and can leave undisturbed areas within the burn perimeter. During this time frame, 80% of the fire events were smaller than 20,000 acres but 18 fire events were greater than 200,000 acres in size (AICC 2022). These burn perimeters cover approximately 30% of the Interior Alaska Uplands area over a period of 20 years.

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 thin organic cap and typically moderately well to 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 tends to cause overall soil temperatures to increase (Hinzman et al. 2006). These alterations to soil temperature may result in increased depths of seasonal frost in the soil profile and improved drainage. High-severity fire events also destroy a majority of the vascular and nonvascular biomass above ground.

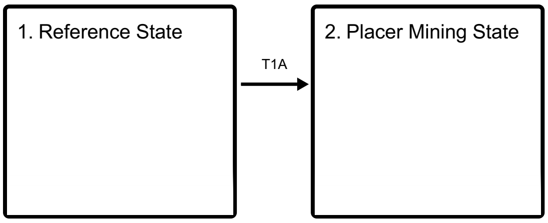
Field data suggest that each of the forested communities burn and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community 1.5) is a mix of species that either regenerate in place (e.g., subterranean root crowns for willow and rhizomes for graminoids) 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 10 years post-fire. 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 10 to 30 years post-fire. In the absence of fire, tree species continue to become more dominant in the stand and eventually develop into forests.

The later 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 phase 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 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 white spruce stands in Interior Alaska occurs approximately once every 150 years (Landfire 2009; Abrahamson 2014). 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 (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 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).

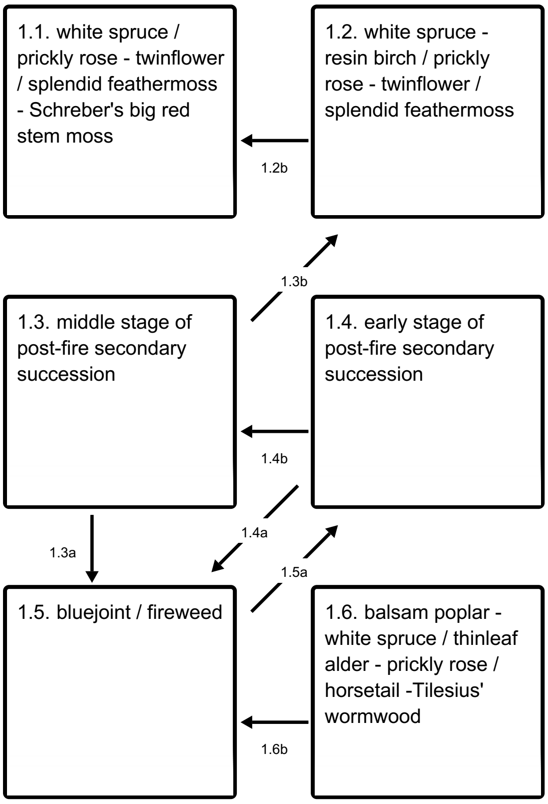
State and transition model

Ecosystem states

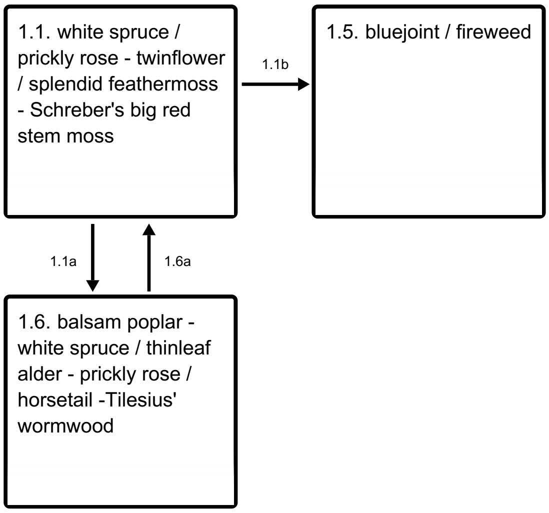


T1A - Mining

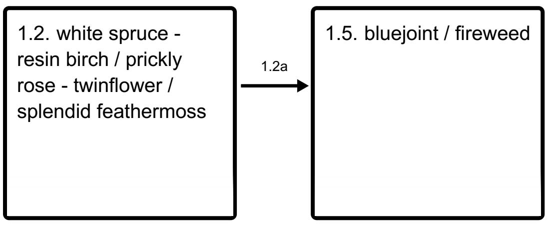
State 1 submodel, plant communities



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 - Time without fire

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

1.3b - Time without fire

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

1.4b - Time without fire

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

1.5a - Time without fire

1.6a - Less frequent and intense flooding

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

State 2 submodel, plant communities

2.1. resin birch - balsam poplar / Siberian alder - thinleaf alder / fireweed

State 1
Reference State

Figure 8. A closed white spruce forest on the high floodplain in the area.

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. While the reference plant community, community 1.2, community 1.5, and community 1.6 are supported with plot data, plant communities 1.3 and 1.4 have limited data and are considered provisional concepts.

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

Figure 9. A typical plant community associated with community 1.1.

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

Figure 10. A typical plant community associated with community 1.2.

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

middle stage of post-fire secondary succession

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. Common understory species from a similar site in the Yukon Flats Lowlands area are prickly rose, a mixture of willow, fireweed, and a mixture of horsetail.

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
early stage of post-fire secondary succession

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

Figure 11. A typical plant community associated with community 1.5.

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 (Viereck 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

Figure 12. A typical plant community associated with community 1.6.

Community 1.6 is more frequently flooded then reference community 1.1. It is characterized as closed mixed forest (Viereck 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

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

bluejoint / fireweed

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

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

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

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

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

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

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

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

bluejoint / fireweed

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

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

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

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

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

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

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

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

bluejoint / fireweed

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.

State 2
Placer Mining State

Figure 13. A pile of rocks found on a high floodplain after mining in the area.

This area has a rich history of placer mining for gold and to this day has many active mines. Placer mining is any technique that uses water to separate gold from sediment (e.g., panning and dredging). Environmental impact varies depending on the placer technique and mining footprint. In areas that had a history of placer mining, it was common to find large piles of gravels adjacent to post-placer mining vegetation. No plant communities were developed for gravel piles as they are primarily barren rock. This post-placer mining community does not represent the vast array of vegetation reclamation in the area and only reflects the snapshot of data collected during field activities. Future research is required to document additional post-mining plant communities, restoration pathways, and alternate states related to placer mining in the area.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- balsam poplar (*Populus balsamifera*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- thinleaf alder (*Alnus incana ssp. tenuifolia*), shrub
- fireweed (*Chamerion angustifolium*), other herbaceous

Community 2.1
resin birch - balsam poplar / Siberian alder - thinleaf alder / fireweed

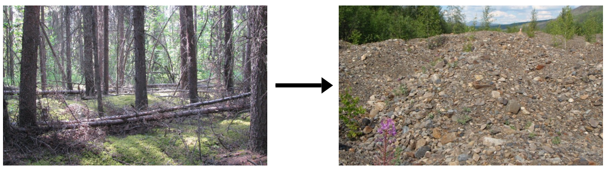
Figure 14. A typical plant community associated with community 2.2.

Large piles of silty sediment were a documented byproduct of placer mining. These large piles of silt are characterized by tall scrub and regenerating trees. Seedlings and saplings of resin birch, balsam poplar, and white spruce were abundant. Other commonly observed species include Siberian alder, thinleaf alder, feltleaf willow, American red raspberry, common yarrow, and fireweed.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- balsam poplar (*Populus balsamifera*), tree
- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- thinleaf alder (*Alnus incana ssp. tenuifolia*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- American red raspberry (*Rubus idaeus*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- common yarrow (*Achillea millefolium*), other herbaceous
- fireweed (*Chamerion angustifolium*), other herbaceous
- Tilesius' wormwood (*Artemisia tilesii*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- northern bedstraw (*Galium boreale*), other herbaceous

Transition T1A
State 1 to 2



Reference State **Placer Mining State**

Mining

Additional community tables

Table 7. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
white spruce	PIGL	*Picea glauca*	Native	13.1–34.4	45–85	12.4–59.2	–
resin birch	BENE4	*Betula neoalaskana*	Native	–	0–10	–	–
balsam poplar	POBA2	*Populus balsamifera*	Native	–	0–10	34.3	–

Table 8. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
bluejoint	CACA4	*Calamagrostis canadensis*	Native	0.6–1.2	0–15
Forb/Herb					
field horsetail	EQAR	*Equisetum arvense*	Native	0.1–0.6	0–45
northern bedstraw	GABO2	*Galium boreale*	Native	0.1–0.6	0–15
alpine sweetvetch	HEAL	*Hedysarum alpinum*	Native	0.1–0.6	0–5
false toadflax	GELI2	*Geocaulon lividum*	Native	0.1–0.6	0–5
tall bluebells	MEPA	*Mertensia paniculata*	Native	0.1–0.6	0–5
liverleaf wintergreen	PYAS	*Pyrola asarifolia*	Native	0–0.1	0–3
fireweed	CHAN9	*Chamerion angustifolium*	Native	0.6–1.2	0–2
Tilesius' wormwood	ARTI	*Artemisia tilesii*	Native	0.6–1.2	0–2
larkspurleaf monkshood	ACDE2	*Aconitum delphiniifolium*	Native	0.6–1.2	0–1
lesser rattlesnake plantain	GORE2	*Goodyera repens*	Native	0–0.1	0–1
bluntleaved orchid	PLOB	*Platanthera obtusata*	Native	0–0.1	0–0.1
Shrub/Subshrub					
prickly rose	ROAC	*Rosa acicularis*	Native	0.9–1.5	0.1–50
bog blueberry	VAUL	*Vaccinium uliginosum*	Native	0.2–0.9	0–20
black crowberry	EMNI	*Empetrum nigrum*	Native	0–0.1	0–15
twinflower	LIBO3	*Linnaea borealis*	Native	0–0.1	0–15
Siberian alder	ALVIF	*Alnus viridis ssp. fruticosa*	Native	1.5–3	0–15
squashberry	VIED	*Viburnum edule*	Native	0.9–1.5	0–10
lingonberry	VAVI	*Vaccinium vitis-idaea*	Native	0–0.1	0–10
Nonvascular					
splendid feather moss	HYSP70	*Hylocomium splendens*	Native	0–0.1	0–95
Schreber's big red stem moss	PLSC70	*Pleurozium schreberi*	Native	0–0.1	0–50

Animal community

n/a

Hydrological functions

n/a

Recreational uses

n/a

Wood products

n/a

Other products

n/a

Other information

n/a

Inventory data references

Tier 2 sampling plots used to develop the reference state. Plot numbers as recorded in NASIS with associated community phase.

Community 1.1

09NP00408, 09TC01401, 09TC03603, 09TC03803, 10NP01602, 11MC01003, 11MC01405, 13NR00304, 14EG00604, 2015AK290527, 2015AK290901, 2015AK290906, 2015AK290907, 2016AK290426, 2016AK290577, 2016AK290619, 2016AK290711, 2016AK290713, 2016AK290724, S2016AK290005

Community 1.2

2016AK290424, 2016AK290728

Community 1.5

2015AK290978

Community 1.6

09NP00506, 09TC03802, 10TC04801, 12SN03101

Community 2.1

09TC01403

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Approval

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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	05/13/2025
Approved by	Kirt Walstad
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:**