

# Ecological site F231XY181AK

## Boreal Forest Gravelly Slopes Steep Cold

Last updated: 2/13/2024  
Accessed: 04/20/2024

---

### 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 than 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  $\geq 1$  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 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 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 – 7416030 – Western North American Boreal White Spruce-Hardwood Forest (Landfire 2009)

## Ecological site concept

This boreal site occurs on cold slopes of escarpments that are very steep. Associated soils lack permafrost, do not have a seasonal water table, and are considered well drained. Slopes typically range between 50 and 70 percent or more and are northwest to east facing. The soil profile has a thin layer of organic material over gravelly colluvium.

Multiple plant communities occur within the reference state and the vegetation in each community differs in large part due to fire. When the reference state vegetation burns, the post-fire plant community is dominantly forbs, grasses, and weedy mosses. 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 open 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).

The reference plant community understory commonly has Siberian alder, thinleaf alder, prickly rose, red currant, lingonberry, bog Labrador tea, bog blueberry, bluejoint, meadow horsetail, false toadflax, tall bluebells, Alaska wild rhubarb, dwarf scouringrush, splendid feathermoss, Schreber's big red stem moss, knights plume moss, and Sphagnum. White spruce tree cover is primarily in the tall tree stratum (greater than 40 feet in height). The understory vegetative strata that characterize this community phase are tall shrubs (greater than 10 feet in height) and bryophytes.

## Associated sites

R231XY109AK	<b>Boreal Scrub Gravelly Slopes Dry</b> Occurs on steeper and more erosive slopes of the same escarpments.
F231XY110AK	<b>Boreal Forest Gravelly Slopes Steep</b> Occurs on warmer slopes of the same escarpments.

## Similar sites

R231XY109AK	<b>Boreal Scrub Gravelly Slopes Dry</b> Site 109 occurs on steeper and more erosive slopes that do not support stands of trees.
F231XY110AK	<b>Boreal Forest Gravelly Slopes Steep</b> The warm slopes associated with site 110 have more productive white spruce stands and different kinds and amounts of understory vegetation.

Table 1. Dominant plant species

Tree	(1) <i>Picea glauca</i>
Shrub	(1) <i>Alnus viridis ssp. fruticosa</i> (2) <i>Ribes triste</i>
Herbaceous	(1) <i>Hylocomium splendens</i> (2) <i>Pleurozium schreberi</i>

## Physiographic features

This boreal site occurs on very steep backslopes of escarpments. Slopes are typically northwest to northeast facing. The boreal life zone typically occurs below 2500 feet but this site at times occurs on warmer hillslopes at 2600 feet or more elevation. These are very steep slopes commonly ranging between 50 and 70 percent or more and are cold slopes that are northwest to east facing. This site does not flood or pond and does not have a water table in the soil profile. This site generates moderate amounts of runoff to adjacent, downslope ecological sites.

**Table 2. Representative physiographic features**

Hillslope profile	(1) Backslope
Landforms	(1) Escarpment
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	650–2,500 ft
Slope	50–70%
Ponding depth	Not specified
Water table depth	60 in
Aspect	NW, N, NE, E

**Table 3. Representative physiographic features (actual ranges)**

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	650–2,625 ft
Slope	50–95%
Ponding depth	Not specified
Water table depth	Not specified

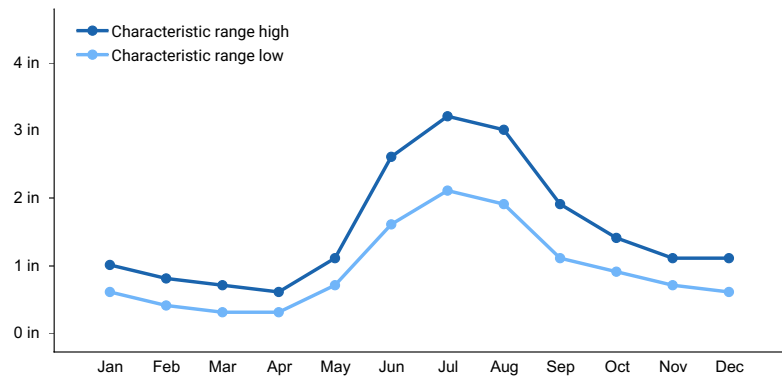
## Climatic features

Short, warm summers and long, cold winters characterize the subarctic continental climate associated with this boreal 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.

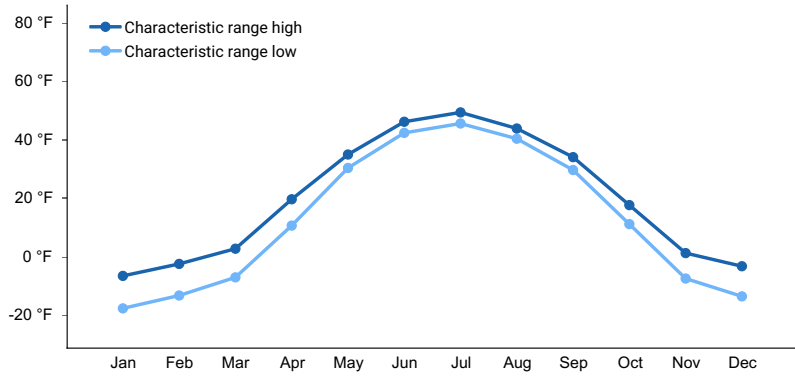
The area receives minimal annual precipitation with the summer months being the wettest. Average annual precipitation across the area typically ranges between 12 to 18 inches. Approximately 3/5th of the annual precipitation occurs during the months of June through September with thunderstorms common. 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**

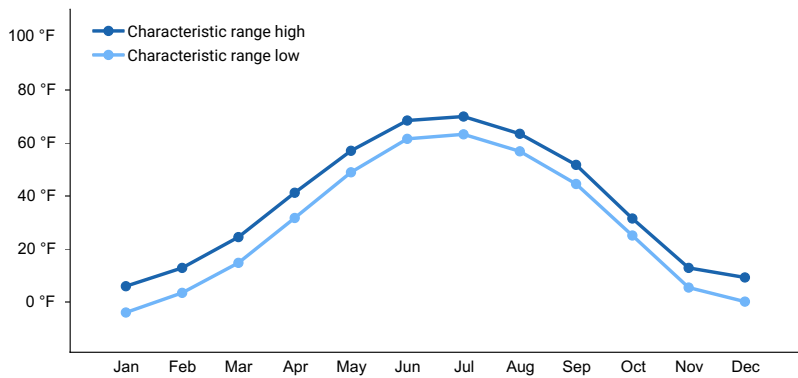
Frost-free period (characteristic range)	16-78 days
Freeze-free period (characteristic range)	76-114 days
Precipitation total (characteristic range)	12-18 in
Frost-free period (actual range)	4-87 days
Freeze-free period (actual range)	48-120 days
Precipitation total (actual range)	9-20 in
Frost-free period (average)	53 days
Freeze-free period (average)	90 days
Precipitation total (average)	15 in



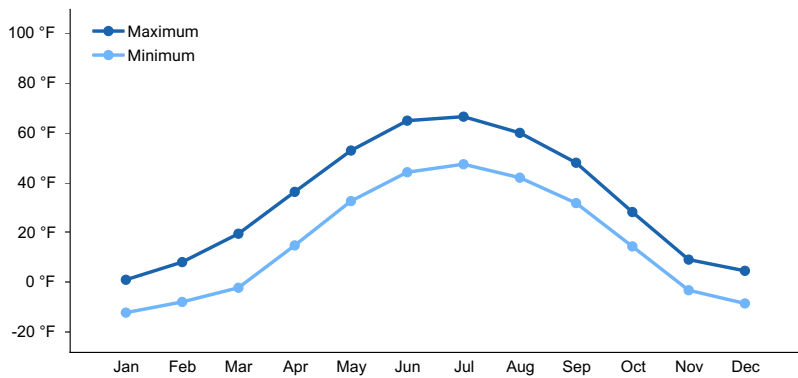
**Figure 1. Monthly precipitation range**



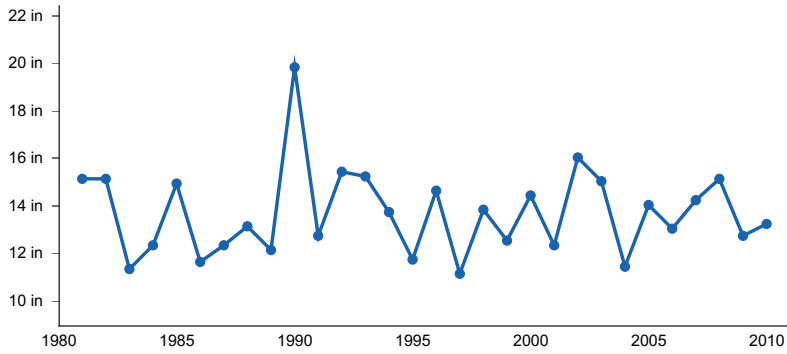
**Figure 2. Monthly minimum temperature range**



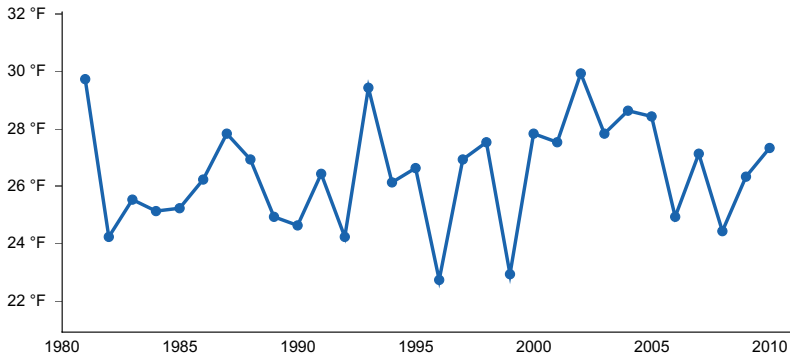
**Figure 3. Monthly maximum temperature range**



**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

Due to its landscape position, this site is neither associated with or influenced by streams or wetlands. Precipitation and throughflow are the main source of water for this ecological site.

## Wetland description

n/a

## Soil features

Soils formed in gravelly colluvium and do not have permafrost. Surface rock fragments are common ranging from 3 to 12 percent ground cover. These are mineral soils commonly capped with 6 inches of organic material. The mineral soil below the organic material is gravelly colluvium with limited water holding capacity. The colluvium has rock fragments ranging between 50 and 90 percent of the soil profile by volume. These are very deep soils without restrictions. The pH of the soil profile often ranges from neutral to moderately alkaline. The soils are dry, lack a

seasonal water table, and are considered well drained.



Figure 7. A typical soil profile associated with this site.

Table 5. Representative soil features

Parent material	(1) Colluvium
Surface texture	(1) Cobbly sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	3–12%
Available water capacity (0-40in)	1.7–2.4 in
Calcium carbonate equivalent (10-40in)	0%
Clay content (0-20in)	3–6%
Electrical conductivity (10-40in)	0–3 mmhos/cm
Sodium adsorption ratio (10-40in)	0
Soil reaction (1:1 water) (10-40in)	6.6–8.2
Subsurface fragment volume <=3" (0-60in)	35–55%
Subsurface fragment volume >3" (0-60in)	15–35%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified

Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	Not specified
Calcium carbonate equivalent (10-40in)	Not specified
Clay content (0-20in)	Not specified
Electrical conductivity (10-40in)	Not specified
Sodium adsorption ratio (10-40in)	Not specified
Soil reaction (1:1 water) (10-40in)	4.2–8.2
Subsurface fragment volume <=3" (0-60in)	Not specified
Subsurface fragment volume >3" (0-60in)	Not specified

## Ecological dynamics

### 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 basic 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 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 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. High-severity fire events also destroy a majority of the vascular and nonvascular biomass above ground.

Field data from this site and similar sites suggest that each of the forested community phases will burn and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community phase 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*



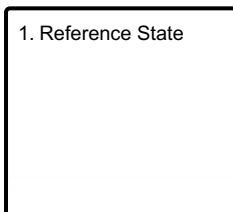
*tremuloides*] and Ceratodon moss [*Ceratodon purpureus*]). The pioneering stage of fire succession is primarily composed of tree seedlings, forbs, grasses, and weedy bryophytes. This stage of succession is thought to persist for up to 10 years post-fire. Willow (*Salix* spp.) and quick growing deciduous 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 phase 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 phase 1.3), a mix of broadleaf and needleleaf trees (community phase 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).

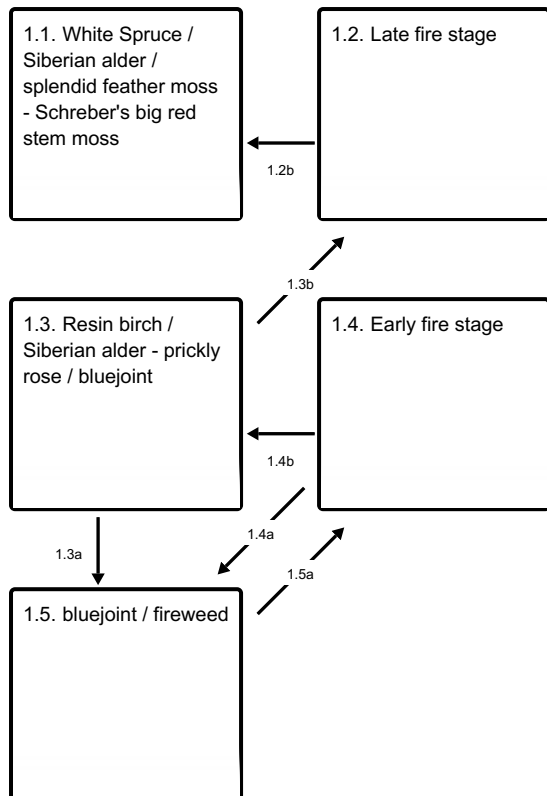
Lands associated with this site may be burning more frequently than in the past, which may result in alternative states of succession. The historic fire return interval for white spruce stands in Interior Alaska occurs approximately once 150 years (Landfire 2009; Abrahamson 2014). Due to global climate 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 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

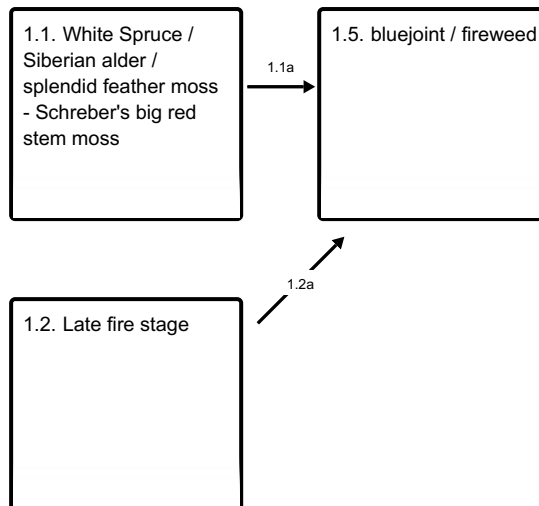
### Ecosystem states



### State 1 submodel, plant communities



### Communities 1, 5 and 2 (additional pathways)



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

**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.

## State 1 Reference State



**Figure 8.** An open forest with white spruce as the dominant tree and Siberian alder and feathermoss dominant in the understory.

The reference plant community is open needleleaf forest (Viereck et al. 1992) with the dominant tree being white spruce. There are five communities within the reference state related to fire. While the reference plant community 1.1, community 1.3, and community 1.5 are supported with plot data, plant communities 1.2 and 1.4 have limited data and are considered provisional concepts.

## Dominant plant species

- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

## Community 1.1

### White Spruce / Siberian alder / splendid feather moss - Schreber's big red stem moss



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

The reference plant community phase is characterized as an open needleleaf forest (25 to 60 percent cover) 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, occasionally occur in the tree canopy, but most have been replaced by white spruce. The soil surface is primarily covered with bryophytes and herbaceous litter. Common and abundant understory species for this community include Siberian alder, thinleaf alder, prickly rose, red currant, lingonberry, bog Labrador tea, bog blueberry, bluejoint, meadow horsetail, false toadflax, tall bluebells, Alaska wild rhubarb, dwarf scouringrush, splendid feathermoss, Schreber's big red stem moss, knights plume moss, and Sphagnum. The understory vegetative strata that characterize this community phase are tall shrubs (greater than 10 feet in height) and bryophytes.

## Dominant plant species

- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- thinleaf alder (*Alnus incana ssp. tenuifolia*), shrub
- prickly rose (*Rosa acicularis*), shrub
- red currant (*Ribes triste*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- meadow horsetail (*Equisetum pratense*), other herbaceous
- false toadflax (*Geocaulon lividum*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- Alaska wild rhubarb (*Polygonum alpinum*), other herbaceous
- dwarf scouringrush (*Equisetum scirpoides*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- knights plume moss (*Ptilium crista-castrensis*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous

## Community 1.2

### Late fire stage

Community 1.2 is in the late stage of fire-induced secondary succession for this ecological site. It is characterized as open mixed forest (Viereck et al. 1992) with mature resin birch and a mixture of immature and mature white spruce as the dominant trees. Common and abundant understory species for this community include Siberian alder, red current, prickly rose, bluejoint, horsetail, tall bluebells, false toadflax, fireweed, and feather mosses. This community was not sampled during field work but is inferred from similar sites and from other plots sampled in the reference state for the site.

#### Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- prickly rose (*Rosa acicularis*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- red currant (*Ribes triste*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- horsetail (*Equisetum*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- false toadflax (*Geocaulon lividum*), other herbaceous
- fireweed (*Chamerion angustifolium*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

## Community 1.3

### Resin birch / Siberian alder - prickly rose / bluejoint



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

Community 1.3 is in the middle stage of fire-induced secondary succession for this ecological site. It is characterized as open deciduous forest (Viereck et al. 1992) with mature stands of resin birch. Immature white spruce are a common subdominant tree in the canopy. Tree cover is split between medium-sized trees (15 to 40 feet in height) and tall trees (greater than 40 feet in height). The soil surface is primarily covered with herbaceous litter and woody debris. Common and abundant understory species for this community include Siberian alder, prickly rose, beaverd spirea, lingonberry, squashberry, red currant, bluejoint, meadow horsetail, tall bluebells, splendid feathermoss, Schreber's big red stem moss, and juniper polytrichum moss. The understory vegetative strata that characterize this community phase are tall shrubs (greater than 10 feet in height), medium graminoids (between 4 inches and 2 feet in height), and medium forbs (between 4 inches and 2 feet in height).

#### Dominant plant species

- white spruce (*Picea glauca*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub

- prickly rose (*Rosa acicularis*), shrub
- beauverd spirea (*Spiraea stevenii*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- squashberry (*Viburnum edule*), shrub
- red currant (*Ribes triste*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- meadow horsetail (*Equisetum pratense*), 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
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous

## Community 1.4

### Early fire stage

Community 1.4 is in the early stage of fire-induced secondary succession for this ecological site. It is characterized as open tall scrubland (Vioreck et al. 1992). The overstory canopy is primarily composed of willow, Siberian alder, and broadleaf tree species, commonly resin birch. Tree cover primarily is in the regenerative tree stratum (less than 15 feet in height). Commonly observed understory species include bluejoint, fireweed, and weedy bryophytes. This community was not sampled during field work but is inferred from similar sites and from other plots sampled in the reference state for the site.

### Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- Bebb willow (*Salix bebbiana*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- Siberian alder (*Alnus viridis* ssp. *fruticosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- pohlia moss (*Pohlia nutans*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous
- ceratodon moss (*Ceratodon purpureus*), other herbaceous

## Community 1.5

### bluejoint / fireweed



Figure 11. Typical plant community associated with community phase 1.5.

Community phase 1.5 is in the pioneering stage of fire-induced secondary succession for this ecological site. It is characterized as a mesic forb herbaceous community. Tree cover primarily is in the regenerative tree stratum (less than 15 feet in height). Deciduous tree seedlings, primarily resin birch, are common throughout the community. Although small areas of exposed bare soil are common, the soil surface is primarily covered with a mixture of weedy bryophyte species, woody debris, and herbaceous litter. Commonly observed species include an assortment

of willow, Siberian alder, bluejoint, fireweed, and pohlia moss. The vegetative strata that characterize this community phase are medium forbs (between 4 inches and 2 feet in height), weedy bryophytes, and tall forbs (greater than 2 feet in height).

### Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- feltleaf willow (*Salix alaxensis*), shrub
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- Bebb willow (*Salix bebbiana*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- pohlia moss (*Pohlia nutans*), other herbaceous
- Tilesius' wormwood (*Artemisia tilesii*), other herbaceous
- dwarf scouringrush (*Equisetum scirpoides*), other herbaceous
- tall bluebells (*Mertensia paniculata*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous
- ceratodon moss (*Ceratodon purpureus*), other herbaceous

### Pathway 1.1a

#### Community 1.1 to 1.5



White Spruce / Siberian alder /  
splendid feather moss -  
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 1.2b

#### Community 1.2 to 1.1

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

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



Resin birch / Siberian alder -  
prickly rose / bluejoint



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 1.4b**  
**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, alder, and deciduous tree seedlings.

**Additional community tables**

Table 7. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
<b>Tree</b>							
white spruce	PIGL	<i>Picea glauca</i>	Native	45–52	45–55	6.1–11.5	–

Table 8. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
bluejoint	CACA4	<i>Calamagrostis canadensis</i>	Native	0.3–2	2–20
<b>Forb/Herb</b>					
meadow horsetail	EQPR	<i>Equisetum pratense</i>	Native	0.3–2	0–10
false toadflax	GELI2	<i>Geocaulon lividum</i>	Native	0.3–2	0–10
Alaska wild rhubarb	POAL11	<i>Polygonum alpinum</i>	Native	2–4	0–7
dwarf scouringrush	EQSC	<i>Equisetum scirpoides</i>	Native	0.1–0.3	0–3
tall bluebells	MEPA	<i>Mertensia paniculata</i>	Native	0.3–2	1–2
<b>Shrub/Subshrub</b>					
thinleaf alder	ALINT	<i>Alnus incana ssp. tenuifolia</i>	Native	10–15	0–30
Siberian alder	ALVIF	<i>Alnus viridis ssp. fruticosa</i>	Native	10–15	0–15
red currant	RITR	<i>Ribes triste</i>	Native	0.6–3	0–10
lingonberry	VAVI	<i>Vaccinium vitis-idaea</i>	Native	0.1–0.6	0–10
bog Labrador tea	LEGR	<i>Ledum groenlandicum</i>	Native	0.6–3	0–5
bog blueberry	VAUL	<i>Vaccinium uliginosum</i>	Native	0.6–3	0–5
prickly rose	ROAC	<i>Rosa acicularis</i>	Native	0.6–3	2–5
<b>Nonvascular</b>					
splendid feather moss	HYSP70	<i>Hylocomium splendens</i>	Native	0.1–0.2	30–80
Schreber's big red stem moss	PLSC70	<i>Pleurozium schreberi</i>	Native	0.1–0.2	0.1–20
knights plume moss	PTCR70	<i>Ptilium crista-castrensis</i>	Native	0.1–0.2	0–10
Girgensohn's sphagnum	SPGI70	<i>Sphagnum girgensohnii</i>	Native	0.1–0.2	0–5

## 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  
10NP02704, 10TC00601

Community 1.3  
09TC03902, 10TC00306, 14EG00503

Community 1.5  
09NP02101

## 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.

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.

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

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..

## Other references

Alaska Interagency Coordination Center (AICC). 2022. <http://fire.ak.blm.gov/>

LANDFIRE. 2009. *Western North American Boreal White Spruce-Hardwood Forest*. In: *LANDFIRE National Vegetation Dynamics Models*. USDA Forest Service and US Department of Interior. Washington, DC.

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).

United States Department of Agriculture-Natural Resources Conservation Service. 2016. U.S. General Soil Map (STATSGO2). Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov>. Accessed (Accessed 3 March 2021).

## Approval

Kirt Walstad, 2/13/2024

## Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	04/20/2024
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:**

---