USDA Natural Resources
Conservation Service

Ecological site R231XY195AK
Boreal Scrubland Gravelly Drainageways Steep

Last updated: 2/13/2024
Accessed: 06/30/2024

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 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 – 7216160 – Western North American Boreal Riparian Stringer Forest and Shrubland (Landfire 2009)

Ecological site concept

This boreal site occurs on steep drainageways with moist and gravelly soils. These drainageways are relatively small, roughly linear depressions that move concentrated water intermittently during the growing season and have a small defined channel. Some may be considered low-order streams. In this area, the soils directly adjacent to the small defined channel of a drainageway typically have minimal to no bare alluvium, which significantly differs from flood plain systems. Given their limited footprint, drainageways have a narrow band of associated vegetation. Associated soils do not typically pond or flood, have a high-water table during portions of the growing season, and typically range from somewhat poorly to moderately well drained. A typical soil profile is a layer of organic material over gravelly alluvium.

One plant community has been documented within the reference state. This community is characterized as closed tall scrub (Viereck et al. 1992) with the dominant shrub being Siberian alder. Other commonly observed species include various willow, red currant, prickly rose, lingonberry, bluejoint, meadow horsetail, field horsetail, and splendid feathermoss.

Associated sites

F231XY111AK	**Boreal Forest Loamy Frozen Slopes** Site 111 occurs on cold backslopes of hills adjacent to these drainageways.
F231XY182AK	**Boreal Forest Gravelly Slopes** Site 182 occurs on warm backslopes of hills adjacent to these drainageways.
F231XY193AK	**Boreal Woodland Loamy Frozen Drainageways** Site 195 occurs on steep drainageways that often are tributaries to site 193.

Similar sites

R231XY152AK	**High-elevation scrub gravelly drainageways** Drainageway concept 152 occurs at higher elevation in the subalpine and alpine life zones.
F231XY193AK	**Boreal Woodland Loamy Frozen Drainageways** Drainageway concept 193 occurs on gentle slopes with wet, silty, and frozen soils. Soils support woodland communities.
R231XY195AK	**Boreal Scrubland Gravelly Drainageways Steep** Drainageway concept 195 occurs on gentler slopes with wetter soils. Soils support shrubby communities dominated by tealeaf willow and bog blueberry.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Alnus viridis ssp. fruticosa* (2) *Ribes triste*
Herbaceous	(1) *Calamagrostis canadensis* (2) *Equisetum arvense*

Physiographic features

This boreal site occurs in steep drainageways that are on hills and mountain slopes. These drainageways were at times considered flood plains. Slopes commonly ranges between 20 and 60 percent or more and occurs on all aspects. This site is associated with the boreal life zone which typically occurs below 2500 feet in this area. At times, elevation can range up to 3000 feet or more on warmer mountain slopes. Ponding and flooding do not occur. During the growing season, the water table typically occurs at shallow to moderate depths. This site generates low to medium amounts of runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Mountains > Hill (3) Mountains > Drainageway (4) Mountains > Flood plain
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	305–762 m
Slope	Not specified
Water table depth	Not specified
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	198–975 m
Slope	Not specified
Water table depth	Not specified

Climatic features

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

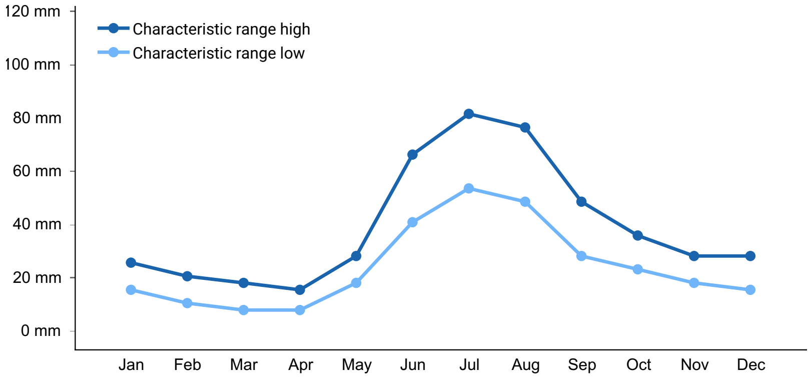

Figure 1. Monthly precipitation range

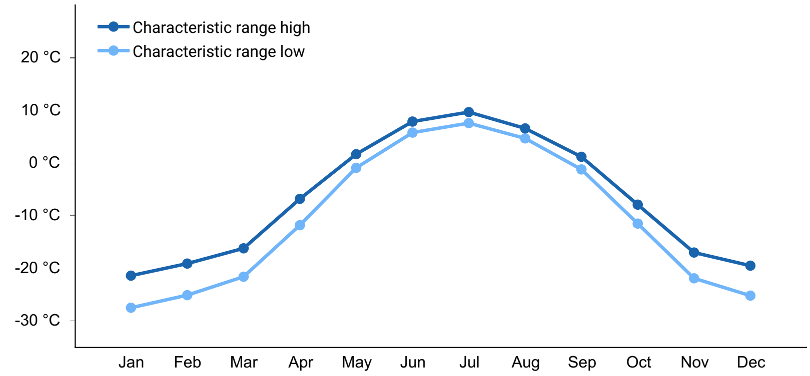

Figure 2. Monthly minimum temperature range

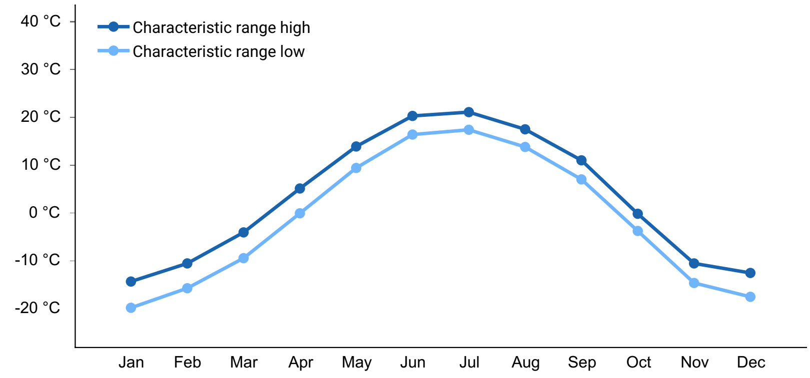

Figure 3. Monthly maximum temperature range

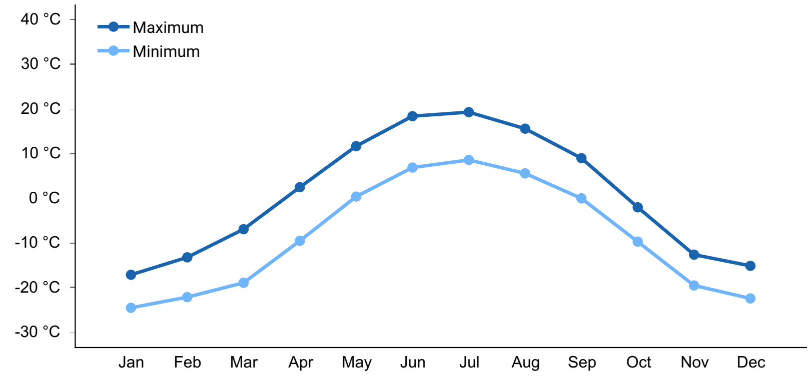

Figure 4. Monthly average minimum and maximum temperature

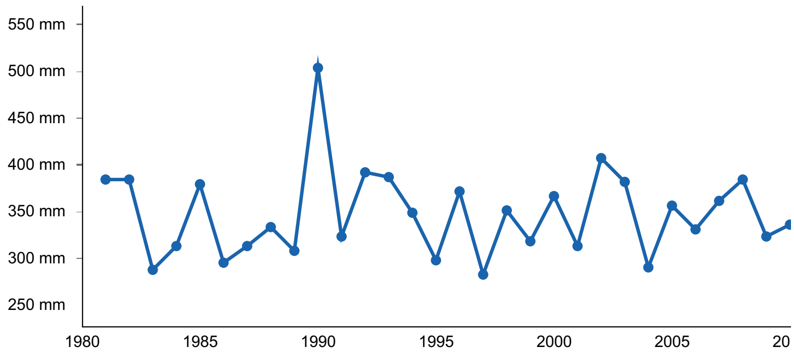

Figure 5. Annual precipitation pattern

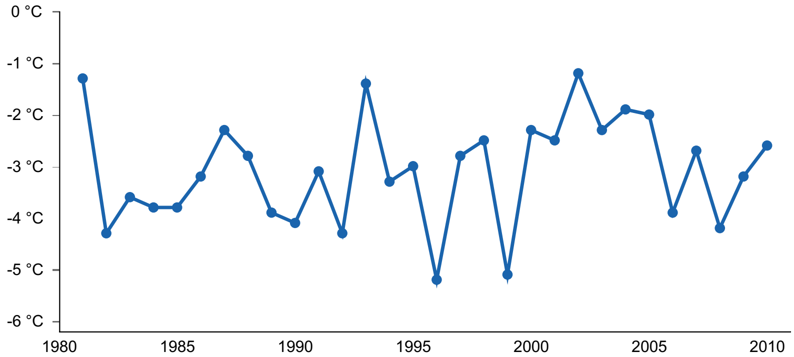

Figure 6. Annual average temperature pattern

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

This site is not considered a wetland. In the associated drainageways, groundwater return flow, interflow from surrounding uplands, and precipitation are considered 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 formed in gravelly alluvium and at times have permafrost. These drainageways commonly have 3 to 15 percent cover of surface rock fragments. These are mineral soils commonly capped with 2 to 8 inches of organic material. The mineral soil below the organic material is often silt loam that at times is stratified with sandy loams, which when devoid of rock fragments has high water holding capacity. This loamy layer is highly variable ranging in thickness from 0 to 7 inches. Below the silty alluvium is gravelly alluvium with rock fragments commonly ranging between 25 and 50 percent of the soil profile by volume. These are very deep soils that occasionally have permafrost at moderate depth (20 to 35 inches). The pH of the soil profile typically ranges from very strongly acidic to slightly acidic. The soils are wet for portions of the growing season and are typically considered somewhat poorly to moderately well drained.

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

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Gravelly silt loam (2) Silt loam (3) Sandy loam
Family particle size	(1) Loamy-skeletal (2) Sandy-skeletal (3) Coarse-loamy
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Moderately rapid
Depth to restrictive layer	89 cm
Soil depth	152 cm
Surface fragment cover <=3"	3–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	2.79–11.94 cm
Calcium carbonate equivalent (25.4-101.6cm)	0%
Clay content (0-50.8cm)	3–8%
Electrical conductivity (25.4-101.6cm)	0–3 mmhos/cm
Sodium adsorption ratio (25.4-101.6cm)	0
Soil reaction (1:1 water) (25.4-101.6cm)	4.9–6.5
Subsurface fragment volume <=3" (0-152.4cm)	20–35%

Subsurface fragment volume >3" (0-152.4cm)	5–15%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained to moderately well drained
Permeability class	Not specified
Depth to restrictive layer	51 cm
Soil depth	Not specified
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	1.78–24.64 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)	4.9–8
Subsurface fragment volume <=3" (0-152.4cm)	0–55%
Subsurface fragment volume >3" (0-152.4cm)	0–35%

Ecological dynamics

Fire

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). Over a period of 20 years, these burn perimeters cover approximately 30% of the Interior Alaska Uplands area.

During fieldwork, fire was not a documented disturbance for this site. Fire may not commonly occur within the narrow band of vegetation associated with these small drainageways. For this site, additional plots and environmental co-variate data will help clarify the effects of fire on associated vegetation and its effects to dynamic soil properties like organic mat thickness and drainage.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. Siberian alder / bluejoint / meadow horsetail - field horsetail

State 1
Reference State

Figure 8. A steep and shrubby drainageway in this area.

The reference plant community is closed tall scrub (Viereck et al. 1992) with the dominant shrub being Siberian alder. Associated soils have a seasonal high water table. The reference state has one documented plant community.

Dominant plant species

- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- red currant (*Ribes triste*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- meadow horsetail (*Equisetum pratense*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous

Community 1.1
Siberian alder / bluejoint / meadow horsetail - field horsetail

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

Reference community 1.1 is characterized as closed tall scrub (Viereck et al. 1992) with the dominant shrub being Siberian alder. Black spruce and white spruce are common but have limited cover. Resin birch can be dominant in the overstory but typically has limited cover. Tree cover primarily occurs in the medium tree stratum (between 15 and 40 feet). Other commonly observed species include various willow, red currant, prickly rose, lingonberry, bluejoint, meadow horsetail, field horsetail, and splendid feathermoss. The soil surface is primarily covered with herbaceous litter and moss but exposed bare soil is common (up to 10 percent of plot). This site typically has a distinct channel with flowing water (as much as 5 percent of the plot). The vegetative strata that characterize this community are tall shrubs (greater than 10 feet) and medium forbs (between 4 and 24 inches).

Forest overstory. Regenerating trees are not considered part of the overstory canopy cover. Basal area values reported for resin birch below are actually for all tree species in the plot.

Dominant plant species

- resin birch (*Betula neoalaskana*), tree
- Siberian alder (*Alnus viridis ssp. fruticosa*), shrub
- willow (*Salix*), shrub
- red currant (*Ribes triste*), shrub
- prickly rose (*Rosa acicularis*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- meadow horsetail (*Equisetum pratense*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

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							
resin birch	BENE4	*Betula neoalaskana*	Native	7.3–8.5	0.1–20	13–14.2	–
black spruce	PIMA	*Picea mariana*	Native	7–9.4	0–12	9.7–10.7	–
white spruce	PIGL	*Picea glauca*	Native	3–5.2	0–1	3.3–4.6	–

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	0–25
Forb/Herb					
meadow horsetail	EQPR	*Equisetum pratense*	Native	0.1–0.6	0–45
field horsetail	EQAR	*Equisetum arvense*	Native	0.1–0.6	0–25
western oakfern	GYDR	*Gymnocarpium dryopteris*	Native	0.1–0.6	0–25
stiff clubmoss	LYAN2	*Lycopodium annotinum*	Native	0–0.1	0–15
tall bluebells	MEPA	*Mertensia paniculata*	Native	0.1–0.6	0–10
Alaska wild rhubarb	POAL11	*Polygonum alpinum*	Native	0.6–1.2	0–7
arctic raspberry	RUAR	*Rubus arcticus*	Native	0–0.1	0–5
heartleaf saxifrage	SANE3	*Saxifraga nelsoniana*	Native	0.1–0.6	0–0.1
Shrub/Subshrub					
Siberian alder	ALVIF	*Alnus viridis ssp. fruticosa*	Native	3–4.6	65–80
red currant	RITR	*Ribes triste*	Native	0.9–1.2	0–15
Bebb willow	SABE2	*Salix bebbiana*	Native	3–4.6	0–15
beauverd spirea	SPST3	*Spiraea stevenii*	Native	0.2–0.9	0–10
prickly rose	ROAC	*Rosa acicularis*	Native	0.9–1.2	0–10
lingonberry	VAVI	*Vaccinium vitis-idaea*	Native	0–0.1	0–10
bog blueberry	VAUL	*Vaccinium uliginosum*	Native	0.2–0.9	0–7
twinflower	LIBO3	*Linnaea borealis*	Native	0–0.1	0–5
tealeaf willow	SAPU15	*Salix pulchra*	Native	0.9–1.8	0–5
Nonvascular					
splendid feather moss	HYSP70	*Hylocomium splendens*	Native	0–0.1	0–40
sphagnum	SPHAG2	*Sphagnum*	Native	0–0.1	0–20

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

09NP00102, 09NP01802, 10TC01503, 10NP04005, 10NP04304, 11BB04603

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Contributors

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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	06/30/2024
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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
