USDA Natural Resources
Conservation Service

# Ecological site R231XY104AK
# Alpine Dwarf Scrub Gravelly Alkaline Cold Slopes

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Accessed: 08/17/2024

## 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 – 69116351 – Western North American Boreal Alpine Ericaceous Dwarf - Shrubland - Complex

## Ecological site concept

This site occurs on cold alpine slopes with dry, gravelly, and alkaline soils. This site is associated with the backslopes of limestone mountains at high elevation. The soils lack permafrost, do not have a water table during the growing season, and are considered well drained. The soils formed in a thin silty layer of loess over gravelly and alkaline colluvium. The pH of the colluvium commonly ranges from neutral to slightly alkaline.

The alpine life zone has a harsh climate that limits growth of vegetation and prevents the establishment of many species common at lower elevations. In this area, alpine vegetation is characterized as dwarf and prostrate shrubs intermixed with low-lying herbaceous plants. These unique plant communities are the result of high winds, a short growing season, deep and persistent snow beds, and cold soils. These climatic factors prevent the establishment and growth of many dominant boreal species like white spruce and black spruce.

The reference plant community is characterized as dryas dwarf scrub (Viereck et al. 1992) and is highly diverse. Stunted white spruce occasionally occur but with limited cover. Common species include eightpetal mountain-avens, white arctic mountain heather, netleaf willow, bog blueberry, northern singlespike sedge, moss campion, northern asphodel, curled snow lichen, arctic Dactylina lichen, star reindeer lichen, witch's hair lichen, various Cetraria lichen, whiteworm lichen, splendid feathermoss, and turgid Aulacomnium moss

## Associated sites

| | |
|---|---|
| R231XY103AK | **Alpine Dwarf Scrub Gravelly Frozen Alkaline Slopes**<br>Occurs on the same alpine slopes but with wet soils that have permafrost. |
| R231XY105AK | **Alpine Dwarf Scrub Gravelly Alkaline Slopes**<br>Occurs on warmer alpine slopes with dry and gravelly soils that lack permafrost. |
| R231XY106AK | **Alpine Dwarf Scrub Gravelly Frozen Alkaline Slopes**<br>Occurs on the same alpine slopes with wet and gravelly soils that do not have permafrost. |
| R231XY152AK | **High-elevation scrub gravelly drainageways**<br>Occurs downslope in high elevation drainageways. |

## Similar sites

| | |
|---|---|
| R231XY101AK | **Alpine dwarf scrub gravelly slopes**<br>Both sites occur on alpine slopes with dry and gravelly soils. Site 104 has alkaline soils resulting in different kinds and amounts of vegetation. |
| R231XY105AK | **Alpine Dwarf Scrub Gravelly Alkaline Slopes**<br>Both sites occur on the same mountains on dry, alkaline soils. Site 105 occurs on warmer slopes with snowpack that persists for shorter durations of time. These two sites have different kinds and amounts of vegetation. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Dryas octopetala ssp. octopetala*<br>(2) *Cassiope tetragona* |
| Herbaceous | (1) *Flavocetraria cucullata*<br>(2) *Cladina* |

## Physiographic features

This alpine site occurs on limestone mountains at high elevation. This site is associated with backslopes of mountains. Elevation typically ranges between 2500 and 3200 feet but can go as low as 2300 feet on the coldest associated slopes. This site occurs on steep and cold slopes that are typically northwest to east facing. During the growing season, a water table occurs at deep depths to not at all in the soil profile. This site does not experience flooding or ponding, but rather generates limited runoff to adjacent, downslope ecological sites.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Hillslope profile | (1) Backslope |
| Landforms | (1) Mountains > Mountain slope |
| Runoff class | Low to medium |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 762–975 m |
| Slope | 20–60% |
| Water table depth | 152 cm |
| 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 | 701–975 m |
| Slope | Not specified |
| Water table depth | 102 cm |

## Climatic features

When compared to the boreal life zone, this high-elevation site has a harsh climate. In this MLRA, snow first blankets and persists the longest in the alpine and subalpine life zones. From spring through fall (April through September) , it is consistently 1 to 2 degrees F colder in the alpine and subalpine. These small differences in temperature are exacerbated due to constant and strong winds. Winds are much more intense in these high elevation areas because of limited trees providing windbreaks. When compared to the boreal life zone, this site has a much shorter growing season and the growing season is significantly colder for associated vegetation.

Short, warm summers and long, cold winters characterize the subarctic continental climate associated with this high-elevation site. The mean annual temperature of the site ranges from 23 to 27 degrees F. The warmest months span June through August with mean normal maximum monthly temperatures ranging from 57 to 63 degrees F. The coldest months span November through February with mean normal minimum temperatures ranging from -9 to -1 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 in the alpine across the area typically ranges between 14 to 21 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 mid-October 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) | 356-533 mm |

| | |
|---|---|
| Frost-free period (actual range) | 4-87 days |
| Freeze-free period (actual range) | 48-120 days |
| Precipitation total (actual range) | 254-635 mm |
| Frost-free period (average) | 53 days |
| Freeze-free period (average) | 90 days |
| Precipitation total (average) | 432 mm |

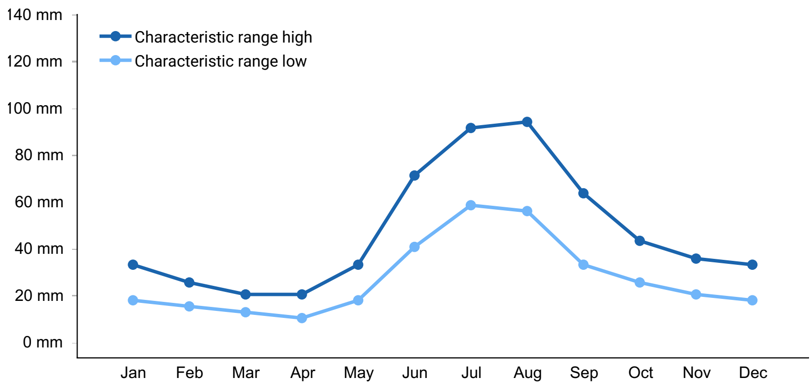


**Figure 1. Monthly precipitation range**

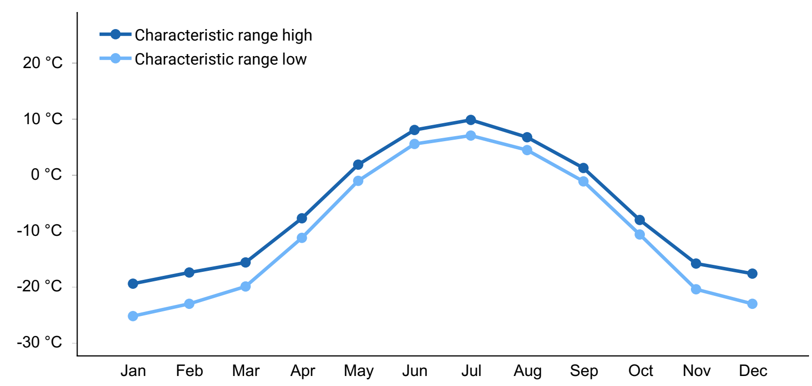


**Figure 2. Monthly minimum temperature range**

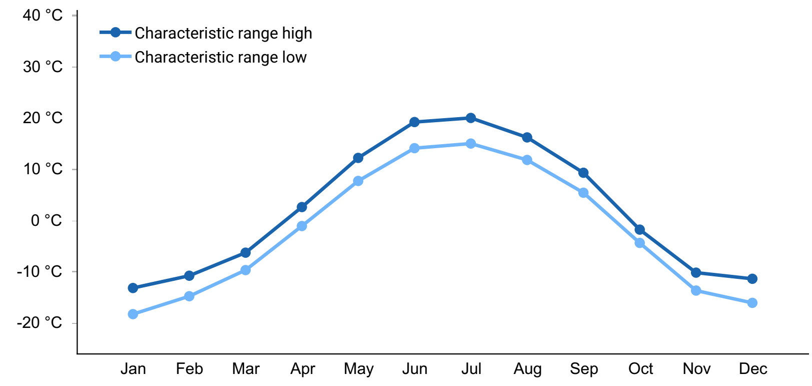


**Figure 3. Monthly maximum temperature range**

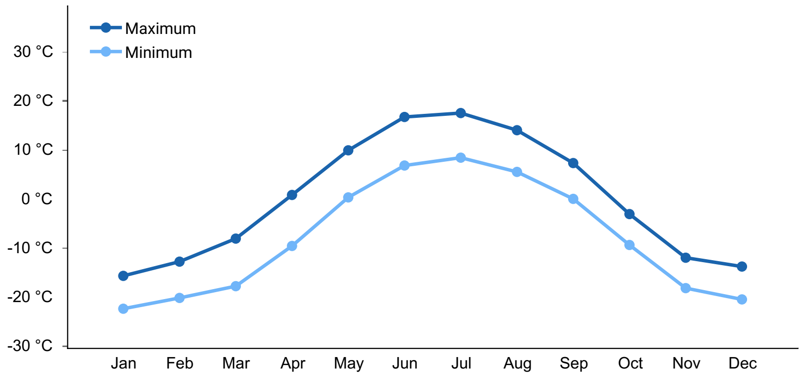


**Figure 4. Monthly average minimum and maximum temperature**

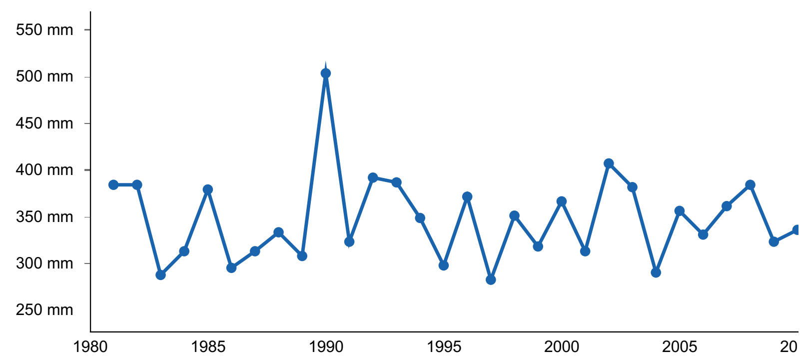


**Figure 5. Annual precipitation pattern**

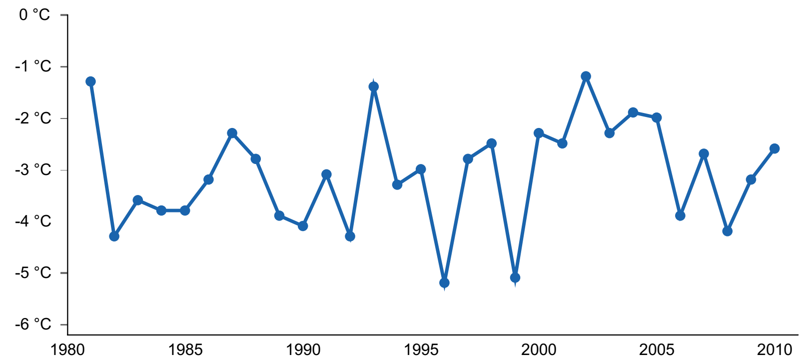


**Figure 6. Annual average temperature pattern**

## 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

## Soil features

Soils formed in windblown silt over gravelly colluvium derived from limestone. Surface rock fragments are not present. These are mineral soils capped with 2 to 5 inches of organic material. The mineral soil below the organic material is a silt loam formed from windblown loess, which is typically mixed with some rock fragments and has high water holding capacity. The thickness of this silty layer is variable and typically ranges from 7 to 13 inches. Rock fragments tend to increase significantly with increased depth. Below the silty parent material is gravelly colluvium with rock fragments ranging between 30 and 80 percent of the soil profile by volume. Soils are very deep without any restrictions. The pH of the soil profile ranges from neutral to moderately alkaline. The soils are dry throughout the growing season and are considered well drained.

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

**Table 5. Representative soil features**

| | |
|---|---|
| Parent material | (1) Loess<br>(2) Eolian deposits<br>(3) Colluvium–limestone and dolomite |
| Surface texture | (1) Silt loam |
| Family particle size | (1) Loamy-skeletal |
| Drainage class | Well drained |
| Permeability class | Moderately rapid |
| Soil depth | 152 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-101.6cm) | 2.03–13.72 cm |
| Calcium carbonate equivalent (25.4-101.6cm) | 0–4% |
| Clay content (0-50.8cm) | 5–10% |
| Electrical conductivity (25.4-101.6cm) | 0–2 mmhos/cm |
| Sodium adsorption ratio (25.4-101.6cm) | 0–1 |
| Soil reaction (1:1 water) (25.4-101.6cm) | 6.6–7.8 |
| Subsurface fragment volume <=3" (0-152.4cm) | 30–75% |

| | |
|---|---|
| Subsurface fragment volume >3" (0-152.4cm) | 2–5% |

## Ecological dynamics

Climate

Located in the alpine life zone, this site is exposed to a variety of harsh environmental conditions. In this area, snowfall first appears and persists the longest in the alpine. As a result, snowpack tends to be deeper and persist for longer durations of time compared to lower-elevation sites and alpine vegetation has a comparatively shorter growing season. When this site is snow-free, cold soil temperatures and high winds also inhibit plant growth and vigor. This harsh climate maintains the dwarfed vegetation within this site and prevents the establishment and/or growth of dominant boreal species like white spruce and black spruce.

## State and transition model

**Ecosystem states**

1. Reference State

**State 1 submodel, plant communities**

1.1. eightpetal mountain-avens - white arctic mountain heather / curled snow lichen - reindeer lichen

## State 1
## Reference State

**Figure 8. A shrubby community associated with this alpine site.**

The reference plant community is Dryas dwarf scrub (Viereck et al. 1992). There is one documented plant community in the reference state.

### Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- white arctic mountain heather (*Cassiope tetragona*), shrub
- (*Flavocetraria cucullata*), other herbaceous

- reindeer lichen (*Cladina*), other herbaceous

### Community 1.1
### eightpetal mountain-avens - white arctic mountain heather / curled snow lichen - reindeer lichen

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

The reference plant community is characterized as dryas dwarf scrub (Viereck et al. 1992) and is highly diverse. Stunted white spruce occasionally occur but with limited cover. Common species include eightpetal mountain-avens, white arctic mountain heather, netleaf willow, bog blueberry, northern singlespike sedge, moss campion, northern asphodel, curled snow lichen, arctic Dactylina lichen, star reindeer lichen, witch's hair lichen, various Cetraria lichen, whiteworm lichen, splendid feathermoss, and turgid Aulacomnium moss. The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches), foliose and fruticose lichen, and mosses. The soil surface is primarily covered with herbaceous litter, surface rock fragments, lichens, and mosses.

#### Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala* ), shrub
- white arctic mountain heather (*Cassiope tetragona*), shrub
- netleaf willow (*Salix reticulata*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- northern singlespike sedge (*Carex scirpoidea*), grass
- (*Flavocetraria cucullata*), other herbaceous
- arctic dactylina lichen (*Dactylina arctica*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- star reindeer lichen (*Cladina stellaris*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous
- turgid aulacomnium moss (*Aulacomnium turgidum*), other herbaceous
- cetraria lichen (*Cetraria ericetorum*), other herbaceous
- island cetraria lichen (*Cetraria islandica*), other herbaceous
- moss campion (*Silene acaulis*), other herbaceous
- whiteworm lichen (*Thamnolia vermicularis*), other herbaceous
- northern asphodel (*Tofieldia coccinea*), other herbaceous

## Additional community tables

**Table 6. 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 | – | 0–1 | – | – |

**Table 7. Community 1.1 forest understory composition**

| Common Name | Symbol | Scientific Name | Nativity | Height (M) | Canopy Cover (%) |
|---|---|---|---|---|---|
| **Grass/grass-like (Graminoids)** | | | | | |
| northern singlespike sedge | CASC10 | *Carex scirpoidea* | Native | 0.1–0.3 | 0–20 |
| shortstalk sedge | CAPO | *Carex podocarpa* | Native | 0.1–0.3 | 0–10 |
| Bigelow's sedge | CABI5 | *Carex bigelowii* | Native | 0.1–0.3 | 0–5 |
| **Forb/Herb** | | | | | |
| stitchwort | MINUA | *Minuartia* | Native | 0–0.1 | 0–15 |
| moss campion | SIAC | *Silene acaulis* | Native | 0–0.1 | 0–10 |
| purple mountain saxifrage | SAOP | *Saxifraga oppositifolia* | Native | 0–0.1 | 0–8 |
| arctic lupine | LUAR2 | *Lupinus arcticus* | Native | 0.1–0.3 | 0–7 |
| northern asphodel | TOCO | *Tofieldia coccinea* | Native | 0–0.1 | 0–5 |
| sweetflower rockjasmine | ANCH | *Androsace chamaejasme* | Native | 0–0.1 | 0–2 |
| **Shrub/Subshrub** | | | | | |
| eightpetal mountain-avens | DROC | *Dryas octopetala* | Native | 0–0.1 | 3–45 |
| white arctic mountain heather | CATE11 | *Cassiope tetragona* | Native | 0–0.1 | 2–45 |
| tealeaf willow | SAPU15 | *Salix pulchra* | Native | 0.1–0.2 | 0–20 |
| Lapland rosebay | RHLA2 | *Rhododendron lapponicum* | Native | 0.1–0.2 | 0–10 |
| netleaf willow | SARE2 | *Salix reticulata* | Native | 0–0.1 | 0–10 |
| bog blueberry | VAUL | *Vaccinium uliginosum* | Native | 0–0.1 | 0–10 |
| lingonberry | VAVI | *Vaccinium vitis-idaea* | Native | 0–0.1 | 0–7 |
| alpine bearberry | ARAL2 | *Arctostaphylos alpina* | Native | 0–0.1 | 0–5 |
| **Nonvascular** | | | | | |
| | FLCU | *Flavocetraria cucullata* | Native | 0–0.1 | 7–45 |
| star reindeer lichen | CLST60 | *Cladina stellaris* | Native | 0–0.1 | 0–20 |
| greygreen reindeer lichen | CLRA60 | *Cladina rangiferina* | Native | 0–0.1 | 0–20 |
| witch's hair lichen | ALOC60 | *Alectoria ochroleuca* | Native | 0–0.1 | 0–15 |
| island cetraria lichen | CEIS60 | *Cetraria islandica* | Native | 0–0.1 | 0–15 |
| arctic dactylina lichen | DAAR60 | *Dactylina arctica* | Native | 0–0.1 | 1–15 |
| splendid feather moss | HYSP70 | *Hylocomium splendens* | Native | 0–0.1 | 0–15 |
| turgid aulacomnium moss | AUTU70 | *Aulacomnium turgidum* | Native | 0–0.1 | 0–10 |
| cetraria lichen | CEER6 | *Cetraria ericetorum* | Native | 0–0.1 | 0–10 |
| whiteworm lichen | THve60 | *Thamnolia vermicularis* | Native | 0–0.1 | 0–10 |
| reindeer lichen | CLMI60 | *Cladina mitis* | Native | 0–0.1 | 0–10 |
| Schreber's big red stem moss | PLSC70 | *Pleurozium schreberi* | Native | 0–0.1 | 0–10 |
| Richardson's masonhalea lichen | MARI60 | *Masonhalea richardsonii* | Native | 0–0.1 | 0–8 |
| | FLNI | *Flavocetraria nivalis* | Native | 0–0.1 | 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

10NP02203, 10NP02208, 10NP03601, 10NP03704, 10TC02301, 12NR04403, 2015AK290554, 2016AK290396

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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 | 08/17/2024 |
| 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):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**