Ecological site R231XY101AK
Alpine dwarf scrub gravelly slopes

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General information

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

MLRA notes

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

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

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

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

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

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

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

Most of this area is forested below an elevation of about 2500 feet. Dominant tree species on slopes are white spruce and black spruce. Black spruce stands are most common on north-facing slopes, stream terraces, and other sites with poor drainage and permafrost. White spruce stands are most common on warm slopes with dry soils. At lower elevations, lightning-caused wildfires are common, often burning many thousands of acres during a single fire. Following wildfires, forbs, grasses, willow, ericaceous shrubs, paper birch, and quacking aspen communities are common until they are eventually replaced by stands of spruce. Tall willow and alder scrub is extensive on low flood plains. White spruce and balsam poplar are common on high flood plains.

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

LRU notes

This area supports three life zones defined by the physiological limits of plant communities along an elevational gradient: boreal, subalpine, and alpine. The boreal life zone is the elevational band where forest communities dominate. Not all areas in the boreal life zone are forest communities, however, particularly in places with too wet or dry soil to support tree growth (e.g., bogs or river bluffs). Above the boreal band of elevation, subalpine and alpine vegetation dominate. The subalpine zone is typically a narrow transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. In the subalpine, certain types of birch and willow shrub species grow at ≥ 1 m in height (commonly Betula glandulosa and Salix pulchra). In the alpine, trees no longer occur, and all shrubs are dwarf or lay prostrate on the ground. In this area, the boreal life zone occurs below 2500 feet elevation on average. The transition between boreal and alpine vegetation can occur within a range of elevations, and is highly dependent on slope, aspect, and shading from adjacent mountains.

Within each life zone, there are plant assemblages that are typically associated with cold slopes and warms slopes. Cold slopes and warm slopes are created by the combination of the steepness of the slope, the aspect, and shading from surrounding ridges and mountains. Warm slope positions typically occur on southeast to west facing slopes that are moderate to very steep (>10% slope) and are not shaded by the surrounding landscape. Cold slopes typically occur on northwest to east facing slopes, occur in shaded slope positions, or occur in low-lying areas that are cold air sinks. Examples of shaded positions include head slopes, low relief backslopes of hills, and the base of hills and mountains shaded by adjacent mountain peaks. Warm boreal slope soils have a cryic soil temperature regime and lack permafrost. In this area, white spruce forests are an indicator of warm boreal slopes. Cold boreal slope soils typically have a gelic soil temperature regime and commonly have permafrost. In this area, black spruce forests and woodlands are an indicator of cold boreal slopes. The boreal life zone can occur at higher elevations on warm slopes, and lower elevations on cold slopes.

Classification relationships

Landfire BPS – 7416310 – Western North American Boreal Alpine Dwarf-Shrub Summit

Ecological site concept

This site occurs on alpine slopes with dry and gravelly soils that do not have permafrost. This site is associated with summits, shoulders, and backslopes of mountains at high elevation. Circles and stripes are common periglacial features associated with this site. When present, these periglacial features are typically unvegetated surface rock fragments. Soils do not pond or flood, do not have a water table during the growing season, and are considered well to somewhat excessively drained. The soils formed in silty loess and gravelly colluvium and/or residuum. Soils with residuum commonly contact bedrock at moderate depths.

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.

Three plant communities occur within the reference state and the vegetation in each community differs in large part due to snowpack and fire. When the reference state vegetation burns, the post-fire plant community is dominantly graminoids, forbs, and weedy mosses. With time and lack of another fire event, the post-fire vegetation goes through succession. For this site, the reference plant community is the most stable with the longest time since the vegetation was burned. This community is characterized as dryas dwarf scrub (Viereck et al. 1992). An additional community occurs in adjacent areas that are small, sheltered, and receive atypically deep snowpack. This deep snowpack community is characterized as ericaceous dwarf scrub (Viereck et al. 1992).

For the reference plant community, krummholz white spruce occasionally occur but have limited cover. Common species include eight-petal mountain-avens, Alaskan mountain-avens, skeletonleaf willow, alpine bearberry, alpine azalea, lingonberry, alpine sweetgrass, Bigelow's sedge, smallawned sedge, curled snow lichen, witch's hair lichen, and Bryocaulon lichen. The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches) and foliose and fruticose lichen.

Associated sites

R231XY113AK	**Alpine Dwarf Scrub Gravelly Moist Slopes** Occurs in the alpine but on wet and gravelly soils.
R231XY115AK	**Alpine sedge silty frozen slopes** Occurs in the alpine but on wet, loamy, and frozen soils.
R231XY134AK	**Alpine Dwarf Scrub Gravelly Frozen Slopes** Occurs in the alpine but on wet, gravelly, and frozen soils.
R231XY152AK	**High-elevation scrub gravelly drainageways** Occurs downslope in high elevation drainageways.
R231XY164AK	**Subalpine Scrub Gravelly Slopes Dry** Occurs downslope on warm subalpine slopes.

Similar sites

R231XY105AK	**Alpine Dwarf Scrub Gravelly Alkaline Slopes** Both sites occur on alpine slopes with dry and gravelly soils. Site 105 has alkaline soils resulting in different kinds and amounts of vegetation.
R231XY134AK	**Alpine Dwarf Scrub Gravelly Frozen Slopes** Both sites support dwarf shrub communities. Site 134 has wet and frozen soils with different kinds and amounts of vegetation.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Dryas octopetala ssp. octopetala* (2) *Salix phlebophylla*
Herbaceous	(1) *Flavocetraria cucullata* (2) *Alectoria*

Physiographic features

This site occurs at high elevation on slopes in the alpine life zone. The site is associated with summits, shoulder, and backslopes of mountains. Sorted circles, sorted stripes, and nonsorted circles (definitions in Schoeneberger and Wysocki 2017) are all common on associated mountain slopes. Elevation typically ranges between 2500 and 3250 feet but can go as low as 2050 feet on lower elevation summits and up to 5000 feet or higher on certain steep south facing mountain backslopes. Associated summits are often gently sloping while mountain backslopes can be very steep. Slopes occur on all aspects. Flooding and ponding do not occur and there is typically no high-water table in the soil profile. This site generates limited runoff to adjacent, downslope sites.

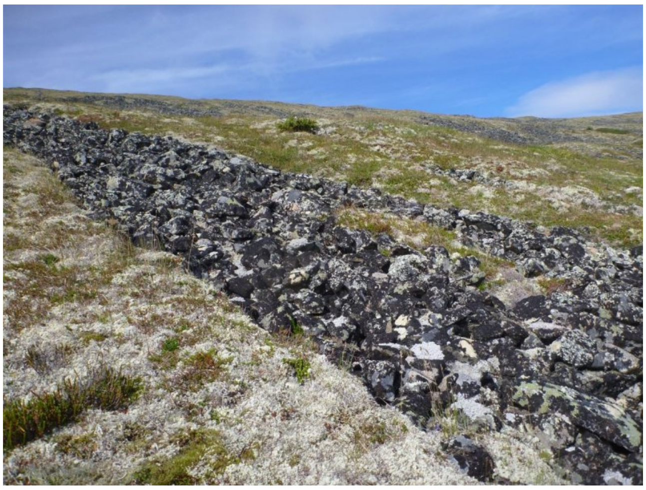


Figure 1. A sorted rock stripe that is primarily unvegetated surface rock fragments. At the highest bands of elevation associated with this site, community 1.1 often occurs adjacent to sorted rock stripes and circles.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Landforms	(1) Mountains > Mountain (2) Mountains > Mountain (3) Mountains > Mountain > Sorted circle (4) Mountains > Mountain > Nonsorted circle (5) Mountains > Mountain > Stripe
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–3,250 ft
Slope	12–45%
Water table depth	60 in
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	2,050–7,550 ft
Slope	1–70%
Water table depth	40 in

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)	14-21 in
Frost-free period (actual range)	4-87 days
Freeze-free period (actual range)	48-120 days
Precipitation total (actual range)	10-25 in
Frost-free period (average)	53 days
Freeze-free period (average)	90 days
Precipitation total (average)	17 in

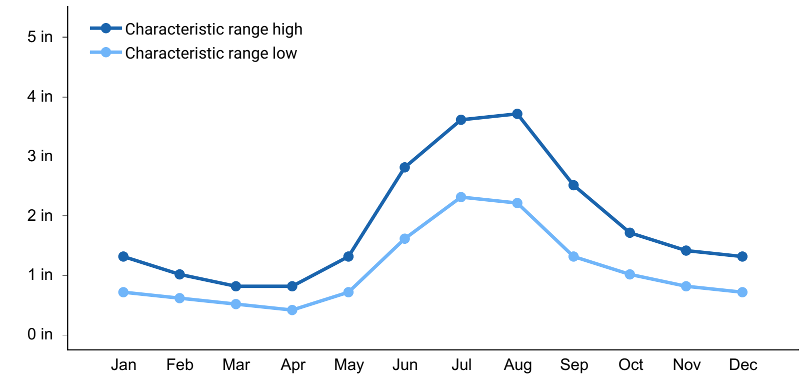


Figure 2. Monthly precipitation range

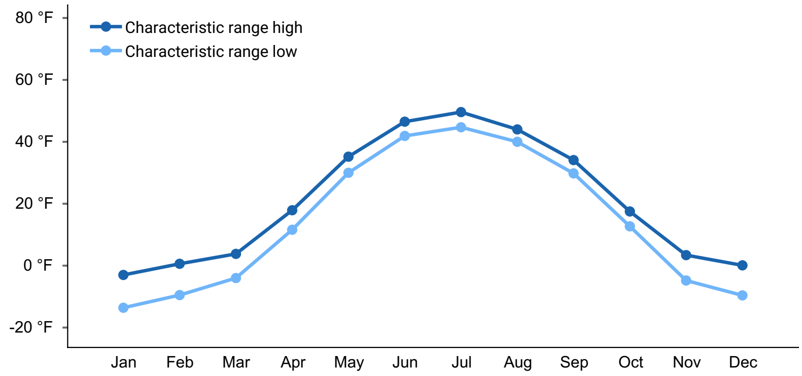


Figure 3. Monthly minimum temperature range

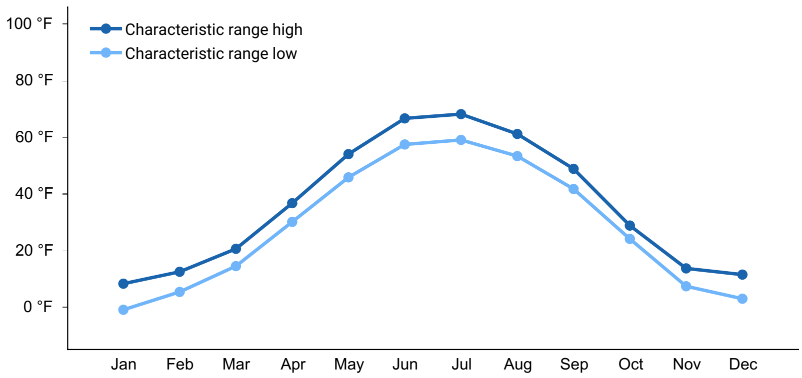


Figure 4. Monthly maximum temperature range

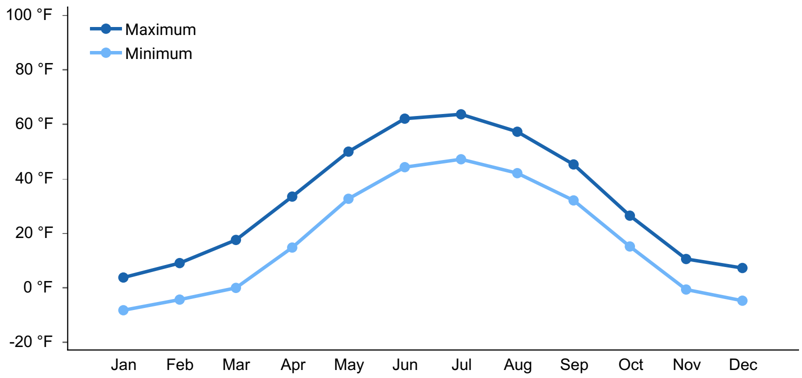


Figure 5. Monthly average minimum and maximum temperature

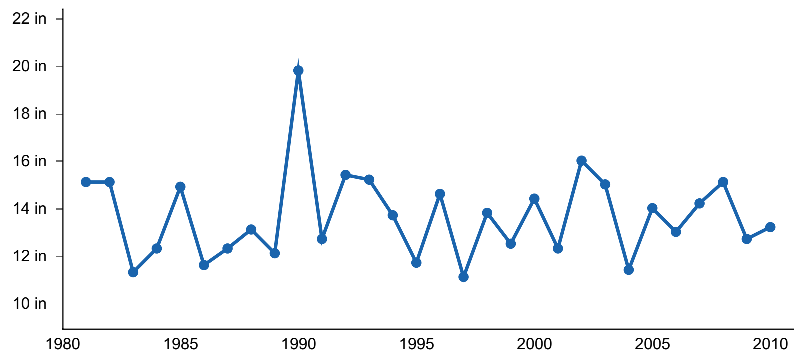


Figure 6. Annual precipitation pattern

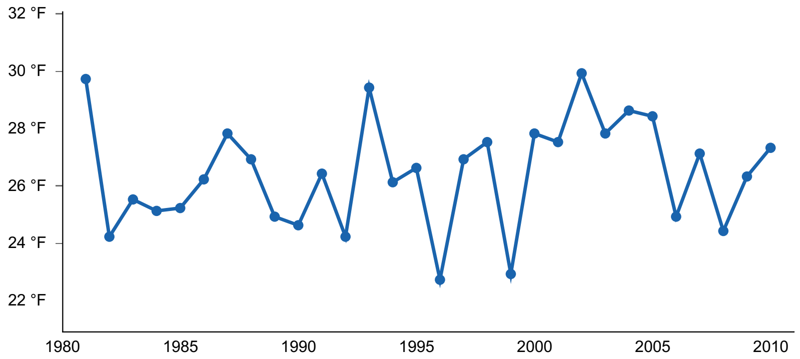


Figure 7. Annual average temperature pattern

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. Surface runoff and throughflow contribute some water to downslope ecological sites.

Wetland description

n/a

Soil features

Soils formed in windblown silt over gravelly parent material and do not have permafrost. Surface rock fragments are common and at the highest range of associated elevation can range up to 75 percent cover. These are mineral soils often capped with 0 to 1 inches of organic material. The mineral soil below the organic material is a silt loam formed from wind-blown loess, which is commonly mixed with some rock fragments from cryoturbation and has high water holding capacity. The loess layer is up to 4 inches thick. Below the silty parent material is gravelly colluvium or residuum with rock fragments commonly ranging between 30 and 80 percent of the soil profile by volume and has low water holding capacity. Soils with colluvium are often very deep without restrictions. On rare occasion, soils with extremely gravelly colluvium have strongly contrasting textural stratification leading to restrictions at very shallow depths (2 to 6 inches). Soils with residuum commonly contact bedrock at moderate depths (30 to 50 inches). The pH of the soil profile typically ranges from strongly acidic to slightly acidic. The soils are dry for the growing season and are considered well to somewhat excessively drained.

Figure 8. A typical soil profile associated with this site.

Table 5. Representative soil features

Parent material	(1) Loess (2) Eolian deposits (3) Colluvium (4) Residuum
Surface texture	(1) Silt loam (2) Gravelly silt loam (3) Stony silt loam (4) Channery silt loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	30 in
Soil depth	30 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	0.8–5 in
Calcium carbonate equivalent (10-40in)	0%
Clay content (0-20in)	5–15%
Electrical conductivity (10-40in)	0 mmhos/cm
Sodium adsorption ratio (10-40in)	0
Soil reaction (1:1 water) (10-40in)	5.8–6.6

Subsurface fragment volume <=3" (0-60in)	15–40%
Subsurface fragment volume >3" (0-60in)	15–40%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	2 in
Soil depth	Not specified
Surface fragment cover <=3"	0–40%
Surface fragment cover >3"	0–75%
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)	4.2–7.3
Subsurface fragment volume <=3" (0-60in)	10–45%
Subsurface fragment volume >3" (0-60in)	10–55%

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.

Snow beds

Community 1.2 occurs in sheltered positions that have atypically deep snowpack. These sheltered positions are small, occur adjacent to community 1.1, and commonly occur on the leeward side of rock outcrops and/or sharp ridges or on steep northing facing slopes. These sheltered positions were often observed to have snowpack that persisted for longer durations of time compared to the more wide-spread community 1.1. This persistent snowpack led to community 1.2 having moister soils wither greater amounts of ericaceous scrubs like white arctic mountain heather (*Cassiope tetragona*).

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 this period of 20 years, these burn perimeters cover approximately 30 percent of the Interior Alaska Uplands area.

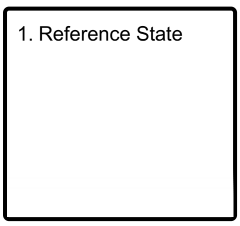
The fire regime within Interior Alaska follows two general scenarios—low-severity burns and high-severity burns. It should be noted, however, that the fire regime in Interior Alaska can be much more complex (Johnstone et al. 2008). Burn severity refers to the proportion of the vegetative canopy and organic 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 to somewhat excessively 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.

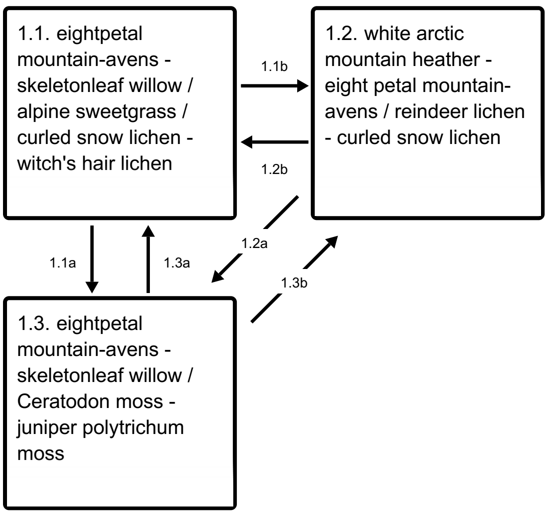
Field data suggest that the scrub dominant community 1.1 burns and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community 1.3) is a mix of species that either regenerate in place (e.g., subterranean root crowns for willow and rhizomes for graminoids) and/or from wind-dispersed seed or spores that colonize exposed mineral soil (e.g., fireweed [*Chamerion angustifolium*] and Ceratodon moss [*Ceratodon purpureus*]). The pioneering stage of fire succession is primarily composed of dwarf scrubs, grasses, forbs, grasses, and weedy bryophytes. This stage of succession currently persists for an unknown amount of time but is thought to last 10 to 30 years post-fire. Eightpetal mountain-avens and other dwarf shrubs and lichen continue to colonize and grow until they become dominant in the plant community, which marks the transition to the reference plant community (community 1.1).

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1b - Increased annual snowpack that persists for longer durations of time

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

1.2b - Decreased annual snowpack that persists for shorter durations of time

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

1.3a - Time without fire

1.3b - Time without fire

State 1
Reference State

Figure 9. A dwarf scrub community associated with this site.

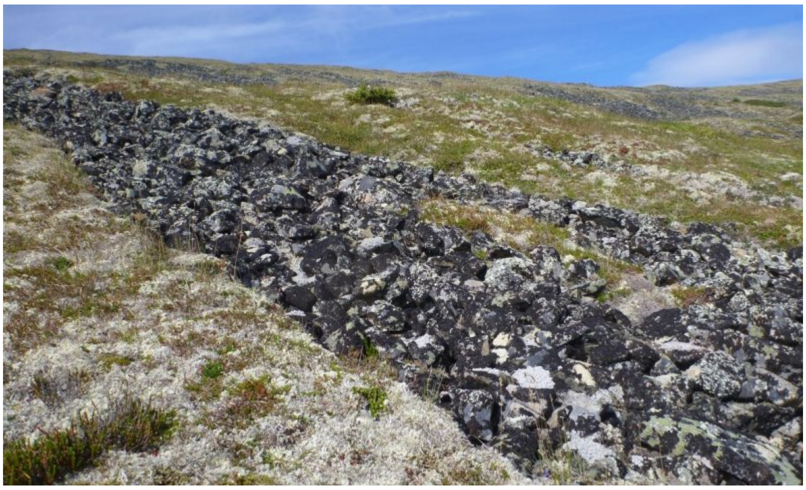


Figure 10. A sorted rock stripe. At the highest bands of elevation associated with this site, community 1.1 often occurs adjacent to sorted rock stripes and circles.

The reference plant community (community 1.1) is dryas dwarf scrub (Viereck et al. 1992). There are three plant communities in the reference state related to either snowpack or fire. Community 1.2 occurs in sheltered positions that have atypically deep snowpack. These sheltered positions are small in size, occur in close proximity to community 1.1, and commonly occur on the leeward side of rock outcrops and/or sharp ridges or on steep northing facing slopes. These sheltered positions were often observed to have snowpack that persisted for longer durations of time compared to the more wide-spread community 1.1. This persistent snowpack led to community 1.2 having slightly moister soils. Both of these communities have the potential to burn resulting in community 1.3. Cryoturbation is process associated with this state that results in the formation of non-sorted circles, sorted circles, and sorted stripes. Cryoturbation is a collective term used to describe all soil movements due to frost action, characterized by folded, broken and dislocated beds and lenses of unconsolidated deposits (Schoeneberger and Wysocki 2017). Since non-sorted circles are uncommon for this site and data did not support these features having a vegetation mosaic, no alternative state was developed for this site (see R231XY134AK for a site that does have this alternate state). No alternative state or plant communities were developed for sorted circles and stripes as they are primarily barren rock.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- skeletonleaf willow (*Salix phlebophylla*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- (*Flavocetraria cucullata*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous

Community 1.1
eightpetal mountain-avens - skeletonleaf willow / alpine sweetgrass / curled snow lichen - witch's hair lichen

Figure 11. A typical plant community associated with community 1.1.

The reference plant community is characterized as dryas dwarf scrub (Viereck et al. 1992). Stunted white spruce occasionally occur but have limited cover. Common species include eight-petal mountain-avens, Alaskan mountain-avens, skeletonleaf willow, alpine bearberry, alpine azalea, lingonberry, alpine sweetgrass, Bigelow's sedge, smallawned sedge, curled snow lichen (*Flavocetraria cucullata*), witch's hair lichen, and Bryocaulon lichen. The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches) and foliose and fruticose lichen. The soil surface is primarily covered with herbaceous litter, surface rock fragments, and lichen.

Forest overstory. Cover from seedlings and saplings (tree regeneration) were not included in the overstory canopy cover values but are included in the cover percent values for individual tree species.

Forest understory. The mountain-avens most commonly associated with this site is Dryas alaskensis (DROCA2) and Dryas ajanensis (DROCO). The Flora of North America no longer recognizes eightpetal mountain-avens (Dryas octopetala) as occurring in Alaska and has split this species concept into several new species (Springer and Parfitt 2015).

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- Alaskan mountain-avens (*Dryas octopetala ssp. alaskensis*), shrub
- skeletonleaf willow (*Salix phlebophylla*), shrub
- alpine bearberry (*Arctostaphylos alpina*), shrub
- alpine azalea (*Loiseleuria procumbens*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- smallawned sedge (*Carex microchaeta*), grass
- (*Flavocetraria cucullata*), other herbaceous
- witch's hair lichen (*Alectoria ochroleuca*), other herbaceous
- bryocaulon lichen (*Bryocaulon divergens*), other herbaceous

Community 1.2
white arctic mountain heather - eight petal mountain-avens / reindeer lichen - curled snow lichen

Figure 12. A typical plant community associated with community 1.2.

Figure 13. This community commonly occurs on the leeward side of rock outcrops or steep north facing slopes.

Community 1.2 is characterized as ericaceous dwarf scrub (Viereck et al. 1992). Common species include white arctic mountain heather, eight-petal mountain-avens, alpine azalea, crowberry, marsh Labrador tea, bog blueberry, lingonberry, various reindeer lichen, and curled snow lichen. The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches) and foliose and fruticose lichen. The soil surface is primarily covered with herbaceous litter, surface rock fragments, and lichens.

Dominant plant species

- white arctic mountain heather (*Cassiope tetragona*), shrub
- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- alpine azalea (*Loiseleuria procumbens*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- (*Flavocetraria cucullata*), other herbaceous
- star reindeer lichen (*Cladina stellaris*), other herbaceous

Community 1.3
eightpetal mountain-avens - skeletonleaf willow / Ceratodon moss - juniper polytrichum moss

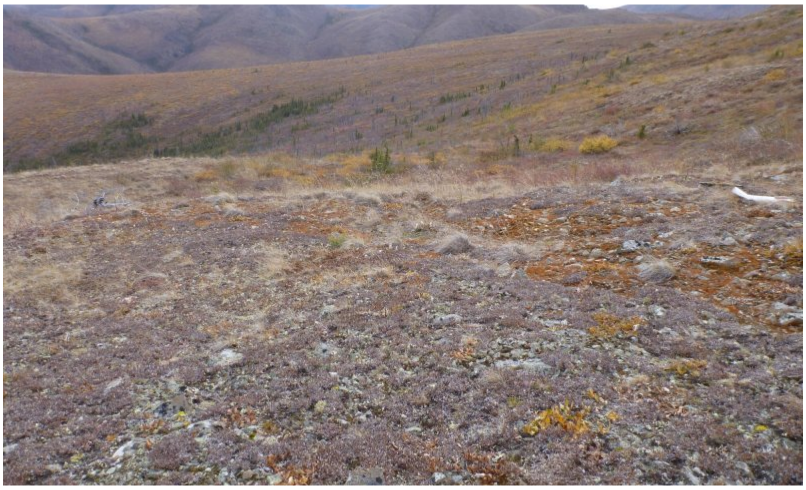


Figure 14. A typical plant community associated with community 1.3.

Community 1.3 is in the pioneering stage of fire-induced secondary succession for this ecological site. Community 1.3. is characterized as dryas dwarf scrub (Viereck et al. 1992). Commonly observed species include eightpetal mountain-avens, arctic willow, skeletonleaf willow, Altai fescue, bluegrass, fireweed, Ceratodon moss, and juniper Polytrichum moss. The vegetative strata that characterize this community are dwarf shrubs (less than 8 inches) and moss. The soil surface is primarily covered with a mixture of herbaceous litter, weedy bryophyte species, and surface rock fragments.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala ssp. octopetala*), shrub
- skeletonleaf willow (*Salix phlebophylla*), shrub
- arctic willow (*Salix arctica*), shrub
- Altai fescue (*Festuca altaica*), grass
- bluegrass (*Poa*), grass
- ceratodon moss (*Ceratodon purpureus*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous
- fireweed (*Chamerion angustifolium*), other herbaceous

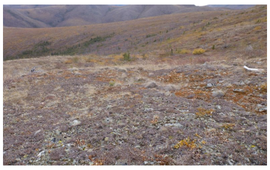
Pathway 1.1b
Community 1.1 to 1.2

eightpetal mountain-avens - skeletonleaf willow / alpine sweetgrass / curled snow lichen - witch's hair lichen

white arctic mountain heather - eight petal mountain-avens / reindeer lichen - curled snow lichen

Multiple growing seasons with atypically deep snowpack. This snowpack persists for longer duration of time and result in slightly moister soils during the growing season. Vegetation shifts from dryas dwarf scrub to ericaceous dwarf scrub.

Pathway 1.1a
Community 1.1 to 1.3



eightpetal mountain-avens - skeletonleaf willow / alpine sweetgrass / curled snow lichen - witch's hair lichen

eightpetal mountain-avens - skeletonleaf willow / Ceratodon moss - juniper polytrichum moss

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.

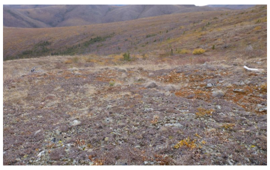
Pathway 1.2b
Community 1.2 to 1.1

white arctic mountain heather - eight petal mountain-avens / reindeer lichen - curled snow lichen

eightpetal mountain-avens - skeletonleaf willow / alpine sweetgrass / curled snow lichen - witch's hair lichen

Protected positions no longer receive atypically deep snowpack. This results in slightly drier soils during the growing season. Vegetation shifts from ericaceous dwarf scrub to Dryas dwarf scrub.

Pathway 1.2a
Community 1.2 to 1.3

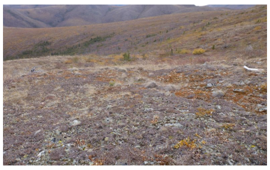


white arctic mountain heather - eight petal mountain-avens / reindeer lichen - curled snow lichen

eightpetal mountain-avens - skeletonleaf willow / Ceratodon moss - juniper polytrichum moss

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 1.3a
Community 1.3 to 1.1



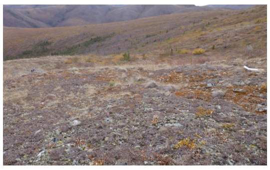
eightpetal mountain-avens - skeletonleaf willow / Ceratodon moss - juniper polytrichum moss

eightpetal mountain-avens - skeletonleaf willow / alpine sweetgrass / curled snow lichen - witch's hair lichen

Time without fire results in decreases to graminoid and weedy moss cover and increases to shrub and lichen cover.

Pathway 1.3b

Community 1.3 to 1.2



eightpetal mountain-avens - skeletonleaf willow / Ceratodon moss - juniper polytrichum moss

white arctic mountain heather - eight petal mountain-avens / reindeer lichen - curled snow lichen

Time without fire results in decreases to graminoid and weedy moss cover and increases to shrub and lichen cover.

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)
Tree							
white spruce	PIGL	*Picea glauca*	Native	1–3	0–2	–	–
black spruce	PIMA	*Picea mariana*	Native	–	0–1	–	–

Table 8. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
fescue	FESTU	*Festuca*	Native	0.3–1	0–25
Bigelow's sedge	CABI5	*Carex bigelowii*	Native	0.3–1	0–20
alpine sweetgrass	ANMOA3	*Anthoxanthum monticola ssp. alpinum*	Native	0.3–1	0–6
northern woodrush	LUCO5	*Luzula confusa*	Native	0.3–1	0–3
Forb/Herb					
blackish oxytrope	OXNI	*Oxytropis nigrescens*	Native	0.1–0.3	0–7
pussytoes	ANTEN	*Antennaria*	Native	0.1–0.3	0–5
arnica	ARNIC	*Arnica*	Native	0.3–1	0–4
mountain harebell	CALA7	*Campanula lasiocarpa*	Native	0.1–0.3	0–3
northern kittentails	SYBO	*Synthyris borealis*	Native	0.1–0.3	0–3
boreal sagebrush	ARAR9	*Artemisia arctica*	Native	0.3–1	0–1
arctic stitchwort	MIAR3	*Minuartia arctica*	Native	0.1–0.3	0–1
lousewort	PEDIC	*Pedicularis*	Native	0.3–1	0–1
Shrub/Subshrub					
eightpetal mountain-avens	DROC	*Dryas octopetala*	Native	0.1–0.3	0–85
alpine bearberry	ARAL2	*Arctostaphylos alpina*	Native	0.1–0.3	0–40
alpine azalea	LOPR	*Loiseleuria procumbens*	Native	0.1–0.3	0–20
skeletonleaf willow	SAPH	*Salix phlebophylla*	Native	0.1–0.3	0–20
white arctic mountain heather	CATE11	*Cassiope tetragona*	Native	0.1–0.3	0–15
arctic willow	SAAR27	*Salix arctica*	Native	0.1–0.8	0–15
black crowberry	EMNI	*Empetrum nigrum*	Native	0.1–0.3	0–15
resin birch	BEGL	*Betula glandulosa*	Native	0.1–0.8	0–12
pincushion plant	DILA	*Diapensia lapponica*	Native	0.1–0.3	0–12
marsh Labrador tea	LEPAD	*Ledum palustre ssp. decumbens*	Native	0.1–0.8	0–10
lingonberry	VAVI	*Vaccinium vitis-idaea*	Native	0.1–0.3	0–10
bog blueberry	VAUL	*Vaccinium uliginosum*	Native	0.1–0.3	0–10
Nonvascular					
	FLCU	*Flavocetraria cucullata*	Native	0.1–0.3	0–40
navel lichen	UMBIL2	*Umbilicaria*	Native	0.1–0.3	0–35
witch's hair lichen	ALOC60	*Alectoria ochroleuca*	Native	0.1–0.3	0–30
witch's hair lichen	ALNI60	*Alectoria nigricans*	Native	0.1–0.3	0–20
greygreen reindeer lichen	CLRA60	*Cladina rangiferina*	Native	0.1–0.3	0–20
tomentose snow lichen	STTO60	*Stereocaulon tomentosum*	Native	0.1–0.3	0–18
	FLNI	*Flavocetraria nivalis*	Native	0.1–0.3	0–15
whiteworm lichen	THVE60	*Thamnolia vermicularis*	Native	0.1–0.3	0–15
bryocaulon lichen	BRDI60	*Bryocaulon divergens*	Native	0.1–0.3	0–15
arctic dactylina lichen	DAAR60	*Dactylina arctica*	Native	0.1–0.3	0–5

Table 9. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white spruce	PIGL	*Picea glauca*	Native	1–3	0–1	–	–

Table 10. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Bigelow's sedge	CABI5	*Carex bigelowii*	Native	0.3–1	0–8
alpine sweetgrass	ANMOA3	*Anthoxanthum monticola ssp. alpinum*	Native	0.3–1	0–5
Forb/Herb					
meadow bistort	POBI5	*Polygonum bistorta*	Native	0.3–1	0–3
mountain harebell	CALA7	*Campanula lasiocarpa*	Native	0.1–0.3	0–2
lousewort	PEDIC	*Pedicularis*	Native	0.3–1	0–2
Shrub/Subshrub					
white arctic mountain heather	CATE11	*Cassiope tetragona*	Native	0.1–0.8	15–70
alpine azalea	LOPR	*Loiseleuria procumbens*	Native	0.1–0.3	0–30
eightpetal mountain-avens	DROCO	*Dryas octopetala ssp. octopetala*	Native	0.1–0.3	0–25
bog blueberry	VAUL	*Vaccinium uliginosum*	Native	0.1–0.8	0–20
black crowberry	EMNI	*Empetrum nigrum*	Native	0.1–0.3	0–15
marsh Labrador tea	LEPAD	*Ledum palustre ssp. decumbens*	Native	0.1–0.8	0–15
lingonberry	VAVI	*Vaccinium vitis-idaea*	Native	0.1–0.3	0–10
skeletonleaf willow	SAPH	*Salix phlebophylla*	Native	0.1–0.3	0–7
pincushion plant	DILA	*Diapensia lapponica*	Native	0.1–0.3	0–5
tealeaf willow	SAPU15	*Salix pulchra*	Native	0.1–0.8	0–1
Nonvascular					
greygreen reindeer lichen	CLRA60	*Cladina rangiferina*	Native	0.1–0.3	0–20
	FLCU	*Flavocetraria cucullata*	Native	0.1–0.3	0–20
star reindeer lichen	CLST60	*Cladina stellaris*	Native	0.1–0.3	0–15
witch's hair lichen	ALNI60	*Alectoria nigricans*	Native	0.1–0.3	0–15
island cetraria lichen	CEIS60	*Cetraria islandica*	Native	0.1–0.3	0–15
witch's hair lichen	ALOC60	*Alectoria ochroleuca*	Native	0.1–0.3	0–10
bryocaulon lichen	BRDI60	*Bryocaulon divergens*	Native	0.1–0.3	0–10
arctic dactylina lichen	DAAR60	*Dactylina arctica*	Native	0.1–0.3	0–10
	FLNI	*Flavocetraria nivalis*	Native	0.1–0.3	0–10
splendid feather moss	HYSP70	*Hylocomium splendens*	Native	0.1–0.3	0–10
whiteworm lichen	THVE60	*Thamnolia vermicularis*	Native	0.1–0.3	0–10
Richardson's masonhalea lichen	MARI60	*Masonhalea richardsonii*	Native	0.1–0.3	0–5
cetraria lichen	CELA60	*Cetraria laevigata*	Native	0.1–0.3	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

08CS01303, 08TC01201, 09TC00402, 09TC00404, 10NP00902, 10NP00905, 10NP02401, 10NP02404, 10NP02601, 10NP02607, 10NP02801, 10TC03004, 11BB03601, 11MC00501, 11MC01502, 12CP00101, 12NR04301, 12SN01701, 13EG00101, 13EG00701, 13EG00802, 13NR00601, 14EG00103, 2015AK290563, 2015AK290564, 2015AK290578, 2015AK290826, 2015AK290828, 2016AK290459, 2016AK290630, 2016AK290636, 2017AK290511

Community 1.2

08CS01501, 10NP02605, 10TC03003, 12SN01901, 13EG00801, 2015AK290567, 2015AK290575, 2015AK290816, 2017AK290512

Community 1.3

14NR05101

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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	05/11/2025
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

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

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

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

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

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**