USDA Natural Resources
Conservation Service

Ecological site YX244X00A103
Calcareous, Dry Arctic Mountain Slopes

Last updated: 5/28/2025
Accessed: 03/22/2026

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): 244X–Northern Brooks Range Mountains

Major Land Resource Area (MLRA) 244X includes the steep, rugged, high mountains and narrow valleys on the northern side of the Brooks Range. This remote wildland is sparsely populated and is approximately 14,525 square miles (37,615 square kilometers). The transition to the Arctic climate is the break into MLRA 244X from the surrounding subartic MLRAs. Elevation ranges from about 1,969 feet (600 meters) to 8,570 feet (2,613 meters) at the summit of Mount Igikpak. The major rivers are the Kongakut, Aichilik, Jago, Canning, Ivishak, Ribdon, Atigun, Anaktuvuk, and Killik Rivers. They drain to the Colville River and Arctic Ocean.

Except for the highest peaks, the steep upper ridges, and some unglaciated valleys, glacial ice during the Early and Middle Pleistocene covered the MLRA. By the Late Pleistocene, only the highest valleys and mountains remained glaciated. Periglacial features (gelifluction lobes, polygons, and stripes) and fluvial deposits are common on terraces and gentle slopes. Glacial deposits overlay stratified sedimentary bedrock. This area is in the zone of continuous permafrost. Inclusions of volcanic and igneous rocks occur in the eastern part of the MLRA.

The Brooks Range is characterized by continental arctic climate. The average annual precipitation ranges from 7 to 40 inches (180 to 1,015 millimeters) with an average annual snowfall of 50 to 100 inches (125 to 255 centimeters). The average annual temperature ranges from 8 to 16 degrees Fahrenheit (-13 to -9 degrees C), with freezing temperatures possible any month of the year. Summer temperatures reach 90 to 100 degrees Fahrenheit (32 to 38 degrees Celsius), and winter temperatures drop as low as -75 degrees Fahrenheit (-60 degrees Celsius). The position of this MLRA above the Arctic

Circle lends to several days of 24-hour sunlight in June and several sunless days in December.

Freshwater is very limited due to frozen or low flow through long winters. Most domestic use water is from private wells. Aquifers are highly susceptible to contamination from surface activities (septic systems, landfills, and leaking fuel storage tanks).

The dominant soil order in this MLRA is Gelisols. The main soils are Aquiturbels, Histoturbels, Molliturbels, and Haploturbels. These are shallow or moderately deep to permafrost, poorly- to very poorly- drained, and formed in colluvium, slope alluvium, and residuum. Fibristels are shallow or moderately deep to permafrost, very poorly drained, and formed in thick deposits of organic material; in depressions, drainageways, and basins. Miscellaneous areas make up about 75 percent of this MLRA primarily composed of rubble, chutes, rock outcrops, and small glaciers. Lakes make up less than two percent of the area

Low willow, ericaceous shrub scrub, and tussocks are most dominant at lower elevations, with wet sites supporting wet meadows and willow scrub. Dwarf scrub communities (black crowberry, ericaceous shrubs, Dryas, and dwarf willow) are prominent on mountain slopes and ridges with exposed areas dominated by lichens, forbs, sedges, and mosses. As elevation and exposure increase, vegetation disappears and is replaced by rubble, talus, and other miscellaneous areas. This elevational transition is highly variable but roughly occurs at 6,500 feet (Zou et al. 2023) where glaciers also commonly prevail.

Villages use this remote area primarily for subsistence. Mining and prospecting of mineral resources historically occurred. Current disturbance relates to the pipeline and construction of Dalton highway. This disturbance of the fragile permafrost-affected soils is of increasing concern.
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Dwarf scrub communities (black crowberry, ericaceous shrubs, Dryas, and dwarf willow) are prominent on mountain slopes and ridges with exposed areas dominated by lichens, forbs, sedges, and mosses. Low willow, ericaceous shrub scrub, and tussocks increase as shift to lower elevations, with wet sites supporting wet meadows and willow scrub.

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LRU notes

No LRUs are developed for this Major Land Resource Area (MLRA). Soils that are within this area are maintained as arctic. Soils corresponding to boreal communities are correlated to the appropriate adjacent MLRA.

Classification relationships

The Brooks Range is the most northerly extension of the Rocky Mountains occurring within the Arctic Mountains province of the Rocky Mountain System.

Description of the Ecoregions of the United States (Bailey 1983)
100 Polar Domain
120 Tundra Division
M120 Tundra Division - Mountain Provinces
M121 Brooks Range Tundra--Polar Desert Province

United States National Vegetation Classification
C04. Polar & High Montane Scrub, Grassland & Barrens Class
S12. Temperate to Polar Alpine & Tundra Vegetation Subclass
F031. Polar Tundra & Barrens Formation
D044. Arctic Tundra & Barrens Division
M173. Feltleaf Willow - Eight-petal Mountain-avens - Tussock Cottongrass Tundra Macrogroup

G896. Arctic Dwarf-shrub Tundra Group
A4336. Arctic Nonacidic Dwarf Willow Tundra Alliance
A4333. Arctic Nonacidic Dryas Dwarf-shrub Tundra Alliance

LandFire BpS Model/Description Version: Nov. 2024
- 16880 North American Arctic Dryas Tundra
- 16860 Alaska Arctic Non-Acidic Sparse Tundra

Ecological site concept

• This arctic ecological site occurs on mountain slopes underlain by limestone. This geology results in calcareous and alkaline soils.
• Soils formed in gravelly colluvium
• Soils range from moderately deep to very deep, with depth controlled by bedrock. Permafrost does not occur in the gravelly soil profile.
• Soils do not flood or pond. These well drained soils do not have growing season water table.
• Reference state vegetation is dominated by eightpetal mountain-avens and various high pH indicator plants like Lapland rosebay.

Associated sites

YX244X00A102	**Calcareous, Wet Arctic Mountain Slopes** The Calcareous, Wet Mountain Slopes ecological site commonly occurs in concave areas, toe slopes, lower slope areas intermixed with the Calcareous Dry slopes. The wet soils support increased sedges and dwarf willows. Dry soils support less dense vegetation and are higher in ericaceous shrub cover.

Similar sites

YX244X00A113	**Arctic Tussock Tundra Mountain Slopes** The dry acidic sites (or non-calcareous substrates) are similar in structure with a change in substrate changing the chemistry. Acidic sites will have less labrador tea, marsh azalea and bog rosemary.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Dryas octopetala ssp. octopetala* (2) *Rhododendron lapponicum*
Herbaceous	(1) *Anthoxanthum monticola* (2) *Trisetum spicatum*

Legacy ID

R244XY103AK

Physiographic features

- Occurs on the summits and backslopes of limestone mountains.
- Elevation typically ranges from about 3,400 feet along the edge of the Arctic Foothills to 6,500 feet which provisionally marks the upper threshold of vegetation in this area.
- Flooding and ponding do not occur. During the growing season, a water table does not occur in the soil profile.
- Slopes are moderately steep to steep and occur on all aspects.
- Associated with medium to high amounts of runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Convex
Slope shape up-down	(1) Linear
Hillslope profile	(1) Summit (2) Backslope
Landforms	(1) Mountain range > Mountain slope (2) Mountain range > Mountain slope
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,036–1,981 m
Slope	15–45%
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	600–2,612 m
Slope	5–60%

Climatic features

Brief, cool summers and long, very cold winters characterize the continental arctic climate. The average annual precipitation throughout most of this area ranges from 15 to 40 inches

(380 to 1,015 millimeters). The average annual snowfall is about 50 to 100 inches (125 to 255 centimeters). The average annual temperature ranges from about 8 to 16 degrees F (-13 to -9 degrees C). Freezing temperatures can occur in any month of the year. The Chandalar Shelf DOT climate station is the only station near this MLRA (Major Land Resource Area) and has incomplete data. The station is on the border of the MLRA and is not representative of the climate within MLRA 244X.

Table 4. Representative climatic features

Frost-free period (characteristic range)	20-60 days
Freeze-free period (characteristic range)	5-45 days
Precipitation total (characteristic range)	381-864 mm
Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	178-1,016 mm
Frost-free period (average)	40 days
Freeze-free period (average)	
Precipitation total (average)	

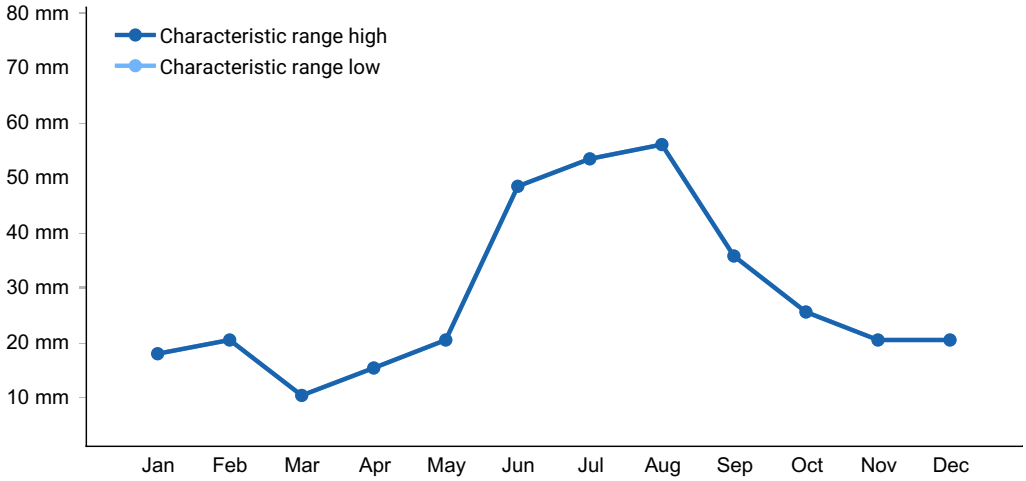

Figure 1. Monthly precipitation range

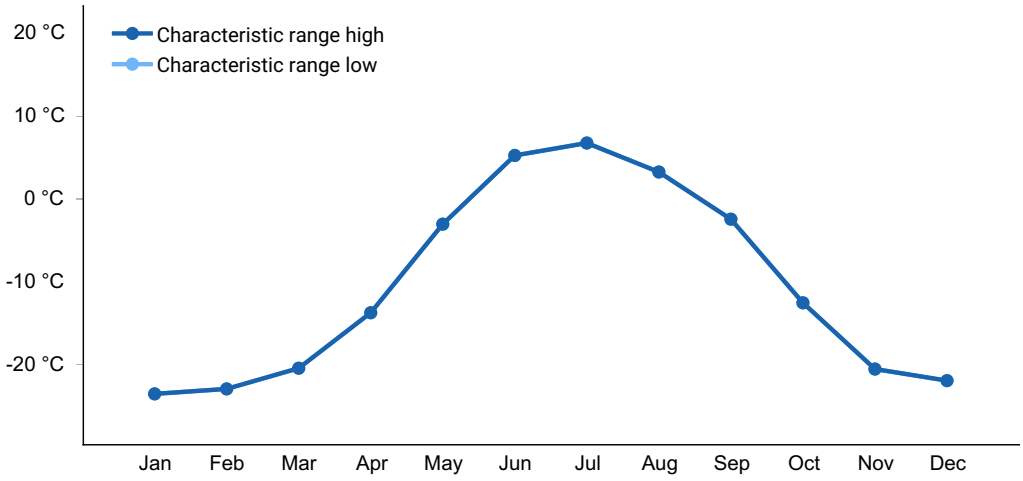

Figure 2. Monthly minimum temperature range

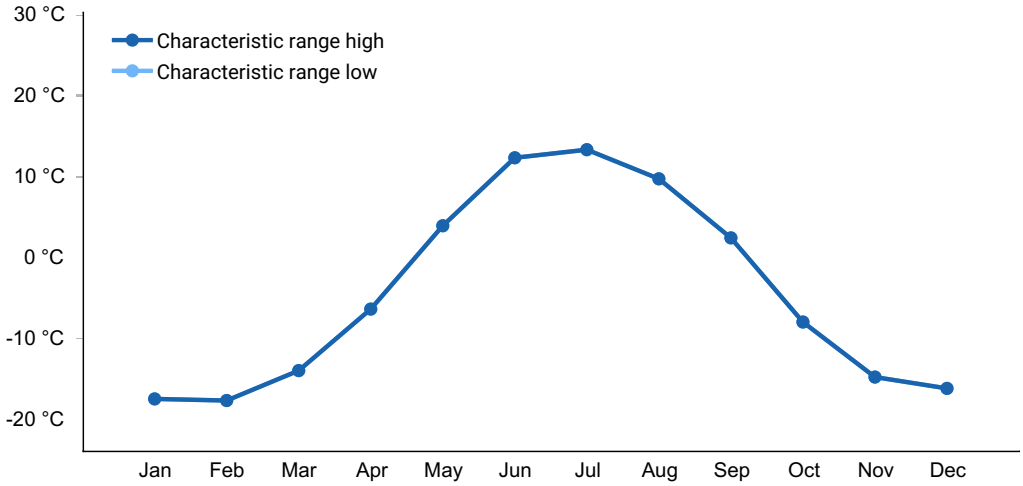

Figure 3. Monthly maximum temperature range

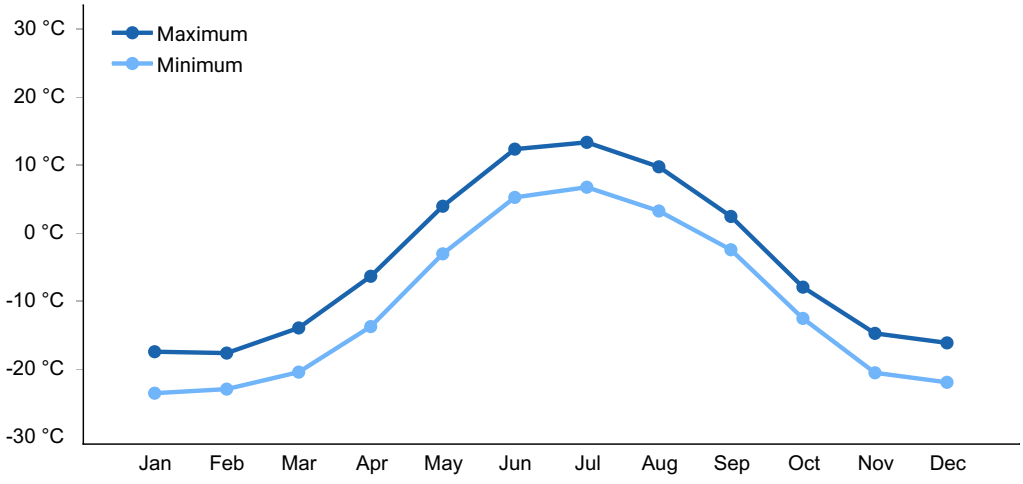

Figure 4. Monthly average minimum and maximum temperature

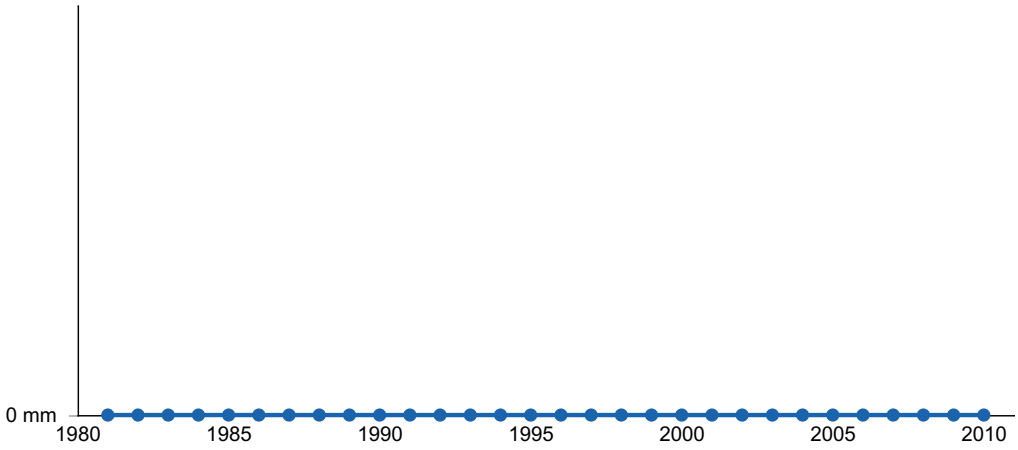

Figure 5. Annual precipitation pattern

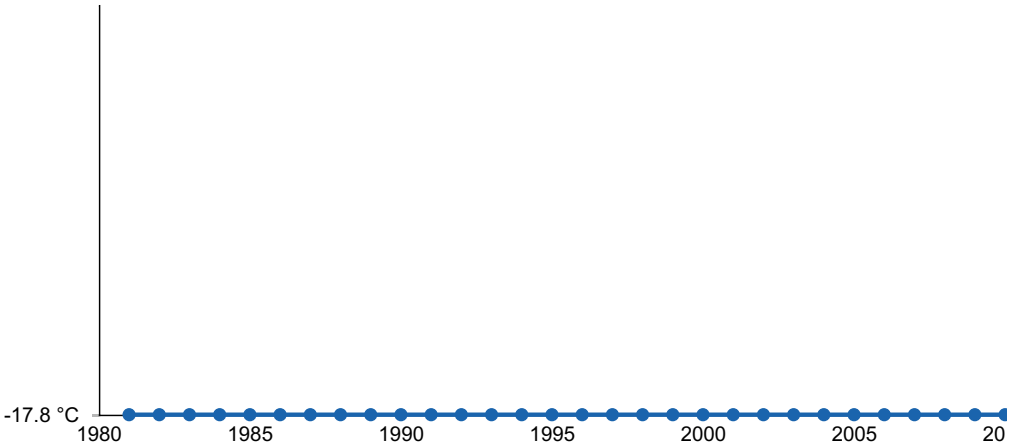

Figure 6. Annual average temperature pattern

Climate stations used

- (1) CHANDALAR SHELF DOT [USC00501497], Southerly North Slope Bo, AK

Influencing water features

Due to topographical position this ecological site is not have influenced from ground water or channel flow.

Wetland description

No wetland features occur on this ecological site.

Soil features

- Soils formed in gravelly colluvium derived from limestone.
- Rock fragments commonly cover 15 to 30 percent or more of the soil surface.
- These mineral soils are capped with up to one inch of organic material. The surface mineral horizon texture is channery loam.

- Subsurface rock fragments range between 25 and 55 percent or more of the soil profile by volume.
- Soils are moderately deep to very deep, which is controlled by bedrock.
- Soils are non-acidic with the pH of the soil profile ranging from slightly alkaline to moderately alkaline
- Soils are considered well drained with moderately rapid permeability.

Components correlated to this ecological site include the Arctic dwarf scrub-gravelly colluvial slopes and the Arctic dwarf scrub-gravelly dark colluvial slopes. These soils classify as Mollisols in the great group Haplogelolls.

This Major Land Resource Area (MLRA) is remote and difficult to reach and has not had soil verification completed. The information was obtained using the STATSGO soils information, a class 5 soils product. When opportunity presents to collect data in this MLRA, this Provisional Ecological Site will be updated.

Table 5. Representative soil features

Parent material	(1) Colluvium–limestone
Surface texture	(1) Very channery loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	61–152 cm
Soil depth	61–152 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	2.03–13.97 cm
Soil reaction (1:1 water) (0-25.4cm)	7.2–8
Subsurface fragment volume <=3" (0-152.4cm)	10–40%
Subsurface fragment volume >3" (0-152.4cm)	15–55%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Moderately rapid to rapid

Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

The Calcareous, Dry Arctic Mountain Slopes ecological site is dominated by Dryas and other dwarf ericaceous shrubs and is on the exposed, convex sites in the arctic Brooks Range. The reference plant community is characterized by sparse to open cover of dwarf-shrubs dominated by eightpetal mountain-avens (*Dryas octopetala*) and/or entireleaf mountain-avens (*Dryas integrifolia*), bog blueberry (*Vaccinium uliginosum*), alpine azalea (*Loiseleuria procumbens*), netleaf willow (*Salix reticulata*), skeletonleaf willow (*Salix phlebophylla*), alpine sweetgrass (*Anthoxanthum monticola* ssp. alpinum), and alpine bistort (*Polygonum viviparum*).

Natural disturbance of this ecological site is driven by solifluction and cryoturbation. The vegetation is slow growing, and unlikely to provide the necessary fuel load to carry fire. Successional pathways are not understood in this community (Viereck et al. 1992).

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. Eightpetal mountain-avens - Lapland rosebay / alpine sweetgrass - alpine bistort

State 1
Reference State

The reference plant community is Arctic dryas tundra (Viereck et al. 1992). There is only one known plant community currently associated with this State. Solifluction creates a mosaic of vegetation with barren or lichen and moss dominated sparse vegetated patches. This mosaic is described by a singular community in this ecological site. Solifluction is the slow, viscous downslope flow of water-saturated soil (Shoeneberger and Wysocki 2017). This process is most active for this ecological site during spring thaw where the upper band of soil material slips on a seasonally frozen layer. Cryoturbation is associated with this state and is responsible for mosaic patchiness in the vegetation. 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). Cryoturbation and solifluction are known to cause disturbance and vegetative changes. However, documentation for and understanding of these changes was not found and so no alternative state was captured.

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala*), shrub
- entireleaf mountain-avens (*Dryas integrifolia*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- spike trisetum (*Trisetum spicatum*), grass
- longawn sedge (*Carex macrochaeta*), grass
- alpine bistort (*Polygonum viviparum*), other herbaceous
- longpod stitchwort (*Minuartia macrocarpa*), other herbaceous
- heartleaf saxifrage (*Saxifraga nelsoniana*), other herbaceous

Community 1.1
Eightpetal mountain-avens - Lapland rosebay / alpine sweetgrass - alpine bistort

This community is dominated by eightpetal mountain avens (*Dryas octopetala*). On fringes of wetter areas or more acidic sites, entireleaf mountain avens (*Dryas integrifolia*) will co-dominate, comprising greater than 10 to 25 percent of the total community composition. Sedges and dwarf-shrubs are subdominant in this community, accounting for

approximately 25 to 50 percent of the cover. The exposed, harsh climate of the channery slopes limits the total cover of vegetation, especially herbaceous cover. The low cover yet high potential diversity creates a variable community across the ecological site. Species that are found commonly in the dwarf shrub component include white arctic mountain heather (Cassiopie tetragona), alpine bearberry (Arctous alpina), netleaf willow (*Salix reticulata*), and skeletonleaf willow (Salix phlebophyla) (Viereck et al. 1992, Alaska Center for Conservation Science unpublished field data). Grasses and sedges are low in stature and in composition but include alpine sweetgrass (*Anthoxanthum monticola* ssp. alpinum), spike trisetum (*Trisetum spicatum*), smallawned sedge (*Carex microchaeta*), and northern singlespike sedge (*Carex scirpoidea*). Forbs are interspersed within this ecological site and are commonly low lying or pincushion type species, such as alpine bistort (*Polygonum viviparum*), longpod stitchwort (*Minuartia macrocarpa*), twinflower sandwort (Minuarta obtusiloba), Anemones spp., and heartleaf saxifrage (*Saxifraga nelsoniana*). Common mosses and lichens include polytrichum moss (Polytrichum spp.), racomitrium moss (*Racomitrium lanuginosum*), whiteworm lichen (*Thamnolia vermicularis*), snow lichen (Stereocaulon spp.), bryocaulon lichen (*Bryocaulon divergens*), witch's hair lichen (*Alectoria ochroleuca*), witch's hair lichen (*Alectoria nigricans*), island cetraria lichen (*Cetraria islandica*), and curled snow lichen (Flavocetraria cucullate). The calcareous substrate of this ecological site supports non-acidic plants that quickly fall away as pH decreases. These species are Lapland rosebay (*Rhododendron lapponicum*), purple mountain saxifrage (*Saxifraga oppositifolia*), oneflower cinquefoil (*Potentilla uniflora*), northern sweetvetch (*Hedysarum boreale* ssp. mackenziei), blackish oxytrope (*Oxytropis nigrescens*), and tortula moss (*Tortula ruralis*).

Dominant plant species

- eightpetal mountain-avens (*Dryas octopetala*), shrub
- Lapland rosebay (*Rhododendron lapponicum*), shrub
- alpine azalea (*Loiseleuria procumbens*), shrub
- alpine sweetgrass (*Anthoxanthum monticola ssp. alpinum*), grass
- spike trisetum (*Trisetum spicatum*), grass
- smallawned sedge (*Carex microchaeta*), grass
- alpine bistort (*Polygonum viviparum*), other herbaceous
- longpod stitchwort (*Minuartia macrocarpa*), other herbaceous
- heartleaf saxifrage (*Saxifraga nelsoniana*), other herbaceous

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				–	
	alpine sweetgrass	ANMO7	*Anthoxanthum monticola*	–	–

	smallawned sedge	CAMI4	*Carex microchaeta*	–	–
	northern singlespike sedge	CASC10	*Carex scirpoidea*	–	–
	spike trisetum	TRSP2	*Trisetum spicatum*	–	–
Forb					
2				–	
	alpine bistort	POVI3	*Polygonum viviparum*	–	–
	longpod stitchwort	MIMA4	*Minuartia macrocarpa*	–	–
	twinflower sandwort	MIOB2	*Minuartia obtusiloba*	–	–
	anemone	ANEMO	*Anemone*	–	–
	heartleaf saxifrage	SANE3	*Saxifraga nelsoniana*	–	–
	purple mountain saxifrage	SAOP	*Saxifraga oppositifolia*	–	–
	oneflower cinquefoil	POUN2	*Potentilla uniflora*	–	–
	northern sweetvetch	HEBOM	*Hedysarum boreale ssp. mackenziei*	–	–
	blackish oxytrope	OXNI	*Oxytropis nigrescens*	–	–
Shrub/Vine					
3				–	
	entireleaf mountain-avens	DRIN4	*Dryas integrifolia*	–	–
	eightpetal mountain-avens	DROC	*Dryas octopetala*	–	–
	white arctic mountain heather	CATE11	*Cassiope tetragona*	–	–
	alpine bearberry	ARAL2	*Arctostaphylos alpina*	–	–
	netleaf willow	SARE2	*Salix reticulata*	–	–
	skeletonleaf willow	SAPH	*Salix phlebophylla*	–	–
	Lapland rosebay	RHLA2	*Rhododendron lapponicum*	–	–
	bog blueberry	VAUL	*Vaccinium uliginosum*	–	–
	lingonberry	VAVI	*Vaccinium vitis-idaea*	–	–
	black crowberry	EMNI	*Empetrum nigrum*	–	–
Moss					
4				–	
	polytrichum moss	POLYT5	*Polytrichum*	–	–
	racomitrium moss	RALA70	*Racomitrium*	–	–

			lanuginosum		
	tortula moss	TORU70	*Tortula ruralis*	–	–
Lichen					
5				–	
	whiteworm lichen	THVE60	*Thamnolia vermicularis*	–	–
	snow lichen	STERE2	*Stereocaulon*	–	–
	bryocaulon lichen	BRDI60	*Bryocaulon divergens*	–	–
	witch's hair lichen	ALOC60	*Alectoria ochroleuca*	–	–
	witch's hair lichen	ALNI60	*Alectoria nigricans*	–	–
	island cetraria lichen	CEIS60	*Cetraria islandica*	–	–
		FLCU	*Flavocetraria cucullata*	–	–

Animal community

The Brooks Range is an important big-game area in Alaska. Mammals common to the area include brown bear, black bear, wolf, caribou, and Dall sheep. The smaller mammals include marmot, red fox, Arctic fox, wolverine, ground squirrel, lemming, and pika. The Brooks Range is an important resting area for migrating waterfowl and songbirds during summer. Raptors prominent in many areas include golden eagles, marsh hawks, gyrfalcons, and snowy and other open country owls.

Hydrological functions

Overland water seepage and subsurface water seepage from snowmelt and precipitation events supports enhanced vegetation in these concave positions. Otherwise, there is no active connection to ground water or channel hydraulics.

Recreational uses

This remote area is used for sport hunting and other kinds of wildland recreation. Visitors use air taxi, guiding, and outfitting companies operating out of the major Alaska communities.

Wood products

Wooded areas reside just outside of the Major Land Resource Area.

Other products

This remote area is primarily used for subsistence hunting, fishing, and gathering.

Inventory data references

No on-site data are available. Information used to build this ecological site was obtained from existing land cover and vegetation maps, literature review, and vegetative summaries from partnering agencies.

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Contributors

Marji Patz
Blaine Spellman
Phil Barber

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Matthew Mayer, Ecological Site Specialist in Wasilla Alaska provided the R script to summarize geospatial data for climate information.

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	03/22/2026
Approved by	Blaine Spellman
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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:**
