

# **Ecological site R223XY706AK**

## **Alpine scrub wet depressions and drainageways**

Last updated: 6/12/2025

Accessed: 12/15/2025

---

### **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): 223X–Cook Inlet Mountains

#### **Physiography**

The Cook Inlet Mountains (Major Land Resource Area (MLRA) 223) are part of the Pacific Mountain physiographic system and occur in Southcentral Alaska. Comprising 19,550 square miles, this alpine MLRA includes mountains of the Chugach, Kenai, Talkeetna, Aleutian, and Alaska Ranges that drain into the Cook Inlet via the Cook Inlet Lowlands (MLRA 224). These rugged mountains are primarily undeveloped and sparsely populated. This MLRA concept is defined by the true alpine zone, while the Cook Inlet Lowlands (MLRA 224) are characterized by lower elevation hills and plains of the subalpine and boreal life zones. Large glaciers and icefields make up 15 percent of the Cook Inlet Mountains, and some glaciers extend down into the Cook Inlet Lowlands to elevations of 1,000 feet. The alpine zone in this MLRA ranges in elevation from roughly 2,500 feet near the boundary MLRA 224 to 20,320 feet at the summit of Denali, the tallest mountain in North America. All rivers in this MLRA drain into Cook Inlet including the Matanuska, Susitna and Little Susitna, Knik, Kenai, and Chakachatna Rivers.

#### **Geology**

The entire Cook Inlet Mountains area, except for the highest peaks and upper ridges, was glaciated during the Pleistocene. Throughout the Holocene, most of the Pleistocene glacial deposits have eroded or were buried in colluvium and slope alluvium, of which now comprise 65 percent of the current landscape. Mid-to-lower mountain slopes and valleys consist of modified moraine and outwash deposits overlain by varying thickness of eolian loess and volcanic ash. Lower valley bottoms are covered in contemporary fluvial deposits. Underlying bedrock consists of Late Paleozoic and Early Mesozoic sedimentary and Tertiary intrusive rock.

## Soils

The dominant soil orders in MLRA 223 are Entisols, Inceptisols, and Spodosols. Soils have a cryic temperature regime or a subgelic soil temperature class, udic or aquic moisture regime, and amorphic or mixed minerology. Miscellaneous areas such as rock outcrop, rubble land, and glaciers, and others make up 70 percent of this MLRA.

## Climate

The climate of this area is characterized by short summers, cloudy conditions, and moderate to cold temperatures. The average annual precipitation ranges from 15 to 30 inches at lower elevations to more than 100 inches in the high mountains, with most rain occurring in the late summer and fall. This area sees high levels of snowfall, ranging from 80 to 400 inches or more. Average annual temperatures in this alpine MLRA are near freezing, with freeze-free periods averaging 60 to 80 days, while at higher elevations, freezing temperatures can occur throughout any time of year.

## Vegetation

The Cook Inlet Mountains are defined by an alpine life zone and therefore plant communities in this area are void of tree and tall shrub species that are common in subalpine and boreal zones. Alpine vegetation primarily consists of dwarf scrub, lichen and herbaceous communities. Low willow-graminoid communities are common in drainages, depression, and stream terraces. On shallow soils on mountain slopes and rocky ridges lichen and ericaceous scrub mosaics are accompanied by scattered forbs are alpine grasses. At elevations above 7,500 feet, little to no plant growth takes place.

## Classification relationships

Alaska Vegetation Classification

Willow-graminoid shrub bog (II.C.1.b – level IV)

(Vioreck et al., 1992)

Landfire Biophysical Settings:

Western North American Boreal Mesic Scrub Birch-Willow Shrubland – Alaska Sub-boreal (LANDFIRE biophysical settings, 2009)

## Ecological site concept

- High elevation scrub community on drainageways and depressions
- Somewhat poorly to very poorly drained soils formed in silty volcanic ash and windblown silts over gravelly glacial material or alluvium
- Elevation generally ranges between 1,500 and 3,600 feet
- The vegetative community is influenced by a persistent shallow water table and other hydrologic effects associated with drainageways (run-off)
- A single plant community identified in reference state. Community 1.1 is characterized as a willow-graminoid shrub bog community

## Associated sites

|             |                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R223XY710AK | <b>Alpine dwarf scrub gravelly slopes</b><br>Ecological site R223XY710AK occurs on gravelly mountain slopes, supporting an alpine dwarf scrub community, and is proximal to R223XY706AK, which occurs in drainageways on these same mountain slopes. |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Similar sites

|             |                                                                                                                                                  |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| R223XY710AK | <b>Alpine dwarf scrub gravelly slopes</b><br>Ecological site R223XY710AK occurs on mountain slopes and supports an alpine dwarf scrub community. |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------|

**Table 1. Dominant plant species**

|            |                                                                          |
|------------|--------------------------------------------------------------------------|
| Tree       | Not specified                                                            |
| Shrub      | (1) <i>Salix barclayi</i><br>(2) <i>Salix pulchra</i>                    |
| Herbaceous | (1) <i>Sanguisorba canadensis</i><br>(2) <i>Calamagrostis canadensis</i> |

## Physiographic features

Ecological site R223XY706AK occurs in depressions and drainageways on mountain slopes in the alpine zone. Elevations range from 1,540 to 3,610 feet above sea level or higher. Slopes generally range from 1 to 16 percent, and this ecological site occurs on all aspects. Although flooding and ponding do not occur, a shallow water table persists within 0 to 18 inches of the soil surface throughout the growing season.

**Table 2. Representative physiographic features**

|                    |                                                           |
|--------------------|-----------------------------------------------------------|
| Landforms          | (1) Mountains > Drainageway<br>(2) Mountains > Depression |
| Runoff class       | Low                                                       |
| Flooding frequency | None                                                      |
| Ponding duration   | Not specified                                             |
| Ponding frequency  | None                                                      |
| Elevation          | 1,540–3,610 ft                                            |
| Slope              | 1–16%                                                     |
| Water table depth  | 0–18 in                                                   |
| Aspect             | W, NW, N, NE, E, SE, S, SW                                |

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

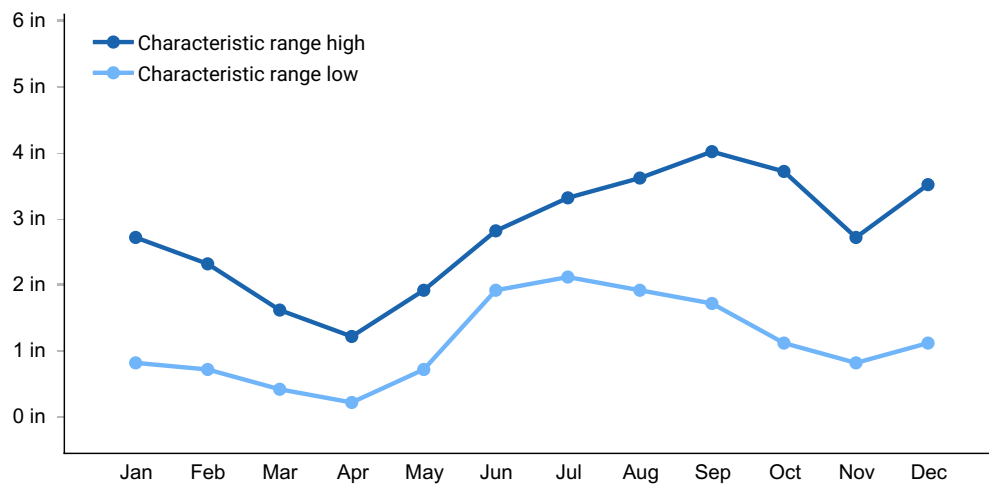
|                    |                               |
|--------------------|-------------------------------|
| Runoff class       | Not specified                 |
| Flooding frequency | Not specified                 |
| Ponding duration   | Very long (more than 30 days) |
| Ponding frequency  | None to frequent              |
| Elevation          | 1,540–5,410 ft                |
| Slope              | 0–30%                         |
| Water table depth  | Not specified                 |

## Climatic features

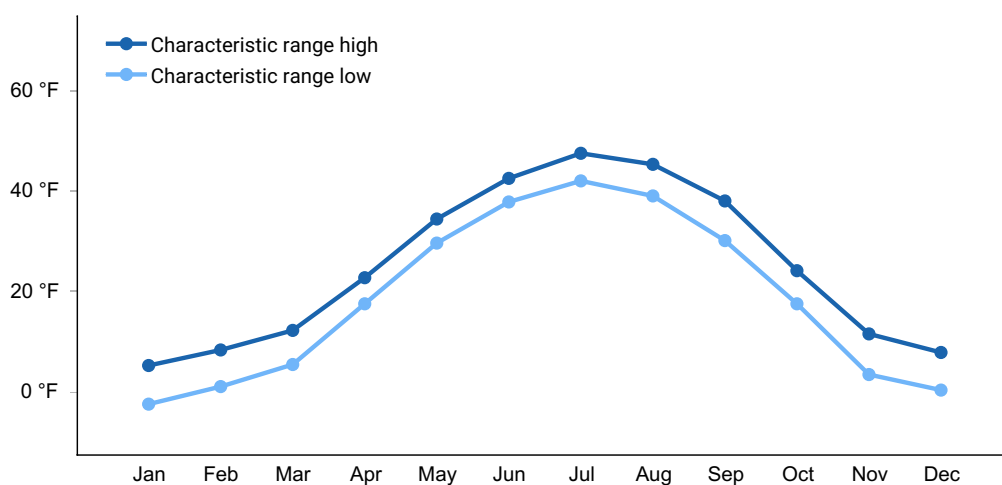
The climate associated with this high-elevation, alpine ecological site is characterized by a short growing season, cloudy conditions, and cold temperatures. Mean annual precipitation ranges from 15 to 32 inches at lower elevations to 100 inches or more at higher elevations. Snowfall ranges from 80 to 400 inches or more, increasing with elevation. Frost free period averages between 23 and 85 days at lower elevations, but at higher elevations, temperatures below freezing can occur any month of the year. Precipitation is greatest between August and October and least in March and April.

**Table 4. Representative climatic features**

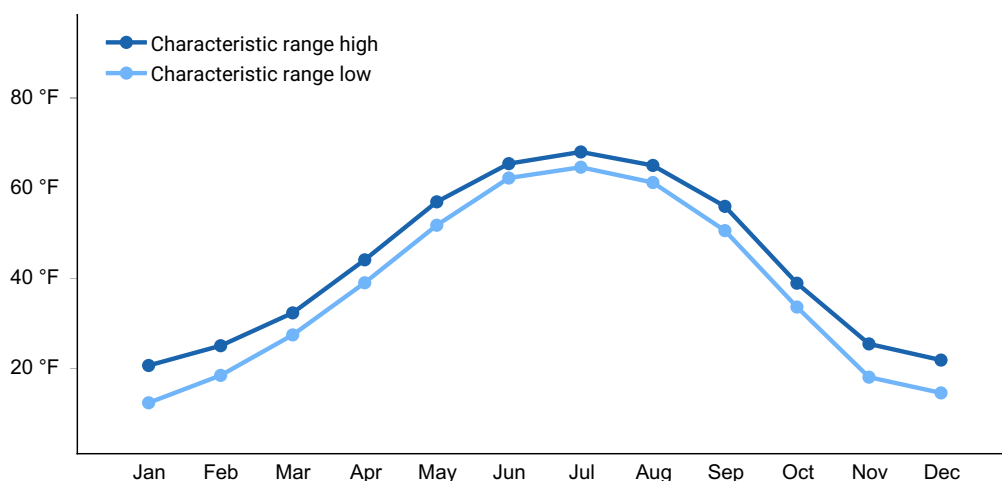
|                                            |             |
|--------------------------------------------|-------------|
| Frost-free period (characteristic range)   | 23-85 days  |
| Freeze-free period (characteristic range)  | 69-119 days |
| Precipitation total (characteristic range) | 15-32 in    |
| Frost-free period (actual range)           | 15-108 days |
| Freeze-free period (actual range)          | 65-138 days |
| Precipitation total (actual range)         | 14-49 in    |
| Frost-free period (average)                | 56 days     |
| Freeze-free period (average)               | 96 days     |
| Precipitation total (average)              | 25 in       |



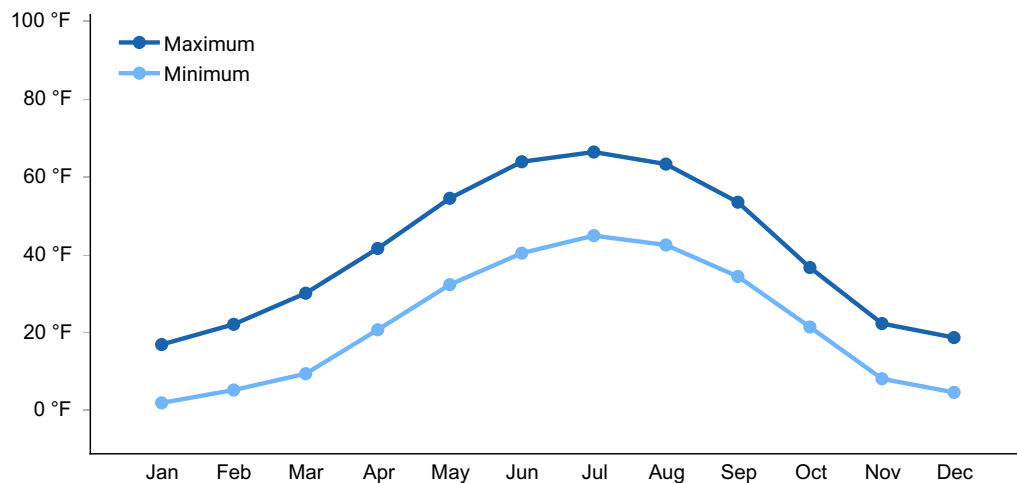
**Figure 1. Monthly precipitation range**



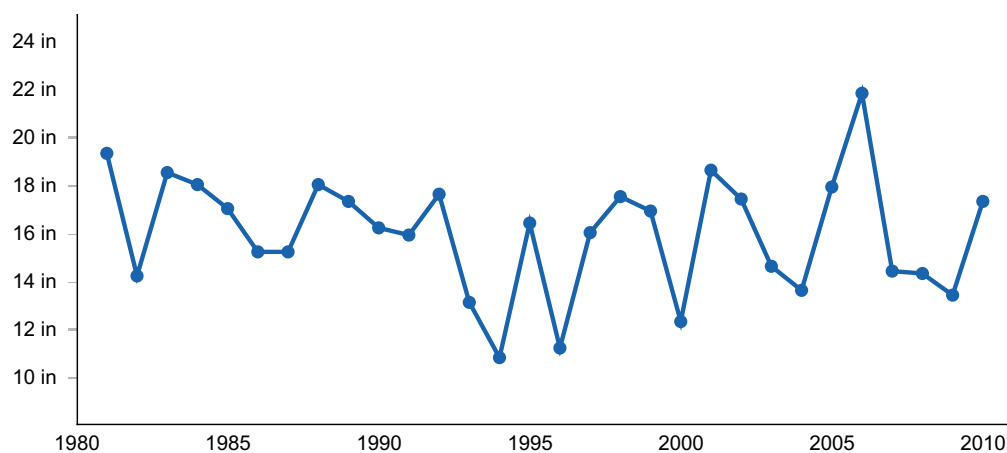
**Figure 2. Monthly minimum temperature range**



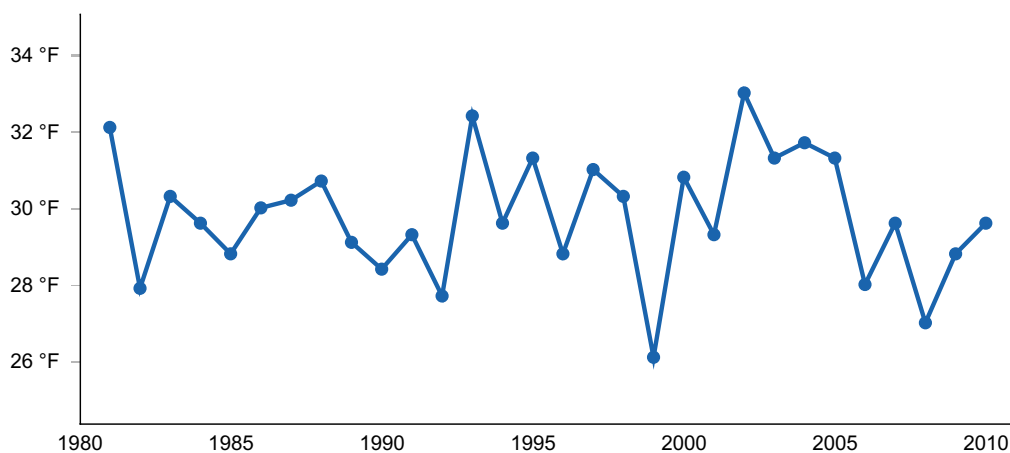
**Figure 3. Monthly maximum temperature range**



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



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) SHEEP MTN LODGE [USC00508409], Palmer, AK
- (2) TAHNETA PASS [USC00508945], Palmer, AK
- (3) BIG RIVER LAKES [USC00500788], W Kenai Peninsula Boroug, AK
- (4) PUNTILLA [USC00507783], Matanuska-Sustina Bor, AK

## Influencing water features

Ecological site R223XY706AK is associated with depressions and drainageways that are somewhat poorly- to very poorly drained. A shallow, seasonal water table persists throughout the growing season ranging from 0 to 18 inches below the soil surface, influencing plant community dynamics on this ecological site. No ponding or flooding occurs on this site.

## Soil features

The soils of ecological site R223XY706AK formed in silty volcanic ash or windblown silt over gravelly parent material. Surface fragments are uncommon, and these mineral soils have a very thin organic cap, if present. The mineral soil is a silt loam formed in volcanic ash or loess overlying gravelly glacial material. These soils are considered very deep, yet a restrictive layer in the form of a strongly contrasting textural stratification is present 5 to 17 inches below the soil surface. Soil pH ranges from strongly acidic to slightly acidic and drainage class is rated from somewhat poorly- to very poorly drained.

**Table 5. Representative soil features**

|                                          |                                                   |
|------------------------------------------|---------------------------------------------------|
| Parent material                          | (1) Volcanic ash<br>(2) Loess<br>(3) Till         |
| Surface texture                          | (1) Silt loam<br>(2) Mucky silt loam<br>(3) Mucky |
| Family particle size                     | (1) Medial<br>(2) Loamy-skeletal                  |
| Drainage class                           | Somewhat poorly drained to very poorly drained    |
| Permeability class                       | Moderately rapid to rapid                         |
| Depth to restrictive layer               | 5–17 in                                           |
| Soil depth                               | 60 in                                             |
| Surface fragment cover ≤3"               | 0%                                                |
| Surface fragment cover >3"               | 0%                                                |
| Available water capacity<br>(0-10in)     | 1.2–3.9 in                                        |
| Calcium carbonate equivalent<br>(0-40in) | 0%                                                |
| Clay content<br>(0-20in)                 | 5–10%                                             |

|                                            |            |
|--------------------------------------------|------------|
| Electrical conductivity<br>(0-40in)        | 0 mmhos/cm |
| Sodium adsorption ratio<br>(0-40in)        | 0          |
| Soil reaction (1:1 water)<br>(0-40in)      | 3.5–6.7    |
| Subsurface fragment volume ≤3"<br>(0-60in) | 0–23%      |
| Subsurface fragment volume >3"<br>(0-60in) | 0–5%       |

**Table 6. Representative soil features (actual values)**

|                                            |               |
|--------------------------------------------|---------------|
| Drainage class                             | Not specified |
| Permeability class                         | Not specified |
| 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<br>(0-10in)       | 1–4.1 in      |
| Calcium carbonate equivalent<br>(0-40in)   | Not specified |
| Clay content<br>(0-20in)                   | Not specified |
| Electrical conductivity<br>(0-40in)        | Not specified |
| Sodium adsorption ratio<br>(0-40in)        | Not specified |
| Soil reaction (1:1 water)<br>(0-40in)      | Not specified |
| Subsurface fragment volume ≤3"<br>(0-60in) | 0–32%         |
| Subsurface fragment volume >3"<br>(0-60in) | 0–10%         |

## Ecological dynamics

Located in the alpine life zone, this ecological site is exposed to a variety of harsh environmental conditions. In the Cook Inlet Mountains, 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 ecological site R223XY706AK is snow-free, cold soil temperatures and high winds also inhibit plant growth and vigor. This harsh climate maintains the dwarfed vegetation within this ecological site and prevents the establishment and/or growth of dominant boreal species like white spruce and black spruce.

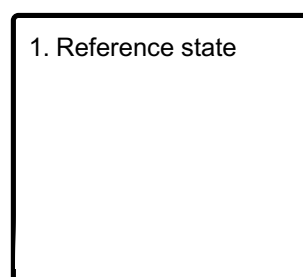
Although fire plays an important role in shaping vegetation communities throughout Alaska, fire frequency in alpine communities is largely unstudied, when compared to interior forest stands. This is likely due to the diminished influence of fire above tree line. Most wildfires in Alaska are caused by lightning strikes which tend to occur near tree line, decreasing in frequency into the subalpine and alpine zones (Dewilde et al. 2006). Despite the propensity of fires to move from boreal stands upslope into higher life zones, it is likely a general lack of fuel in alpine scrub communities that accounts for diminished fire frequency (Kasischke et al. 2002, Dewilde et al. 2006). Due to low fire frequency, the disturbance regime in this alpine community is likely driven by avalanche, rockslides, and other mass movement events associated with eroding and unstable mountain slopes.

Field data suggest this ecological site supports a single dominant plant community, without known transitional pathways to other plant communities or alternative states. Community 1.1 is characterized by a willow-graminoid shrub bog community (Viereck et al. 1992). Notable species include *Salix barclayi*, *Salix pulchra*, *Sanguisorba canadensis*, and *Calamagrostis canadensis*. Various moss species including *Sphagnum* are common on this site and make up as much as 90 percent of the soil surface cover.

This plant community extends from the alpine zone into the subalpine zone, which is classified as Major Land Resource Area (MLRA) 224: The Cook Inlet Lowlands. However, hydrologic influence leads to congruency between alpine and subalpine plant communities at the elevations on which this ecological site is found. This congruency leads to plant community composition that includes shrub species that would otherwise only be found in subalpine community but are found at higher elevations in stunted growth forms.

## State and transition model

### Ecosystem states



## State 1 submodel, plant communities

1.1. Barclay's willow -  
tealeaf willow /  
bluejoint / Canadian  
burnet

### State 1 Reference state

The reference state of this ecological site includes a single plant community characterized as a willow-graminoid shrub-bog. This community extends into the subalpine zone where shrubs exhibit medium to tall growth forms. In this alpine community, these same shrubs are diminished to the low shrub class.

#### Dominant plant species

- Barclay's willow (*Salix barclayi*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- Richardson's willow (*Salix richardsonii*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- resin birch (*Betula glandulosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- Canadian burnet (*Sanguisorba canadensis*), other herbaceous
- subarctic ladyfern (*Athyrium filix-femina* ssp. *cyclosorum*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous

### Community 1.1

#### Barclay's willow - tealeaf willow / bluejoint / Canadian burnet

The reference community is characterized by a willow-graminoid shrub bog community (Viereck et al. 1992). Shrubs in this community include several willow species (*Salix* spp.) and resin birch (*Betula glandulosum*). Bluejoint (*Calamagrostis canadensis*) and Bigelow's sedge (*Carex bigelowii*) are the dominant graminoids in this community and various forbs are present. Notable willow species include Barclay's willow (*Salix barclayi*), tealeaf willow (*S. pulchra*), feltleaf willow (*S. alaxensis*), and Richardson's willow (*S. richardsonii*). Although designated as an alpine community, a similar community extends into the subalpine zone where shrubs exhibit full growth forms.

#### Dominant plant species

- Barclay's willow (*Salix barclayi*), shrub
- tealeaf willow (*Salix pulchra*), shrub

- Richardson's willow (*Salix richardsonii*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- resin birch (*Betula glandulosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- Canadian burnet (*Sanguisorba canadensis*), other herbaceous
- subarctic ladyfern (*Athyrium filix-femina* ssp. *cyclosorum*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

## **Additional community tables**

## **Inventory data references**

The vegetation modeled for this ecological site has limited data and is considered provisional. The associated model was largely developed from NRCS (Natural Resources Conservation Service) staff with working knowledge of the area and literature review.

Plant community composition is largely based on ecological sites from AK651: Soil Survey of Denali National Park Area, Alaska.

## **References**

Viereck, L.A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-286..

## **Other references**

Chapin, F.S., L.R. Walker, C.L. Fastie, and L.C. Sharman. 1994. Mechanisms of primary succession following deglaciation at Glacier Bay, Alaska. *Ecological Monographs* 64: 149-175.

Clague, John J., and V.N. Rampton. 1982. Neoglacial Lake Alsek. *Canadian Journal of Earth Sciences* 19.1: 94-117.

Clarke, J.A. 1977. An inverse problem in glacial geology: The reconstruction of glacier thinning in Glacier Bay, Alaska, between AD 1910 and 1960 from relative sea level data. *Journal of Glaciology* 80: 481-503.

Hall, D.K., C.S. Benton, and W.O. Field. 1994. Changes of glaciers in Glacier Bay, Alaska,

using ground and satellite measurements. *Physical Geography* 16(1): 27-41.

Hall, M.H.P., and D. Fagre. 2003. Modeled climate-induced glacier change in Glacier National Park 1850–2100. *BioScience* 53:131-140.

Hicks, S.D., and W. Shofnos. 1965. The documentation of land emergence from sea-level observations in southeast Alaska. *Journal of Geophysical Research* 70: 3315-3320.

Jorgensen, T. and Meidlinger, D., 2015. The Alaska Yukon Region of the Circumboreal Vegetation map (CBVM). *Conservation of Arctic Flora and Fauna (CAFF)*.

LANDFIRE. 2009. Western North American Boreal Alpine Dwarf-Shrub Summit. In: *LANDFIRE National Vegetation Dynamics Models*. USDA Forest Service and US Department of Interior. Washington, DC.

Larsen, C.F., K.A. Echelmeyer, J.T. Freymueller, and R.J. Motyka. 2003. Tide gauge records of uplift along the northern Pacific-North American plate boundary, 1937 to 2001. *Journal of Geophysical Research*. Volume 108, number B4. doi:10.1029/2001JB001685

Lawson, D.E. 2015. An overview of selected glaciers in Glacier Bay. National Park Service. Retrieved August 15, 2010.

Milne, G.A., and I. Shennan. 2013. Isostasy: Glaciation-induced sea-level change. In *Encyclopedia of Quaternary Science*. Volume 3, pages 452-459. Elsevier, Oxford.

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

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and W.D. Broderson, editors. 2012. *Field book for describing and sampling soils*. Version 3.0. U.S. Department of Agriculture, Natural Resources Conservation Service.

Soil Survey Division Staff. 2017. *Soil survey manual*. U.S. Department of Agriculture Handbook 18.

## **Contributors**

Tyler Annetts  
Phil Barber

## **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                                        | 12/15/2025        |
| Approved by                                 | Blaine Spellman   |
| 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:**
-