

Ecological site R228XY706AK

White spruce/willow-birch scrub dry slopes

Last updated: 6/12/2025

Accessed: 12/19/2025

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): 228X—Interior Alaska Mountains

Physiography

The Interior Alaska Mountains Major Land Resource Area (MLRA) (228X) includes portions of the high mountain slopes, hills, and plains of the Alaska Range, Talkeetna Mountains, Chugach Mountains, Wrangell Mountains and the northern Aleutian Range. This MLRA comprises 54,205 square miles and consists of rugged, high mountains and low, rounded hills and extended footslopes along the base of the mountains. Most of the area is undeveloped wildland and includes true alpine and subalpine life zones. Geology consists of sedimentary, metamorphic, and igneous bedrock. Climate is considered continental subarctic.

MLRA boundaries

MLRA 228X is expansive and therefore shares a boundary with many MLRAs. Boundaries with other mountainous MLRAs such as 222X (Southern Alaska Coastal mountains), 223X (Cook Inlet Mountains), and 225X (Southern Alaska Peninsula Mountains) result from orogenic differences (225X,223X) or variation in climate (222X). Other MLRAs such as 236X (Bristol-Bay-Northern Alaska Peninsula Lowlands), 227X (Copper River Basin), 229X (Interior Alaska Lowlands), and 230X (Yukon-Kuskokwim Highlands) have distinct physiographic boundaries where steep mountains meet lowlands, basins, and floodplains.

Waterways

Encompassed within the Pacific Mountain system, the mountains of MLRA 228X are dissected by high-gradient valleys with braided floodplains in the valley bottoms. Glaciers, snowfields, and ice fields make up 15 percent of the area and elevations range from about 1,500 feet in the Copper River Basin to 20,320 feet at the summit of Denali. The major

rivers of this MLRA include the Tanana, Kuskokwim, and Copper, and drain into the Bering Sea (Tanana, Kuskokwim), and the Gulf of Alaska (Copper). The headwaters of the Susitna River are part of this MLRA and drain into Cook Inlet through the Cook Inlet Mountains, and Cook Inlet Lowlands (MLRA 223X and 224X, respectively). This MLRA is in the zone of discontinuous permafrost, where permafrost mostly occurs in fine-textured soils on gently sloping landforms and/or on northerly aspects.

Geology

Except for the highest peaks and upper ridges, all of this area was glaciated during the late Pleistocene. Glacial deposits have mostly eroded or have been buried by colluvium and alluvium throughout the Holocene, yet some highly modified glacial deposits remain at lower elevations on low mountain slopes and valleys. Loess also occurs at lower elevations, and most valley bottoms have been buried by recent alluvial deposits. Bedrock geology is comprised of sedimentary, metamorphic, igneous, and volcanic rock, and gold mining does take place in this MLRA.

Soils

The dominant soil orders in MLRA 228X are Gelisols, Inceptisols, Spodosols, and Entisols. The Gelisols are shallow or moderately deep to permafrost, occur on finer textured sediments, and are poorly drained or very poorly drained. Common Gelisol suborders are Histels, Orthels, and Turbels. The Histels have thick accumulations of surface organic material and occur in depressions and peat plateau. The Orthels and Turbels have comparably thinner surface organic material and occur on drainageways, stream terraces, and outwash plains. The Inceptisols, Spodosols, and Entisols lack permafrost in the soil profile. Spodosols are formed from weathering processes that strip organic matter combined with aluminum from upper horizons and deposit them into lower horizons. Entisols and Inceptisols are characteristically undeveloped, with Inceptisols exhibiting only moderate weathering and development while Entisols exhibit little to no evidence of development at all. Soils have a subgelic or cryic temperature regime with aquic or udic moisture regime and mixed mineralogy. Miscellaneous areas make up 58 percent of this MLRA and are classified as rock outcrop, rubble land, and glaciers.

Climate

The climate of this area is characterized by brief, cool summer, and long, cold winters, but extreme variation in elevation results in a wide range of climatic conditions. Average annual precipitation ranges from 15 to 20 inches at lower elevations to 100 inches at high elevations. Rainfall is generally highest in July, August, and early September. The average annual snowfall ranges from 70 to 400 inches, and the average annual temperature at Denali Park headquarters is 27 degrees F. Freeze-free period ranges from 50 to 80 days, but at higher elevations, freezing temperatures can occur at any point throughout the year.

Vegetation

The Interior Mountains MLRA is defined by subalpine and alpine life zones; therefore, true forested communities do not occur and are restricted to surrounding lowland MLRAs. Black and white spruce trees do occur in the subalpine zone, but are often sporadic, and

exhibit Krummholz (stunted and/or crooked) growth forms and do not produce viable seed. Subalpine vegetation is characterized by birch-willow scrublands or spruce-scrub woodlands on loamy, stable mountain slopes. Unstable, colluvial slopes are typically dominated by alder scrub communities which can, on occasion, include scattered black and white spruce. Willow typically dominates drainages, while wet, poorly to very poorly drained swales are comprised of tussock sedge-scrub species. Low birch-ericaceous scrub communities climb up mountain slopes until they are replaced by dryas-ericaceous dwarf scrub communities in the true alpine zone. Lichen also plays an important role in skeletal and bedrock-controlled high elevation mountain slopes, ridges, and summits. There is generally little to no plant growth at elevations above 7,500 feet (USDA, 2022).

LRU notes

This area supports two life zones defined by the physiological limits of plant communities along an elevational gradient: subalpine, and alpine. In this area, the boreal life zone occurs below 2500 feet elevation on average, and is relegated to surrounding, lowland MLRAs. 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 over one meter 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. 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 warm 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 (over 10 percent 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. These warm and cold slopes can shift the elevation at which life zones occur. Warm slopes can allow communities to persist at higher elevations, while cold slopes can restrict these same communities to lower elevations.

Classification relationships

Alaska Vegetation Classification

Open tall shrub birch-willow scrub (II.B.2.e – level IV)
(Viereck et al. 1992)

Circumboreal Vegetation Map – Alaska-Yukon Region
Southern Alaska Subalpine Spruce Woodlands and Scrub

(Jorgensen and Meidinger, 2015)

LANDFIRE Biophysical Settings
Western North American Boreal Mesic Scrub Birch-Willow Shrubland - Boreal
(LANDFIRE biophysical settings, 2009)

Ecological site concept

- Ecological site R228XY706AK is a subalpine willow-birch scrub community on mountain slopes, hillslopes, and glacial landforms
- Well drained soils formed in organic material and silty loess over gravelly colluvium and glacial till
- Elevations range from 2030 to 4080 feet
- Harsh growing conditions, persistent snowpack, fire, and shallow soils influence the reference plant community
- The representative plant community (1.1) is characterized by an open tall shrub birch-willow scrub community

Associated sites

R228XY705AK	White spruce/alder scrub unstable slopes The white spruce/alder scrub unstable slopes ecological site occurs adjacent to ecological site R228XY705AK, on soils that are unstable. This instability selects for a shrub community that is dominated by alder, rather than birch-willow.
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Similar sites

R228XY714AK	Mixed spruce/birch-ericaceous scrub woodland mesic slopes The white spruce/willow-birch scrub mesic slopes ecological site occurs on similar landforms on soils that are somewhat poorly to moderately well drained. This results in similar dominant plant species with slight variation in associated species and composition.
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Table 1. Dominant plant species

Tree	(1) <i>Picea glauca</i>
Shrub	(1) <i>Betula glandulosa</i> (2) <i>Salix pulchra</i>
Herbaceous	(1) <i>Hylocomium splendens</i> (2) <i>Pleurozium schreberi</i>

Physiographic features

Ecological site R228XY706AK occurs in the subalpine zone on mountain slopes, hillslopes

and various glacial landforms. Elevation ranges from 2030 to 4080 feet above sea level on slopes ranging 1 to 50 percent on all aspects. Soils do not flood or pond.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Mountains > Hillslope (3) Mountains > Moraine (4) Mountains > Outwash plain
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,030–4,080 ft
Slope	1–50%
Water table depth	Not specified
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–80%
Water table depth	39–60 in

Climatic features

The climate of this high-elevation area is characterized by short growing season, cool summers, and long winters. Mean annual precipitation is around 15 inches at lower elevations but can reach much higher totals at higher elevations. June, July, and August are the wettest months of the year, while February, March, and April are the driest. On average, there are 17 frost free days per year, but at high elevations, freezing temperatures can occur any month of the year. The mean maximum temperature is 67 degrees Fahrenheit in July, while the mean low temperature is -9 degrees Fahrenheit in January. At higher elevations, this temperature range will be greatly skewed towards colder temperatures.

Table 4. Representative climatic features

Frost-free period (characteristic range)	5-30 days
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Freeze-free period (characteristic range)	63-77 days
Precipitation total (characteristic range)	12-17 in
Frost-free period (actual range)	1-41 days
Freeze-free period (actual range)	50-84 days
Precipitation total (actual range)	12-18 in
Frost-free period (average)	17 days
Freeze-free period (average)	69 days
Precipitation total (average)	15 in

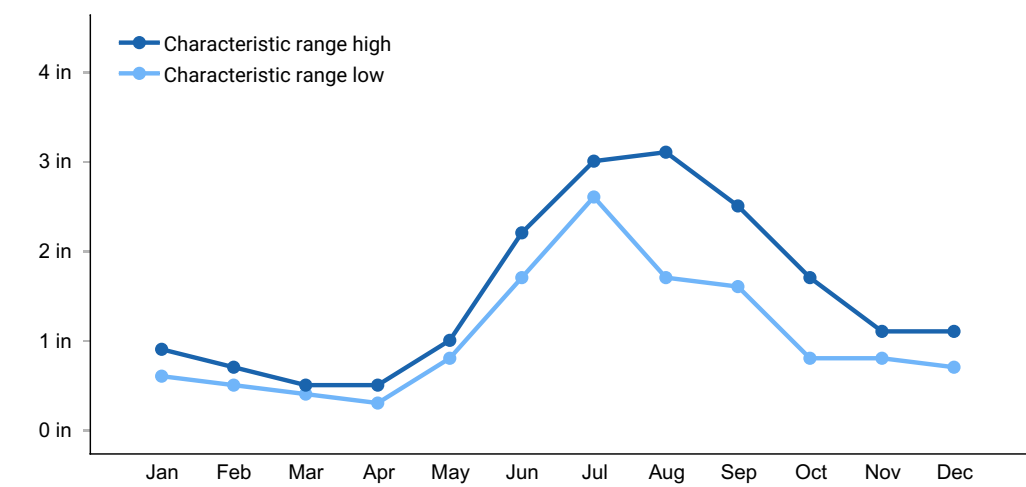


Figure 1. Monthly precipitation range

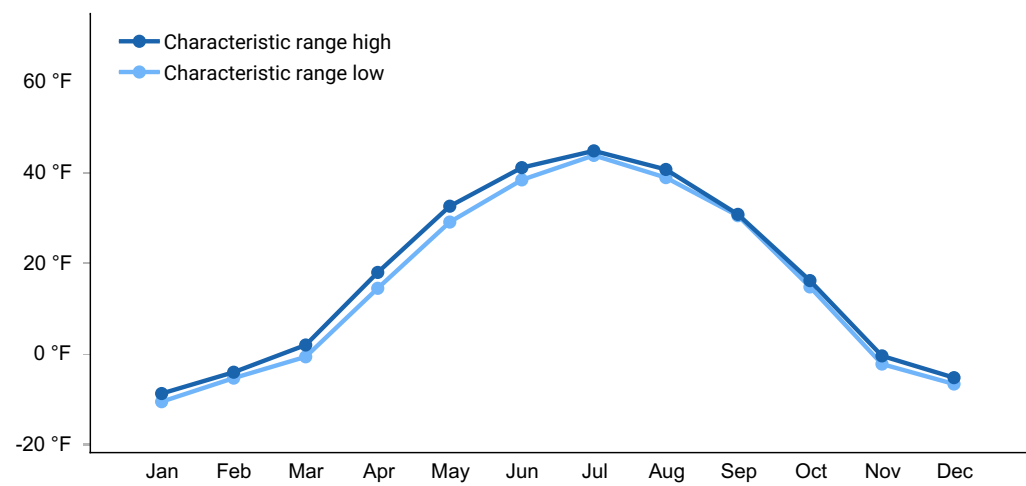


Figure 2. Monthly minimum temperature range

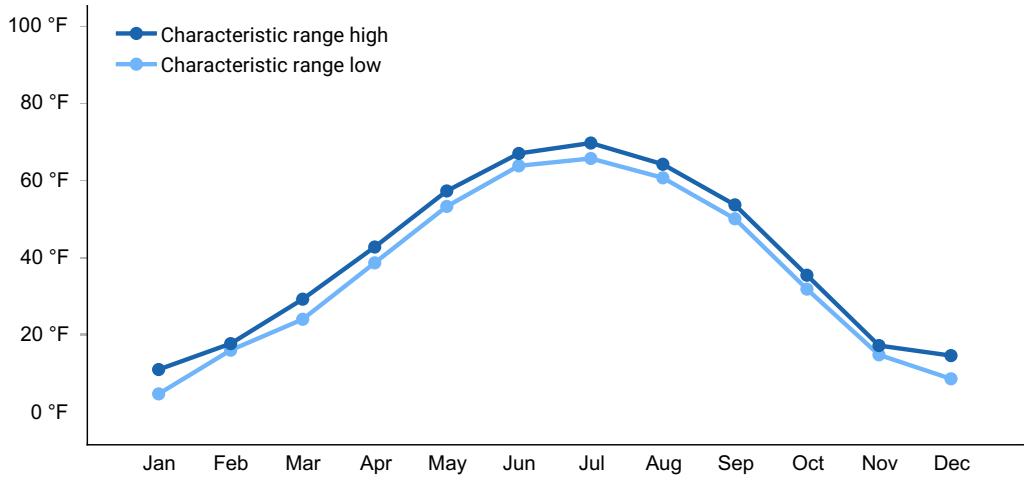


Figure 3. Monthly maximum temperature range

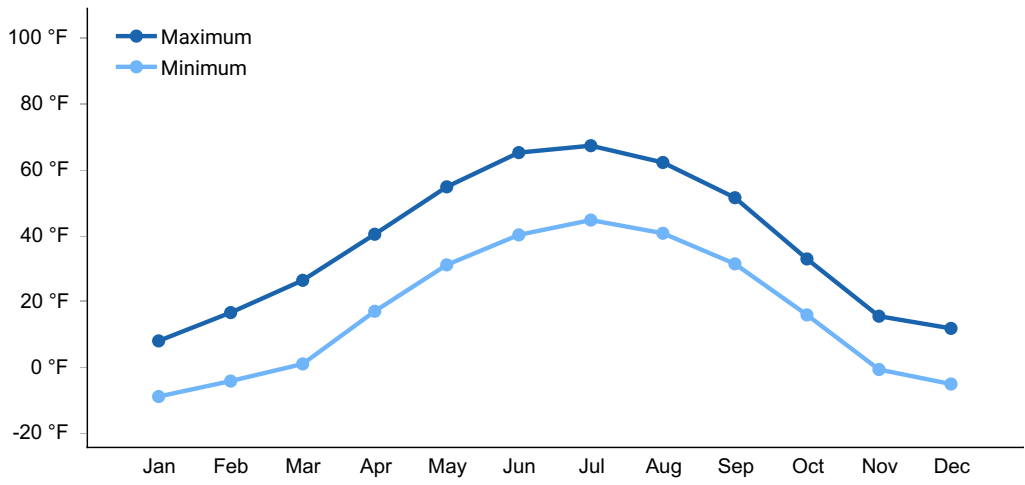


Figure 4. Monthly average minimum and maximum temperature

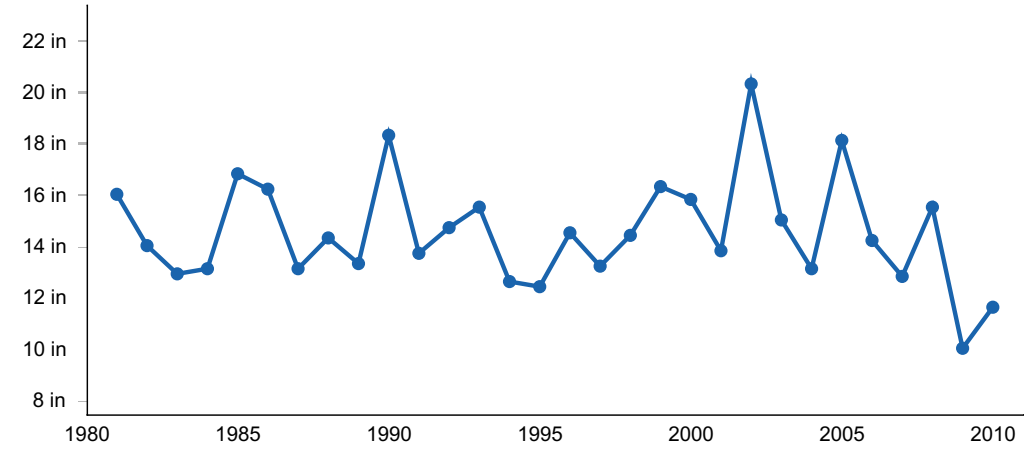


Figure 5. Annual precipitation pattern

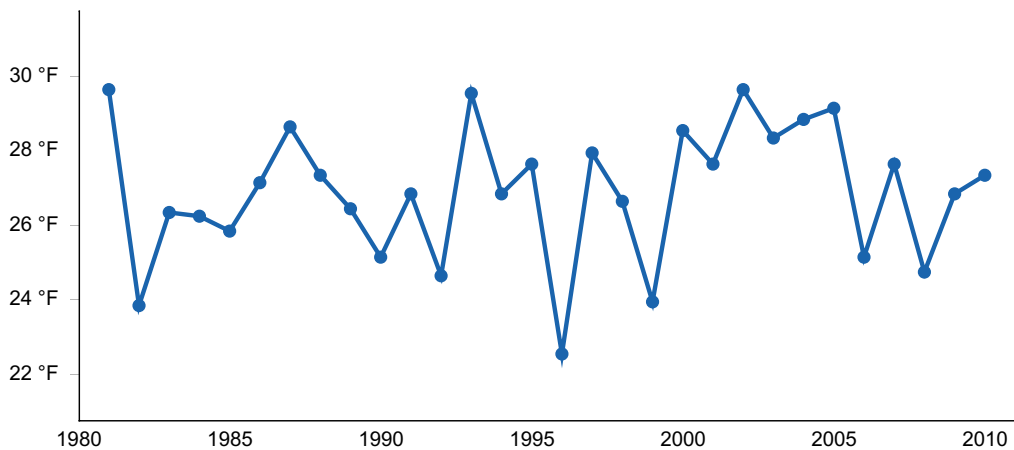


Figure 6. Annual average temperature pattern

Climate stations used

- (1) TONSINA [USC00509385], Copper Center, AK
- (2) NABESNA [USC00506147], Gakona, AK
- (3) PAXSON [USC00507097], Copper Center, AK
- (4) CANTWELL 2 E [USC00501243], Cantwell, AK
- (5) MCKINLEY PARK [USC00505778], Healy, AK
- (6) FAREWELL LAKE [USC00503009], Mc Grath, AK

Influencing water features

Due to topographic position, no water features or wetlands are associated with this site.

Wetland description

Not a wetland.

Soil features

Soils formed in organic material and loess over gravelly colluvium and glacial till. Surface fragments are not common, and surface textures are silt loams. The mineral soil is loamy-skeletal and restrictive layers commonly occur between 3 and 10 inches of the soil surface in the form of strongly contrasting textural stratifications and contact with bedrock. Soils are considered very shallow to shallow and pH ranges from acidic to slightly basic depending upon parent material minerology. Drainage class is rated as well drained.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Loess (3) Colluvium (4) Till
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Surface texture	(1) Silt loam
Drainage class	Well drained
Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	2–7 in
Soil depth	59–60 in
Surface fragment cover ≤3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-10in)	0.4–3.3 in
Calcium carbonate equivalent (0-40in)	0%
Clay content (0-20in)	5–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–3
Soil reaction (1:1 water) (0-40in)	4–7.6
Subsurface fragment volume ≤3" (0-60in)	0–45%
Subsurface fragment volume >3" (0-60in)	10–40%

Table 6. Representative soil features (actual values)

Drainage class	Well drained to excessively drained
Permeability class	Not specified
Depth to restrictive layer	1–79 in
Soil depth	33–79 in
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-10in)	0.2–3.4 in
Calcium carbonate equivalent (0-40in)	0–1%

Clay content (0-20in)	Not specified
Electrical conductivity (0-40in)	Not specified
Sodium adsorption ratio (0-40in)	Not specified
Soil reaction (1:1 water) (0-40in)	3.5–7.6
Subsurface fragment volume ≤3" (0-60in)	0–65%
Subsurface fragment volume >3" (0-60in)	0–70%

Ecological dynamics

Growing conditions

Located in the subalpine life zone, ecological site R228XY706AK is exposed to a variety of harsh conditions including high winds, persistent snowpack, and extremely cold temperatures. Persistent snowpack and cold temperatures reduce the growing season in the alpine, when compared to lower elevations. These harsh climate conditions result in dominance of scrub communities and limit tree growth and reproduction.

Disturbance

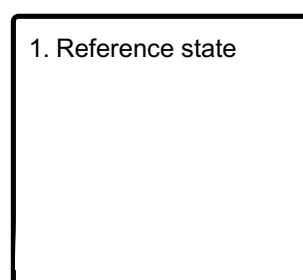
Although fire plays an important role in shaping plant communities across Alaska, fire frequency in high elevation communities is largely unstudied, when compared to interior forest stands. Most wildfires in Alaska are caused by lightning strikes which tend to occur near tree line, decreasing in frequency 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 scrub communities that accounts for diminished fire frequency (Kasischke et al. 2002, Dewild et al. 2006). Although fire is less frequent in subalpine and alpine zones, fire likely still plays a significant role in this ecological site, particularly in the lower elevations of the subalpine zone. Depending upon other exogenous factors, fire would likely burn quickly through areas of dense scrub cover and lessen in intensity as elevation increases and shrubs in the tall and medium strata give way to more diminished growth forms. In addition to fire, the disturbance regime in this community is likely also driven by avalanche, rockslides, and other mass movement events associated with eroding, unstable mountain slopes coupled with substantial snowfall.

Reference community 1.1

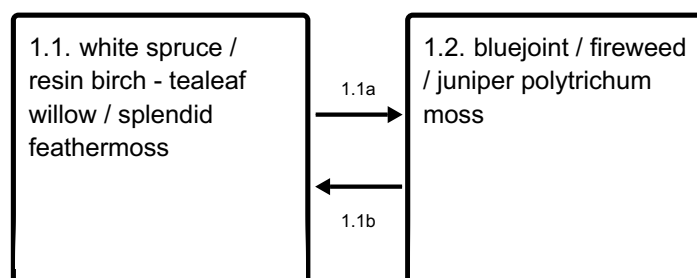
Field data suggests that a single reference state exists on this ecological site. The reference plant community (1.1) is characterized by an open tall shrub birch-willow scrub community (Viereck et al., 1992). Community 1.2 is an early successional fire-induced community dominated by herbaceous species that colonizes exposed mineral soil. Notable plant species include white spruce (*Picea glauca*), dwarf birch (*Betula nana*), tealeaf willow (*Salix pulchra*) (amongst other *Salix* species), black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), splendid feather moss (*Hylocomium splendens*), Schreber's big redstem moss (*Pleurozium schreberi*), fireweed (*Chamerion angustifolium*), bluejoint (*Calamagrostis canadensis*), and various lichen species.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1a - Fire

1.1b - Time without fire

State 1 Reference state

The reference community for ecological site R228XY706AK is characterized by an open tall shrub birch-willow plant community (Viereck et al., 1992). This site occurs on well-drained mountain slopes and glacial landforms in loamy-skeletal soils. White spruce can be found in scrublands and woodlands of this ecological site, but limitations based on subalpine climate prevent spruce from reaching full growth forms and proliferating into forested communities.

Dominant plant species

- white spruce (*Picea glauca*), tree
- resin birch (*Betula glandulosa*), shrub

- tealeaf willow (*Salix pulchra*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Community 1.1

white spruce / resin birch - tealeaf willow / splendid feathermoss

The reference plant community is dominated by shrub birch and various willow species. White spruce occurs in this community but rarely reached substantial cover to meet the woodland classification. In the low shrub stratum, bog blueberry and labrador tea dominate. Cover of feather mosses is generally high, and several lichen species are common.

Dominant plant species

- white spruce (*Picea glauca*), tree
- resin birch (*Betula glandulosa*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Community 1.2

bluejoint / fireweed / juniper polytrichum moss

Community 1.2 is an early-succession, fire-induced community and is characterized as a mesic forb herbaceous community (Vioreck et al., 1992). This herbaceous community pioneers freshly-exposed mineral soil. Eventually, shrubs begin to establish through resprouting or seeding. This community is comprised of low shrubs (less than 8 inches), medium forbs (4 to 24 inches), medium graminoids (4 to 24 inches) and mosses.

Dominant plant species

- tealeaf willow (*Salix pulchra*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fireweed (*Chamerion angustifolium*), other herbaceous
- juniper polytrichum moss (*Polytrichum juniperinum*), other herbaceous

Pathway 1.1a

Community 1.1 to 1.2

A fire burns much of the above ground vegetation and resets succession. This leaves exposed mineral soil to be colonized by seeding and resprouting.

Pathway 1.1b

Community 1.2 to 1.1

Time without fire allows woody vegetation to overtake forbs and graminoids. Willow and birch species proliferate and begin to dominate the scrub community.

Additional community tables

Inventory data references

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

Plant community composition is largely based on ecological sites from AK638: Soil Survey of Cantwell Area, Alaska.

References

Jorgensen, T. and D. Meidinger. 2015. The Alaska Yukon Region of the Circumboreal Vegetation map (CBVM). CAFF Strategies Series Report. Conservation of Arctic Flora and Fauna, Akureyri, Iceland..

Other references

Bernhardt, E.L., T.N. Hollingsworth. 2011. Fire severity mediates climate-driven shifts in understory community composition of black spruce stands of interior Alaska. *Journal of Vegetation Science* 22:32–44.

Chapin, F.S., L.A. Viereck, P.C. Adams, K.V. Cleve, C.L. Fastie, R.A. Ott, D. Mann, and J.F. Johnstone. 2006. Successional processes in the Alaskan boreal forest. Page 100 in *Alaska's changing boreal forest*. Oxford University Press.

Hinzman, L.D., L.A. Viereck, P.C. Adams, V.E. Romanovsky, and K. Yoshikawa. 2006. Climate and permafrost dynamics of the Alaskan boreal forest. *Alaska's changing boreal forest* 39–61.

I. H. Myers-Smith, J. W. Harden, M. Wilmking, C. C. Fuller, A. D. McGuire, and F. S. Chapin III. 2008. Wetland succession in a permafrost collapse: interactions between fire and thermokarst. *Biogeosciences* 5:1273–1286.

Johnstone, J.F., T.N. Hollingsworth, F.S. CHAPIN III, and M.C. Mack. 2010. Changes in fire regime break the legacy lock on successional trajectories in Alaskan boreal forest.

Global change biology 16:1281–1295.

Johnstone, J.F., F.S. Chapin, T.N. Hollingsworth, M.C. Mack, V. Romanovsky, and M. Turetsky. 2010. Fire, climate change, and forest resilience in interior Alaska. *Canadian Journal of Forest Research* 40:1302–1312.

Johnstone, J.F. 2008. A key for predicting postfire successional trajectories in black spruce stands of interior Alaska. US Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Kelly, R., M.L. Chipman, P.E. Higuera, I. Stefanova, L.B. Brubaker, and F.S. Hu. 2013. Recent burning of boreal forests exceeds fire regime limits of the past 10,000 years. *Proceedings of the National Academy of Sciences* 110:13055–13060.

LANDFIRE. 2009. Western North American Boreal Black Spruce Dwarf-tree Peatland – Boreal Complex. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

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

Smith, R.D., A.P. Ammann, C.C. Bartoldus, and M.M. Brinson. 1995. An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices.

United States Department of Agriculture. 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.

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.

Contributors

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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	12/19/2025
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:
