USDA Natural Resources
Conservation Service

Ecological site R228XY702AK
High elevation scrub complex floodplains and terraces

Last updated: 6/12/2025
Accessed: 03/16/2026

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): 228X–Interior Alaska Mountains

Physiography
The Interior Alaska Mountains Major Land Resources 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 minerology. 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 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 (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
mesic shrub birch-ericaceous low scrub (II.B.2.e – level IV)
(Viereck et al., 1992)

Circumboreal Vegetation Map – Alaska-Yukon Region:
Southern Alaska Alder-Willow-Dwarf Birch Scrub

(Jorgensen and Meidinger, 2015)

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

Ecological site concept

• Ecological site R228XY702AK is a willow-birch community complex that occurs on floodplains and terraces on mountain slopes and valleys
• Communities transition from a willow-dominated low floodplain community to a birch-dominated terrace community through a willow-birch scrub community as flooding frequency decreases
• Soil drainage is variable, but is mostly well drained
• Soils form in organic material and silty aeolian deposits over alluvium
• Elevations range from 1650 to 4330 feet
• Vegetation is influenced by harsh climate, short growing season, persistent snowpack, and flooding
• The representative plant community (1.1) which is characterized by a mesic birch-ericaceous low scrub community (Viereck et al., 1992)

Associated sites

R228XY711AK	**High elevation scrub drainageways** Ecological site R228XY711AK is a high elevation scrub community that occurs in drainages adjacent to ecological site R228XY702AK.

Similar sites

R228XY706AK	**White spruce/willow-birch scrub dry slopes** Ecological site R228XY706AK occurs adjacent to floodplains and terraces on mountain slopes and supports a similar willow-birch scrub community that closely resembles the reference plant community of ecological site R228XY702AK.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Betula glandulosa* (2) *Salix pulchra*
Herbaceous	(1) *Hylocomium splendens* (2) *Pleurozium schreberi*

Physiographic features

Ecological site R228XY102AK occurs at high elevation on floodplains and river terraces in the alpine and subalpine life zones. This site is associated with mountain slopes, valleys, alluvial fans, and outwash plains. Elevation ranges from 1650 to 4330 feet above sea level on slopes ranging 0 to 26 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Stream terrace (2) Mountains > Flood plain
Runoff class	Very low to medium
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	503–1,320 m
Slope	0–26%
Water table depth	0–152 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	503–1,975 m
Slope	0–35%
Water table depth	Not specified

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
Freeze-free period (characteristic range)	63-77 days
Precipitation total (characteristic range)	305-432 mm
Frost-free period (actual range)	1-41 days
Freeze-free period (actual range)	50-84 days
Precipitation total (actual range)	305-457 mm
Frost-free period (average)	17 days
Freeze-free period (average)	69 days
Precipitation total (average)	381 mm

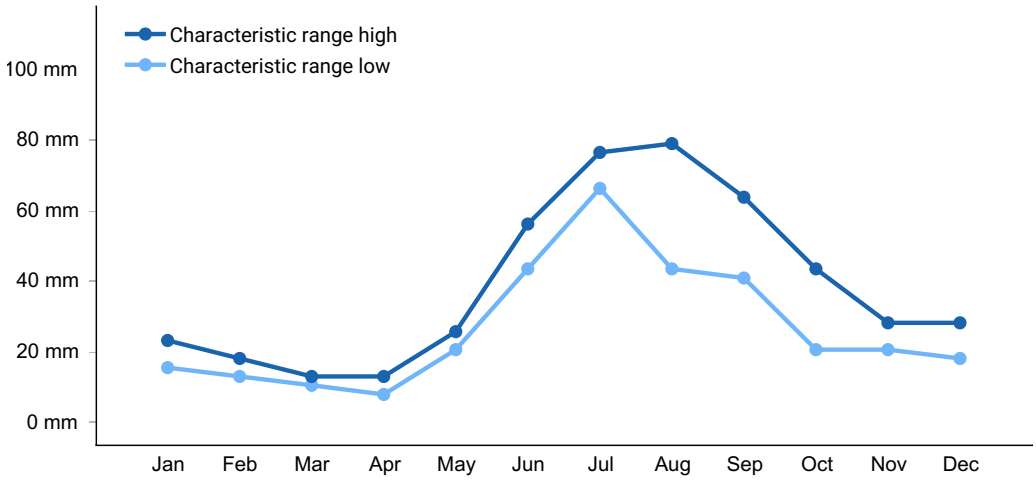


Figure 1. Monthly precipitation range

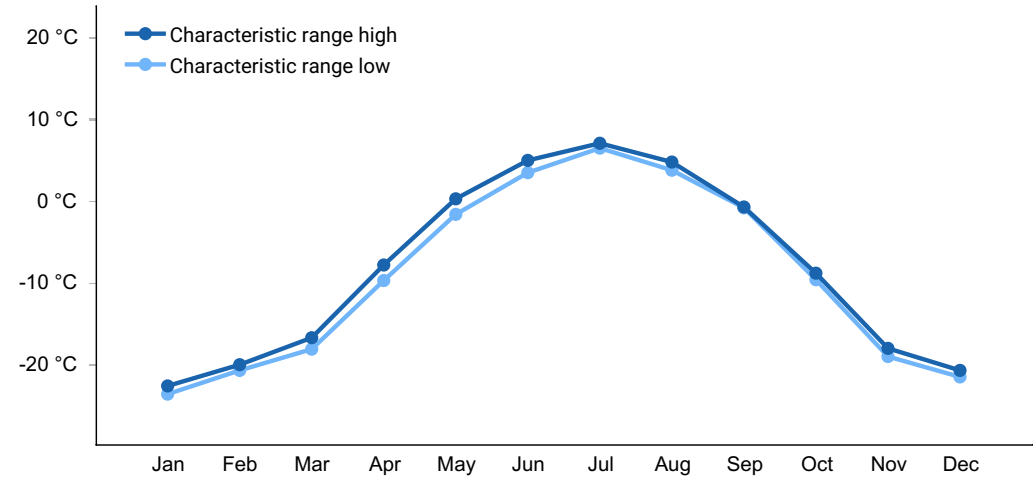


Figure 2. Monthly minimum temperature range

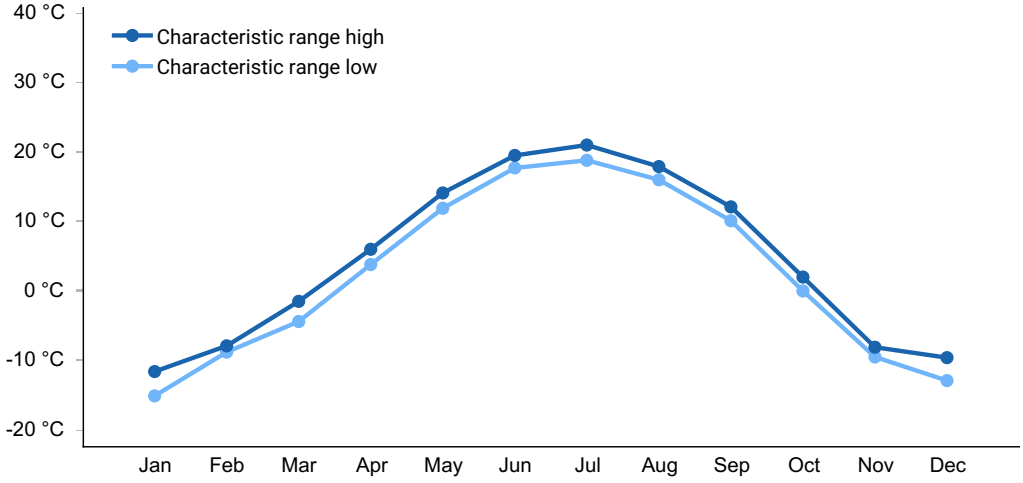


Figure 3. Monthly maximum temperature range

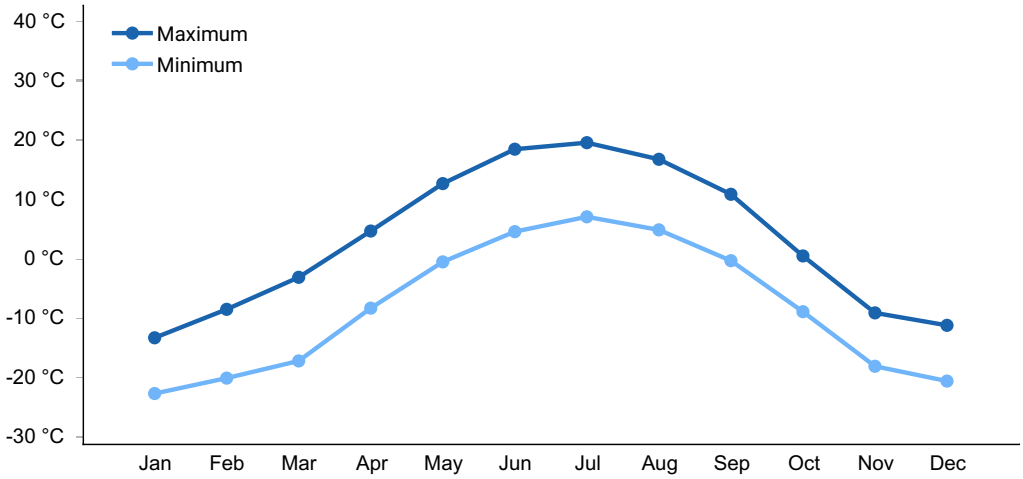


Figure 4. Monthly average minimum and maximum temperature

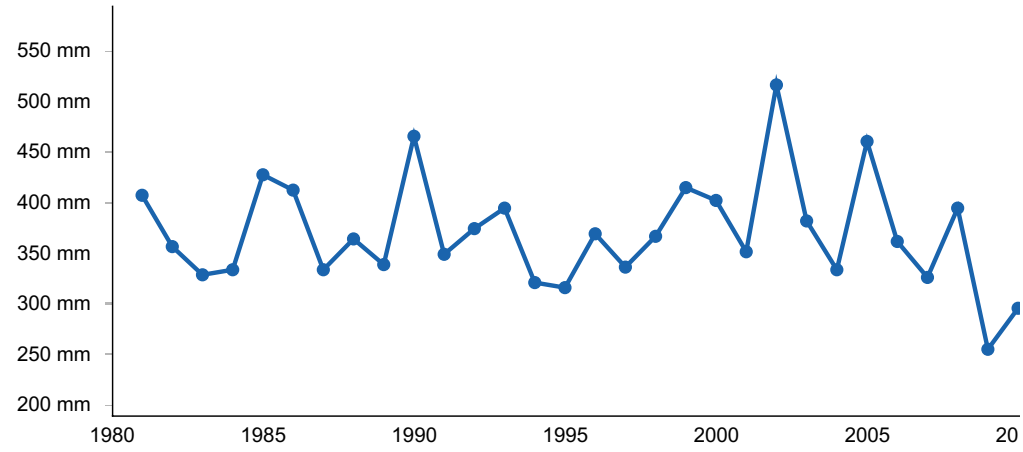


Figure 5. Annual precipitation pattern

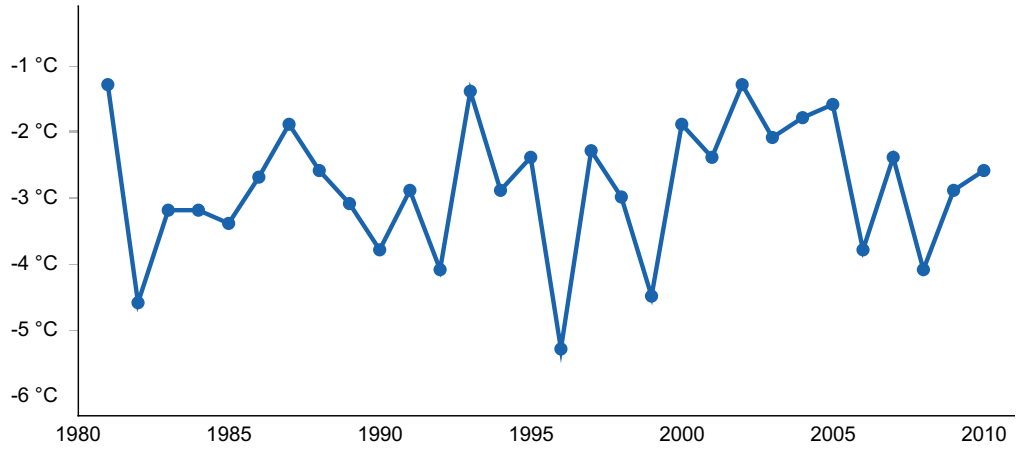


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

This ecological site is associated with stream terraces and floodplains. Soils are mostly well drained and are not influenced by a water table.

Soil features

The soils of ecological site R228XY702AK formed in organic material and loess over alluvium. Surface fragments are not common, but when present, do not exceed 5 percent cover. Surface textures are loams and silt loams. The mineral soil is considered coarse-loamy and sandy-skeletal and forms in windblown aeolian silt and alluvium deposits. Restrictive layers in the form of strongly contrasting textural stratification are variable in depth, but occur within 38 inches of the soil surface. Despite these restrictions, soils are considered very deep. Soil pH ranges from strongly acidic to basic, depending on parent material orogeny. Drainage class is generally well drained, but drainage is variable and can reach very poorly drained in some instances.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Loess (3) Alluvium

Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Coarse-loamy (2) Sandy-skeletal
Drainage class	Well drained
Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	5–97 cm
Soil depth	152 cm
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0–5%
Available water capacity (0-25.4cm)	0.76–10.41 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Clay content (0-50.8cm)	2–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	3.8–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–60%
Subsurface fragment volume >3" (0-152.4cm)	0–30%

Table 6. Representative soil features (actual values)

Drainage class	Well drained to very poorly drained
Permeability class	Not specified
Depth to restrictive layer	5–132 cm
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-25.4cm)	0.51–14.48 cm

Calcium carbonate equivalent (0-101.6cm)	Not specified
Clay content (0-50.8cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	0–72%
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

Growing conditions

Located in the subalpine and alpine life zones, ecological site R228XY102AK 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 stunted vegetative growth forms, inhibiting growth of tree species and causing shrubby vegetation to be dwarf-like in stature.

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). The disturbance regime at high elevation is likely driven by avalanche, rockslides, and other mass movement events associated with eroding, unstable mountain slopes coupled with substantial snowfall.

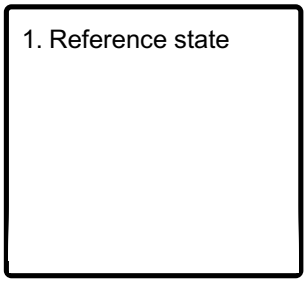
This ecological site occurs on floodplains and stream terraces, and although uncommon, flooding is the dominant disturbance mechanism on this site. This ecological site complex was created to capture the high level of variation in flood frequency and corresponding vegetation communities that occur as distance from drainageways increase from low to high floodplain to the surrounding terraces. It is this high level of variation in over small

distance that is responsible for a wide range of drainage classes and flooding frequency.

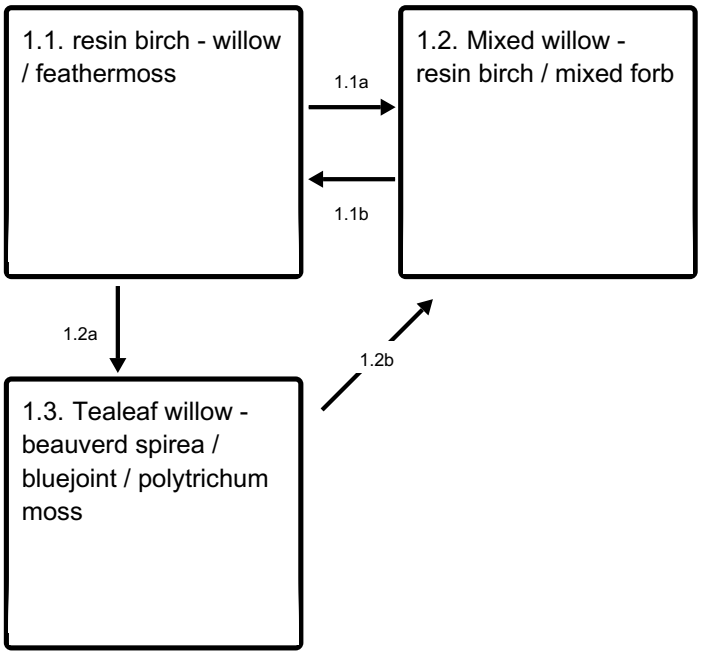
Field data suggests that plant communities for this ecological site move along a continuum as distance from drainageways, the source of disturbance, increases. The representative plant community for low flood plains, the community in closest proximity to drainageways (community 1.3), is characterized by a closed, low willow scrub community (Viereck et al., 1992). The representative community on stream terraces, furthest from the source of disturbance (community 1.1), is characterized by a mesic shrub birch-ericaceous low scrub community (Viereck et al., 1992). As flooding decreases in frequency, communities transition from being willow-dominated to being birch-dominated. Along this continuum, on mid to high floodplains, a shrub birch-willow low scrub community (community 1.2) (Viereck et al., 1992) can be found. Notable species include tealeaf willow (*Salix pulchra*), feltleaf willow (*Salix alaxensis*), Barclay's willow (*Salix barclayi*), Sitka willow (*Salix sitchensis*), grayleaf willow (*Salix glauca*), resin birch (*Betula glandulosa*), bog blueberry (*Vaccinium uliginosum*), and bog Labrador tea (*Ledum groenlandicum*).

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1a - Moderate Flood

1.2a - Severe Flood

1.1b - Time without flooding
1.2b - Time without flooding

State 1
Reference state

The reference state of ecological site R228XY702AK is characterized by a complex of plant communities. The reference community (1.1) is oriented with floodplain terraces, which no longer flood or flood on extremely rare occasions and is characterized as a mesic birch/ericaceous scrub community. Community 1.3 is associated with low, active flood plains and is characterized by a low willow scrub community. As distance from drainageways increases, flooding decreases and community 1.3 transitions to a birch-willow low scrub community (1.2). This mid-sere, transitional community occurs on mid to high floodplains. Once flooding no longer occurs, birch becomes more competitive and eventually out-competes willow. At this point, the reference community (1.1) has reached its climax and closely resembles the surrounding birch/dwarf ericaceous scrub subalpine community that occurs on mountain slopes. In instances in the true alpine, birch will disappear giving way to a greater variety of dwarf ericaceous shrubs and lichen.

Dominant plant species

- resin birch (*Betula glandulosa*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Community 1.1
resin birch - willow / feathermoss

This is a birch-dominated community that occurs on stream terraces, furthest from drainageways and associated disturbance. The transition from this community to the commonly occurring subalpine birch/dwarf ericaceous scrub community (R228XY706AK) will be almost indistinguishable in community composition due to adjacent seed source and removal of disturbance.

Dominant plant species

- resin birch (*Betula glandulosa*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- Altai fescue (*Festuca altaica*), grass

- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- polytrichum moss (*Polytrichum commune*), other herbaceous
- reindeer lichen (*Cladina*), other herbaceous

Community 1.2
Mixed willow - resin birch / mixed forb

This community occurs on mid to high floodplains as the willow-dominated community on low floodplains transitions to a birch-dominated terrace community. This transition occurs as flood frequency is reduced or removed, and birch becomes more competitive. Over time, birch will replace willow entirely, but the mid-sere community composition includes a mix of willow and birch.

Dominant plant species

- feltleaf willow (*Salix alaxensis*), shrub
- Barclay's willow (*Salix barclayi*), shrub
- Sitka willow (*Salix sitchensis*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- resin birch (*Betula glandulosa*), shrub
- undergreen willow (*Salix commutata*), shrub
- yellow thimbleweed (*Anemone richardsonii*), other herbaceous
- creeping sibbaldia (*Sibbaldia procumbens*), other herbaceous
- Moss (*Moss*), other herbaceous

Community 1.3
Tealeaf willow - beauverd spirea / bluejoint / polytrichum moss

Community 1.3 is characterized as a closed low willow scrub community and occurs on low floodplains. This community is dominated by an active flooding frequency as it is the closest community to active drainageways. Over time, if flooding frequency decreases, birch will start to become more competitive with willow. At this time, a transition from community 1.3 to community 1.2 has occurred.

Dominant plant species

- tealeaf willow (*Salix pulchra*), shrub
- Barclay's willow (*Salix barclayi*), shrub
- feltleaf willow (*Salix alaxensis*), shrub
- beauverd spirea (*Spiraea stevenii*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- arctic raspberry (*Rubus arcticus*), other herbaceous
- yellow thimbleweed (*Anemone richardsonii*), other herbaceous
- polytrichum moss (*Polytrichum commune*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.2

A moderate flood occurs, removing woody vegetation.

Pathway 1.2a
Community 1.1 to 1.3

A severe flood occurs, removing vegetation and resetting succession.

Pathway 1.1b
Community 1.2 to 1.1

Time without flooding. Birch establishment begins to compete with willow, creating a scrub community that is birch-dominated.

Pathway 1.2b
Community 1.3 to 1.2

Time without flooding. Willow seedlings become established and out-compete herbaceous species. Willow dominates while birch begins to establish.

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.

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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	03/16/2026
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:**

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

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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):**

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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:**
