Ecological site F234XY712AK
Boreal forest silty wet slopes

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 234X–Interior Brooks Range Mountains

Geography The Interior Brooks Range mountains area consists of predominantly steep, jagged mountains and narrow valleys that drain the southern side of the Brooks Range. This area is bordered by the Northern Brooks Range Mountains (Major Land Resource Area (MLRA) 244) to the north, the Western Brooks Range Mountains Foothills and Valleys (MLRA 243) to the west, and the Upper Kobuk and Koyukuk Hills and Valleys (MLRA 233) and the Interior Alaska Highlands (MLRA 231) to the south. The Brooks Range represents a drainage divide that is also the dividing line between MLRA 234 and MLRA 244. Rivers draining to the north wind their way along the North Slope until they reach the Arctic Ocean, while rivers that drain to the south reach the northern Pacific Ocean via the Bering Sea. MLRA 234 covers an area of 22,479 miles and is sparsely populated (USDA, 2022) Geology The Brooks Range is the northernmost extension of the Rocky Mountains and the highest range within the Arctic Circle, with high peaks in the eastern part of the range reaching elevations of nearly 9,000 feet. This area falls within the zone of discontinuous permafrost, with the continuous permafrost zone primarily occurring north of the Brooks Range. Wide, U-shaped valleys are evidence of extensive glaciation in the Early and Mid-Pleistocene, with most glaciers retreating to their current, high-elevation positions by the Late Pleistocene. The characteristically sharp upper peaks give way to lower mountain slopes comprised of alluvial and colluvial fans before reaching the gently sloping flood plains and terraces of the valley bottoms. While Paleozoic and Jurassic igneous and volcanic rocks can be found in the eastern part of the range, most of the lower slopes of this area are comprised of modified glacial material, alluvial, and colluvial deposits. Many rivers and streams, such as the Koyukuk, have their headwaters in the Brooks Range and drain to the Bering Sea and North Pacific Ocean via the Yukon River. Soils The dominant soils orders in this MLRA are Gelisols, Entisols, and Inceptisols. Soils in the area have a gelic (subgelic) or cryic temperature regime, a udic or aquic moisture regime, and mixed minerology. Gelisols are common on soils that are shallow or moderately deep to permafrost and are somewhat poorly to very poorly drained. Gelisols are more common on cold slopes and stream terraces. In some cases, higher-intensity wildfires lead to loss of insulation when the surface organic layer is burned. This can lead to permafrost loss or active layer expansion and ultimately alter hydrology and taxonomic classification. Entisols and Inceptisols lacking in permafrost range from excessively-well to poorly drained. Entisols and Inceptisols are more common on rocky terrain, warm boreal slopes, and flood plains. Miscellaneous areas such as glaciers, riverwash, rock outcrop, and rubble land make up 63 percent of the MLRA. Vegetation The continental subarctic climate of the Brooks Range in conjunction with shallow, rocky soils leads to a sparsely forested landscape in this MLRA. Spruce-hardwood forests and woodlands tend to be relegated to lower elevations where deeper soils form on foot slopes and terraces. This is contrasted by the ericaceous dwarf shrub communities that are abundant on shallow, rocky slopes and ridges. Exposed sites are predominantly covered in lichen and sporadic forbs. Black spruce (Picea mariana) woodlands and tussock-forming sedge communities are on high stream terraces and foot slopes where permafrost occurs, as are wet sedge meadows. Floodplains tend to be dominated by low to tall willow scrub communities. Land use Except for areas along the Dalton Highway, access to most of this MLRA is extremely limited, lending itself to intact natural vegetation communities. For this reason, land use primarily takes the form of subsistence hunting, gathering, and fishing by local communities. In additions to subsistence activity, the Brooks Range is also a popular recreation destination, with many users utilizing air taxi and guiding services to access remote parts of the area. As is the case with much of interior Alaska, major resource concerns involve the persistence of permafrost, the degradation of which can lead to various changes in hydrology and nutrient cycling.

LRU notes

This area supports three life zones defined by the physiological limits of plant communities along an elevational gradient: boreal, subalpine, and alpine. The boreal life zone is the elevational band where forest communities dominate. Not all areas in the boreal life zone are forest communities, however, particularly in places where soil is too wet or dry to support tree growth (e.g., bogs or river bluffs). Above the boreal band of elevation, subalpine and alpine vegetation dominate. The subalpine zone is typically a narrow transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. In the subalpine, certain types of birch and willow shrub species grow at taller than one meter in height (commonly resin birch (Betula glandulosa) and tealeaf willow (Salix pulchra)). In the alpine, trees no longer occur, and all shrubs are dwarf or lay prostrate on the ground. In this area, the boreal life zone occurs below

2,500 feet elevation on average. The transition between boreal and alpine vegetation can occur within a range of elevations, and is highly dependent on slope, aspect, and shading from adjacent mountains. Within each life zone, there are plant assemblages that are typically associated with cold slopes and warms slopes. Cold slopes and warm slopes are created by the combination of the steepness of the slope, the aspect, and shading from surrounding ridges and mountains. Warm slope positions typically occur on southeast to west facing slopes that are moderate to very steep (greater than ten 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. Warm boreal slope soils have a cryic soil temperature regime and lack permafrost. In this area, white spruce (Picea glauca) forests are an indicator of warm boreal slopes. Cold boreal slope soils typically have a gelic soil temperature regime and commonly have permafrost. In this area, black spruce forests and woodlands are an indicator of cold boreal slopes. The boreal life zone can occur at higher elevations on warm slopes, and lower elevations on cold slopes.

Classification relationships

Alaska Vegetation Classification Open needleleaf black spruce-white spruce forest (I.A.2.g – level IV) (Viereck et al. 1992) Circumboreal Vegetation Map – Alaska-Yukon Region Southern Alaska Spruce-Birch-Herb Forests (Jorgensen and Meidinger, 2015) LANDFIRE Biophysical Settings 7416041 – Western North American Boreal Mesic Black Spruce forest (LANDFIRE biophysical settings, 2009)

Ecological site concept

Key soil and site characteristics • Occurs in the boreal life zone typically at elevations below 2,310 feet • Slopes range 4 to 12 percent • A shallow water table persists throughout the growing season and influences plant community dynamics • The reference plant community is characterized by a black spruce- white spruce needleleaf woodland (Viereck et al. 1992)

Associated sites

F234XY711AK	**Boreal forest gravelly steep slopes** Ecological site F234XY711 occurs adjacent to this ecological site on well-drained soils that lack a seasonal water table.

Similar sites

F234XY711AK	**Boreal forest gravelly steep slopes** Ecological site F234XY711AK supports a plant community that is also dominated by spruce, but lacks the influence of black spruce (Picea mariana) in the overstory. This ecological site is considered well-drained, but experiences similar disturbance and successive processes.

Table 1. Dominant plant species

Tree	(1) *Picea mariana* (2) *Picea glauca*
Shrub	(1) *Betula glandulosa* (2) *Ledum groenlandicum*
Herbaceous	(1) *Calamagrostis canadensis*

Physiographic features

Ecological site R234XY712AK occurs on hills and mountain slopes in the boreal zone. Elevation ranges from 890 to 2,310 feet on slopes between 4 and 12 percent. A persistent seasonal water table is associated with this site and influences plant community dynamics.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Hillslope (2) Mountains > Mountain slope
Runoff class	Very low
Flooding frequency	None
Ponding frequency	None
Elevation	270 – 700 m
Slope	0 – 10 %
Water table depth	0 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Characterized by a continental subarctic climate; cool, short summers interspace long, cool winters in this Major Land Resource Area (MLRA). Average annual temperatures range from 8 to 16 degrees, with freezing temperatures possible throughout the year. Precipitation ranges from 10 inches at low elevations up to 30 inches in the high elevations, with average snowfall ranging from 60 to 100 inches, annually. On average, there are only four frost free days per year at lower elevations, with frost possible throughout the year at higher elevations. The average high temperature in July (the warmest month, on average) is 65 degrees F, while the average high temperature in January is -1 degrees F. Extreme lows are common throughout interior Alaska. The lowest temperature recorded in Bettles Field, the location of one of the weather stations below, reached -69 degrees F.

Table 3 Representative climatic features

Frost-free period (characteristic range)	0-0 days
Freeze-free period (characteristic range)	50-60 days
Precipitation total (characteristic range)	250-360 mm
Frost-free period (actual range)	0-0 days
Freeze-free period (actual range)	50-60 days
Precipitation total (actual range)	230-360 mm
Frost-free period (average)	0 days

Freeze-free period (average)	50 days
Precipitation total (average)	310 mm

- (1) WISEMAN [USC00509869], Bettles Field, AK
- (2) CHANDALAR SHELF DOT [USC00501497], Southerly North Slope Bo, AK
- (3) CHANDALAR LAKE [USC00501492], Yukon Flats Nat Wildlife, AK

Influencing water features

This ecological site is associated with a shallow water table that persists throughout the growing season and influences plant community dynamics.

Soil features

Soils formed in organic material and loess over gravelly glacial till and do not have permafrost. Surface fragments are not common, and surface textures are silt loams. The mineral soil is considered coarse-loamy, and a restrictive layer occurs between 15 and 21 inches in the form of a strongly contrasting textural stratification. Despite restriction, soils are considered very deep and are poorly drained. Soil pH ranges from very strongly acidic to slightly acidic.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Loess (3) Till
Surface texture	(1) Silt loam
Family particle size	(1) Coarse-loamy
Drainage class	Poorly drained
Permeability class	Very rapid
Depth to restrictive layer	40 – 50 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-101.6cm)	9.91 – 20.57 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Clay content (0-101.6cm)	10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	4.9 – 6.5
Subsurface fragment volume <=3" (0-101.6cm)	20 – 30 %
Subsurface fragment volume >3" (0-101.6cm)	10 %

Table 5. 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 (0-101.6cm)	Not specified
Calcium carbonate equivalent (0-101.6cm)	Not specified
Clay content (0-101.6cm)	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" (0-101.6cm)	20 – 40 %
Subsurface fragment volume >3" (0-101.6cm)	10 – 20 %

Ecological dynamics

In interior Alaska, fire is a common and natural event that has a significant control on the vegetation dynamics across the landscape. A typical fire event in the lands associated with this ecological site will reset plant succession and alter dynamic soil properties (e.g., thickness of the organic material). For this ecological site to progress from the earliest stages of post-fire succession dominated by grasses and forbs to the oldest stages of succession dominated by white spruce forests, data suggest that 150 years or more must elapse without another fire event (Foot, 1982; Chapin et al., 2006; Landfire, 2009).

Within this area, fire is considered a natural and common event that typically is unmanaged. Fire suppression is limited and generally occurs adjacent to the various villages spread throughout the area or on allotments with known structures, all of which have a relatively limited acre footprint. Most fires are caused by lightning strikes.

The fire regime within Interior Alaska follows two basic scenarios—low-severity burns, and high-severity burns. It should be noted, however, that the fire regime in interior Alaska is generally thought to be much more complex (Johnstone et al. 2008). Burn severity refers to the proportion of the vegetative canopy and organic material consumed in a fire event (Chapin et al. 2006). Fires in cool and moist habitat tend to result in low-severity burns, while fires in warm and dry habitat tend to result in high-severity burns. Because the soils have a thin organic cap and are well drained, the typical fire scenario for this ecological site is considered to result in a high severity burn.

Large portions of the organic mat are consumed during a high-severity fire event, commonly exposing pockets of mineral soil. The loss of this organic mat, which insulates the mineral soil, and the decrease in site albedo tends to cause overall soil temperatures to increase (Hinzman et al. 2006). These alterations to soil temperature may result in increased depths of seasonal frost in the soil profile. High-severity fire events also destroy a majority of the vascular and nonvascular biomass above ground.

Literature and field data from similar sites suggest that each of the forested community phases will burn and that fire events will cause a transition to the pioneering stage of fire succession. The pioneering stage (community 1.5) is dominated by herbaceous species including bluejoint (Calamagrostis canadensis), fireweed (Chamerion angustifolium), and horsetail (Equisetum). Following the pioneering stage, shrubby vegetation begins to dominate. This community (1.4) includes several species of willow (Salix), dwarf birch (Betula nana), labrador tea (Ledum), and prickly rose (Rosa acicularis). This community persists for roughly 30 years before tree species begin to colonize the site. Community 1.3 is comprised of mixed spruce-hardwood overstory species such as Betula papyrifera, Populus tremuloides, Picea mariana, and Picea glauca. Eventually hardwood becomes less dominant in the overstory, being replaced by an open needleleaf community (1.2) comprised of Picea mariana, Picea glauca, Betula nana, and Ledum. This process occurs within 30-120 years of disturbance.

The reference community (1.1) is characterized by a black spruce- white spruce needleleaf woodland (Viereck et al., 1992) comprised of Picea mariana, Picea glauca, Betula nana, and Ledum. This occurs 120+ years following disturbance. Occasionally, hardwoods remain in the overstory but are less dominant by this stage. Given the mean fire return interval of this site is around 130 years, this community should reset shortly after reaching this reference community (LANDFIRE, 2009).

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

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

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Contributors

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Approval

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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	11/01/2026
Approved by	
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:

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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:**
