

Ecological site F230XY614AK

Boreal Black Spruce Unfrozen Well Drained Slopes

Last updated: 6/11/2025
Accessed: 10/03/2026

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): 230X–Yukon-Kuskokwim Highlands

TMLRA notes The Yukon-Kuskokwim Highlands (MLRA 230X) include the most western parts of Interior Alaska (Land Resource Region X2) and have a continental climate. MLRA 230X is approximately 42,300 square miles spread across mountain, hills, and valleys. Flood plain systems are common. The watershed drains into the Bering Sea to the west and Bristol Bay to the southwest. Major rivers include the Yukon, Innoko, Kuskokwim, Mulchatna, and Nushagak Rivers. This sparsely populated area is mostly undeveloped wildland. Residents use this remote area primarily for subsistence hunting, fishing, and gathering. Villages are primarily located along rivers along the MLRA 230X boundary and include Greyling, Nulato, and Koyukuk. Federally managed lands in the MLRA include parts of Innoko, Nowitna, and Koyukuk National Wildlife Refuges. **Geology and Soils** The Yukon-Kuskokwim Highlands MLRA was mostly unglaciated during the Pleistocene. Glaciers were limited to the Lime Hills in the southeast. Glacial moraines and drift are evident in areas of past glacial activity. Unglaciated upland areas are covered with colluvium and slope alluvium originating from bedrock. Loess deposits cover gentle sloping hills and footslopes of mountains near major rivers. Bedrock material is primarily sedimentary rocks with intrusive volcanic rock (USDA, 2022). This MLRA is in the zone of discontinuous permafrost. Permafrost is most common in finely textured soils on terraces, gently sloping hills, and cold mountain footslopes. It is typically absent from flood plains and mountain backslopes. Across the MLRA, permafrost presence decreases as proximity to the Yukon-Kuskokwim delta increases. The dominant soil orders are Gelisols, Entisols, Inceptisols, and Spodosols. Gelisols support shallow to deep permafrost and often have a perched water table for at least part of the growing season. Inceptisols, Spodosols, and Entisols lack permafrost. Two important factors that prevent permafrost aggradation are groundwater connectivity and thick bands of sandy and/or gravelly soil horizons. Inceptisols have minimal development and are common on alpine scrublands and high flood plains. Entisols are common on mountain backslopes and scoured flood plains. Spodosols support a spodic soil horizon and are common in the acidic soils underlying spruce forests and ericaceous shrublands. Non-soil areas such as rock outcrops, rubble lands and beaches make up approximately ten percent of the MLRA surface. **Climate** The Yukon-Kuskokwim Highlands MLRA has short, warm summers and cold, long winters. Mean annual precipitation is 10 to 15 inches at low elevations and increases to 20 to 40 inches at higher elevations (USDA, 2022). Annual snowfall is between 80 and 100 inches. Mean annual temperatures ranges from 25 to 32 degrees F (SNAP, 2014a; SNAP, 2014b). **Vegetation** Vegetation is mainly influenced by site and soil characteristics such as temperature-degree days, exposure, soil depth, and soil hydrology. Dwarf scrublands are prevalent on shallow soils on convex slopes and in the alpine. Mesic, lowland slopes are a mix of forests and shrublands of alder, willow, and ericaceous shrubs. Cold slopes generally support black spruce, while warm slopes support white spruce. Valley bottoms and steep slopes support a deciduous forest. Tussock tundra is associated with wet soils underlain by shallow permafrost and is ubiquitous across the lower footslopes of mountains and the coastal plain (USDA, 2022). **Fire** Fire is a major disturbance across the Yukon-Kuskokwim Highlands. Low severity fires destroy the canopy but leave the organic mat and rootstock mostly undisturbed. The vegetative community progresses directly back to a forest. Severe forest fires are stand replacement events. Post-fire communities typically pass through an herbaceous meadow community before ericaceous shrubs, birch, and willows colonize. Drier soils may support a deciduous aspen or birch forest, while moist soils support cottonwoods and spruce. On all forest and woodland ecological sites, post-fire succession leads to a relatively rapid accumulation of organic matter and mosses on the surface. This accumulation results in decreases in soil temperature, biologic activity, and nutrient availability and a gradual decrease in site productivity.

LRU notes

MLRA 230X contains three life zones defined by the physiological limits of plant communities along an elevational gradient. The boreal life zone is the elevational band where forest communities dominate. Non-forested areas in the boreal life zone are often hydrologically driven, and are either too wet (i.e., bogs) or too dry (i.e., river bluffs) to support forest communities. Subalpine and alpine vegetation dominates at higher elevations. The subalpine zone is a transitional band between the boreal and the alpine life zones, and is characterized by sparse, stunted trees. Shrub height can be over four feet. Trees are absent from the alpine, and all shrubs are dwarf or prostrate. In general, the boreal life zone occurs below 1,200 feet of elevation. Within each life zone, there are plant assemblages associated with cold and warm slopes. Slope temperature is a factor of slope steepness, aspect, and shading from surrounding ridges

and mountains. Warm slopes occur on southeast to west aspects that are moderate to very steep and are not shaded by the surrounding landscape. Cold slopes 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 slopes have a cryic soil temperature regime and lack permafrost. White spruce forests are an indicator of warm boreal slopes. Cold boreal slope soils 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.

Classification relationships

Alaska Vegetation Classification: Needleleaf woodland (I.A.3 - level III) / Black spruce woodland (I.A.3.d - level IV) (Vioreck et al., 1992)
Circumboreal Vegetation Map: Western North American Boreal Mesic Black Spruce Forest - Boreal (Jorgensen and Meidinger, 2015)
BioPhysical Settings: 7316041 – Western North American Boreal Mesic Black Spruce Forest - Boreal (Landfire, 2009)

Ecological site concept

Ecological Site characteristics: • Occurs on cold slopes and terraces • Soils are very deep. Permafrost and lithologic discontinuities may be present. • Soils formed in loess and/or colluvium and are capped with organic horizons greater than six inches thick • Soils do not pond or flood. These well drained soils have water table at deep depth only when permafrost is present. • The reference plant community is a black spruce forest with medium and low shrubs, graminoids and mosses dominating the understory • Fire is the major disturbance in this ecological site and is responsible for four communities.

Associated sites

F230XY611AK	Boreal Forest Loamy Frozen Slopes Ecological site F230XY611AK describes black spruce forests on poorly drained soils with permafrost. This ecological site occurs on well drained soils, which are usually on steeper, upslope positions.
F230XY612AK	Boreal Forest Loamy Slopes Ecological site F230XY612AK describes white spruce forest on warm slopes. This ecological site occurs on adjacent cold slopes, which are usually on north facing slopes or in shaded valleys.
F230XY615AK	Boreal Deciduous Forest Loamy Steep Slopes Ecological site F230XY615AK occurs on adjacent slopes that are much steeper and are associated with paper birch forests.

Similar sites

F230XY611AK	Boreal Forest Loamy Frozen Slopes F230XY614AK and F230XY611AK both support black spruce forests. F230XY611AK is distinguished by poorly drained soils with permafrost which influences the vegetative community and fire dynamics.
F230XY615AK	Boreal Deciduous Forest Loamy Steep Slopes F230XY615AK describes a paper birch forest on steep slopes. This ecological site can support a hardwood forest community as a post-fire successional plant community.

Table 1. Dominant plant species

Tree	(1) <i>Picea mariana</i>
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Shrub	(1) <i>Betula nana</i> (2) <i>Ledum palustre ssp. decumbens</i>
Herbaceous	(1) <i>Carex bigelowii</i> (2) <i>Equisetum sylvaticum</i>

Physiographic features

- This boreal ecological site occurs on cool slopes of river terraces treads and the backslopes and shoulders of hills and mountains.
- Elevation typically ranges between 100 and 1200 feet
- Slope gradients are gently sloping to steep (1 to 45 percent)
- This ecological site occurs on cool slopes. These locations are on north-facing slopes and slopes shaded by adjacent hills and mountains. Shaded river valley terraces on all aspects also support this ecological site.
- Flooding and ponding do not occur. A water table is generally absent or is very deep during the growing season.

Table 2. Representative physiographic features

Slope shape across	(1) Linear (2) Convex
Slope shape up-down	(1) Linear (2) Convex
Hillslope profile	(1) Backslope (2) Shoulder (3) Summit
Geomorphic position, terraces	(1) Tread
Geomorphic position, mountains	(1) Lower third of mountain flank
Geomorphic position, hills	(1) Side Slope
Landforms	(1) Valley > Terrace (2) Hills > Terrace (3) Mountains > Mountain
Runoff class	Low to high
Flooding frequency	None

Ponding frequency	None
Elevation	30 – 370 m
Slope	0 – 50 %
Water table depth	Not specified
Aspect	NW, N, NE, E, SE

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	Not specified
Water table depth	100 – 150 cm

Climatic features

The Yukon-Kuskokwim Highlands MLRA has short, warm summers and long, cold winters. Mean annual temperature ranges from 25 to 32 degrees Fahrenheit, with temperatures typically below freezing from October through April. June through August are the warmest months of the year and constitute the heart of the growing season. Approximately 60 percent of total annual precipitation occurs from June through September (PRISM, 2018; SNAP, 2014a). Across the MLRA, snowfall ranges from 80 to 100 inches (USDA, 2022).

Table 4 Representative climatic features

Frost-free period (characteristic range)	80-100 days
Freeze-free period (characteristic range)	70-90 days
Precipitation total (characteristic range)	330-510 mm
Frost-free period (actual range)	60-110 days
Freeze-free period (actual range)	50-100 days

Precipitation total (actual range)	250-1,020 mm
Frost-free period (average)	80 days
Freeze-free period (average)	70 days
Precipitation total (average)	380 mm

Influencing water features

This site is not associated with or influenced by streams or wetlands. Precipitation and throughflow are the main source of water for this ecological site. Surface runoff and throughflow contribute water to downslope ecological sites.

Wetland description

This ecological site is not a wetland.

Soil features

- Common Inceptisol great groups are Dystricrypts while common Gelisol great groups are Folistels (Soil Survey Staff, 2013)
- Soils formed in loess and/or colluvium. Cryoturbated organics may be mixed with mineral material in areas of permafrost. Alluvium is present on terraces.
- Rock fragments do not occur on the soil surface.
- Soils have an organic cap of six inches or greater
- Soils are very deep but usually support a restrictive layer of permafrost or a lithologic discontinuity
- Subsurface rock fragments vary from 0 to 45 percent volume
- Soil pH is extremely to moderately acidic.
- Soils are considered well drained.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Loess (3) Colluvium (4) Alluvium
Surface texture	(1) Silt loam (2) Gravelly very fine sandy loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	60 – 150 cm

Soil depth	60 – 150 cm
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	6.1 – 21.34 cm
Soil reaction (1:1 water) (0-25.4cm)	4.1 – 10
Subsurface fragment volume ≤3" (0-152.4cm)	0 – 40 %
Subsurface fragment volume >3" (0-152.4cm)	0 – 10 %

Table 6. Representative soil features (actual values)

Drainage class	Moderately well drained to well drained
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-25.4cm)	Not specified

Subsurface fragment volume <=3" (0-152.4cm)	0 – 70 %
Subsurface fragment volume >3" (0-152.4cm)	0 – 10 %

Ecological dynamics

The Yukon-Kuskokwim Highlands MLRA (MLRA 230X) is in Interior Alaska where the continental climate produces warm summers and cold winters. Climate influences the composition and structure of plant communities. Summers are warm enough to support trees on the terraces, plains, and mountain and hill slopes described by this ecological site.

Fire

Fire has a major influence on vegetation across the Yukon-Kuskokwim Highlands MLRA. Wildland fire is a common and natural event that is unmanaged except near towns and villages. Fires are patchy and different locations within a single burn experience different levels of fire intensity, or no fire at all. In general, cooler and wetter areas experience low-severity fires, while warmer and drier areas experience high-severity fires. Other factors such as fire load and recent weather also affect fire characteristics. A typical fire event considerably alters vegetation, above ground biomass, and the organic soil cap.

Fire is the major natural disturbance on this ecological site. The fire return interval ranges between 25 and 130 years, with an average of less than 100 years (Vioreck et al., 1992; Fryer, 2014). Fire is facilitated by a high fuel load, flammable chemical contents within the plant, and the multilayer community structure of black spruce (Landfire, 2009; Fryer, 2014). Ericaceous shrubs in the lower canopy act as ladder fuels. Black spruce forests are susceptible to all fire severity levels. This tree species is fire adapted, and seed release is facilitated by fire. Post-fire seeding rates are exceptionally high, and reestablishment occurs within five years (Fryer, 2014).

The normal fire cycle in black spruce is a stand-replacement event. However, there is no single pathway regarding boreal forest fire dynamics; post-fire communities depend on various factors including pre-fire community composition, fire severity, weather, and the presence/absence of permafrost (Fryer, 2014). In general, a typical post-fire successional pathway begins with an herbaceous meadow before progressing through a low shrubland and then onto a black spruce woodland or forest. Earlier post-fire communities are less likely to burn than the reference plant community (Landfire, 2009).

The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

State and transition model

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 1.4 plant community composition

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

not available

Hydrological functions

not available

Recreational uses

not available

Wood products

not available

Other products

not available

Other information

not available

Inventory data references

Vegetative communities and transitions are described using existing models and expert knowledge. There are no vegetation inventory data points in NASIS associated with this ecological site. External model data sources: The Alaska-Yukon Region of the Circumboreal Vegetation Map (CBVM) (Jorgensen and Meidinger, 2015) LANDFIRE Biophysical Settings Models (Landfire, 2009) Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. Gen. Tech. Rep. PNW-GTR-286. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 p. (Viereck et al., 1992)

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Contributors

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Approval

Blaine Spellman, 6/11/2025

Acknowledgments

This ecological site description (ESD) fulfills the requirements of the Provisional Ecological Site (PES) national initiative. This ESD is published to fit current site-soil correlations as they are currently mapped and understood. Further data collection may provide the information to update this ESD from the provisional level to the approved level.

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	10/03/2026
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:

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:
