Ecological site F229XY013AK
Boreal Forest Loamy Frozen High Floodplain

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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): 229X–Interior Alaska Lowlands

The Interior Alaska Lowlands MLRA includes the flood plains and terraces along the upper reaches of the Tanana and Kuskokwim Rivers and the middle reaches of the Yukon River. This area makes up 39,065 square miles. The northern portion of this area that contains the cities of Fairbanks and North Pole are the second most densely populated lands in Alaska. Other towns along the road system include Nenana, Delta Junction, and Tok; and parts of Fort Wainwright and Fort Greely, the two largest military reservations in Alaska. Elsewhere, the area is mostly undeveloped wild land and is sparsely populated. In the western part of the area, the communities of Tanana, Galena, and McGrath are accessible only by air or by river. Parts of the Denali National Park and Preserve and Tetlin National Wildlife Refuge are in this area. The Trans-Alaska Pipeline parallels the Alaska Highway from Delta Junction to Fairbanks. This area is on broad, nearly level, braided to meandering flood plains, stream terraces, and outwash plains. In many places, shallow basins and undulating stream terraces are dotted with hundreds of small and medium size lakes and interconnecting wetlands. Sloughs, oxbow lakes, and escarpments along river channels are features associated with the flood plains, terraces, and basins. Isolated bedrock-controlled hills and low- to moderate-relief mountains are in scattered places throughout the area. Extended footslopes are common at the base of hills and mountains and along the boundaries with adjoining mountainous MLRAs. Elevation ranges from about 100 feet in the southwestern part of the area, along the lower Yukon River, to about 1,900 feet in the upper Tanana Valley. Geology and Soils Although never glaciated, this area is filled with a deep layer of Pleistocene glaciofluvial deposits. Additional fluvial sediments from the Alaska Range and the northern Aleutian Range accumulated along the Tanana and Kuskokwim Rivers during the Holocene Epoch. The Koyukuk and lower Yukon River drainages have undergone several periods of deposition followed by erosion. In some places old terraces are 33 to 250 feet above the flood plain. Quaternary glaciofluvial and fluvial sediments are estimated to be as much as 330 to 660 feet thick throughout the area. Much of the MLRA, particularly along the Tanana and Kuskokwim Rivers, is mantled with a layer of silty micaceous loess originating from the unvegetated flood plains and outwash plains along the Alaska Range. Thick eolian deposits, including loess dunes, sand dunes, and sand sheets, make up about 12 percent of the area. Inclusions of glacial moraines and drift are near the mountains. Unconsolidated sediments bury the bedrock geology, except for structural hills in some places. This area is in the zone of discontinuous permafrost. Permafrost is close to the surface in lands with finer textured silty sediments on stream terraces, plains, and the more gently sloping footslopes and hills throughout the area. Isolated masses of ground ice occur on terraces and the lower side slopes of hills. Permafrost does not generally occur on floodplains, soils with sandy and gravelly parent material, and in areas near lakes and other water bodies. The dominant soil orders in this area are Gelisols, Entisols, Inceptisols, and Spodosols. 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. Two important factors that prevent permafrost aggradation are groundwater connectivity and thick bands of sandy and/or gravelly soil horizons. Entisols most commonly occur on the floodplain with the most common suborder being Fluvents. Inceptisols and Spodosols occurs on streams terraces and slopes of hills and outwash plains. Dry soils on these landforms support soil suborders related to Cryods and Cryepts, while wet soils support Aquepts. Miscellaneous (nonsoil) areas make up about 19 percent of this MLRA. The most common are riverwash and water. For Gelisols, wildfires disturb the insulating organic material at the soil surface and can change the presence and/or depth of permafrost in the soil profile. These fire related changes to permafrost can also change the depth and presence of perched water tables. Gelisols that burn in this area can change soil taxonomic classification. For instance, depending on fire-severity, Histels may change to Orthels and Orthels may change to Inceptisols. Depending on the frequency and intensity of fires, landform position, and soil texture, the soils may or may not revert back to their original taxonomic classification. Climate Short, warm summers and long, very cold winters characterize the continental subarctic climate of the area. The average annual precipitation for this area ranges from 11 to 17 inches. The maximum precipitation occurs in late summer, mainly during thunderstorms. The average annual snowfall ranges from 30 to 80 inches. The average annual temperature for this area ranges from about 23 to 30 degrees Fahrenheit. The freeze-free period averages about 90 to 110 days. The temperature usually remains above freezing from June through early-September. Vegetation Much of the soil in this area supports forested communities in some stage of post-fire recovery. Mesic to dry soils in the uplands support mixed forests of black spruce, white spruce, paper birch, and quaking aspen. White spruce and white spruce-balsam poplar forests occur on occasionally to rarely flooded portions of the floodplain-step. Black spruce woodlands occur on stream terraces and other places with wet soils and/or shallow permafrost. On permafrost-affected alluvial flats, tamarack occurs in association with black spruce. Lightning-caused wildfires are common. Many thousands of acres are often burned during a single fire. Following wildfires, willow, shrub birch, and ericaceous shrub scrub invade most previously forested ecological sites until they eventually are replaced by forest vegetation. After fire, resin birch is common on wet and mesic soils and quaking aspen on dry soils. 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. Frequently flooded and continuously ponded soils lack forested communities. Nonforested soils include shrub birch, ericaceous shrub scrub, and tussock tundra in peat areas and in drainageways. Wet sedge meadows, sedge-moss bog meadows, and sedge-grass meadows are along the margins of lakes and on continuously ponded sites such as fens. Low to tall willow and alder scrub are on low flood plains.

Classification relationships

Landfire BPS - 16150 – Western North American Boreal Lowland Large River Floodplain Forest and Shrubland (Landfire 2009)

Ecological site concept

- Occurs on the highest levels of the flood plain step with flooding ranging from occasional to rare. Soils are wet and have permafrost. - Soils formed in alluvium and are capped with three to eight inches of peat. The surface mineral horizons are mucky silt loams and mucky fine sandy loams. - Elevation ranges between 100 and 1400 feet. - Soils do not pond. - Soils have a water table between 0 and 10 inches and are considered poorly drained. - Soils are very deep but have permafrost at shallow to moderate depths. - The reference plant community is open needleleaf forest with white spruce and black spruce the dominant trees. Multiple plant communities occur within the reference state related to wildfire.

Associated sites

F229XY011AK	**Boreal Loamy Floodplain Complex** Occurs on lower levels of the same floodplain step with more frequent flooding. Soils are comparatively drier and lack permafrost. Associated with willow and alder shrubland and productive balsam poplar and white spruce forests.
F229XY012AK	**Boreal Woodland Loamy High Floodplain** Occurs on the same high levels of the floodplains step with similar flooding. Soils are very wet and lack permafrost. Associated with stunted tamarack and black spruce woodlands.
R229XY001AK	**Boreal Herbaceous Peat Depressions** Occurs in flood plain depressions with thick peat. Associated with herbaceous meadows dominated by obligate sedges, forbs, and moss.
R229XY003AK	**Boreal Grass Loamy Depressions** Occurs in flood plain depressions with loamy soils. Associated with herbaceous meadows dominated by grasses.

Similar sites

F231XY151AK	**Boreal Forest Loamy Frozen Floodplain Moist** Ecological site 151 is associated with the highest levels of the flood-plain step and share similar soils and vegetation. Ecological site 151 occurs to the North in the Interior Alaska Highlands MLRA.

F229XY011AK	**Boreal Loamy Floodplain Complex** Compared to ecological complex 11, ecological site 13 has colder and wetter soils commonly with less productive stands of white and black spruce and more obligate wetland understory species.

Table 1. Dominant plant species

Tree	(1) *Picea glauca* (2) *Picea mariana*
Shrub	(1) *Alnus incana ssp. tenuifolia* (2) *Vaccinium uliginosum*
Herbaceous	(1) *Sphagnum* (2) *Hylocomium splendens*

Physiographic features

- Occurs on alluvial flats and flood plains that are distal to the river channel. These are the highest levels of the flood-plain step.
- Flooding is occasional to rare and occurs for brief durations of time
- Elevation occurs between 100 and 1400 feet
- Slope is nearly level and occurs on all aspects
- In general, this ecological site is not associated with ponding. On occasion, soils pond but before the growing season and during the months of April and May.
- A water table occurs between 0 and 10 inches during the growing season.
- Associated with negligible to very low amounts of runoff to adjacent, downslope ecological sites.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Flood plain (2) Alluvial plain > Alluvial flat (3) Alluvial plain > Flood-plain step
Runoff class	Negligible to very low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding duration	Not specified
Ponding frequency	None
Elevation	30 – 430 m

Slope	0 %
Water table depth	0 – 30 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Not specified
Flooding frequency	Not specified
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	Not specified
Slope	0 – 10 %
Water table depth	0 – 50 cm

Climatic features

Short, warm summers and long, very cold winters characterize the subarctic continental climate associated with this ecological site. The mean annual temperature for Interior Alaska Lowlands area ranges from 23 to 31 degrees Fahrenheit. The warmest months span May through August with mean temperatures ranging from 60 to 71 degrees Fahrenheit. The coldest months span December through February with mean temperatures ranging from -15 to -10 degrees Fahrenheit. The freeze-free period ranges between 96 and 115 days and typically lasts from late May through early-September.

The average annual precipitation across the Interior Alaska Lowlands area ranges between 11 and 17 inches. July through September are the wettest months with approximately 60 percent of the annual precipitation occurring, and thunderstorms are common. The average annual snowfall ranges from 30 to 80 inches (USDA 2022). The ground is consistently covered with snow from November through March.

Table 4 Representative climatic features

Frost-free period (characteristic range)	70-80 days
Freeze-free period (characteristic range)	100-120 days
Precipitation total (characteristic range)	310-360 mm

Frost-free period (actual range)	60-90 days
Freeze-free period (actual range)	90-120 days
Precipitation total (actual range)	280-430 mm
Frost-free period (average)	80 days
Freeze-free period (average)	110 days
Precipitation total (average)	330 mm

- (1) GALENA [USC00503212], Nulato, AK
- (2) TANANA CALHOUN MEM AP [USW00026529], Tanana, AK
- (3) MCGRATH AP [USW00026510], Mc Grath, AK
- (4) MINCHUMINA [USW00026512], Lake Minchumina, AK
- (5) KOBE HILL [USC00504971], Healy, AK
- (6) NENANA MUNI AP [USW00026435], Clear, AK
- (7) FAIRBANKS INTL AP [USW00026411], Fairbanks, AK
- (8) NORTH POLE [USC00506581], North Pole, AK
- (9) EIELSON FLD [USC00502707], Eielson AFB, AK
- (10) SALCHA [USC00508140], Salcha, AK
- (11) BIG DELTA AP [USW00026415], Delta Junction, AK

Influencing water features

In the associated flood plains, overbank flow from the channel and subsurface hydraulic connections between the stream and adjacent wetlands are the main sources of water (Smith et al. 1995).

Depth to the water table may decrease following summer storm events or spring snowmelt and increase during extended dry periods.

Wetland description

This ecological site is classified a an riverine wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008).

Soil features

- Soils formed in alluvium.
- Rock fragments do not occur on the soil surface.
- Mineral soils are capped with three to eight inches of peat.
- The surface mineral horizon is mucky silt loam or mucky fine sandy loam.
- Subsurface rock fragments in these flood plain soils range between 0 and 10 percent of the soil profile by volume. Gravelly horizons most commonly occur at depth.
- Soils are considered very deep but have permafrost at shallow to moderate depths (16 to 25 inches). Permafrost occurs as a thin band in the soil profile.
- The pH of the soil profile ranges from slightly acidic to neutral.
- Soils are considered poorly drained.

Table 5. Representative soil features

Parent material	(1) Alluvium

Surface texture	(1) Mucky silt loam (2) Mucky fine sandy loam
Family particle size	(1) Coarse-loamy
Drainage class	Poorly drained
Permeability class	Rapid
Depth to restrictive layer	40 – 60 cm
Soil depth	150 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	14.99 – 18.03 cm
Calcium carbonate equivalent (25.4-101.6cm)	Not specified
Clay content (0-50.8cm)	10 %
Electrical conductivity (25.4-101.6cm)	Not specified
Sodium adsorption ratio (25.4-101.6cm)	Not specified
Soil reaction (1:1 water) (25.4-101.6cm)	6.1 – 7.2

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

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	10 – 120 cm
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 (25.4-101.6cm)	0 %
Clay content (0-50.8cm)	10 – 50 %
Electrical conductivity (25.4-101.6cm)	Not specified
Sodium adsorption ratio (25.4-101.6cm)	0

Soil reaction (1:1 water) (25.4-101.6cm)	0 – 7.3
Subsurface fragment volume <=3" (0-152.4cm)	Not specified
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

Flood Regime

The large rivers in the Interior Alaska Lowlands MLRA have low, middle, and high flood plain levels, which are all part of a floodplain step. These flood plain levels represent major breaks in the flood regime and dominant vegetative type on associated tributaries. The low flood plain floods frequently (>50 times in 100 years) for long durations of time (7 to 30 days) and supports shrub dominant communities. The middle flood plain floods occasionally (between 5 and 50 times in 100 years) for brief durations of time (between 2 and 7 days) and supports productive stands of balsam poplar and white spruce. The high flood plain floods rarely (between 1 and 5 times in 100 years) for brief durations of time (between 2 and 7 days). Areas without groundwater influences have thin bands of permafrost aggrandizing in the soil profile and support mixed less productive stands of white spruce and black spruce. Areas with groundwater influences have very wet soils with black spruce and tamarack woodlands.

The shift of vegetative type from shrubland to forest represents riparian primary succession along rivers in this MLRA, which is thought to take between 200 and 300 years (Chapin et al. 2006). The flood regime, growth traits of vegetation, biotic competition, and a slew of other factors contribute to the dynamic nature of boreal flood plain succession. For more detailed information on boreal flood plain succession and successional drivers, refer to Walker et al. (1986) and Chapin et al. (2006).

Fire

In the Interior Alaska Lowlands (herein called area), 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 boreal forest loamy frozen high flood plain ecological site will reset plant succession and alter dynamic soil properties (e.g., thickness of the organic material and depth to permafrost). 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 and black spruce forests, data suggest that 130 to 150 years or more must elapse without another fire event (Foot 1982; Chapin et al. 2006; Landfire 2009).

Within this area, wildfire is considered a natural and common event that in many places goes unmanaged. Fire suppression is limited and occurs adjacent to the municipalities 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. From 2000 to 2020, 513 known fire events occurred in this area and the burn perimeter of the fires totaled approximately 12.4 million acres (AICC 2022). Fire-related disturbances are highly patchy and can leave undisturbed areas within the burn perimeter. During this time frame, 73 percent of the fire events were smaller than 20,000 acres but 34 fire events were greater than 100,000 acres in size (AICC 2022). Over this period of 20 years, these burn perimeters cover approximately 50 percent of this area.

The fire regime within Interior Alaska follows two general scenarios—low-severity burns and high-severity burns. It should be noted, however, that the fire regime in Interior Alaska can be considered 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. While these soils are moist, they are capped with thin-organic mats. As a result, fire is provisionally thought 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 permafrost thaw in the soil profile and result in increased drainage of soils. High-severity fire events also destroy a majority of the vascular and nonvascular biomass above ground.

Field data from similar ecological sites suggest that each of the forested communities burn and that fire events will cause a transition to the pioneering stage of fire succession. This stage (community 1.5) is a mix of species that either regenerate in place (e.g., subterranean root crowns for willow and rhizomes for graminoids) and/or from wind-dispersed seed or spores that colonize exposed mineral soil (e.g., quaking aspen [Populus tremuloides] and Ceratodon moss [Ceratodon purpureus]). The pioneering stage of fire succession is primarily composed of tree seedlings, forbs, grasses, and weedy bryophytes. This stage of succession is thought to persist for up to 4 years post-fire (Landfire 2009). Willow (Salix spp.) and quick growing deciduous tree seedlings continue to colonize and grow in stature on recently burned sites until they become dominant in the overstory, which marks the transition to the early stage of fire succession (community 1.4). This early stage of fire succession is thought to persist 25 to 45 years post-fire (Landfire 2009). In the absence of fire, tree species continue to become more dominant in the stand and eventually develop into forests.

The later stages of succession have an overstory that is dominantly deciduous trees (community 1.3), a mix of broadleaf and needleleaf trees (community 1.2), or needleleaf trees (community 1.1). The recruitment of trees species during the pioneering and early stages of post-fire succession largely controls the composition of the stand of trees in the later stages of post-fire succession (Johnstone et al. 2010a). During these later stages of succession, the slower growing white spruce seedlings mature and eventually replace the shade-intolerant broadleaf tree species. The typical fire return interval for white spruce stands in Interior Alaska is 150 years (Landfire 2009; Abrahamson 2014).

Lands in Interior Alaska are burning more frequently than in the past, which may result in alternative states of succession. The historic fire return interval for white spruce stands in Interior Alaska occurs approximately once every 150 years (Landfire 2009; Abrahamson 2014). Due to global climate change, stands of spruce in certain portions of the Alaskan boreal forest are burning more frequently than these historic averages (Kelly et al. 2013). Increases to burn frequency favors forested stands dominated by quick growing deciduous trees (community 1.3). A major reason being that increased fire frequency decreases the presence and abundance of mature, cone-bearing trees. Less mature trees result in less spruce seedlings post-fire and an overall decreased abundance of spruce in the developing forest canopy. Increased fire frequency paired with decreased spruce propagules lowers the chances for the site to progress to post-fire successional communities 1.2 and 1.1. Increased burn frequency in the boreal forest may result in alternative states of post-fire succession with stands of deciduous trees persisting for longer than normal durations of time (Johnstone et al. 2010b).

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 (%)

Table 8. Community 1.2 plant community composition

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

Table 9. Community 1.3 plant community composition

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

Table 10. Community 1.4 plant community composition

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

Table 11. Community 1.5 plant community composition

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

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

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 species are largely based on the soil survey of Denali National Park Area, Alaska (Clark and Duffy 2006).

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Contributors

Blaine Spellman

Approval

Blaine Spellman, 6/12/2025

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	09/17/2026
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:**