USDA Natural Resources Conservation Service

Ecological site F236XY202AK
Boreal Forest Frozen Loamy Slopes

Last updated: 2/13/2024
Accessed: 05/13/2025

General information

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

MLRA notes

Major Land Resource Area (MLRA): 236X–Bristol Bay-Northern Alaska Peninsula Lowlands

The Bristol Bay-Northern Alaska Peninsula Lowland Major Land Resource Area (MLRA 236) is located in Western Alaska. This MLRA covers approximately 19,500 square miles and is defined by an expanse of nearly level to rolling lowlands, uplands and low to moderate hills bordered by long, mountain footslopes. Major rivers include the Egegik, Mulchatna, Naknek, Nushagak, and Wood River. MLRA 236 is in the zone of discontinuous permafrost. It is primarily in areas with finer textured soils on terraces, rolling uplands and footslopes. This MLRA was glaciated during the early to middle Pleistocene. Moraine and glaciofluvial deposits cover around sixty percent of the MLRA. Alluvium and coastal deposits make up a large portion of the remaining area (Kautz et al., 2012; USDA, 2006).

Climate patterns across this MLRA shift as one moves away from the coast. A maritime climate is prominent along the coast, while continental weather, commonly associated with Interior Alaska, is more influential inland. Across the MLRA, summers are general short and warm while winters are long and cold. Mean annual precipitation is 13 to 50 inches, with increased precipitation at higher elevations and areas away from the coast. Mean annual temperatures is between 30 and 36 degrees F (USDA, 2006).

The Bristol Bay-Northern Alaska Peninsula MLRA is principally undeveloped wilderness. Federally managed land includes parts of the Katmai and Aniakchak National Parks, and the Alaska Peninsula, Becharof, Togiak and Alaska Maritime National Wildlife Refuges. The MLRA is sparsely populated. Principal communities include Dillingham, Naknek, and King Salmon. Commercial fishing in Bristol Bay and the Bering Sea comprises a major part of economic activity in the MLRA. Other land uses include subsistence activities (fishing, hunting, and gathering) and sport hunting and fishing (USDA, 2006).

Classification relationships

Alaska Vegetation Classification:
Needleleaf woodland (I.A.3 - level III) / Black spruce open forest (I.A.3.d - level IV)
(Viereck et al., 1992)

Circumboreal Vegetation Map – Alaska-Yukon Region:
Southern Alaska Spruce-Birch-Herb Forests
(Jorgensen and Meidinger, 2015)

BioPhysical Settings: 7616220 - Western North American Boreal Black Spruce Wet-Mesic Slope Woodland
(LANDFIRE biophysical settings, 2009)

Ecological site concept

This boreal ecological site is on mountain backslopes and footslopes. It is typically at elevations between 400 and 1,500 feet. Soils contain permafrost and are poorly drained. Soil hydrology, low soil fertility caused by soil acidity,

and a fire regime shape the vegetation on this landform.

The reference state supports three communities. The reference plant community is characterized as a black spruce woodland (Viereck et al., 1992). It is composed of a black spruce canopy with an open understory of ericaceous and other woody shrubs and mosses. Post-fire communities are typically absent a forest overstory and are comprised of extant shrubs and colonizing trees.

Associated sites

R236XY107AK	**Western Alaska Maritime Scrub Gravelly Drainages** R236XY107AK describes scrub communities in drainages and swales. These hydrologically influenced areas are typically too wet to support trees.
F236XY115AK	**Boreal Forest Loamy Moist Slopes** F236XY115AK describes mixed forests on rounded mountain backslopes. This ecological site is associated with well drained soils, which are more suitable for trees such as white spruce and paper birch. The soil in F236XY202AK is too wet and cold to support those species.
F236XY201AK	**Boreal Open Forest Wet Loamy Warm Mountain Slopes** F236XY201AK is associated with warmer soils that F236XY202AK. This ecological site is found primarily at warmer aspects and is associated with soils with a large percentage of subsurface rock fragments, which help transport heat into the soil profile. These conditions allow for the growth of white spruce, which is typically restricted from the permafrost soils of F236XY202AK.

Similar sites

F236XY201AK	**Boreal Open Forest Wet Loamy Warm Mountain Slopes** These ecological sites are both associated with poorly drained soils on mountain backslopes and footslopes. F236XY201AK is restricted to warmer soils, due to southerly aspects and greater than 50% subsurface rock fragments. F236XY201AK may support black spruce in areas, particularly as a result of local conditions and fire disturbance(s). It can be recognized by the absence of permafrost and the presence of other conifer and broadleaf tree species.

Table 1. Dominant plant species

Tree	(1) *Picea mariana*
Shrub	(1) *Betula nana* (2) *Empetrum nigrum*
Herbaceous	(1) *Carex*

Physiographic features

This site is on rugged and glaciated mountain backslopes and toeslopes. Elevation typically ranges from 400 to 1,500 feet (2,200 feet maximum) above sea level. Slopes are usually gently to strongly sloped (4 – 14 percent). This site is found at all aspects. A water table is present at the beginning of the growing season between March and June. Ponding and flooding do not occur.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	122–457 m
Slope	4–14%
Water table depth	15–152 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	9–671 m
Slope	2–25%
Water table depth	15–152 cm

Climatic features

The climate of this site reflects that of the MLRA, which is described as maritime polar (EPA, 2013). Temperatures are moderated by the nearby Bristol Bay and norther Pacific bodies of water. Annual precipitation ranges from 21 – 34 inches with approximately 40 percent occurring during the June-September growing season (PRISM, 2018).

Table 4. Representative climatic features

Frost-free period (characteristic range)	75-100 days
Freeze-free period (characteristic range)	65-90 days
Precipitation total (characteristic range)	533-864 mm
Frost-free period (actual range)	75-100 days
Freeze-free period (actual range)	65-90 days
Precipitation total (actual range)	381-1,041 mm
Frost-free period (average)	90 days
Freeze-free period (average)	75 days
Precipitation total (average)	737 mm

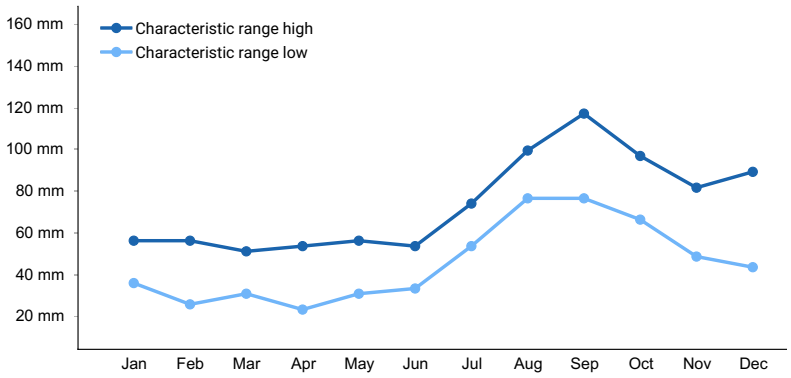


Figure 1. Monthly precipitation range

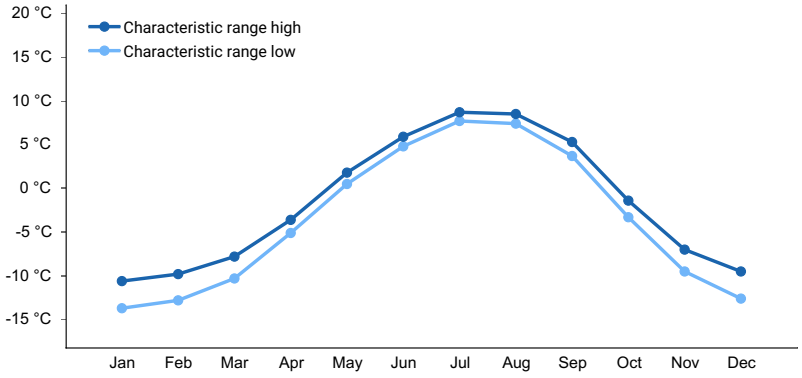


Figure 2. Monthly minimum temperature range

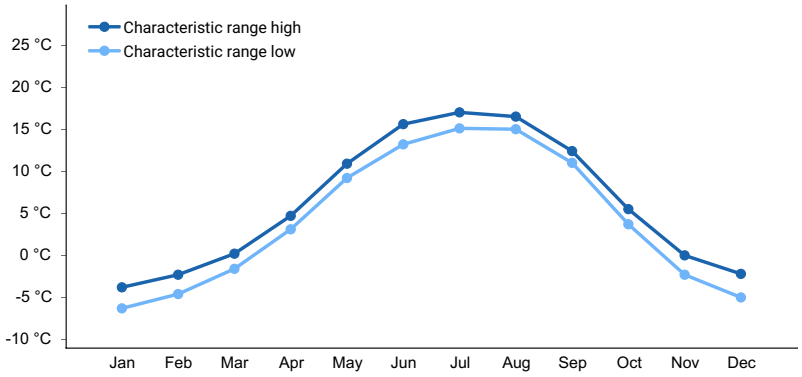


Figure 3. Monthly maximum temperature range

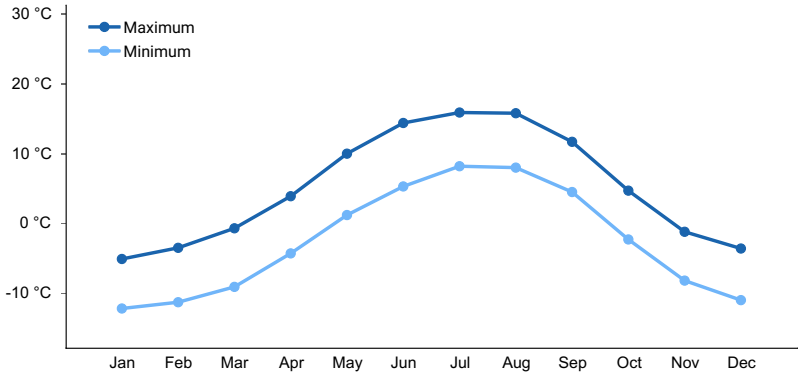


Figure 4. Monthly average minimum and maximum temperature

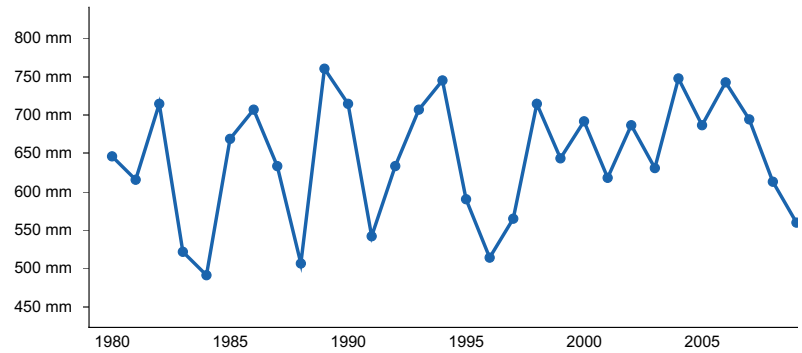


Figure 5. Annual precipitation pattern

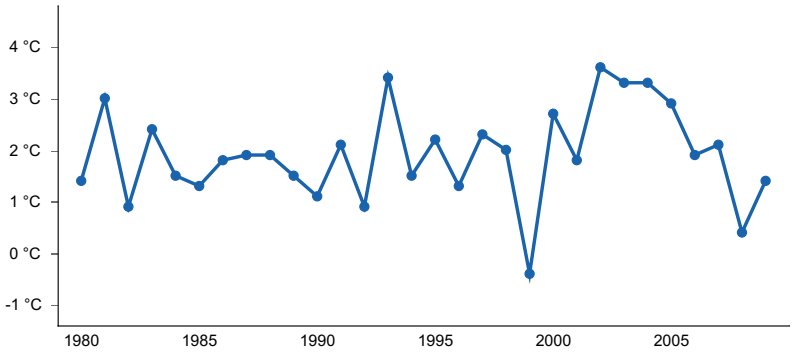


Figure 6. Annual average temperature pattern

Influencing water features

Due to its landscape position, this site is not influenced by wetland or riparian water features. Precipitation is the main source of water. Snow melt and seasonal ice melt contribute to a water table during the early months of the growing season.

Soil features

Soil is very deep, poorly drained, and supports permafrost. It is moderately deep (22 to 39 inches) to the restrictive permafrost layer. Parent material is comprised of mossy organic material over loamy cryoturbate.

Soil characteristics affecting vegetation include soil hydrology, soil temperature, and a thick organic layer. Soils are wet during the beginning of the growing season, due to increased inputs from snow melt and seasonal frost melt. The poorly drained soil supports a very shallow water table from March through June, which restricts vegetation. Soil temperature, which remains low in the profile throughout the year, further restricts vegetation. Low temperatures decrease decomposition rates, allowing a thick organic layer to build which serves as ideal substrate for moss ground cover. The top ten inches of soil is strongly to extremely acidic, which favors ericaceous shrubs.

Correlated soil components in MLRA 236: E36-Boreal taiga-loamy frozen till slopes

Table 5. Representative soil features

Parent material	(1) Cryoturbate
Surface texture	(1) Peat
Drainage class	Poorly drained
Permeability class	Moderate to rapid
Depth to restrictive layer	56–99 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	1.27–4.32 cm
Soil reaction (1:1 water) (0-25.4cm)	3.5–5
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Table 6. Representative soil features (actual values)

Drainage class	Poorly drained
Permeability class	Moderate to rapid
Depth to restrictive layer	56–99 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	1.27–4.32 cm
Soil reaction (1:1 water) (0-25.4cm)	3.5–5
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This boreal site is on mountain backslopes and footslopes. Elevation ranges from 400 to 1,500 feet above sea level. Slope gradients are strong (4 to 14 percent). Soil characteristics, including hydrology and strong acidity, and a fire regime shape the vegetation.

The reference plant community is a black spruce woodland (Viereck et al., 1992). It is composed of a black spruce canopy with an open understory of ericaceous and other woody shrubs and mosses. Vegetation on this site is linked with soil characteristics. Snow and seasonal ice melt combine with a poorly drained soil and a restrictive permafrost layer to support a very shallow water table from March through June. Soil temperature remains low throughout the year, causing low rates of organic decomposition. The resulting thick organic layer is excellent substrate for black spruce and ericaceous shrubs. Additionally, the top ten inches of soil is strongly to extremely acidic, which also favors ericaceous shrubs.

Fire is a major disturbance. Fire dynamics and successional pathways in Alaskan spruce forests are complex (Viereck et al., 1992; LANDFIRE Biophysical Settings, 2009). The fire cycle and post-fire communities are shaped by factors including existing vegetation, soil characteristics, climate, and fire characteristics such as frequency and severity. Fire is responsible for three documented communities in the reference state. Post fire communities are typically comprised of extant shrubs and colonizing trees, along with fast-growing herbaceous species immediately preceding the fire event.

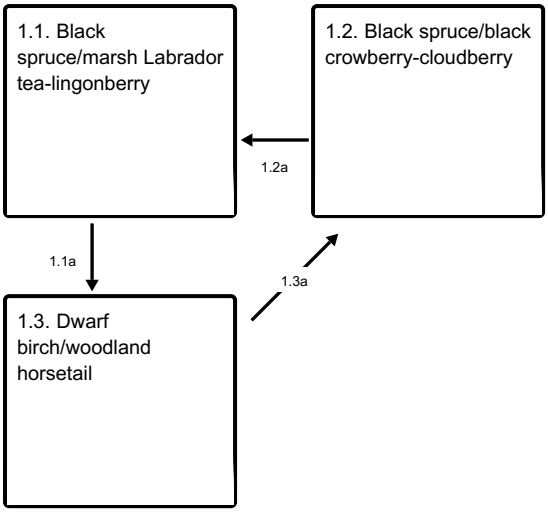
The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant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

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities



1.1a - Fire

1.2a - Post-fire recovery

1.3a - Post-fire recovery

State 1
Reference State

The reference state supports three community phases grouped by the structure and dominance of the vegetation (e.g., trees, shrubs, forbs, and graminoids) and their ecological function and stability. The reference plant community is characterized by an open black spruce forest with an understory of ericaceous shrubs and thick moss. The presence of this and related communities are dictated temporally and spatially by a fire cycle. All community phases in this report are characterized using the Alaska vegetation classification system (Viereck et al., 1992).

Dominant plant species

- black spruce (*Picea mariana*), tree
- dwarf birch (*Betula nana*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- sedge (*Carex*), grass
- Bigelow's sedge (*Carex bigelowii*), grass
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous

Community 1.1
Black spruce/marsh Labrador tea-lingonberry

The reference plant community is a black spruce woodland (Viereck et al., 1992). The understory is typically a mix of ericaceous and other woody shrubs. Ground cover is primarily mosses. Lichens may also be present.

Dominant plant species

- black spruce (*Picea mariana*), tree
- marsh Labrador tea (*Ledum palustre ssp. decumbens*), shrub
- lingonberry (*Vaccinium vitis-idaea*), shrub
- dwarf birch (*Betula nana*), shrub
- bog blueberry (*Vaccinium uliginosum*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- Bigelow's sedge (*Carex bigelowii*), grass
- sedge (*Carex*), grass
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous

Community 1.2
Black spruce/black crowberry-cloudberry

Community 1.2 is a mix of black spruce saplings and young, mature trees over a dense understory of shrubs. The understory community is comprised of a mix of ericaceous and other woody shrubs. Shrub density typically decreases as black spruce overtop and shade out the understory.

Dominant plant species

- black spruce (*Picea mariana*), tree
- black crowberry (*Empetrum nigrum*), shrub
- cloudberry (*Rubus chamaemorus*), shrub

Community 1.3
Dwarf birch/woodland horsetail

Community 1.3 can be an open or closed low or dwarf scrubland, depending on previous fire disturbance and local site conditions. The shrub community is comprised of ericaceous and other woody shrubs.

Dominant plant species

- dwarf birch (*Betula nana*), shrub
- cloudberry (*Rubus chamaemorus*), shrub
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.3

Fire is the major disturbance in this ecological site. It is primarily caused by lightning strikes during summer storms. Black spruce are susceptible to fire due to their dense growth and layering and highly resinous branches and needles. Fires are typically stand replacement events (Fryer, 2014). Shrubs and herbaceous species naturally recolonize following a fire. Shrub species will eventually overshadow herbaceous species and become the dominant plant form in this community (Landfire, 2009).

Pathway 1.2a
Community 1.2 to 1.1

As time since fire increases, black spruce density and height increase. Moss and the associated organic soil horizon increase in depth. The understory is comprised of a mix of ericaceous, acidophile shrubs.

Pathway 1.3a
Community 1.3 to 1.2

Black spruce regrowth typically begins five or more years post-fire. As saplings grow, they begin to overshadow shorter shrubs, which in turn opens the understory (Fryer, 2014; Landfire, 2009).

Additional community tables

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 data sources:
The Alaska Vegetation Classification (Viereck et al., 1992)
The Alaska-Yukon Region of the Circumboreal Vegetation Map (CBVM) (Jorgensen and Meidinger, 2015)
LANDFIRE Biophysical Settings Models (LANDFIRE Biophysical Settings, 2009)

References

Viereck, L.A., C. T. Dyrness, A. R. Batten, and K. J. Wenzlick. 1992. The Alaska vegetation classification. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station General Technical Report PNW-GTR-286..

Other references

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Contributors

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Approval

Kirt Walstad, 2/13/2024

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	05/13/2025
Approved by	Kirt Walstad
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:**
