USDA Natural Resources
Conservation Service

Ecological site R230XY606AK
Boreal Sedge Peat Depressions

Last updated: 6/11/2025
Accessed: 04/11/2026

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

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-first 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; the subalpine life zone occurs between 1,200 and 1,600 feet; and the alpine life zone occurs above 1,600 feet.

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:
Open low scrubland (II.C.2 - level III) / Sweetgale graminoid bog (II.C.2.j - level IV)
(Viereck et al., 1992)

Circumboreal Vegetation Map:
Yukon Sphagnum Bogs and Herbaceous Fens
(Jorgensen and Meidinger, 2015)

BioPhysical Settings:
7316181 - Western North American Boreal Herbaceous Fen - Alaska Sub-Boreal Complex
(Landfire, 2009)

Ecological site concept

Ecological Site characteristics:
• Occurs in the boreal life zone in organic depressions
• Soils are very deep and lack root restrictions like permafrost
• Soils formed in organic material over loess with peat layers that are often 60 inches thick.

• Ponding is frequent with long to very long durations. These very poorly drained soils have a water table at the soil surface for much of the growing season.
• The reference plant community is a sedge-scrub wetland
• Hydrology governs the vegetation on this ecological site. The vegetation is stable if hydrology remains the same. As hydrology changes, the vegetation responds by shifting between the three communities in the reference state.

Associated sites

F230XY611AK	**Boreal Forest Loamy Frozen Slopes** Ecological site F230XY611AK describes black spruce forests on cold, forested slopes. Ecological site 606 occurs in slope depressions, which are interspersed among the black spruce forest.
F230XY612AK	**Boreal Forest Loamy Slopes** Ecological site F230XY612AK describes white spruce forest on warm slopes. Ecological site 606 occurs in slope depressions, which are interspersed among the white spruce forest.
R230XY601AK	**Boreal Forest Flood Plain Complex** Ecological site R230XY606AK describes the flood plain complex. Ecological site 606 describes depressions on flood plains.
R230XY620AK	**Boreal Peat Frozen Flats Complex** R230XY620AK describes the tussock tundra. Ecological site 606 describes the depression on the tussock tundra plain.

Similar sites

R230XY620AK	**Boreal Peat Frozen Flats Complex** Hydrophytic vegetation dominates both ecological sites R230XY606AK and R230XY620AK. Ecological site 606 does not have permafrost and supports a year-round water table which is absent from the tussock tundra described by R230XY620AK.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Myrica gale* (2) *Salix*
Herbaceous	(1) *Carex* (2) *Sphagnum*

Physiographic features

• This ecological site occurs in depressions on mountains, hills, terraces, and flood plains
• Elevation typically ranges between 100 and 800 feet
• Slope gradients are nearly level to gentle (1 to 5 percent)

• This ecological site in on all aspects.
• Ponding has a major influence on the vegetative community. A water table is present at the soil surface throughout the year.
• Flooding does not occur, except for on flood plain depression.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Concave
Geomorphic position, flats	(1) Dip
Geomorphic position, mountains	(1) Lower third of mountainflank
Hillslope profile	(1) Footslope (2) Toeslope
Landforms	(1) Hills > Depression (2) Mountains > Depression (3) Valley > Terrace > Swale (4) Valley > Flood plain > Closed depression
Runoff class	Negligible to medium
Flooding duration	Not specified
Flooding frequency	None
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Frequent
Elevation	30–244 m
Slope	1–5%
Ponding depth	0–20 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	Not specified
Ponding depth	Not specified

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)	75-95 days
Freeze-free period (characteristic range)	65-85 days
Precipitation total (characteristic range)	330-508 mm
Frost-free period (actual range)	60-110 days
Freeze-free period (actual range)	50-100 days
Precipitation total (actual range)	254-1,016 mm
Frost-free period (average)	80 days
Freeze-free period (average)	70 days
Precipitation total (average)	381 mm

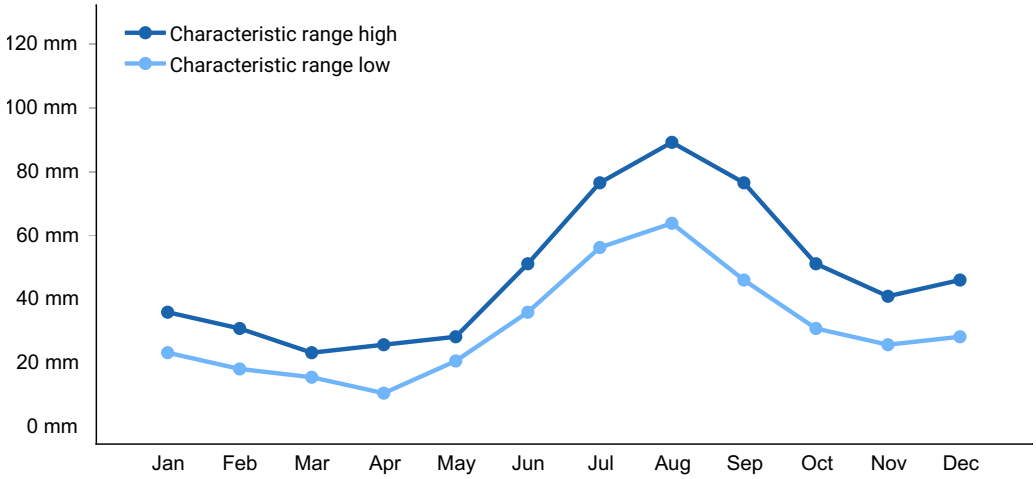


Figure 1. Monthly precipitation range

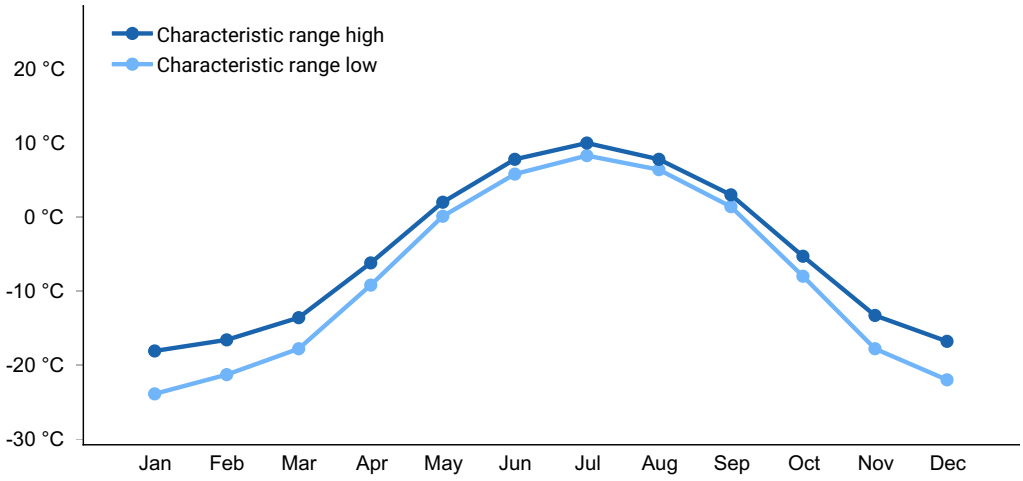


Figure 2. Monthly minimum temperature range

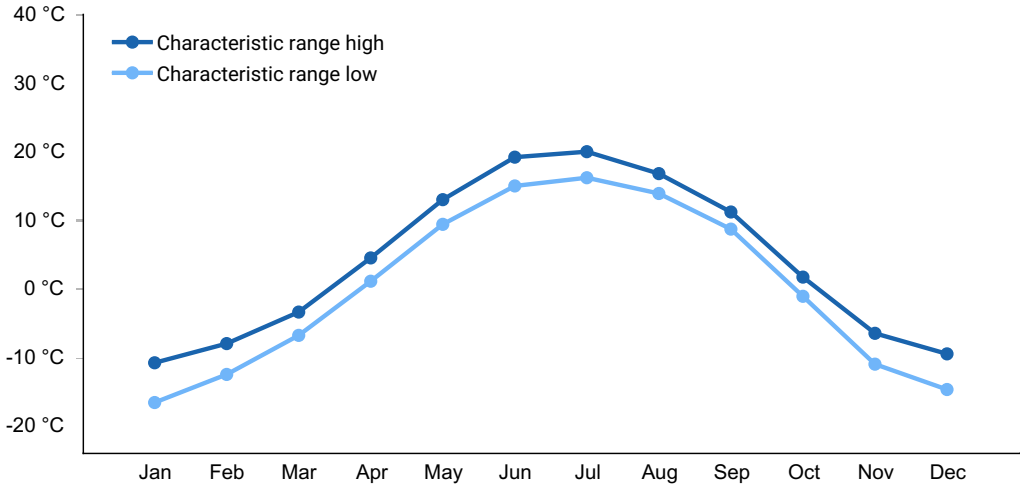


Figure 3. Monthly maximum temperature range

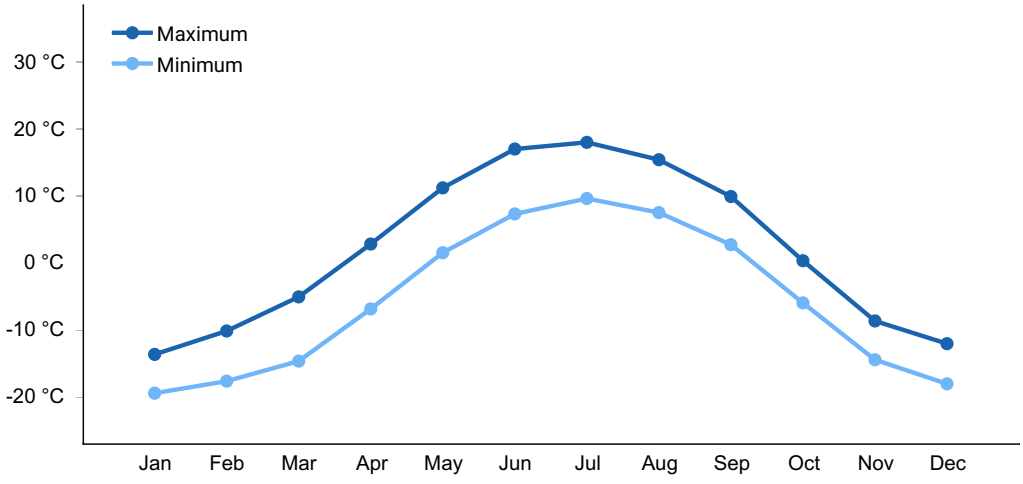


Figure 4. Monthly average minimum and maximum temperature

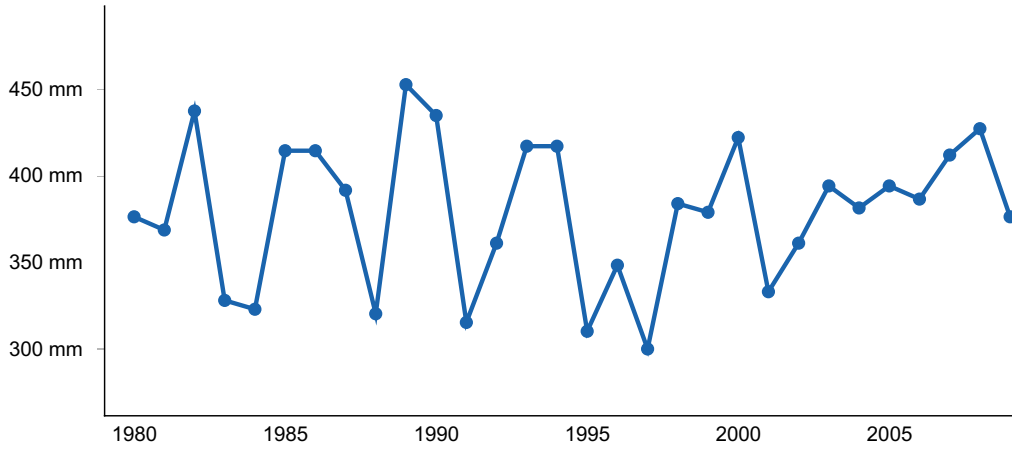


Figure 5. Annual precipitation pattern

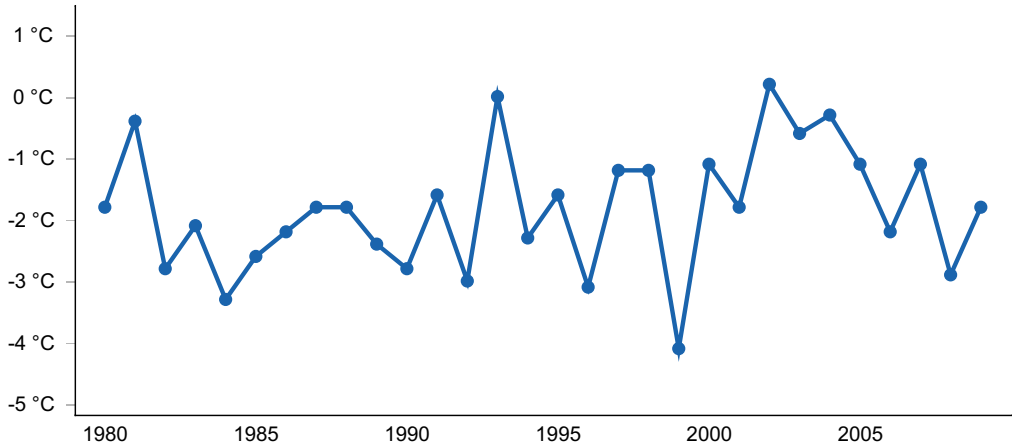


Figure 6. Annual average temperature pattern

Influencing water features

This site is a wetland. Precipitation, ground water discharge, and throughflow are the main water sources. Surface runoff and throughflow contribute water to downslope ecological sites.

Wetland description

This ecological site is a depressional wetland under the Hydrogeomorphic (HGM) classification system (Brinson, 1993; USDA-NRCS, 2008). Slope concavity allows for the accumulation of ponded surface water. Depth to the water table may increase during extended dry periods.

Soil features

• Soils are commonly Histosols with great groups being Cryosaprists and Cryohemists (Soil Survey Staff, 2013).
• Soils formed in organic material over loess. Alluvium may underlie flood plain

depressions.
• Rock fragments do not occur on the soil surface.
• Peat depth varies but often extends below 60 inches.
• Soils are very deep and do not support a restrictive layer
• Subsurface rock fragments are absent.
• Soil pH is extremely to slightly acidic.
• Soils are very poorly drained

Table 5. Representative soil features

Parent material	(1) Organic material (2) Loess (3) Alluvium
Surface texture	(1) Peat (2) Mucky peat
Drainage class	Very poorly drained
Permeability class	Slow to moderate
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	28.96–50.04 cm
Soil reaction (1:1 water) (0-25.4cm)	3.8–6.2
Subsurface fragment volume <=3" (0-152.4cm)	0%
Subsurface fragment volume >3" (0-152.4cm)	0%

Ecological dynamics

Site and soil hydrology, especially the stress caused by ponding (Vartapetian and Jackson, 1997), shape the vegetative community. Vegetation is primarily restricted to facultative wet to obligate wetland species. Permanently ponded areas support emergent species.

The reference state contains three communities. Hydrology is the driving factor behind each community. Obligate to facultative wetland species are prevalent throughout all communities. The wettest areas are permanently ponded and support floating and emergent species (Landfire, 2009). The driest areas are a mix of slow growing shrubs and hydrophytic graminoids and forbs. Communities 1.2 and 1.3 are most common in deeper parts of the depression. Changes in water input due to shifts in precipitation patterns or

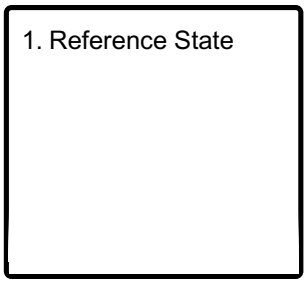
increased/decreased run-in from upslope areas are responsible for the successional shift between communities.

There is no evidence of historical fire in this ecological site. To date, no alternative states have been documented on this ecological site. Human activity currently has little impact on this site due to its remote location/inaccessibility.

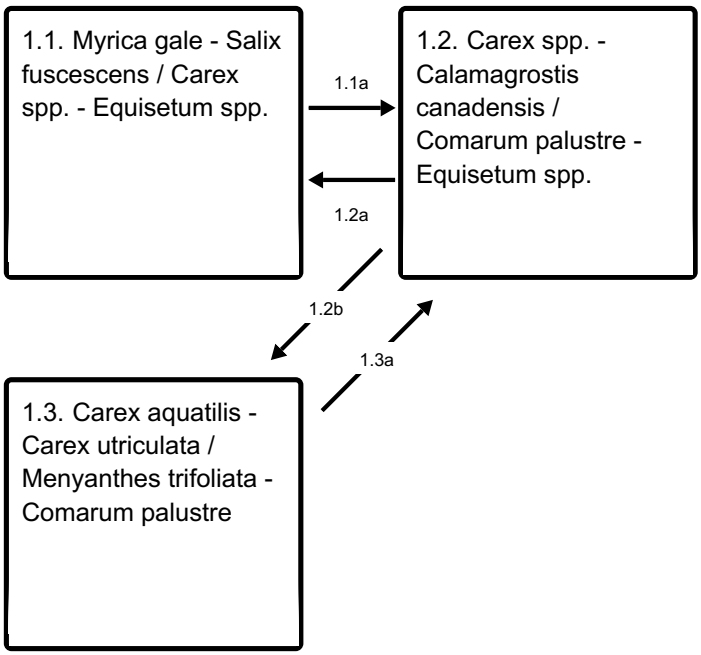
The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant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

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1a - Increase in water level

1.2a - Decrease in water level

1.2b - Increase in water level

1.3a - Decrease in water level

State 1
Reference State

The reference state describes three distinct vegetative communities grouped by the structure and dominance of the vegetation (e.g., shrubs, forbs, and graminoids) and their ecological function and stability. Hydrology is the major factors influencing vegetation. This reference state is developed and characterized using available vegetation models, including Landfire BpS and the Alaska vegetation classification system (Landfire, 2009; Viereck et al., 1992).

Dominant plant species

- sweetgale (*Myrica gale*), shrub
- Alaska bog willow (*Salix fuscescens*), shrub
- dwarf birch (*Betula nana*), shrub
- sedge (*Carex*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- horsetail (*Equisetum*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- purple marshlocks (*Comarum palustre*), other herbaceous

Community 1.1
Myrica gale - Salix fuscescens / Carex spp. - Equisetum spp.

This community is an open low scrubland (Viereck et al., 1992). The major plant groups are low shrubs, dwarf shrubs, and medium graminoids. Black spruce may be present. Sedges (Carex spp.) are the dominant herbaceous species. Ground cover is predominantly herbaceous litter but also contains mosses, lichens, and water. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- sweetgale (*Myrica gale*), shrub
- Alaska bog willow (*Salix fuscescens*), shrub
- tealeaf willow (*Salix pulchra*), shrub
- dwarf birch (*Betula nana*), shrub
- sedge (*Carex*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- livid sedge (*Carex livida*), grass
- water sedge (*Carex aquatilis*), grass
- mud sedge (*Carex limosa*), grass
- boreal bog sedge (*Carex magellanica*), grass
- silvery sedge (*Carex canescens*), grass
- woodland horsetail (*Equisetum sylvaticum*), other herbaceous
- horsetail (*Equisetum*), other herbaceous

- sphagnum (*Sphagnum*), other herbaceous
- purple marshlocks (*Comarum palustre*), other herbaceous
- water horsetail (*Equisetum fluviatile*), other herbaceous
- buckbean (*Menyanthes trifoliata*), other herbaceous

Community 1.2
Carex spp. - Calamagrostis canadensis / Comarum palustre - Equisetum spp.

This community is a wet graminoid herbaceous meadow (Viereck et al., 1992). The major plant groups are medium graminoids and forbs. Shrubs are common. The community is comprised of obligate to facultative wetland species. Graminoids are the dominant herbaceous species. Ground cover is a mix of mosses and herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- bluejoint (*Calamagrostis canadensis*), grass
- sedge (*Carex*), grass
- creeping sedge (*Carex chordorrhiza*), grass
- livid sedge (*Carex livida*), grass
- purple marshlocks (*Comarum palustre*), other herbaceous
- water horsetail (*Equisetum fluviatile*), other herbaceous
- horsetail (*Equisetum*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous

Community 1.3
Carex aquatilis - Carex utriculata / Menyanthes trifoliata - Comarum palustre

This community is a wet graminoid herbaceous meadow (Viereck et al., 1992). The major plant groups are medium graminoids and forbs. Obligate wetland species are prevalent and emergent and floating species are common in permanently ponded areas. Sedges (Carex spp.) are the dominant herbaceous species. Ground cover is a mix of surface water, mosses, and herbaceous litter. The binomial and vernacular name of common plants are listed in the dominant plant species table.

Dominant plant species

- water sedge (*Carex aquatilis*), grass
- Northwest Territory sedge (*Carex utriculata*), grass
- sedge (*Carex*), grass
- buckbean (*Menyanthes trifoliata*), other herbaceous
- purple marshlocks (*Comarum palustre*), other herbaceous

Pathway 1.1a
Community 1.1 to 1.2

An increase in water level within a depression drowns susceptible plants and creates space for more hydrophytic species.

Pathway 1.2a
Community 1.2 to 1.1

A decrease in water level allows less hydrophytic species to colonize and spread. Slow growing hydrophytic shrubs form the dominant canopy cover.

Pathway 1.2b
Community 1.2 to 1.3

An increase in water level drowns susceptible plants and creates space for more hydrophytic species. Permanently ponded areas support emergent and floating species.

Pathway 1.3a
Community 1.3 to 1.2

A decrease in water level allows less hydrophytic species to colonize and spread. Emergent species are replaced as areas no longer permanently pond.

Additional community tables

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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Western Regional Climate Center (WRCC). 2025. “McGrath WB Airport, Alaska ‘Freeze Free’ Season Probabilities.” https://wrcc.dri.edu/cgi-bin/cliTFrezD.pl?akmcgr. Accessed Mar 6, 2025.

Contributors

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Michael Singer

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	04/11/2026
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):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:**
