USDA Natural Resources
Conservation Service

Ecological site R238XY101AK
Arctic Silty Shore Complex

Last updated: 6/05/2025
Accessed: 03/12/2026

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): 238X–Yukon-Kuskokwim Coastal Plain

Geography

The Yukon-Kuskokwim Coastal Plain area (MLRA 238x) consists of the broad, nearly level delta along the lower reaches of the Yukon and Kuskokwim rivers, where the rivers empty into the Bering Sea. The Yukon River runs along the northern edge of the area while the Kuskokwim River runs along the southern edge. This MLRA makes up 31,565 square miles. MLRA 238x is bordered by MLRA 240x (Nulato Hills-Southern Seward Peninsula Highlands) to the North, MLRA 237x (Ahklun Mountains) to the South, and MLRAs 230x (Yukon-Kuskokwim Highlands) and 229x (Interior Alaska Lowlands) to the East. Although the MLRA is mostly undeveloped wild land and is sparsely populated, there are 42 villages scattered along the coast or the banks of the Yukon and Kuskokwim Rivers. The principal communities are Aniak, Bethel, Emmonak, Hooper Bay, and Saint Mary’s.
Physiography

Although primarily comprised of deltaic lowlands, in a few areas, isolated low hills rise above the surrounding coastal plain. Numerous low-gradient streams meander through this MLRA, many of which are tributaries or former channels of the Yukon and Kuskokwim Rivers. Depressions and shallow basins on the coastal plain are dotted with interconnecting stream channels, wetlands, and countless small and medium-size lakes. On the floodplains between channels and wetlands, low escarpments, meander scars, oxbow lakes, sloughs, and islands can be found. The coastline is broken by several large inlets and bays, including Baird Inlet, which forms a large inland sea behind Nelson Island.

Elevations generally range from sea level to 300 feet but reach heights of 2,342 feet at the

summit of Towak Mountain. A vast majority of the surface water from interior and western Alaska drains into the Bering Sea through MLRA 238x. Major rivers include the Yukon, Kuskokwim, Tovers, Black, Azun, Kashunuk, and Izaviknek Rivers. In addition to the various rivers and tributaries, lakes make up about 40 percent of this MLRA. This area is in the zone of discontinuous permafrost, where permafrost is thin to moderately thick and primarily occurs in fine textured soils. Permafrost does not generally occur on flood plains or in areas near bodies of water.

Geology

MLRA 238x was unglaciated during the Pleistocene, except for along the southern edge, where glaciers from the Ahklun mountains may have extended into portions of the lowlands. A majority of the sediments across the area are fine textured Holocene and Pleistocene deltaic deposits from the Yukon and Kuskokwim Rivers, and loamy and sandy Holocene fluvial deposits on flood plains and stream terraces. In the western part of the MLRA, low basalt hills, cinder cones, and volcanic craters from the Cretaceous and Tertiary can be found.

Climate

The climate of MLRA 238x is primarily maritime throughout the summer, and when Bering Sea ice pack forms in the winter, it becomes more characteristic of a continental climate. Summers are short, cloudy, and rainy while winters are long, cold, and foggy, especially in coastal areas. Windy conditions are common throughout the year. Mean annual precipitation is 12 to 30 inches and mean annual snowfall ranges from 40 to 90 inches. Freeze-free period range 116 to 150 days, but freezing temperatures can occur year-round, although rare in June, July, and August. This cold climate leads to MLRA 238x being included in the Arctic.

Soils

The dominant soil orders in MLRA 238x are Gelisols, Histosols, Inceptisols, and Entisols. Soils have a subgelic or cryic temperature regime, and an aquic or udic moisture regime. Fibristels, Hemistels, Histoturbels, and Aquiturbels are the most common Gelisol great groups. Fibristels and Hemistels have thick accumulations of organic material and occur in depressions and shallow basins. The Orthels and Turbels have comparably thinner surface organic material. The Histoturbels are common in elevated and convex areas and Aquiturbels are common on terraces and drainageways. Inceptisols, Entisols, and Histosols do not have permafrost within the soil profile. Histosols occur in depressions with thick accumulations of organic material. Inceptisols occur on the slopes of hills and mountains, swales, terraces, and flood plains. Entisols occur on shore complex and flood plains.

Vegetation

Lakes, ponds, and other types of surface water are common in this area and vegetation near these water bodies include wet sedge meadows, sedge-shrub meadows, and sedge-moss meadows. Low uplands support low and dwarf ericaceous shrubs, tussock-forming sedges, other hydrophytic plants, and mosses. Sites with higher local relief and better drainage support low ericaceous scrub with mosses, lichens, willows, and forbs. Low ericaceous shrubs, willow, alder, and mosses are understory associated in these forests and woodlands.

Land use

Residents use this area primarily for subsistence hunting, fishing, and gathering. Less than one percent of the MLRA is urban, and most communities are along the coast or major rivers and lakes. Disturbance of fragile permafrost soils is the major soil resource concern in this area, resulting from damage of insulating organic material that allows permafrost in upper soil layers to thaw. This can lead to ponding, soil subsidence, erosion, and altered hydrologic function. In order to slow the thawing of permafrost, management is needed to protect organic material and promote thermal balance of soils.

Classification relationships

Landfire Biophysical Settings:

7217010 – Alaska Arctic Coastal Sedge Dwarf-Shrubland
7217120 – Alaska Arctic Coastal Brackish Meadows
7617110 – Alaska Arctic Tidal Marsh
(LANDFIRE biophysical settings 2009)

Viereck Communities:

Sedge-willow tundra - III.A.2.h
Halophytic sedge wet meadow - III.A.3.i
(Viereck et al. 1992)

Ecological site concept

• This arctic ecological site occurs on shore complex, coastal plain, and depressions on both landforms.
• Soils form in organic material and marine deposits.
• Soils in depressions pond, while soils on the shore complex flood. Soils have a very shallow water table and are considered poorly and very poorly drained.
• Soils are very deep. Flooded areas on the shore complex and depressions lack restrictions. The coastal plain has permafrost at shallow to moderate depths.
• Reference state vegetation includes sedge-willow tundra and halophytic sedge wet meadow (Viereck et al. 1992).

Associated sites

R238XY405AK	**Arctic Scrub Loamy Flood Plain** Ecological site R238XY405AK occurs on coastal plain flood plains beyond the tidal influence associated with ecological site R238XY101AK.
R238XY408AK	**Arctic Scrub Loamy Frozen Swales and Drainageways** Ecological site R238XY408AK occurs on drainageways and swales beyond the tidal influence associated with ecological site R238XY101AK.

Similar sites

R238XY407AK	**Arctic Sedge Peat Depressions** Ecological site R238XY407AK occurs in peat depressions that produces vegetation that can be described as a wet sedge meadow, similar to the halophytic sedge meadow produced within ecological site 101, the shore complex.
R238XY408AK	**Arctic Scrub Loamy Frozen Swales and Drainageways** Ecological site R238XY408AK occurs in drainageways and swales that produces vegetation that can be described as a wet sedge meadow, similar to the halophytic sedge meadow produced within ecological site 101, the shore complex.
R239XY053AK	**Arctic Sedge Loamy Tidal Marsh** Associated with similar halophytic sedge meadow vegetation on shore complex but to the West in the Northern Bering Sea Islands MLRA (239X).

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Empetrum nigrum* (2) *Salix fuscescens*
Herbaceous	(1) *Carex ramenskii* (2) *Carex subspathacea*

Physiographic features

• This ecological site complex occurs on lands adjacent to the Bering Sea and is associated with depressions, shore complex, and the low coastal plain.
• Elevations range from sea level to 30 feet above sea level.
• Slope is nearly level and occur on all aspects.
• Sites proximal to the shore complex flood frequently while more distal areas do not flood.
• Depressions pond frequently, while other landforms do not pond.
• All associated soils have a water table at very shallow depth.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Coastal plain (2) Coastal plain > Depression (3) Coastal plain > Shore complex
Runoff class	Medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	0–9 m
Slope	0–1%
Ponding depth	5–15 cm
Water table depth	0–25 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Sea ice strongly influences the climate of MLRA 238x, as it does throughout Western Alaska. The climate is characteristically maritime throughout the summer months, where cool, moist air moves from the Bering Sea into coastal lowlands. As sea ice forms in the winter, the climate becomes more characteristic of a continental climate. These cold year-round conditions is the reason MLRA 238x is considered Arctic despite being approximately 500 miles south of the Arctic circle.

Winters are cold and long, with average low temperatures between 0 and 4 degrees (F) December through February. Winter and early spring is the driest time of the year with less than an inch of precipitation per month falling January through April. Summers in this area are cool, short, and often cloudy and rainy. June through October are considerably wetter, with the most precipitation falling in August and September. This area receives, on average, 16 inches of precipitation and 116 frost free days per year.

Table 3. Representative climatic features

Frost-free period (characteristic range)	106-122 days
Freeze-free period (characteristic range)	129-142 days
Precipitation total (characteristic range)	381-457 mm
Frost-free period (actual range)	90-129 days
Freeze-free period (actual range)	116-150 days
Precipitation total (actual range)	305-762 mm
Frost-free period (average)	116 days

Freeze-free period (average)	136 days
Precipitation total (average)	406 mm

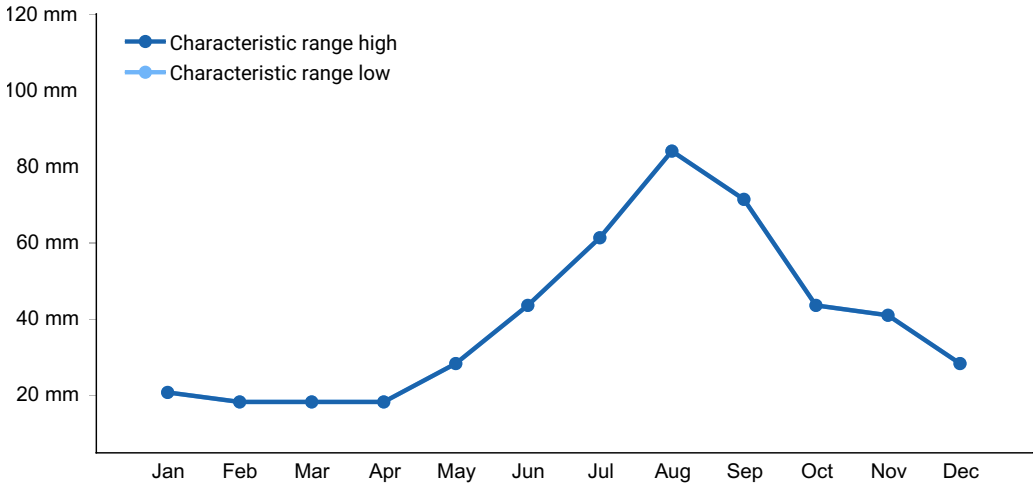


Figure 1. Monthly precipitation range

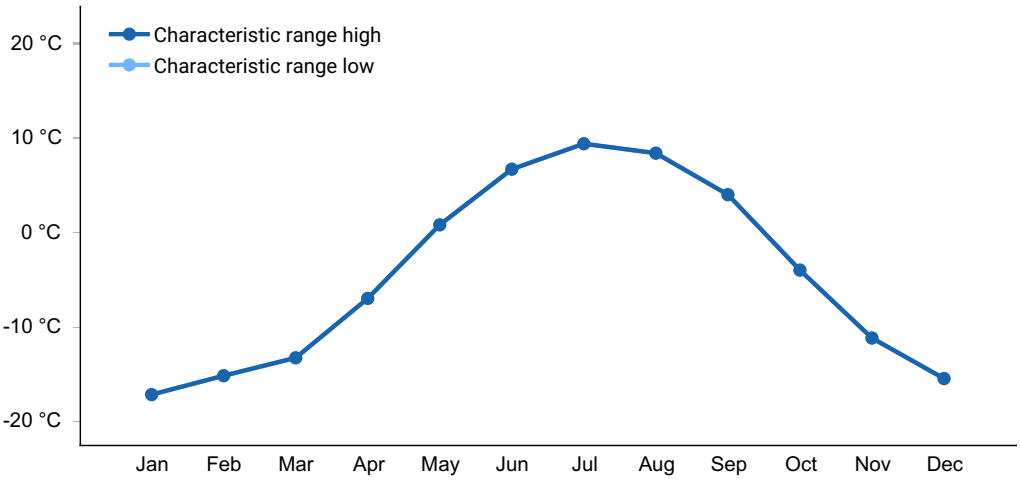


Figure 2. Monthly minimum temperature range

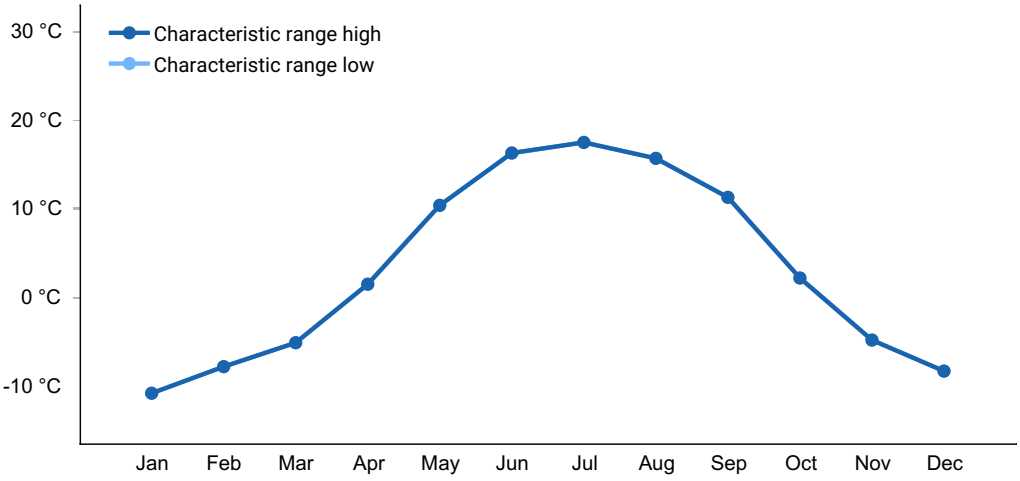


Figure 3. Monthly maximum temperature range

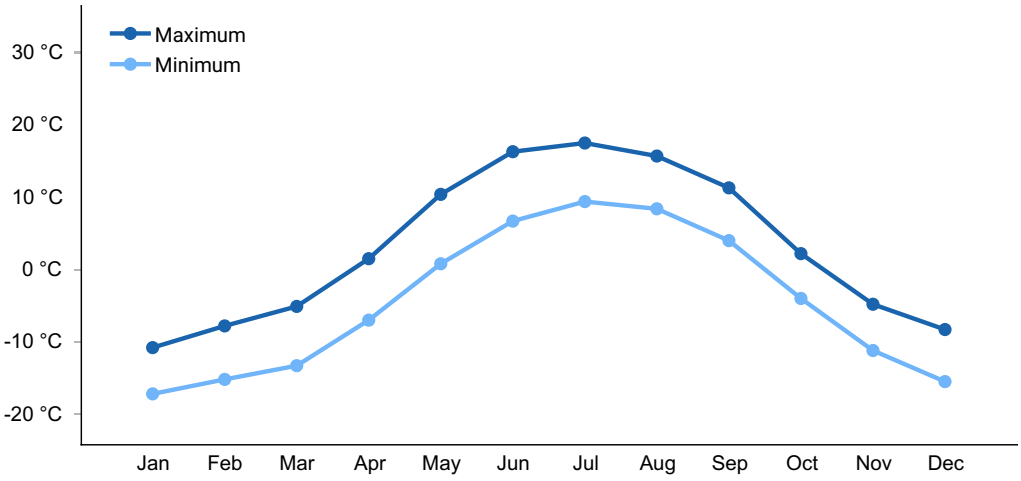


Figure 4. Monthly average minimum and maximum temperature

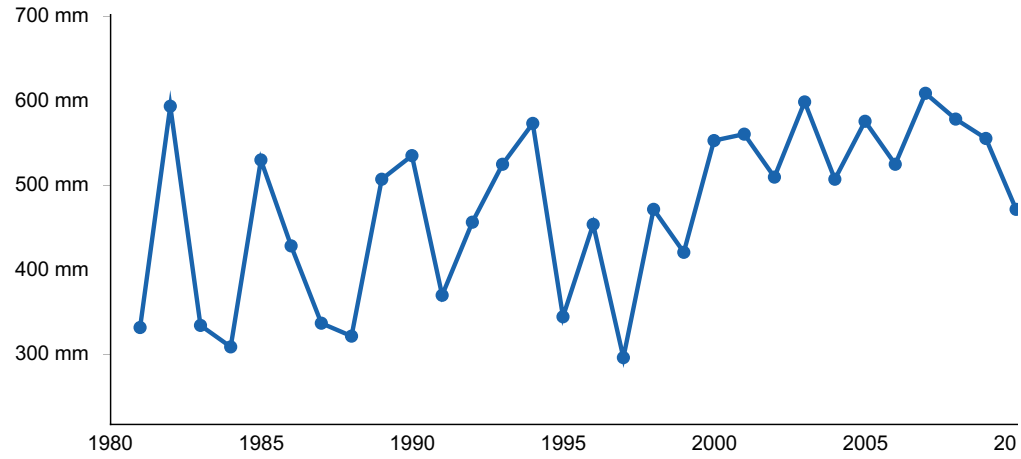


Figure 5. Annual precipitation pattern

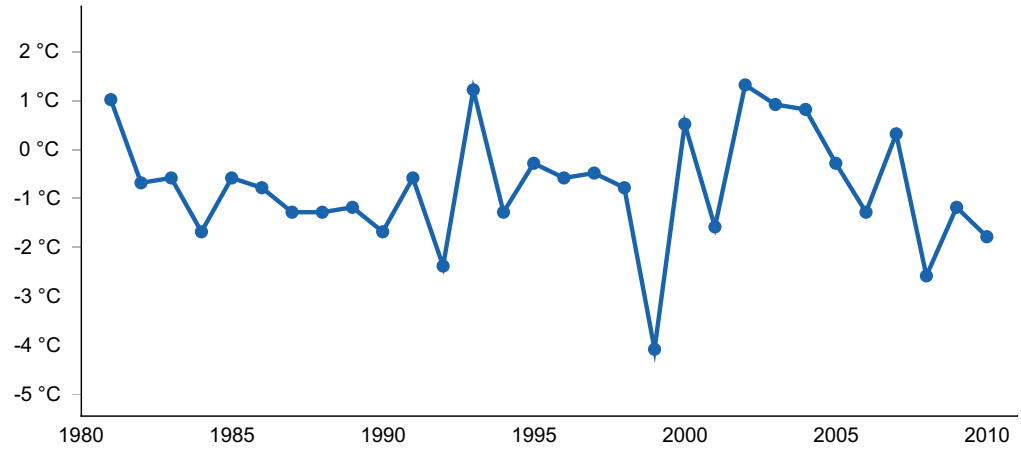


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BETHEL AP [USW00026615], Bethel, AK

Influencing water features

The tidal flats and brackish meadows of this ecological site complex are considered estuarine fringe wetlands. Estuarine fringe wetlands intergrade landward with riverine wetlands where tidal currents diminish, and river flow becomes the dominant water source. Additional water sources may be ground water discharge and precipitation.

Wetland description

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

Soil features

• Soils formed in organic material and silty and/or clayey marine deposits.
• Rock fragments do not occur on the soil surface and typically not in the soil profile.
• Mineral soils are capped with up to 33 inches of organic material in depressions and 4 to 9 inches of peat on shore complex and coastal plains. The surface horizon texture is peat or stratified silty clay loam and very fine sands.
• While soils are considered very deep, permafrost is common and when present occurs at shallow to moderate depths (between 10 and 26 inches).
• The pH of the soil profile ranges from very strongly acidic to neutral.
• Soils proximal to the shore have higher electrical conductivity, Sodium Absorption Ratio, and Calcium Carbonate Equivalent percent values compared to more distal soils.
• Soils are considered poorly and very poorly drained.

The Arctic Silty Shore Complex is correlated to eight soil components. Soils in depressions classify as Histosols in the great group Cryofibrists. Soils on the shore complex that are flooded classify as Entisols in the great group Cryaquepts. Soils on the coastal plain classify as Gelisols in the great group Historthels.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Marine deposits
Surface texture	(1) Peat (2) Silty clay loam (3) Very fine sand
Family particle size	(1) Coarse-silty (2) Fine-silty
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately rapid
Depth to restrictive layer	25–66 cm
Soil depth	152 cm

Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	21.08–28.19 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Clay content (0-50.8cm)	5–25%
Electrical conductivity (0-101.6cm)	0–20 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–9
Soil reaction (1:1 water) (0-25.4cm)	3.5–5.7
Subsurface fragment volume <=3" (0-152.4cm)	0%
Subsurface fragment volume >3" (0-152.4cm)	0%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	25–152 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 (0-101.6cm)	Not specified
Clay content (0-50.8cm)	0–25%
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-25.4cm)	3.5–8
Subsurface fragment volume <=3" (0-152.4cm)	0–10%
Subsurface fragment volume >3" (0-152.4cm)	Not specified

Ecological dynamics

The Yukon-Kuskokwim Coastal Plain MLRA has a harsh climate and cold soils and occurs in the zone of discontinuous permafrost. This MLRA occurs in the arctic biome and has a growing season that is both short and cold. As a result, the vertical and horizontal structure of vegetation is severely limited. Vegetation within the arctic biome is typically restricted to dwarf shrubs, mosses, and lichens.

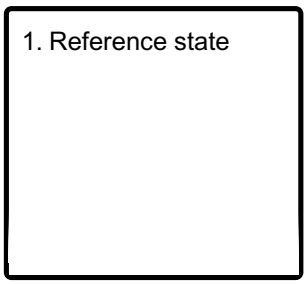
Saltwater Influences

Within the shore complex, there are multiple landforms such as tidal flats, foredunes, estuaries, and backshores each with unique tidal influences. Tidal flats, foredunes, and estuaries are all proximal to the ocean and receive frequent salt spray and/or routine tidal flooding. Backshores are comparatively distal landforms that receive tidal flooding only during exceptionally severe storms or unusually high tides.

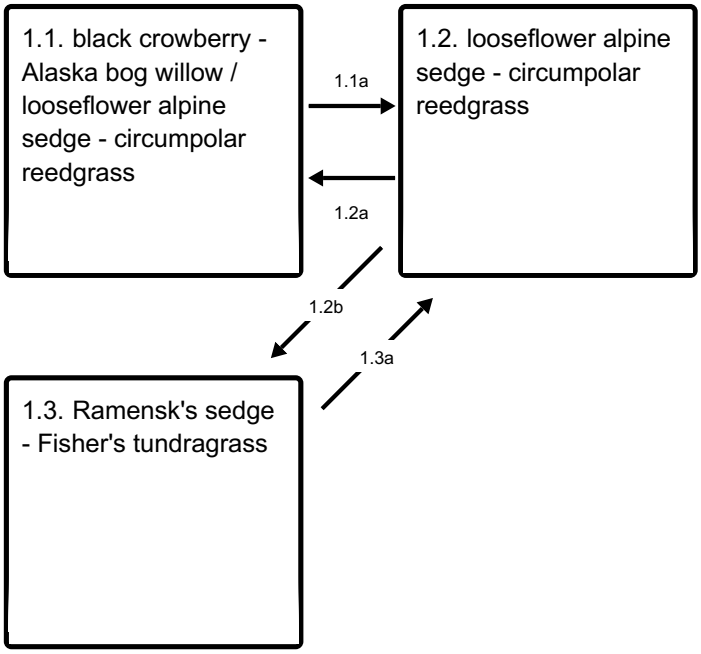
This ecological site complex represents a predictable vegetation gradient beginning immediately adjacent to the shore and moving inland. The ecological site closest to the shore (community 1.3) is a tidal marsh system. Tidal marshes represent a complex range of plant communities including marshes and herbaceous or barren mudflats (Landfire 2009). They also feature a range of salinity conditions from saline to nearly fresh. Moving inland as the tidal influence wanes to inundation only during storm tides and extreme high tides a coastal brackish meadow community (community 1.2) emerges. Brackish meadows are shaped primarily by tidal processes. This community could be considered seral to the adjacent plant communities (1.3 and 1.1) over very long time periods (Landfire 2009) and subsequent erosion or deposition of materials affecting the location of the shoreline. The furthest inland community (community 1.1) is considered a sedge-dwarf shrubland. This community is very rarely tidally flooded, far less so than the tidal marsh or brackish meadow communities. This community typically has permafrost present.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1a - coastal erosion

1.2a - coastal deposition

1.2b - coastal erosion

1.3a - coastal deposition

State 1
Reference state

There are three plant communities within the reference state. Tidal influences and inundation with saltwater are the dominant processes which shape these communities (Landfire 2009). All plant communities associated with this ecological site have limited data, so the state-and-transition model is provisional.

Dominant plant species

- Alaska bog willow (*Salix fuscescens*), shrub
- oval-leaf willow (*Salix ovalifolia*), shrub
- dwarf birch (*Betula nana*), shrub
- looseflower alpine sedge (*Carex rariflora*), grass
- circumpolar reedgrass (*Calamagrostis deschampsioides*), grass

- Anderson's alkaligrass (*Puccinellia andersonii*), grass

Community 1.1
black crowberry - Alaska bog willow / looseflower alpine sedge - circumpolar reedgrass

Community 1.1 supports vegetation that can be characterized as a coastal sedge-dwarf shrubland (Landfire 2009). Community 1.1 is the furthest upland site within the shore complex ecological site. The dominant plant species in community 1.1 are black crowberry (*Empetrum nigrum*), Alaska bog willow (*Salix fuscescens*), looseflower alpine sedge (*Carex rariflora*), and circumpolar reedgrass (*Calamagrostis deschampsioides*).

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- Alaska bog willow (*Salix fuscescens*), shrub
- oval-leaf willow (*Salix ovalifolia*), shrub
- dwarf birch (*Betula nana*), shrub
- looseflower alpine sedge (*Carex rariflora*), grass
- circumpolar reedgrass (*Calamagrostis deschampsioides*), grass
- Anderson's alkaligrass (*Puccinellia andersonii*), grass

Community 1.2
looseflower alpine sedge - circumpolar reedgrass

Community 1.2 supports vegetation that can be characterized as a coastal brackish meadow (Landfire 2009). Community 1.2 occurs as an intermediate plant community between the heavily tidally influenced tidal marsh closer to the shore, and the sedge-dwarf shrubland that is less influenced by saltwater and less dominated by halophytic vegetation. The dominant plant species in community 1.2 are looseflower alpine sedge (*Carex rariflora*), circumpolar reedgrass (*Calamagrostis deschampsioides*), arctic daisy (*Chrysanthemum arcticum*), and tall cottongrass (*Eriophorum angustifolium*) (Landfire 2009).

Dominant plant species

- looseflower alpine sedge (*Carex rariflora*), grass
- circumpolar reedgrass (*Calamagrostis deschampsioides*), grass
- tall cottongrass (*Eriophorum angustifolium*), grass
- water sedge (*Carex aquatilis*), grass
- Fisher's tundragrass (*Dupontia fisheri*), grass
- Ramensk's sedge (*Carex ramenskii*), grass
- Lyngbye's sedge (*Carex lyngbyei*), grass
- arctic daisy (*Chrysanthemum arcticum*), other herbaceous

Community 1.3
Ramensk's sedge - Fisher's tundragrass

Community 1.3 supports vegetation that can be characterized as a tidal marsh (Landfire 2009). Community 1.3 is the community closest to the ocean or sea. Community 1.3 is dominated by Ramensk's sedge (*Carex ramenskii*), Hoppner's sedge (*Carex subspathacea*), and Fisher's tundragrass (*Dupontia fisheri*) (Landfire 2009).

Dominant plant species

- Ramensk's sedge (*Carex ramenskii*), grass
- Hoppner's sedge (*Carex subspathacea*), grass
- Lyngbye's sedge (*Carex lyngbyei*), grass
- Fisher's tundragrass (*Dupontia fisheri*), grass
- alkaligrass (*Puccinellia*), grass
- Pacific silverweed (*Argentina egedii*), grass

Pathway 1.1a
Community 1.1 to 1.2

Coastal erosion will degrade the stable shrub communities and shift to a more herbaceous dominated system. Erosion is a result of permafrost thaws due to thermoregulation from standing water. Thawing occurs from more frequent inundation with saltwater and for longer periods.

Pathway 1.2a
Community 1.2 to 1.1

The silt and sand deposits along the coastline helps rebuild or helps shoreline recover. Deposition will occur with less frequent inundation with saltwater and for shorter periods. Deposition over time will allow permafrost to begin to form under soil surface.

Pathway 1.2b
Community 1.2 to 1.3

Increase in coastal erosion occurs as shoreline is impacted by more frequent inundation with saltwater and for longer periods.

Pathway 1.3a
Community 1.3 to 1.2

As inundation with saltwater is decreased with shorter periods of inundation, vegetation establishes. Coastal deposition of sands and silts allows for further vegetation establishment and continues to build the shoreline.

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

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.

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Contributors

Tyler Annetts
Jamin Johanson
Blaine Spellman

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	03/12/2026
Approved by	Blaine Spellman
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):**

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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:

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:**