USDA Natural Resources
Conservation Service

Ecological site R224XY102AK
Tidal Basin Provisional Ecological Site Group

Last updated: 6/13/2025
Accessed: 03/14/2026

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): 224X–Cook Inlet Lowlands

Major Land Resource Area (MLRA) 224X consists of lowlands and lower mountain slopes of the Susitna and Matanuska Valleys, western Kenai Peninsula, and west side of Cook Inlet. It makes up about 10,965 square miles (28,400 square kilometers). The terrain is a broad expanse of braided flood plains, high gradient rivers, rolling plains, terraces and hills bordered by the surrounding mountains. This MLRA contains a large percentage of Alaska's total population and includes the most extensive road systems in the state. Major rivers include the Susitna, Yentna, Little Susitna, Matanuska, Kenai, and Deep Creek that all drain into Cook Inlet. Large lakes include Tustumena and Skilak.

Climate is highly variable ranging from temperate maritime to continental subarctic. Winter arctic weather systems are common in the northern portion of the MLRA. The average annual precipitation ranges from 15 to 60 inches (380 to 1,525 millimeters). The average annual snowfall is about 60 to 120 inches (150 to 305 centimeters). The average annual temperature is about 27 to 36 degrees F (-3 to 2 degrees C). The freeze-free period averages 65 to 160 days, decreasing with elevation.

Vegetation ranges from spruce/birch forests in the lowlands to subalpine scrubland at high elevations. Saltwater meadows along the coast and wetlands and extensive marsh occur throughout the lowlands across the valley. In most years precipitation is adequate for crops, with limited irrigation. Major rivers are affected by high sediment-laden glacial meltwater and ice dam damage and flooding is a risk during spring thaw. Water is hard or very hard, with high potential levels of iron, but is otherwise of excellent quality. Alpine vegetation is associated with the adjacent Cook Inlet Mountains MLRA (223X).

The dominant soil orders in this MLRA are Spodosols, Histosols, Entisols, and Inceptisols. Water, riverwash, beaches, and other miscellaneous (non-soil) areas are 15 percent of this MLRA. Glacial and volcanic ash wind-blown deposits influence much of area, while fluvial deposits are common in riparian areas.

The MLRA is visited by a great number of migrating birds and supports large populations of waterfowl. Most of the rivers and streams are important spawning grounds for salmon (Chinook, coho, and red salmon). Peonies, hay, potatoes, and hardy vegetables are important agriculture with a few dairy and beef cattle farms present. Commercial logging and subsistence firewood gathering are locally important, as is subsistence gathering. Other major industries in the area include commercial fishing, fish processing, and oil and gas extraction. Tourism and wildland recreation are becoming increasingly important.

The major resource concerns are water erosion and water quality. Aquifers are highly susceptible to contamination from runoff. The intrusion of seawater can be a problem along Cook Inlet. Rapid development and off-road recreation are creating significant damage to the wildlands.

LRU notes

This MLRA is a transitional zone between temperate maritime and continental subarctic climatic zones. Arctic winter weather patterns are present in northern areas. With this transition, there are major variations in climatic influences and vegetative responses. With further soil survey and vegetative surveys, this MLRA will be evaluated for potential Land Resource Unit (LRU) development.

Classification relationships

LandFire BpS Model/Description Version: Nov. 2024
- 16680 Temperate Pacific Tidal Salt and Brackish Marsh
- 16650 Alaskan Pacific-Aleutian Coastal Dune, Beach, and Beach Meadow
(Landfire, 2024)

Ecological site concept

- Occurs on tidal flats and beaches
- Soils affected by tidal flow, and eolian sand and silt movement along the coastline.
- Soils are primarily affected by saltwater with localized areas of freshwater influence.
- Fluctuating tidal water levels and subsurface seep support a very shallow to shallow water table for some or all of the growing season
- Flooding is variable. Lower tidal flats experience daily tides.
- Vegetation is somewhat sparse on newer and more active tidal locations, but vegetation cover increases with landform age and stability.
- Plant community is characterized by a salt-tolerant forb and grass dominated early successional community, then a higher diversity of grass and forbs establish with a mix of

short and tall shrubs.

Associated sites

R224XY103AK	**Sand Dunes Provisional Ecological Site Group (R/F)** The Dunes and Ridges ecological site group is closely associated with the tidal basins. The basins are at sea-level and have a saltwater influence and tidal influence. The dunes and ridges are a rise above this with minimal to no tidal and salt influence.

Similar sites

R224XY201AK	**Depressions and Seep Provisional Ecological Site Group** The Tidal Basin and Depression Complex ecological site have similar wetland characteristics. The tidal basins have a saltwater influence with a more rhythmic pattern of inundation than the Depression Complex ecological site. This lends to a less variable community composition.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex ramenskii* (2) *Carex lyngbyei*

Physiographic features

This ecological site group is on tidal flats, estuary, and salt marsh along Cook Inlet, Goose Bay, and at the mouths of the Susitna, Little Susitna, and Matanuska Rivers. Elevation ranges from sea level to 50 feet, and areas are sometimes partially to entirely inundated by tide water. The water table continuously remains within 1.5 feet of the surface.

Tidal flats and salt marshes are nearly level (zero to two percent). These landforms are dissected by channels from one to two foot deep and five to ten feet wide. The channels are stabilized by scattered vegetation.

- frequently flooded by tidal waters.
- water table is near the surface.

Table 2. Representative physiographic features

Landforms	(1) Shore complex > Tidal flat (2) Shore complex > Estuary (3) Shore complex > Salt marsh (4) Shore complex > Coastal plain > Open depression

Runoff class	Negligible to very low
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Frequent to very frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to rare
Elevation	0–15 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	0–46 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding duration	Not specified
Flooding frequency	None to very frequent
Ponding duration	Not specified
Ponding frequency	Not specified
Elevation	0–61 m
Slope	Not specified
Ponding depth	0–30 cm
Water table depth	0–61 cm

Climatic features

Climate is highly variable, generally ranging from temperate maritime to continental subarctic. Most weather systems originate in the North Pacific and the Gulf of Alaska. In winter, particularly in the northern part of the area, arctic weather systems are more common. In the Matanuska Valley, seasonal winds pick up fine-earth material from unvegetated flood plains and create extensive dust clouds that can reach an altitude of 5,000 feet (1,525 meters) or more. The average annual precipitation ranges from 15 to 60 inches (380 to 1,525 millimeters). It generally is higher on the southern Kenai Peninsula, in the northern Susitna Valley, and at the higher elevations along the mountains. The average annual snowfall is about 60 to 120 inches (150 to 305 centimeters). The average annual temperature is about 27 to 36 degrees F (-3 to 2 degrees C). The freeze-free period averages 65 to 160 days, decreasing in length with elevation. (USDA-NRCS 2022).

For detailed information visit the Natural Resources Conservation Service National Water

and Climate Center at http://www.wcc.nrcs.usda.gov/. Point Mackenzie, Anchorage INTL AP, Talkeetna AP, Homer AP, and Kenai Muni AP are the representative climate stations. The following graphs and charts are a collective sample representing the averaged normals and 30-year annual rainfall data for the selected weather stations from 1981 to 2010.

Table 4. Representative climatic features

Frost-free period (characteristic range)	84-115 days
Freeze-free period (characteristic range)	118-142 days
Precipitation total (characteristic range)	457-635 mm
Frost-free period (actual range)	81-117 days
Freeze-free period (actual range)	112-144 days
Precipitation total (actual range)	432-686 mm
Frost-free period (average)	100 days
Freeze-free period (average)	130 days
Precipitation total (average)	533 mm

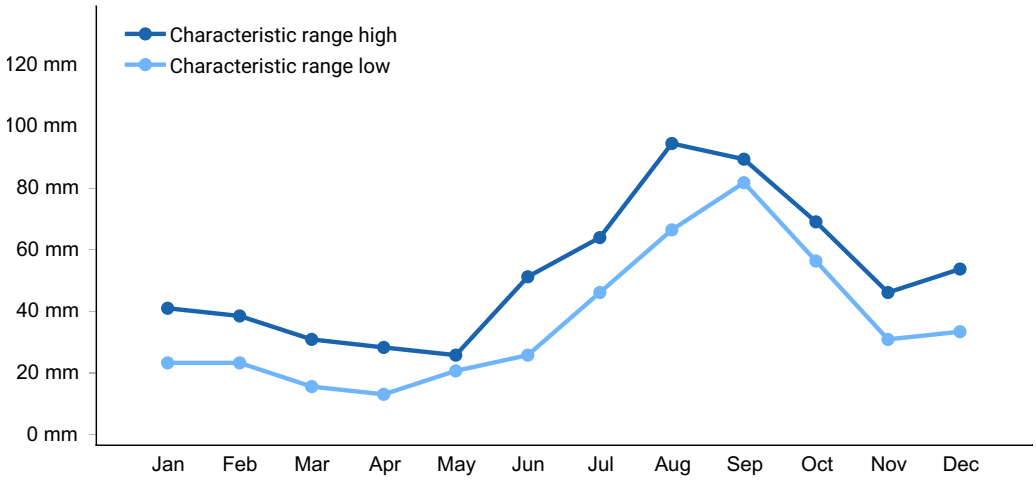

Figure 1. Monthly precipitation range

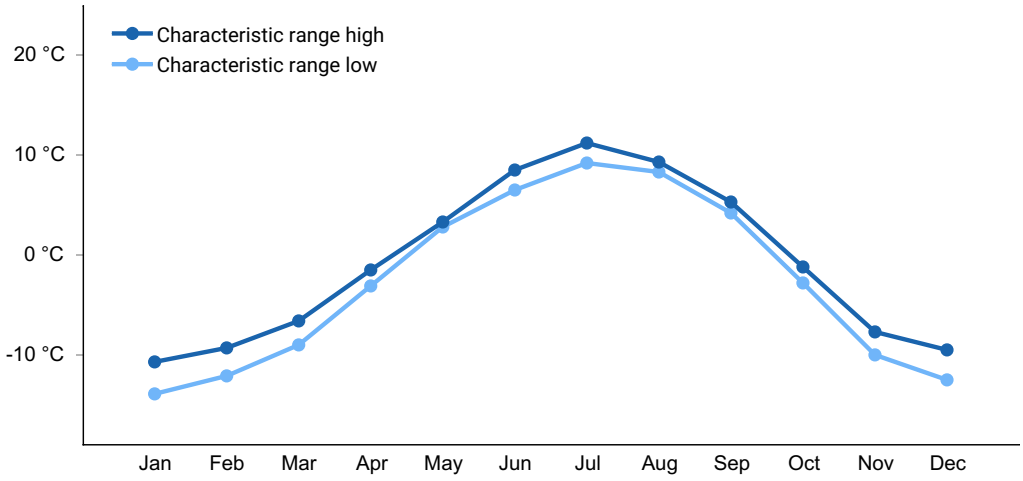

Figure 2. Monthly minimum temperature range

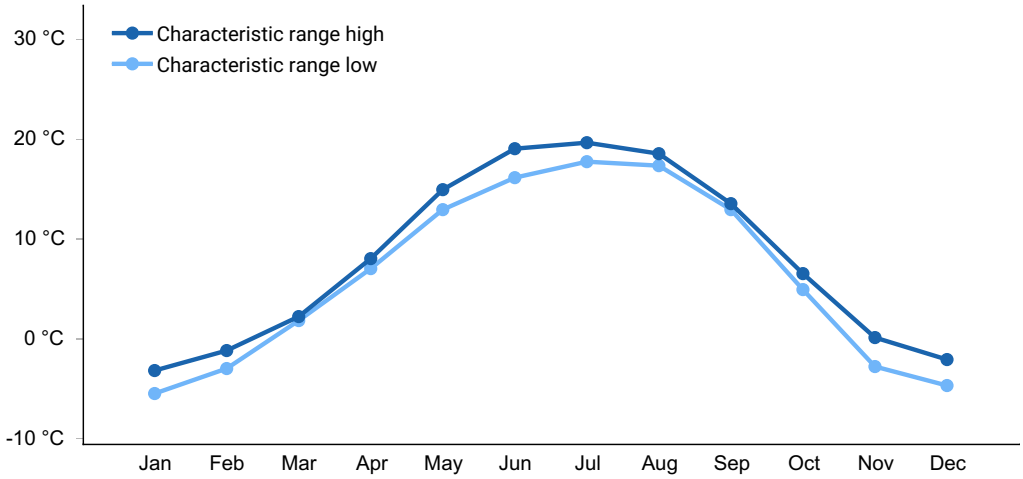

Figure 3. Monthly maximum temperature range

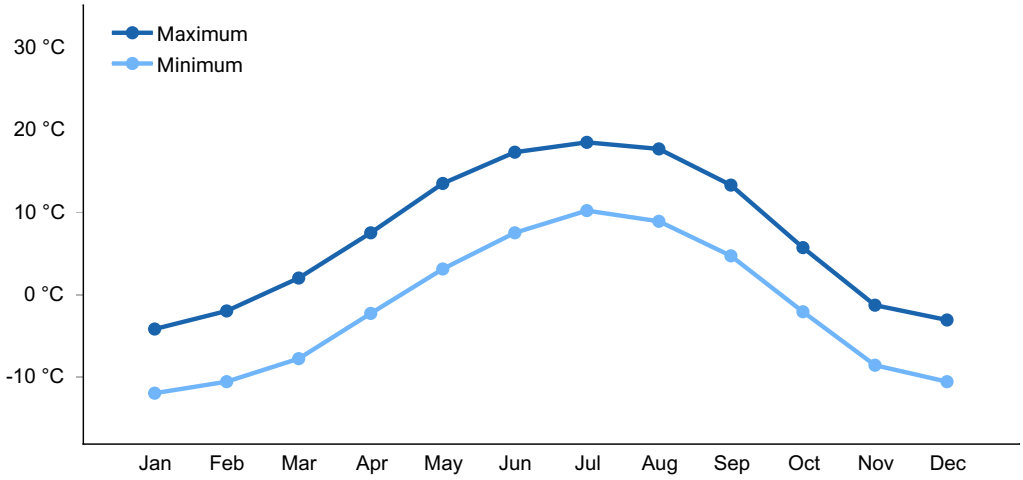

Figure 4. Monthly average minimum and maximum temperature

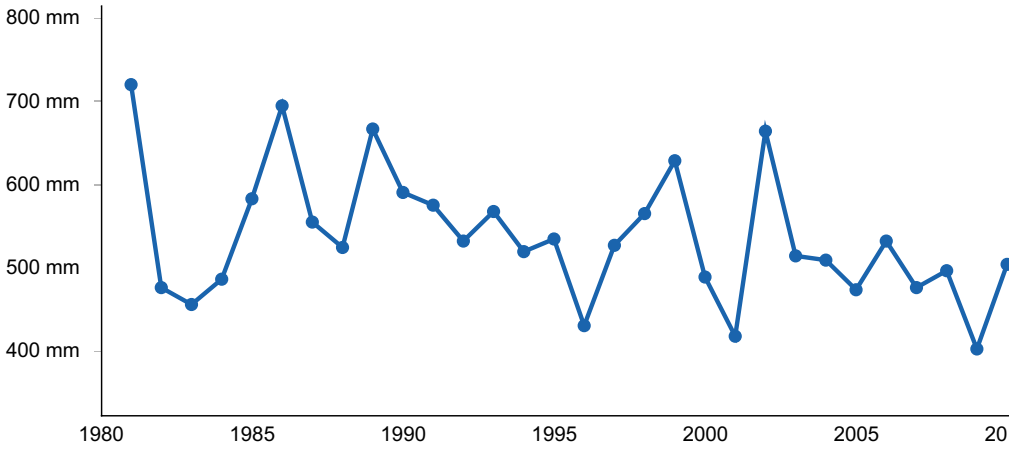

Figure 5. Annual precipitation pattern

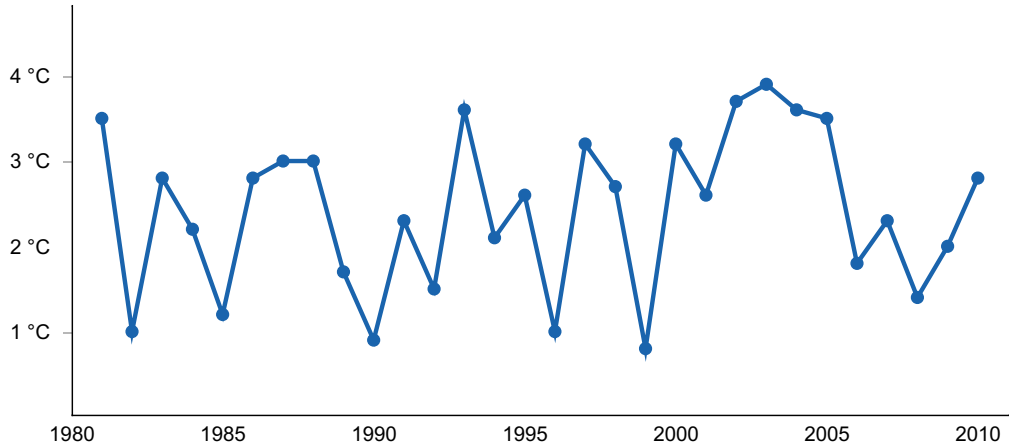

Figure 6. Annual average temperature pattern

Climate stations used

- (1) TALKEETNA AP [USW00026528], Talkeetna, AK
- (2) POINT MACKENZIE [USC00507444], Wasilla, AK
- (3) ANCHORAGE INTL AP [USW00026451], Anchorage, AK
- (4) KENAI MUNI AP [USW00026523], Kenai, AK
- (5) HOMER AP [USW00025507], Homer, AK

Influencing water features

Soils and vegetation are influenced by tidal flooding and a very shallow to shallow water table. Surface ponding occurs in depressional areas, and stream channels cut across the tidal flats bringing freshwater into the basins.

Wetland description

Shallow tidal pools and saltwater marshes are included within this ecological site concept. Freshwater wetland areas are correlated to a drainage complex ecological site.

Soil features

This ecological site is associated with very poorly to poorly drained soils on tidal flats.

- formed in marine sediments or glaciofluvial deposits.
- silty and very deep.
- surface layer is dark gray silt loams.
- strongly acidic to neutral.

Table 5. Representative soil features

Parent material	(1) Marine deposits (2) Organic material (3) Glaciofluvial deposits
Surface texture	(1) Silt loam (2) Peat
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.05–21.08 cm
Soil reaction (1:1 water) (0-25.4cm)	5.4–7
Subsurface fragment volume <=3" (0-152.4cm)	0–4%
Subsurface fragment volume >3" (0-152.4cm)	0–7%

Table 6. Representative soil features (actual values)

Drainage class	Very poorly drained to well drained
Permeability class	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	2.54–23.88 cm

Soil reaction (1:1 water) (0-25.4cm)	4–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–23%
Subsurface fragment volume >3" (0-152.4cm)	0–22%

Ecological dynamics

Tidal Basins ecological site describes the vegetated zone above bare mud flats. Normal and extreme tidal fluctuations support several vegetative communities, from sparsely vegetated, to forb meadows and grasslands. There does not seem to be a successional range of plant communities on tidal flats. Instead, communities are formed along a salt-tolerance gradient. The same soils are present across the ecological site. The vegetation is shaped less by soil factors and more by hydrology (flood frequency, salt intrusion, depth to water table, ponding).

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. Ramensk's sedge - Lyngbye's sedge

1.2. Creeping alkaligrass / Seaside arrowgrass - Goose tongue

1.3. Scrub birch - Sweetgale / Buckbean/ Moss

State 1

Reference State

Three plant communities occur on this ecological site. They appear along a salt gradient from most to least tidally influenced. These communities are hydrologically driven. A major disturbance that shifts coastal hydrology, such as isostatic rebound, is required to change site hydrology, and as such no transitional pathways are described between the communities. The first community is comprised of broad expanses of a mosaiced sedgeland. Ramensk's sedge (*Carex ramenskii*) and Lyngbye's sedge (*Carex lyngbyei*) are on drier and wetter areas, respectively, of this mid-tidal zone area. Lower, more frequently flooded areas support a resilient community of creeping alkaligrass (*Puccinellia phryganodes*), seaside arrowgrass (*Triglochin maritima*), and goose tongue (*Plantago maritima*). This community also grows in depressions higher on the tidal flats that are inundated slightly longer. These first two communities have a broad tolerance to tidal influence and salt tolerance and cover a wider range within the tidal zones. They do not seem to replace each other but rather occur together in varying degrees. A third community occurs on higher ground. Vegetation consists primarily of halophytic sedges and grass meadows with scrub birch and willow scrub on better drained soils along drainages and on elevated microsites. Tidal flooding is less frequent here than in the other two communities but still occurs during extreme high tides and storm surges. Scrub birch (Betula gladulosa), labrador tea (*Ledum groenlandicum*), and sweetgale (*Myrica gale*) are indicators of the slightly higher, drier position within the tidal flats.

Dominant plant species

- resin birch (*Betula glandulosa*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- sweetgale (*Myrica gale*), shrub
- Ramensk's sedge (*Carex ramenskii*), grass
- Lyngbye's sedge (*Carex lyngbyei*), grass
- creeping alkaligrass (*Puccinellia phryganodes*), grass
- seaside arrowgrass (*Triglochin maritima*), other herbaceous

Community 1.1
Ramensk's sedge - Lyngbye's sedge

This community is a mosaic of Ramensk's sedge on dryer edges and Lyngbye's sedge in the wetter depressional areas. This plant community is directly shaped by tidal fluctuation, to which it is resilient. Both sedges and the community as a whole have a wide salt tolerance range. The binomial name of these and other less common associated plants can be found in the below dominant plant species table.

Dominant plant species

- Ramensk's sedge (*Carex ramenskii*), grass
- Hoppner's sedge (*Carex subspathacea*), grass
- creeping alkaligrass (*Puccinellia phryganodes*), grass
- Nootka alkaligrass (*Puccinellia nutkaensis*), grass

- seaside arrowgrass (*Triglochin maritima*), other herbaceous
- Pacific silverweed (*Argentina egedii*), other herbaceous
- goose tongue (*Plantago maritima*), other herbaceous

Community 1.2
Creeping alkaligrass / Seaside arrowgrass - Goose tongue

This stable plant community is comprised of salt-loving halophytic species. Common species include creeping alkaligrass, seaside arrowgrass, and goose tongue. Wetter areas may support more forbs. The binomial name of these and other less common associated plants can be found in the below dominant plant species table.

Dominant plant species

- creeping alkaligrass (*Puccinellia phryganodes*), grass
- largeflower speargrass (*Poa eminens*), grass
- arctic rush (*Juncus arcticus*), grass
- Nootka alkaligrass (*Puccinellia nutkaensis*), grass
- smoothcone sedge (*Carex laeviconica*), grass
- goose tongue (*Plantago maritima*), other herbaceous
- seaside arrowgrass (*Triglochin maritima*), other herbaceous
- Pacific silverweed (*Argentina egedii*), other herbaceous
- Virginia glasswort (*Salicornia depressa*), other herbaceous
- alkali buttercup (*Ranunculus cymbalaria*), other herbaceous
- arctic daisy (*Chrysanthemum arcticum*), other herbaceous

Community 1.3
Scrub birch - Sweetgale / Buckbean/ Moss

This community is less frequently flooded by tides and is located distally from the ocean, on soils alongside drainages or on topographically raised positions. Slower growing, less halophytic species are present. Common plant strata include low shrubs, medium graminoids, medium forbs, and moss. The binomial name of these and other less common associated plants can be found in the below dominant plant species table.

Dominant plant species

- resin birch (*Betula glandulosa*), shrub
- sweetgale (*Myrica gale*), shrub
- creeping alkaligrass (*Puccinellia phryganodes*), grass
- buckbean (*Menyanthes trifoliata*), other herbaceous
- Moss (*Moss*), other herbaceous

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				–	
	Ramensk's sedge	CARA4	*Carex ramenskii*	–	35–75
	Hoppner's sedge	CASU8	*Carex subspathacea*	–	20–50
	creeping alkaligrass	PUPH	*Puccinellia phryganodes*	–	5–20
	Nootka alkaligrass	PUNU	*Puccinellia nutkaensis*	–	0–10
Forb					
2				–	
	seaside arrowgrass	TRMA20	*Triglochin maritima*	–	5–20
	Pacific silverweed	AREG	*Argentina egedii*	–	0–15
	goose tongue	PLMA3	*Plantago maritima*	–	0–5

Animal community

Tidal basin provides habitat for moose, bald eagles and hawks, a variety of waterfowl, shore birds, and other wildlife.

Hydrological functions

Tides frequently inundate this ecological site, maintaining the channels that dissect it. The water table is near the surface and drainage is typically poor.

Recreational uses

Hunting, bird watching, and recreational activities are major activities on tidal flats. Recreationists on horseback may use this ecological site for traveling through. Other recreational uses are limited due to the tidal influence. All-terrain and off-road vehicles sometimes drive through this ecological site, which cause the wheel tracks to lose their vegetative cover and expose soil to potential erosion. Deep ruts quickly become exaggerated.

Wood products

0ccasionally large sea logs and tree trunks wash up during extreme high tides and large

storm events.

Inventory data references

No field plots were available for this ecological site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

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

Bailey, R.G. 1995. Ecoregions of North America. U.S. Department of Agriculture, Forest Service, Washington, DC, map scale 1: 15,000,000. Available at https://www.fs.fed.us/rm/ecoregions/products/map-ecoregions-north-america/.

Boggs, K.W., S.C. Klein, J.E. Grunblatt, G.P. Streveler, and B. Koltun. 2008. Landcover Classes and Plant Associations of Glacier Bay National Park and Preserve. Natural Resource Technical Report NPR/GLBA/NRTR-2008/093. National Park Service, Fort Collins, CO. 254 pps.

Boggs, K., S.C. Klein, J. Grunblatt, T. Boucher, B. Koltun, M. Sturdy, and G.P. Streveler. 2010. Alpine and subalpine vegetation chronosequences following deglaciation in coastal Alaska. Arctic, Antarctic, and Alpine Research 42: 385-395.

Boggs, K., L. Flagstad, T. Boucher, T. Kuo, M. Aisu, J. Tande, and J. Michaelson. 2016. Vegetation Map and Classification: Southern Alaska and Aleutian Islands. Alaska Natural Heritage Program, Alaska Center for Conservation Science, University of Alaska Anchorage. 90 pps.

Carsten, R. 2007. Chapter 5.2 Terrestrial habitats of Southeast Alaska. In: Schoen, J.W. and E. Dovichin (eds). The Coastal Forests and Mountains Ecoregion of Southeastern Alaska and the Tongass National Forest: A Conservation Assessment and Resource Synthesis. Audubon Alaska and The Nature Conservancy, Anchorage, AK.

Gallant, A.L., E.F. Binnian, J.M. Omernick, and M.B. Shasby. 2010. Level III Ecoregions of Alaska. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research

Laboratory, map scale 1: 5,000,000. Available at http://http://www.epa.gov/eco-research//ecoregion-download-files-state-region-10. (Accessed 11 September 2018).

Kauffman, D.S., N.E. young, J.P. Briner, and W.F. Manley. 2011. Alaska Paleo-Glacier Atlas (Version 2), pps. 427-445. In: Ehlers, J., P.L. Gibbard, and P.D. Hughes (eds.). Developments in Quaternary Science, Volume 15. Amsterdam, The Netherlands.

LANDFIRE. 2024. Biophysical Setting 16680 Temperate Pacific Tidal Salt and Brackish Marsh. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

LANDFIRE. 2024. Biophysical Setting 16650 Alaskan Pacific-Aleutian Coastal Dune, Beach, and Beach Meadow. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http://explorer.natureserve.org. (Accessed 10 September 2018).

Peel, M.C., B.L. Finlayson, and T.A. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences 11: 1633-1644.

United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 682 pps.

Wahrhaftig, C. 1965. Physiographic Divisions of Alaska. Geological Survey Professional paper 482. U.S. Department of the Interior, Geological Survey, U.S. Government Printing Office, Washington, DC. 52 pps.

Contributors

Marji Parz
Jamin Johanson
Blaine Spellman
Phil Barber
Tyler Annetts

Acknowledgments

The original site concepts for the Loamy slopes was created and published by Karin Sonnen, the State Grazing/Rangeland Management Specialist for Alaska in May of 2010.

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	03/14/2026
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):**

   _____

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:**
