USDA Natural Resources
Conservation Service

Ecological site R220XY422AK
Estuarine Herbaceous Dry Sand

Last updated: 3/10/2025
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): 220X–Alexander Archipelago-Gulf of Alaska Coast

The Alexander Archipelago-Gulf of Alaska Coast area consists of a narrow arc of islands and lower elevation coastal mountains in the Southern Alaska Region. This area spans from the Alexander Archipelago in southeastern Alaska, north and west along the coast of the Gulf of Alaska and Prince William Sound, and further west to the southern tip of the Kenai Peninsula and the northeastern islands of the Kodiak Archipelago. The area makes up about 27,435 square miles (USDA 2006). The terrain primarily consists of low to moderate relief mountains that are deeply incised. Throughout the area glaciers, rivers, and streams have cut deep, narrow to broad valleys. The broader valleys have nearly level to strongly sloping flood plains and stream terraces. Alluvial and colluvial fans and short footslopes are common in the valleys along the base of the mountains. Rocky headlands, sea cliffs, estuaries, and beaches are common along the coast.

This area includes the Municipality of Juneau, Alaska's capital, and a number of smaller coastal towns and villages. Federally administered lands within this MLRA include Admiralty Island National Monument and part of Misty Fjords National Monument, Tongass National Forest, Chugach National Forest, and Glacier Bay, Wrangell-St. Elias, and Kenai Fjords National Parks and Preserves. The southern terminus of the Trans-Alaska Pipeline is in Valdez.

During the late Pleistocene epoch, the entire area was covered with glacial ice. The numerous fjords of the Alexander Archipelago and Prince William Sound were formed chiefly as a result of glacial scouring and deepening of preglacial river valleys. Most glacial deposits have been eroded away or buried by mountain colluvium and alluvium, which cover about 90 percent of the present landscape. The remaining glacial and glaciofluvial deposits are generally restricted to coastal areas. During the Holocene epoch, volcanic activity within and adjacent to this area deposited a layer of volcanic ash of varying thickness on much of the landscape in the southeastern and northwestern parts of the area. Paleozoic, Mesozoic, and Lower Tertiary stratified sedimentary rocks and Cretaceous and Tertiary intrusive rocks underlie much of the area and are exposed on steep mountain slopes and ridges (USDA 2006).

The dominant soil orders in this MLRA are Spodosols, Histosols, and Entisols. Soils in the area typically have a cryic soil temperature regime, an udic moisture regime, and have mixed minerology. Spodosols are common on mountains and hills having been formed in gravelly or cobbly colluvium, glacial till, and varying amounts of silty volcanic ash. These Spodosols commonly range from shallow to deep, are well to somewhat poorly drained, and typically classify as Humicryods or Haplocryods. Histosols that are poorly to very poorly drained occur on footslopes, discharge slopes, and valley floors. These wet histosols commonly classify as Cryosaprists, Cryohemists, and Cryofibrists. Histosols that are well drained occur on steep mountainsides. These dry Histosols commonly classify as Cryofolists. Entisols are common on flood plains, stream terraces, and outwash plains having been formed in silty, sandy, and gravelly to cobbly alluvium. These Entisols are generally deep, range from well to somewhat poorly drained, and commonly classify as Cryaquents and Cryofluvents. Miscellaneous (non-soil) areas make up about 23 percent of the MLRA. The most common miscellaneous areas are avalanche chutes, rock outcrop, rubble land, beaches, river wash, and water.

This area represents the northern extent of the Pacific temperature rainforest and is characterized by productive stands of conifers. Western hemlock and Sitka spruce are the dominant trees on mountains and hills at the lower elevations. Due to warmer temperatures, western red cedar and Alaska cedar are more prevalent in the southern part of the area. Black cottonwood and mixed forest types occur on flood plains. Areas of peat and other sites that are too wet for forest growth support sedge-grass meadows and low scrub. The transition to subalpine and alpine communities typically occurs at elevations between 1500 to 3000 feet (Boggs et al. 2010, Carstensen 2007, Martin et al. 1995), which characterize the vegetation of the Southern Alaska Coastal Mountains area.

For many decades, logging, commercial fishing, and mining have been the primary industrial land uses throughout much of the area. In recent years, changes in public interests, land use policies, and timber economics have contributed to a significant decline in the timber industry. Commercial fishing continues to be an important industry and most communities support a fleet of boats and fishing related facilities. A number of mines operate in the area and others have been prospected and proposed. Tourism and wildland recreation are becoming increasingly important. Subsistence hunting, fishing, and gathering provide food and a variety of other resources to local residents and remain the principal economy for residents of remote villages.

Ecological site concept

This site occurs on dry beach ridges and sandy terraces associated with ocean shores. These landscape positions are not flooded or ponded by tides, but are influenced by salt spray in varying degrees. These sandy soils are the driest in the coastal landscape with moderate to somewhat excessive drainage. The water table is usually more than 52 inches below the soil surface, but can be to within 30 inches during wet periods. Slopes range from 0-15% and elevations are typically less than 50 feet above sea level.

Three plant communities occur on this site and are differentiated by grass, forb, or shrub dominance. American dunegrass dominates in relatively dry areas and beach strawberry, little yellow rattle, and beach pea dominate in relatively wet areas. Sitka alder dominates in areas that are relatively protected from salt spray, particularly on the upper reaches of this site farthest from the ocean.

Associated sites

R220XY329AK	**Estuarine Herbaceous Tidal Marsh** Site R220XY329AK occurs downslope from this site on tidal areas that are frequently flooded by ocean tides, often along coastal rivers.
R220XY450AK	**Estuarine Herbaceous Loamy Floodplain** Site R220XY450AK occurs in sandy alluvium near estuarine rivers, sometimes downslope from this site.
R220XY424AK	**Estuarine Herbaceous Sandy Beach Plain** Site R220XY424AK occurs on similar landscape positions, but is poorly- to somewhat poorly-drained and supports more mesic plant communities.

Similar sites

R220XY424AK	**Estuarine Herbaceous Sandy Beach Plain** Site R220XY424AK also occurs on coarse-textured coastal terraces, but only in areas that are poorly- to somewhat poorly-drained, having an elevated water table year round, and incapable of supporting American dunegrass.
R220XY450AK	**Estuarine Herbaceous Loamy Floodplain** Site R220XY450AK also occurs in coastal areas that support American dunegrass, but is frequently flooded by estuarine rivers.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Leymus mollis* (2) *Lathyrus japonicus*

Physiographic features

This site occurs on dry beach ridges and sandy terraces associated with ocean shores. These landscape positions are not flooded or ponded by tides, but are influenced by salt spray in varying degrees. The water table is usually more than 52 inches below the soil surface, but can be to within 30 inches during wet periods. Slopes range from 0-15%. Elevations are typically less than 50 feet above sea level, but may be as high as 330 feet.

Table 2. Representative physiographic features

Landforms	(1) Shore complex > Beach ridge (2) Shore complex > Marine terrace (3) Shore complex > Beach terrace (4) Shore complex > Fluviomarine terrace (5) Coastal plain > Beach ridge
Runoff class	Medium
Flooding duration	Not specified
Flooding frequency	None
Ponding frequency	None
Elevation	0–15 m
Slope	0–8%
Water table depth	132 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	0–101 m
Slope	0–15%
Water table depth	76 cm

Climatic features

Cloudy skies, moderate temperatures, and abundant rainfall characterize the temperate maritime climate of this site. Frequent winter storms may consist of snow or heavy rainfall. Moderate to strong winds from the south and southeast are common before and during storms throughout the year. Annual precipitation ranges from 44-94 inches, and annual snowfall ranges from 30-70 inches along the coast and up to 200 inches at higher elevations (USDA 2006). The average annual temperature at lower elevations ranges from about 38-43 degrees F (3-6 degrees C). The frost-free period ranges from about 90-140 days, and the freeze-free period ranges from about 125-180 days.

Table 4. Representative climatic features

Frost-free period (characteristic range)	89-139 days
Freeze-free period (characteristic range)	126-181 days
Precipitation total (characteristic range)	1,118-2,388 mm
Frost-free period (actual range)	77-147 days
Freeze-free period (actual range)	116-184 days
Precipitation total (actual range)	787-3,556 mm

Frost-free period (average)	110 days
Freeze-free period (average)	153 days
Precipitation total (average)	1,880 mm

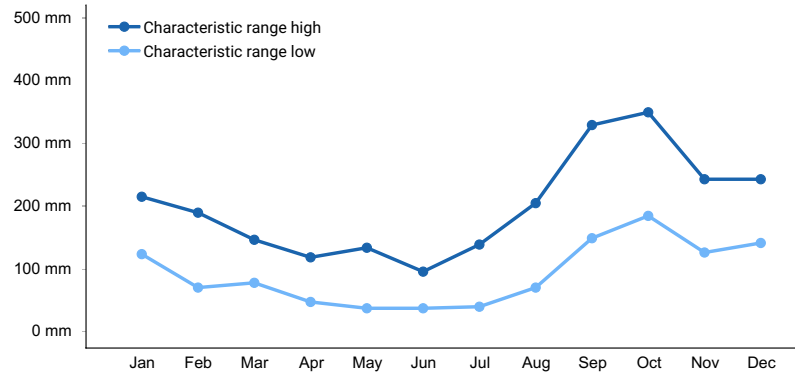


Figure 1. Monthly precipitation range

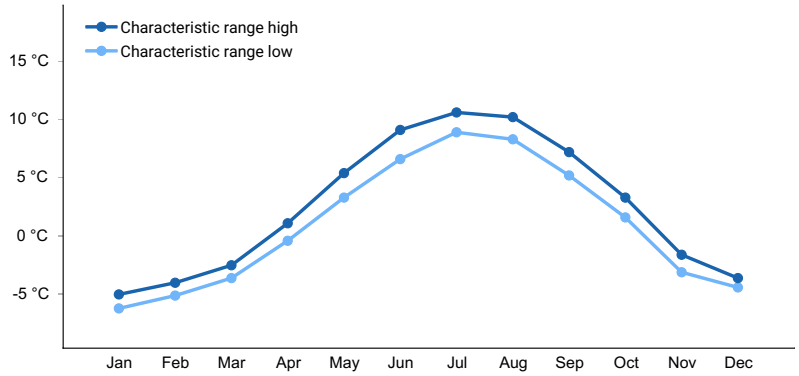


Figure 2. Monthly minimum temperature range

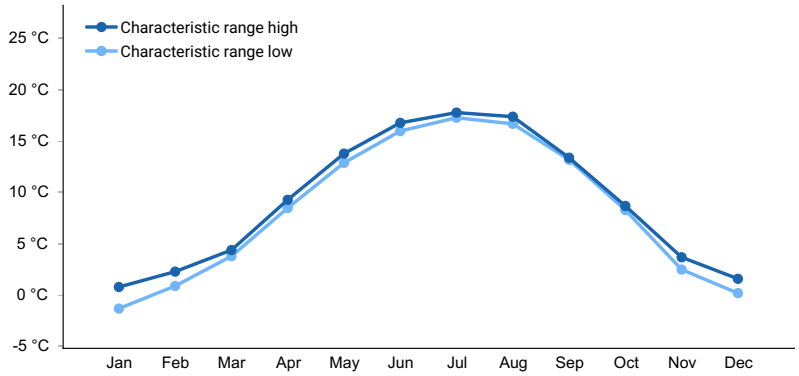


Figure 3. Monthly maximum temperature range

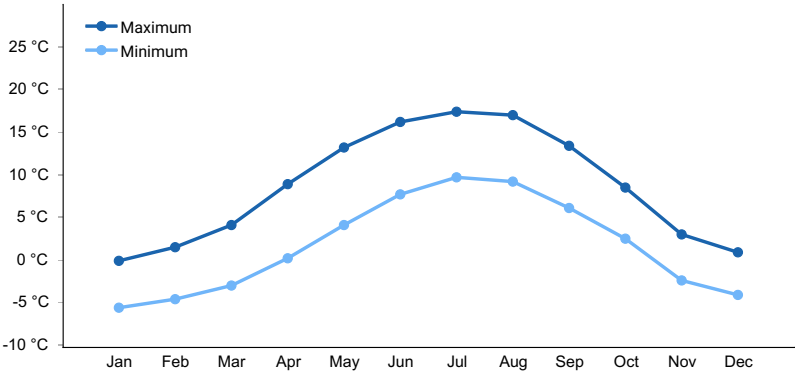


Figure 4. Monthly average minimum and maximum temperature

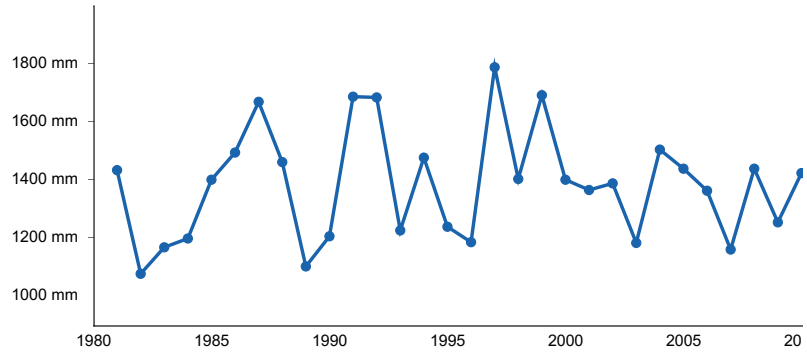


Figure 5. Annual precipitation pattern

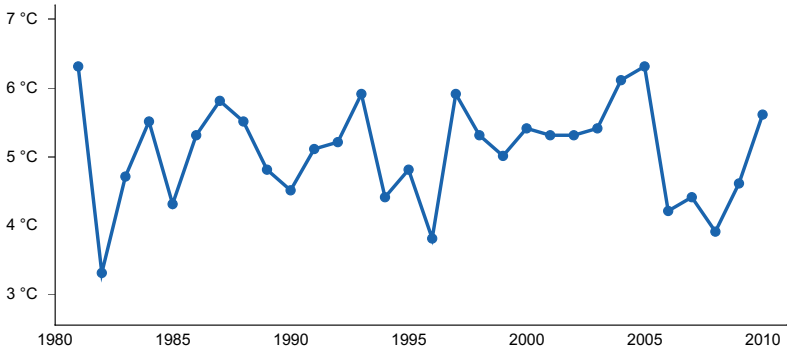


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GUSTAVUS [USW00025322], Gustavus, AK
- (2) GLACIER BAY [USC00503294], Gustavus, AK
- (3) YAKUTAT STATE AP [USW00025339], Yakutat, AK
- (4) SKAGWAY AP [USW00025335], Skagway, AK
- (5) HAINES AP [USW00025323], Haines, AK
- (6) SELDOVIA AP [USW00025516], Homer, AK
- (7) MAIN BAY [USC00505604], Valdez, AK
- (8) CORDOVA M K SMITH AP [USW00026410], Cordova, AK
- (9) SITKA AIRPORT [USW00025333], Sitka, AK
- (10) JUNEAU INTL AP [USW00025309], Juneau, AK
- (11) ANNETTE ISLAND AP [USW00025308], Metlakatla, AK
- (12) PETERSBURG 1 [USW00025329], Petersburg, AK
- (13) KETCHIKAN INTL AP [USW00025325], Ketchikan, AK
- (14) PELICAN [USC00507141], Hoonah, AK

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands. Most of the plant-available soil moisture enters this site as precipitation.

Soil features

The soils of this site formed in deep sands deposited near the ocean shore by wind or water. These are the driest soils in the coastal landscape with moderate to somewhat excessive drainage. Textures are sandy and sometimes capped with a loamy surface horizon. Depending on the mode of deposition of the soil parent material, these soils may have very few or very many gravels throughout the profile. The salt spray that occurs on this site may result in relatively minor soil salinity. The soil moisture regime of this site is udic or ustic udic.

Table 5. Representative soil features

Parent material	(1) Beach sand (2) Eolian sands (3) Alluvium (4) Fluviomarine deposits (5) Marine deposits
Surface texture	(1) Extremely gravelly loam (2) Fine sandy loam (3) Sand (4) Extremely gravelly coarse sand
Family particle size	(1) Sandy-skeletal (2) Sandy (3) Not used
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	152 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	0.51–4.32 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Clay content (0-50.8cm)	1–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	3.5–7.5
Subsurface fragment volume <=3" (0-152.4cm)	0–82%
Subsurface fragment volume >3" (0-152.4cm)	0–5%

Table 6. Representative soil features (actual values)

Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately rapid to very rapid
Depth to restrictive layer	152 cm
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	0–4.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Clay content (0-50.8cm)	1–10%

Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	3.5–8.5
Subsurface fragment volume <=3" (0-152.4cm)	0–82%
Subsurface fragment volume >3" (0-152.4cm)	0–15%

Ecological dynamics

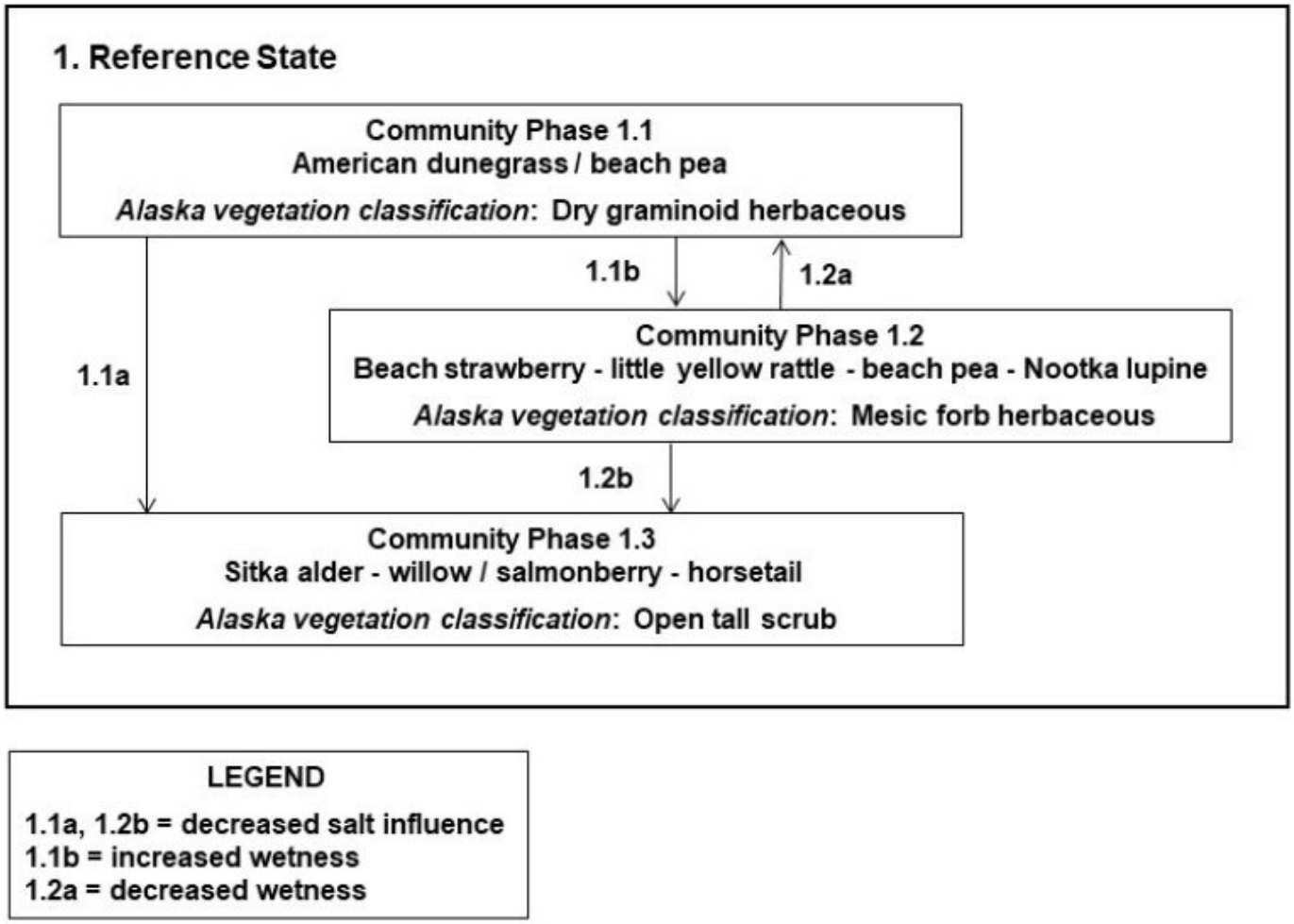
This site is associated with estuaries along the Gulf of Alaska. Until about 10,000 years ago, this area had many continental-scale ice sheets that advanced and retreated many times over millennia (Chapin 1994). The final advance of these glaciers occurred during the Little Ice Age, which peaked about 1750 AD. Since then, many glaciers have thinned and retreated inland, while numerous tidewater glaciers still exist in the area (Lawson 2015). The 250-year glacial retreat is attributed to less regional snowfall in the mountains, rising winter temperatures, and decreased cloud cover and lower precipitation during the growing season in summer (Hall et al. 2003).

During the past 250 years of glacial retreat, meltwater transported and deposited a large amount of silt and sediment via numerous short, high-gradient rivers. Alluvial and colluvial fans and long footslopes are common in the valleys along the base of the mountains. Drainageways dissect these fans and flats, which ultimately feed into the streams, rivers, and estuaries along the coastal plain.

This site is associated with the dry sandy beach ridges and terraces near estuaries. Though flooding is rare on these landforms, the ecosystem potential and dynamics are limited by their proximity to the ocean, and general exposure to wind and salt spray. As elevation and distance from the tidal influence increase, the proportion of salt-intolerant species increases.

State and transition model

R220XY422AK – Estuarine Herbaceous Dry Sand



State 1
Reference State

The reference state consists of three plant communities differentiated by either grass, forb, or shrub dominance. American dunegrass dominates in relatively dry areas and beach strawberry, little yellow rattle, and beach pea dominate in relatively wet areas. Sitka alder dominates in areas that are relatively protected from salt spray, particularly on the upper reaches of this site farthest from the ocean. Changes in hydrology due culverts, other human disturbance, or natural events may shift the relative dominance of grasses compared to forbs. Isostatic rebound may be one process by which alder is able to expand into herbaceous communities as the landmass rises following deglaciation.

Dominant plant species

- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- American dunegrass (*Leymus mollis*), grass
- beach pea (*Lathyrus japonicus var. maritimus*), other herbaceous
- little yellow rattle (*Rhinanthus minor*), other herbaceous
- beach strawberry (*Fragaria chiloensis*), other herbaceous
- field horsetail (*Equisetum arvense*), other herbaceous

Community 1.1
American dunegrass / beach pea

This community is characterized as dry graminoid herbaceous and is primarily composed of salt-tolerant American dunegrass (*Leymus mollis*). Other graminoids include red fescue (*Festuca rubra*) and meadow barley (*Hordeum brachyantherum*). Salt-tolerant forbs in low coverages include beach pea (*Lathyrus japonicus* var. maritimus), redwool plantain (*Plantago eriopoda*), and seacoast angelica (*Angelica lucida*).

Dominant plant species

- American dunegrass (*Leymus mollis*), grass
- beach pea (*Lathyrus japonicus var. maritimus*), other herbaceous
- redwool plantain (*Plantago eriopoda*), other herbaceous

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	33-90%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-65%

Community 1.2

Beach strawberry - little yellow rattle - beach pea

This community is characterized as mesic forb herbaceous, and is composed primarily of beach strawberry (*Fragaria chiloensis*), beach pea (Lathyrus japonicas var. maritimus), and little yellow rattle. American dunegrass is common but not dominant in this community. Most of the soil surface is covered with herbaceous litter, with mosses more prevalent on the edges of the site near adjacent shrub and tree communities (primarily goose neck moss (*Rhytidiadelphus loreus*).

Dominant plant species

- beach strawberry (*Fragaria chiloensis*), other herbaceous
- beach pea (*Lathyrus japonicus var. maritimus*), other herbaceous
- little yellow rattle (*Rhinanthus minor*), other herbaceous

Table 8. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	1-45%
Biological crusts	0%
Litter	60-85%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-20%

Community 1.3
Sitka alder - willow / salmonberry - horsetail

This community is characterized as open tall scrub, dominated by Sitka alder (*Alnus viridis*) in the overstory and horsetail (*Equisetum arvense*) in the understory. Sitka spruce (*Picea sitchensis*) may be present but is not common, and bluejoint grass (Calamagrostis spp.) can sometimes be abundant.

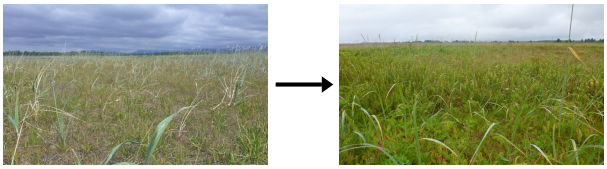
Dominant plant species

- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- field horsetail (*Equisetum arvense*), other herbaceous

Table 9. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	0%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	1-40%
Biological crusts	0%
Litter	65-95%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-2%

Pathway 1.1b
Community 1.1 to 1.2



American dunegrass / beach pea

Beach strawberry - little yellow rattle - beach pea

Altered hydrology that results in increased wetness causes a shift to decreased grass cover and increased forb dominance.

Pathway 1.1a
Community 1.1 to 1.3

American dunegrass / beach pea

Sitka alder - willow / salmonberry - horsetail

Decreased salt influence permits the establishment and dominance of alder. This may be driven by isostatic rebound or some other mechanism.

Pathway 1.2a
Community 1.2 to 1.1

Beach strawberry - little yellow rattle - beach pea

American dunegrass / beach pea

Altered hydrology that results in decreased wetness causes an increase in American dunegrass dominance and decrease in forb cover.

Pathway 1.2b
Community 1.2 to 1.3

Beach strawberry - little yellow rattle - beach pea

Sitka alder - willow / salmonberry - horsetail

Decreased salt influence permits the establishment and dominance of alder. This may be driven by isostatic rebound or some other mechanism.

Additional community tables

Table 10. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)

Table 11. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)

Table 12. Community 1.3 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)

Table 13. Community 1.3 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)

Inventory data references

All data currently reside in NASIS under the User Site IDs in the following table:

Other references

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Contributors

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Approval

Marji Patz, 3/10/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/13/2025
Approved by	Marji Patz
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:**