Ecological site F220XY466AK
Maritime Forest Sandy Plains Eolian

Last updated: 3/10/2025
Accessed: 05/12/2025

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 ecological site is associated with eolian dunes on alluvial plains in Dry Bay of Glacier Bay National Park and Preserve. Soils are sandy, well drained and very deep, and are derived from eolian material. Flooding is rare and ponding is not known to occur. This site supports a closed needleleaf forest reference state comprised of three forest community phases driven by isostatic rebound. Plant community dynamics illustrate a rapid transition from dense, regenerating Sitka spruce to a stand of highly productive, mature mixed conifers.

The reference community phase is characterized as a productive, closed needleleaf community with a thick mat of feathermoss species. The dominant overstory tree species are Sitka spruce and western hemlock. Common understory species include devil’s club, strawberryleaf raspberry, oval-leaf blueberry, bunchberry dogwood, and spreading woodfern, Common feathermoss species include Schreberi’s big red stem moss, Rhizomnium moss, and splendid feather moss.

Associated sites

R220XY461AK	**Maritime Scrub Sandy Depressions** Ecological site R220XY461AK also occurs on sandy dunes and outwash plains but is associated with a shallow water table and supports an open low scrubland community.

Similar sites

F220XY430AK	**Maritime Forest Sandy Plain Alluvial Fan** Ecological site F220XY430AK is subject to a flood regime associated with active flood alluvial plains.
F220XY427AK	**Maritime Forest Gravelly High Floodplain** Ecological site F220XY427AK is subject to a flood regime associated with active flood plains.
F220XY432AK	**Maritime Forest Gravelly Plain** Ecological site F220XY432AK occurs in Glacier Bay Inlet and supports later successional communities.
W1220X433	**Maritime Forest Loamy Slopes** Ecological site F220XY433AK occurs on mountain slopes, occurs in different geographic regions, exhibits dissimilar soil characteristics, and is subject to windthrow disturbance.
F220XY435AK	**Maritime Forest Loamy Wet Plains** Ecological site F220XY435AK occurs on wetter soils and exhibits lower levels of biomass production.
F220XY468AK	**Maritime Forest Loamy Slopes Warm** Ecological site F220XY468AK occurs on mountain slopes, occurs in different geographic regions, exhibits dissimilar soil characteristics, and is subject to windthrow disturbance.

Table 1. Dominant plant species

Tree	(1) *Picea sitchensis* (2) *Tsuga heterophylla*

Shrub	(1) *Oplopanax horridus* (2) *Rubus pedatus*
Herbaceous	(1) *Pleurozium schreberi* (2) *Hylocomium splendens*

Physiographic features

This site is associated with eolian dune deposits on coastal outwash plains. Flooding rarely occurs and ponding is not known to occur on these well-drained soils. This site typically occurs on elevations under 100 feet and slopes range from 0 to 15%.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain > Dune
Runoff class	Medium
Flooding frequency	None to rare
Ponding frequency	None
Elevation	0–30 m
Slope	0–15%
Water table depth	152–0 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Medium
Flooding frequency	None to rare
Ponding frequency	None
Elevation	0–76 m
Slope	0–30%
Water table depth	152–0 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)	95-142 days
Freeze-free period (characteristic range)	147-183 days
Precipitation total (characteristic range)	1,397-3,683 mm
Frost-free period (actual range)	84-170 days
Freeze-free period (actual range)	119-218 days
Precipitation total (actual range)	889-4,369 mm
Frost-free period (average)	120 days

Freeze-free period (average)	168 days
Precipitation total (average)	2,464 mm

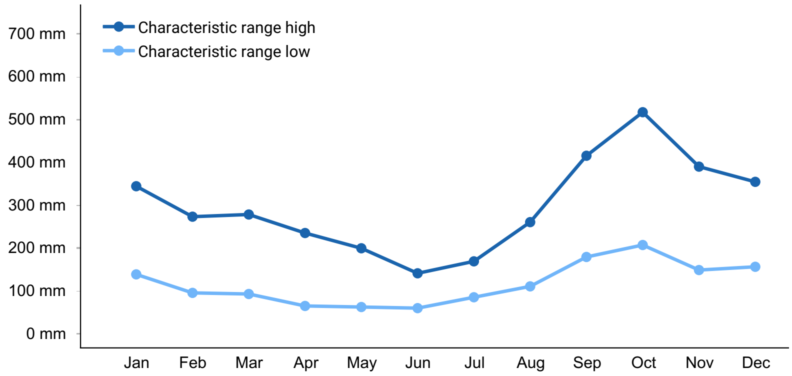


Figure 1. Monthly precipitation range

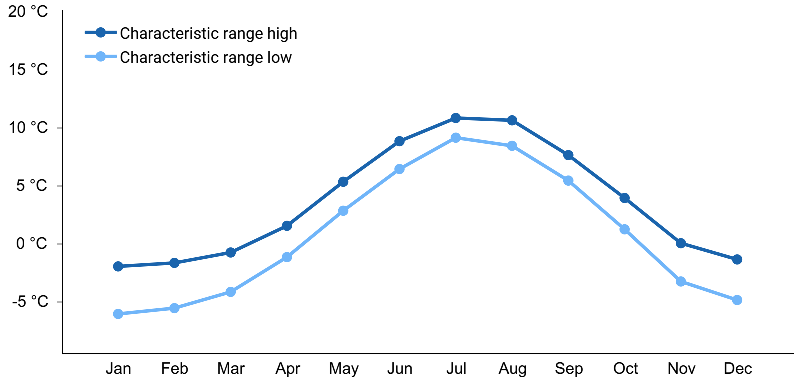


Figure 2. Monthly minimum temperature range

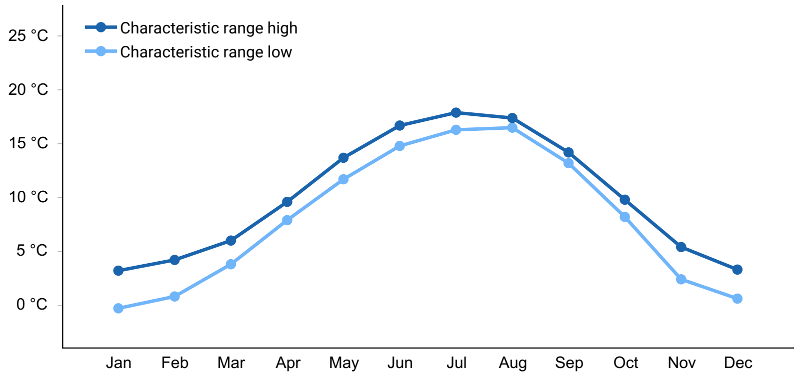


Figure 3. Monthly maximum temperature range

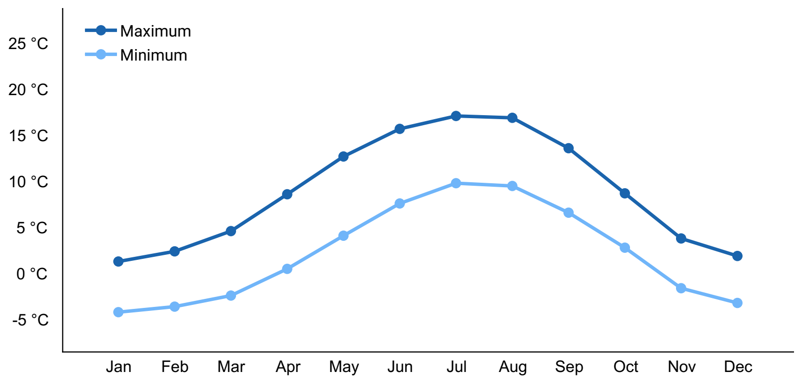


Figure 4. Monthly average minimum and maximum temperature

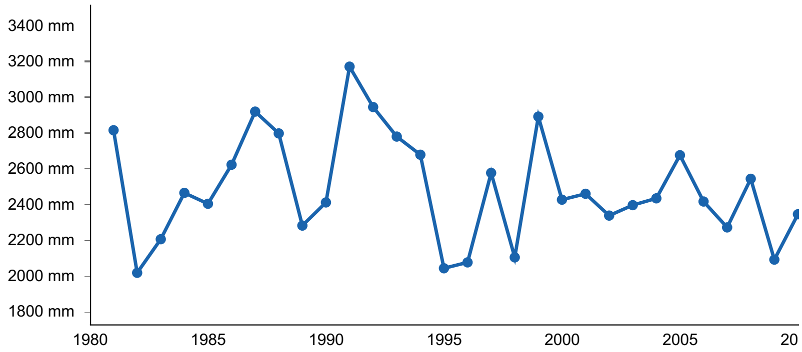


Figure 5. Annual precipitation pattern

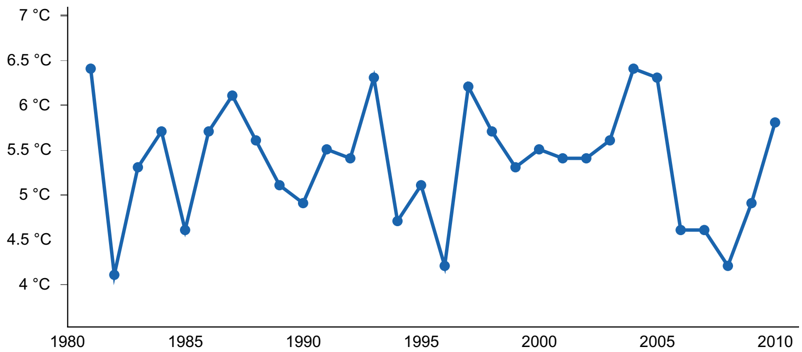


Figure 6. Annual average temperature pattern

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 topographic position, no streams or wetlands are associated with this site.

Soil features

The soils of this site formed in very deep eolian deposits on coastal outwash plains. Soil textures are generally sandy throughout and include loamy fine sand and sandy loams in the surface horizon. These soils are well-drained and no water table is associated with this site. Ponding is not known to occur and flooding is rare. The soil moisture regime is udic.

Figure 7. Typical soil profile associated with Beardslee soils in Glacier Bay National Park and Preserve-Gustavus Area, Alaska.

Figure 8. Typical soil profile associated with Bartlettcove soils in Glacier Bay National Park and Preserve-Gustavus Area, Alaska.

Table 5. Representative soil features

Parent material	(1) Eolian sands (2) Outwash (3) Beach sand
Surface texture	(1) Sandy loam (2) Sand (3) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderately rapid to very rapid
Soil depth	152–0 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	1.52–2.03 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Clay content (0-50.8cm)	1–3%
Electrical conductivity (0-101.6cm)	0 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.7–6.5
Subsurface fragment volume <=3" (0-152.4cm)	0–12%
Subsurface fragment volume >3" (0-152.4cm)	0%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderately rapid to very rapid
Soil depth	152–0 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-25.4cm)	0.51–3.3 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Clay content (0-50.8cm)	1–3%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–8.4
Subsurface fragment volume <=3" (0-152.4cm)	0–12%
Subsurface fragment volume >3" (0-152.4cm)	0%

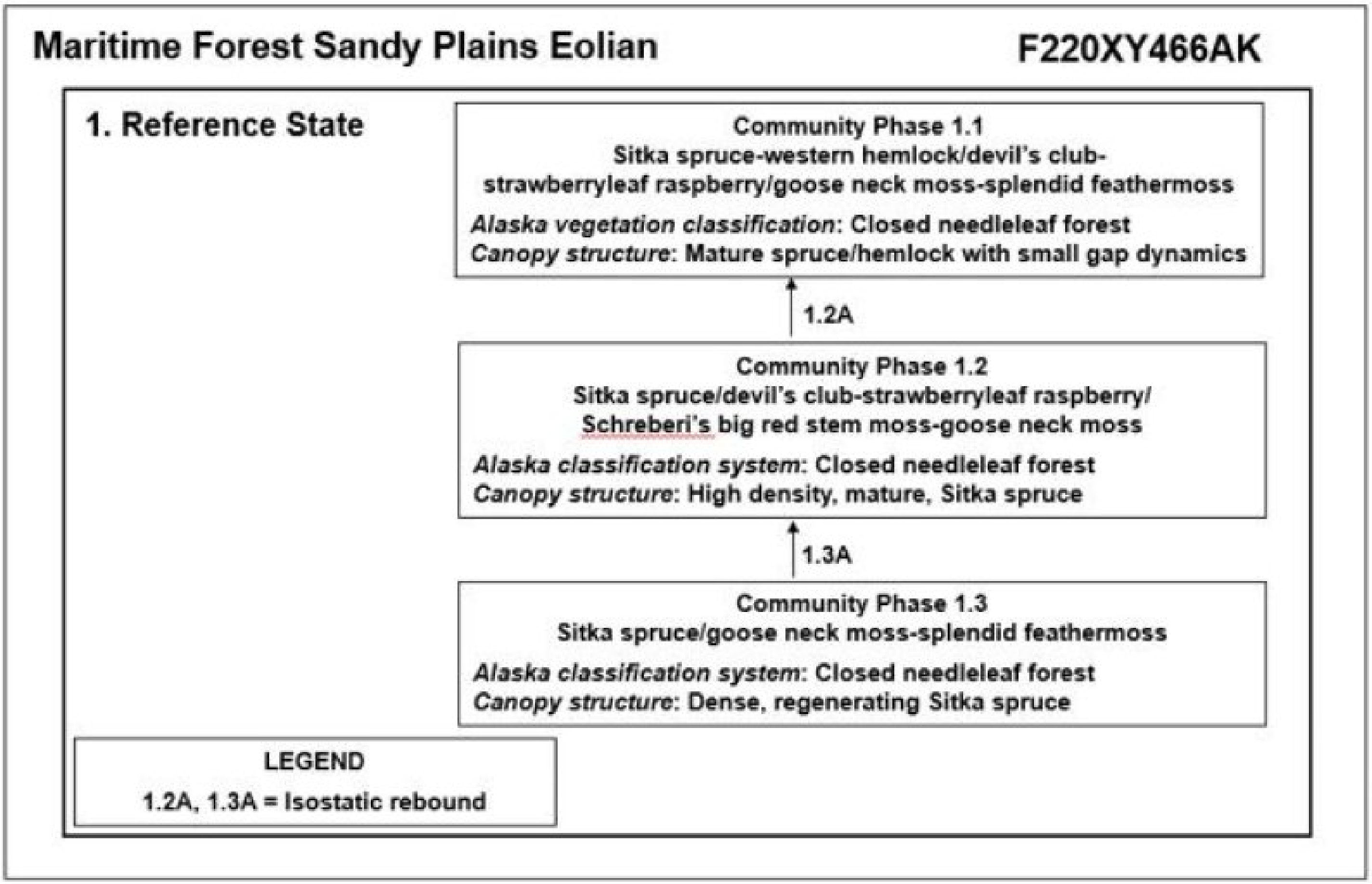
Ecological dynamics

This site is associated with eolian dunes on alluvial plains in the Dry Bay area of Glacier Bay National Park and Preserve. Until about 10,000 years ago, this area had many large continental-scale glacial ice sheets that advanced and retreated many times over millennia (Chapin 1994). Glacier Bay of today is a product of the Little Ice Age, a geologically recent glacial advance that occurred across most of the northern region. It reached its maximum extent about 1750 AD, when the glaciers terminated into the Icy Strait (Hall et al. 1994). Since then, the glaciers of Glacier Bay have thinned and retreated. Numerous tidewater glaciers still exist, including Johns Hopkins Glacier, Grand Pacific Glacier, Lamplugh Glacier, McBride Glacier, and Muir Glacier (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).

The Dry Bay area is surrounded by numerous glaciated mountain ranges, most notably the glacier-rich Fairweather and St. Elias Ranges. Meltwater from glaciers and snowpack have formed the broad alluvial plains and the silt-rich Alsek River of Dry Bay. Over time, North Pacific storms and glacially derived winds have transported sediment from the alluvial plains and redeposited it across the plains and into the ocean (Koster 1988). Through the deposition of sediment from lunar-derived tides, unvegetated coastal dunes and beach ridges have formed along the North Pacific coast and are now subject to isostatic rebound. This ecological site occurs on these uplifted, eolian dunes and supports a rapid succession of three closed needleleaf forest community phases.

This site supports a reference state composed of three community phases. Plant communities in the reference state appear to be largely controlled by the influences of isostatic rebound. With time, dense, regenerating Sitka spruce gives way mature Sitka spruce and western hemlock. The result is a closed coniferous forest controlled by small gap dynamics.

State and transition model



State 1
Reference State

This site supports a closed needleleaf forest reference state comprised of three forest community phases driven by isostatic rebound. The reference community phase is characterized as a productive, closed needleleaf community comprised of Sitka spruce and western hemlock (Viereck et al. 1992).

Resilience management. This state has been observed to be resilient and/or resistant to current disturbance drivers, lacking alternative states and at-risk communities.

Dominant plant species

- Sitka spruce (*Picea sitchensis*), tree
- western hemlock (*Tsuga heterophylla*), tree
- devilsclub (*Oplopanax horridus*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Community 1.1
Sitka spruce - western hemlock / devil’s club - strawberryleaf raspberry / Schreberi’s big red stem moss - Rhizomnium moss

Figure 9. Typical plant community associated with community 1.1.

The reference community phase is characterized by closed coniferous forest primarily composed of mature Sitka spruce and western hemlock. Common understory species include devil’s club, strawberryleaf raspberry, oval-leaf blueberry, squashberry, bunchberry dogwood and spreading woodfern. The cover on the forest floor can be variable, but prevalent mosses include stairstep moss, Rhizomnium moss, and Schreber’s big red stem moss. The vegetative stratum that characterizes this community phase is tall trees, medium shrubs, and medium forbs.

Dominant plant species

- Sitka spruce (*Picea sitchensis*), tree
- western hemlock (*Tsuga heterophylla*), tree
- devilsclub (*Oplopanax horridus*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), shrub
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Table 7. Soil surface cover

Tree basal cover	55-75%
Shrub/vine/liana basal cover	20-70%
Grass/grasslike basal cover	0%
Forb basal cover	5-20%
Non-vascular plants	50-90%
Biological crusts	0%
Litter	10-50%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%

Water	0%
Bare ground	0%

Community 1.2
Sitka spruce / devil’s club - strawberryleaf raspberry / Schreberi’s big red stem moss - goose neck moss

Figure 10. Typical plant community associated with community 1.2.

Community phase 1.2 is characterized as a closed needleleaf community. The overstory is high-density, mature, Sitka spruce. The structure and density of the trees exhibit moderate rates of productivity and growth. Stem exclusion is ongoing during this phase. Common understory species include devil’s club, strawberryleaf raspberry, oval-leaf blueberry, heartleaf twayblade, bunchberry dogwood, and Lapland cornel. The cover on the forest floor generally consists of large woody debris, herbaceous litter, and significant coverages of feathermoss species, including Schreber’s big red stem moss, goose neck moss, and splendid feathermoss. The vegetative stratum that characterizes this community phase is tall trees, medium shrubs, and medium forbs.

Dominant plant species

- Sitka spruce (*Picea sitchensis*), tree
- western hemlock (*Tsuga heterophylla*), tree
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- devilsclub (*Oplopanax horridus*), shrub
- splendid feather moss (*Hylocomium splendens*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous

Table 8. Soil surface cover

Tree basal cover	30-80%
Shrub/vine/liana basal cover	0-25%
Grass/grasslike basal cover	0%
Forb basal cover	0-25%
Non-vascular plants	85-100%
Biological crusts	0%
Litter	5-20%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%

Bare ground	0%

Community 1.3
Sitka spruce / goose neck moss - splendid feathermoss

Figure 11. Typical plant community associated with community 1.1.

Community phase 1.3 is characterized as a closed needleleaf forest community. The overstory is composed of high density, regenerating Sitka spruce. Shrub coverages are minimal; occasional Sitka alder was observed. Forbs are sparse; some common yarrow and beach strawberry was observed. The ground cover is largely moss. Goose neck moss and splendid feathermoss are most common. The vegetative stratum that characterizes this community phase is regen trees with feathermoss ground cover.

Dominant plant species

- Sitka spruce (*Picea sitchensis*), tree
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- goose neck moss (*Rhytidiadelphus*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Table 9. Soil surface cover

Tree basal cover	85%
Shrub/vine/liana basal cover	2%
Grass/grasslike basal cover	0%
Forb basal cover	0%
Non-vascular plants	95%
Biological crusts	0%
Litter	3%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Pathway 1.2a
Community 1.2 to 1.1

Sitka spruce / devil's club - strawberryleaf raspberry / Schreberi's big red stem moss - goose neck moss

Sitka spruce - western hemlock / devil's club - strawberryleaf raspberry / Schreberi's big red stem moss - Rhizomnium moss

Following glacial retreat and isostatic rebound, succession takes place on recently glaciated till and outwash plains. As the stand matures, a Sitka spruce dominated forest gives way to a mature, mixed, closed hemlock-spruce forest.

Pathway 1.3a
Community 1.3 to 1.2

Sitka spruce / goose neck moss - splendid feathermoss

Sitka spruce / devil's club - strawberryleaf raspberry / Schreberi's big red stem moss - goose neck moss

Following glacial retreat and isostatic rebound, primary succession takes place on the recently glaciated till and outwash plains. Sitka spruce regenerates creating a closed needleleaf forest.

Additional community tables

Table 10. Community 1.1 forest overstory composition

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

Table 11. Community 1.1 forest understory composition

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

Table 12. Community 1.2 forest overstory composition

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

Table 13. Community 1.2 forest understory composition

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

Table 14. Community 1.3 forest overstory composition

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

Table 15. Community 1.3 forest understory composition

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

Inventory data references

NASIS ID Plant community
13NP05901 Community 1.1
2015AK282112 Community 1.1

13NP03502 Community 1.2
13NP03503 Community 1.2
13DM01503 Community 1.2
13DM01504 Community 1.2
13DM01402 Community 1.2
2015AK282113 Community 1.2
14NP00402 Community 1.2
14NP00401 Community 1.3

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	05/12/2025
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:**