USDA Natural Resources Conservation Service

Ecological site F220XY202AK
Subalpine Woodlands Gravelly Dry Slopes, Limestone

Last updated: 3/10/2025
Accessed: 05/21/2025

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.

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 (nonsoil) areas make up about 23 percent of this MLRA. The most common miscellaneous areas are chutes, rock outcrop, rubble land, beaches, riverwash, 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 lower elevations. Due to warmer temperatures, western red cedar and Alaska cedar are more prevalent in the southern portion of this 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. As elevation increases, mountain hemlock becomes the dominant tree in forested stands, which marks the transition to subalpine vegetation. The subalpine life zone typically occurs at elevations between 1500 to 3000 feet (Boggs et al. 2010, Carstensen 2007, Martin et al. 1995). Other common subalpine plant communities include tall alder scrub and bluejoint-forb meadows. Alpine vegetation occurs at even higher elevations, which marks the transition to the Southern Alaska Coastal Mountains Area (MLRA 222).

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.

Classification relationships

National Vegetation Classification – Ecological Systems: Alaskan Pacific Maritime Subalpine Mountain Hemlock Woodland (CES204.143) (NatureServe 2015)

Alaskan Vegetation Classification: Mountain Hemlock Dwarf Tree Scrub (Viereck et al. 1992)

Ecological site concept

This subalpine site occurs on mountain slopes at the highest bands of elevation before the true alpine life zone. This site has a harsh climate where trees are often stunted and grow in patches. The soils are dry for much of the growing season and are well drained. The soils are gravelly Spodosols formed in colluvium derived from limestone. Soils are deep with bedrock typically occurring at a depth of 55 inches or greater.

The reference plant community is a krummholz woodland, dominated by coniferous trees, ericaceous shrubs, and forbs. Mountain hemlock and subalpine fir are the dominant trees on the site (Jaques 1983). The understory vegetation is a mixture of species common in subalpine and alpine plant communities. Common understory species include oval-leaf blueberry, Alaska blueberry, partridgefoot, Hulten's saxifrage, fivestamen miterwort, and Sitka valerian (Jaques 1983). The primary disturbance processes that maintain this plant community are exposure to cold temperatures, wind, and avalanches (NatureServe 2018).

Similar sites

F220XY350AK	**Subalpine Woodland Gravelly Dry Slopes** Both sites occur in a similar band of elevation. Both sites have dry soils and a mountain hemlock dominant overstory. F220XY350AK does not have limestone parent material and supports a different understory community.

Table 1. Dominant plant species

Tree	(1) *Tsuga mertensiana* (2) *Abies lasiocarpa*
Shrub	(1) *Vaccinium ovalifolium* (2) *Vaccinium alaskaense*
Herbaceous	(1) *Saxifraga lyallii ssp. hultenii* (2) *Mitella pentandra*

Physiographic features

This site occurs on mountain backslopes and shoulders at elevations approaching treeline, which typically occurs between 1500 and 3000 feet depending on slope and aspect. Slopes are moderate to very steep ranging from 20 to 90 percent. This site likely occurs at much higher elevations on warm southerly slopes and at much lower elevations on cold northernly slopes. This site does not experience flooding or ponding, but rather generates runoff to adjacent, downslope ecological sites.

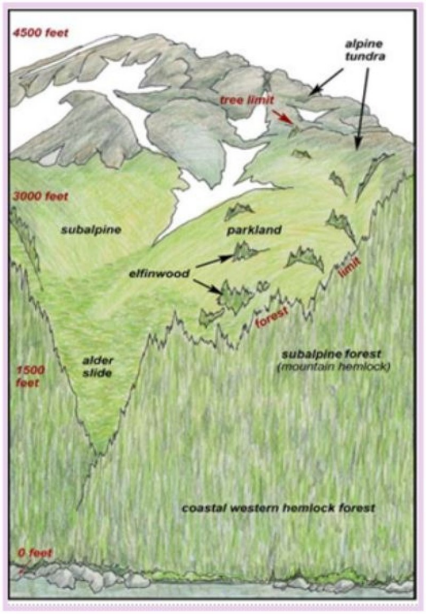

Figure 1.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Shoulder
Landforms	(1) Mountains > Mountain (2) Mountains > Hill
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	457–914 m
Slope	20–85%
Water table depth	152–0 cm

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	None to frequent
Ponding frequency	Not specified
Elevation	457–1,140 m
Slope	Not specified
Water table depth	Not specified

Climatic features

Cloudy skies, moderate temperatures, and abundant rainfall characterize the temperate maritime climate of this area. Winter storms, accompanied by heavy rainfall at lower elevations and snow at higher elevations, are frequent. Moderate to strong, south and southeast winds are common before and during storms. The average annual precipitation is approximately 60 to 140 inches. The average annual snowfall ranges from about 30 to 70 inches along the coast, to as much as 200 inches at higher elevations (USDA 2006). Average annual temperatures are considerably warmer in the Southern portion of this area. The average annual temperature at lower elevations ranges from about 37 degrees F (2.7 degrees C) in the northwest, to 46 degrees F (7.7 degrees C) in the southeast (USDA 2006). The average annual temperatures associated with lower elevation maritime vegetation is considerably warmer compared to higher elevation subalpine vegetation. The average frost-free period is about 105 to 140 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

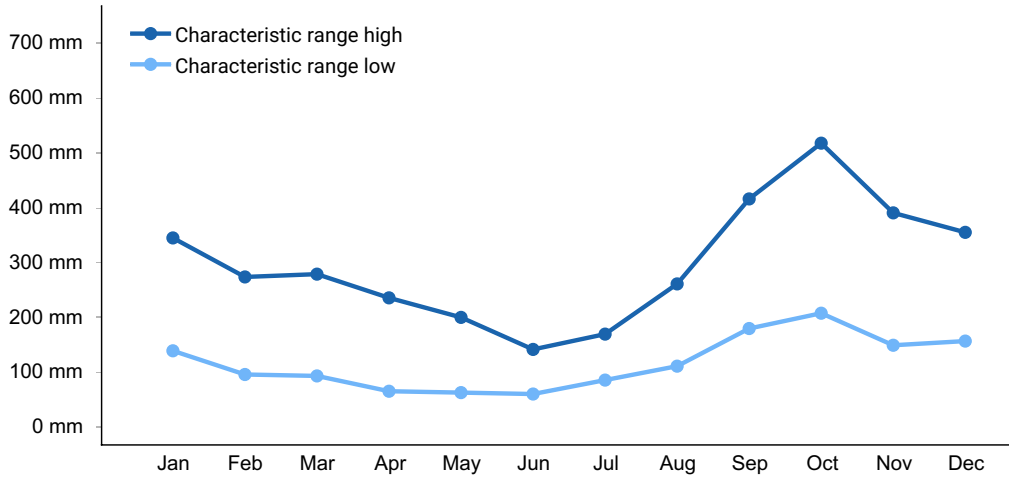

Figure 2. Monthly precipitation range

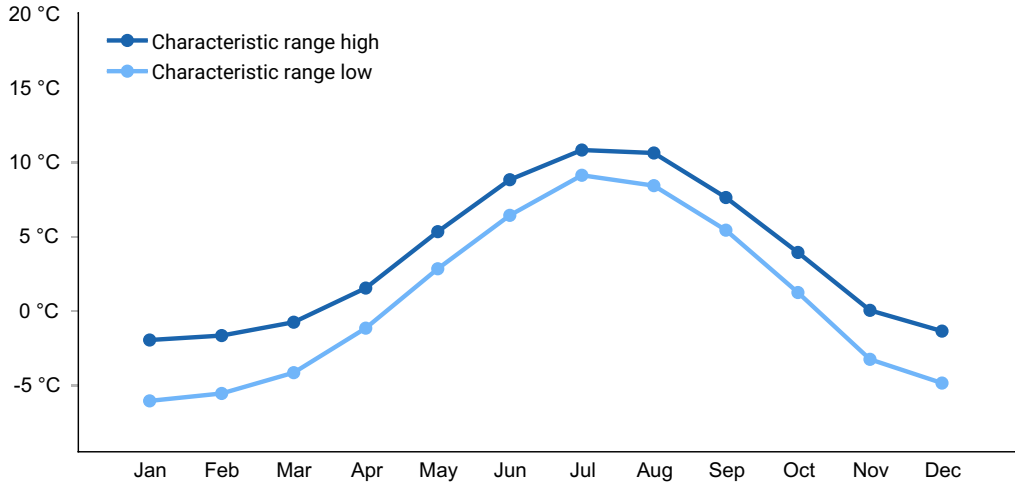

Figure 3. Monthly minimum temperature range

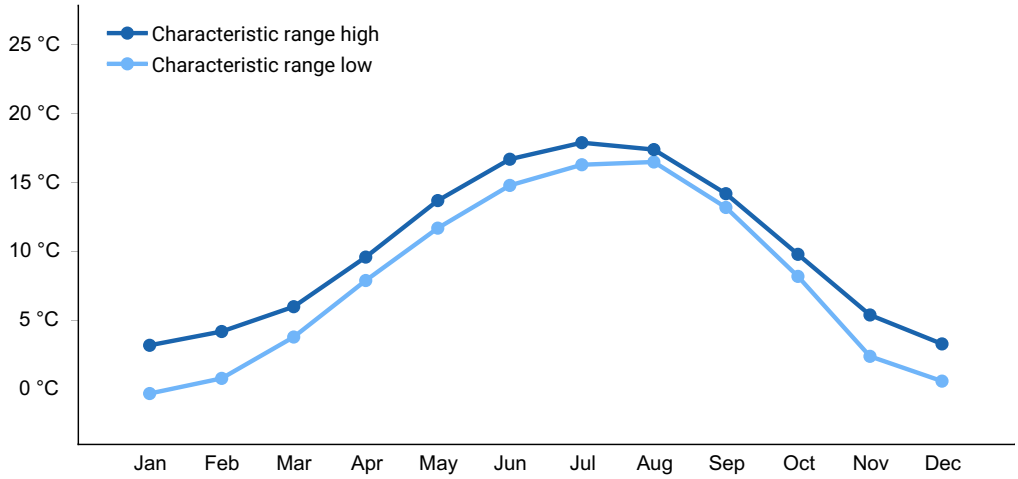

Figure 4. Monthly maximum temperature range

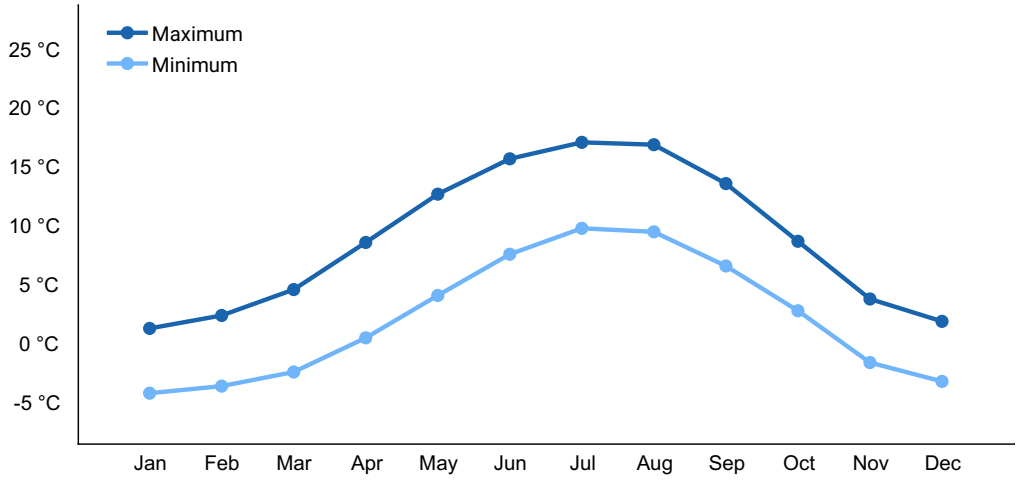

Figure 5. Monthly average minimum and maximum temperature

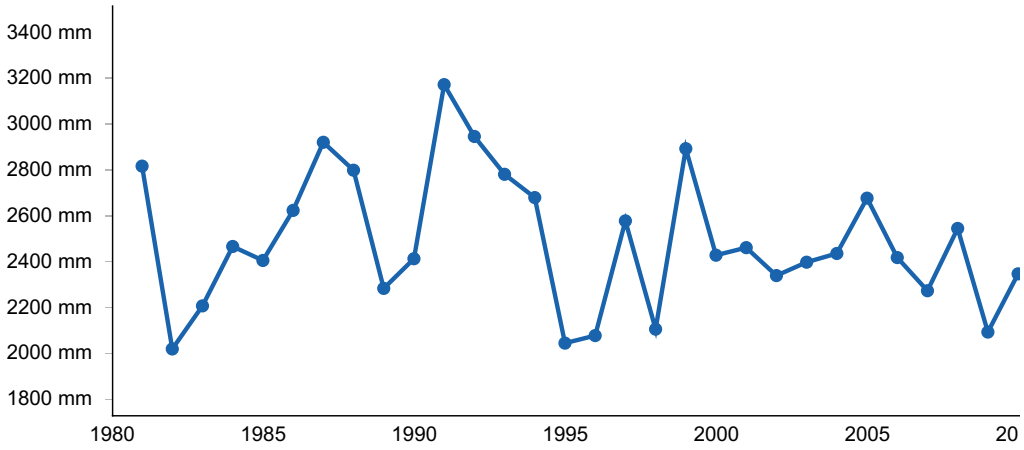

Figure 6. Annual precipitation pattern

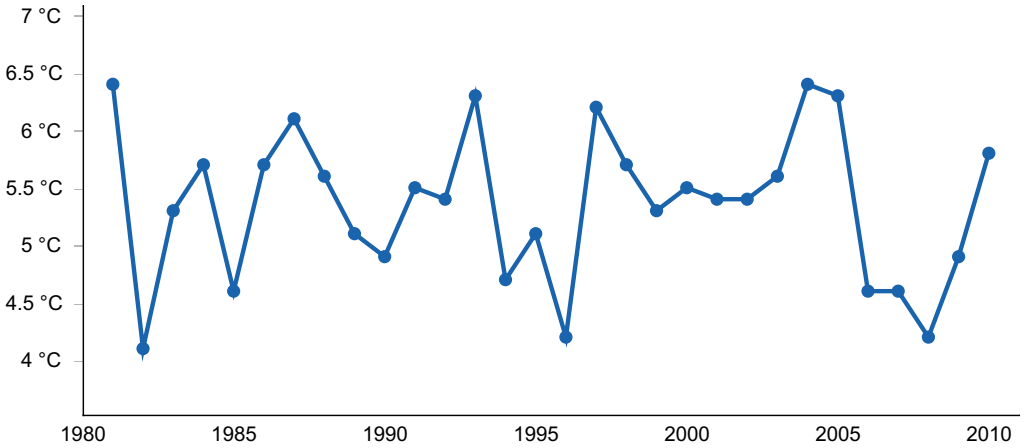

Figure 7. Annual average temperature pattern

Climate stations used

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

Influencing water features

Due to its landscape position, this site has dry soil. This site is neither associated with or influenced by streams or wetlands. Precipitation is the main source of water for this ecological site. Infiltration is very slow, and surface runoff is high. Surface runoff contributes some water to downslope ecological sites.

Soil features

The soil of this site formed in gravelly colluvium derived from limestone bedrock. The bedrock occurs at 40 to 60 inches. Subsurface soil pH is neutral ranging from 6.6 to 7.3. Rock fragments do not typically occur on the soil surface. Rock fragments in the soil subsurface are approximately 25 percent of the soil profile by volume. Soils are dry and well drained.

The soil moisture regime is udic and soil temperature regime is cryic, where the mean annual soil temperature is between 32°F and 46°F (USDA-NRCS 2006).

Table 5. Representative soil features

Parent material	(1) Colluvium–limestone
Surface texture	(1) Silt loam
Family particle size	(1) Coarse-loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	102–152 cm
Soil depth	102–152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	16.51–18.29 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–7.3
Subsurface fragment volume <=3" (0-152.4cm)	20–25%
Subsurface fragment volume >3" (0-152.4cm)	0%

Ecological dynamics

The information in this Ecological Dynamics section, including the state-and-transition model (STM), was developed based on historical data, current field data, professional

experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

This ecological site occurs on mountain slopes on dry soils at the highest bands of subalpine vegetation. While the subalpine life zone typically occurs between 1500 and 3000 feet of elevation, subalpine vegetation in this area can be split into various subzones. Located in the subalpine parkland subzone (Carstensenten 2007) just below treeline and the true alpine life zone, this site is exposed to a variety of harsh environmental conditions that drive and maintain the reference state plant communities.

Species characteristic of this ecological site consist of stunted coniferous trees, ericaceous shrubs, and forbs. Cold temperatures and high winds prevent the trees from growing tall. Avalanches, creeping snowpack that crushes woody vegetation, fungal pathogens, and blowdown are small-patch disturbances that typically result in mortality of individual or small groups of trees (Viereck et al. 1992; Carstensenten 2007; Zouhar 2017; NatureServe 2018). These small-patch disturbances, combined with important site factors like elevation and drainage class, maintain vegetation within this site and the larger subalpine parkland subzone.

The state-and-transition model that follows provides a detailed description of each known state, community phase, pathway, and transition. This model is based on available experimental research, field observations, literature reviews, professional consensus, and interpretations.

State and transition model

Ecosystem states

1. Reference State

State 1 submodel, plant communities

1.1. Mountain hemlock – subalpine fir / oval-leaf blueberry-Alaska blueberry / Hulten’s saxifrage - fivestamen miterwort

State 1
Reference State

The reference plant community is a krummholz woodland, dominated by coniferous trees. The one community phase within the reference state is maintained by cold temperatures, wind, avalanches, fungal pathogens, and blowdown (NatureServe 2018).

Community 1.1
Mountain hemlock – subalpine fir / oval-leaf blueberry-Alaska blueberry / Hulten’s saxifrage - fivestamen miterwort

The plant community is characterized as needleleaf woodland (10 to 25 percent cover) that is composed primarily of stunted mountain hemlock and subalpine fir. While stands are typically woodlands, tree cover can at times range up to 60% cover. Common understory species include oval-leaf blueberry, Alaska blueberry, partridgefoot, Hulten’s saxifrage, fivestamen miterwort, Sitka valerian, and strawberryleaf raspberry.

Dominant plant species

- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- Alaska blueberry (*Vaccinium alaskaense*), shrub
- partridgefoot (*Luetkea pectinata*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- Hulten's saxifrage (*Saxifraga lyallii ssp. hultenii*), other herbaceous
- fivestamen miterwort (*Mitella pentandra*), other herbaceous
- Sitka valerian (*Valeriana sitchensis*), other herbaceous
- strawberryleaf raspberry (*Rubus pedatus*), other herbaceous
- heartleaf twayblade (*Listera cordata*), other herbaceous
- twistedstalk (*Streptopus lanceolatus*), other herbaceous
- fernleaf goldthread (*Coptis aspleniifolia*), other herbaceous
- threeleaf foamflower (*Tiarella trifoliata*), other herbaceous

Additional community tables

Other references

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.

Carstensen, 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.

Jaques, D. 1973. Reconnaisance botany of alpine ecosystems on Prince of Wales Island, Southeast Alaska. Master of Science. Oregon State University, Corvallis, Oregon.

LANDFIRE. 2009. Alaskan Pacific Maritime Subalpine Alder-Salmonberry Shrubland. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

Martin, J., S. Trull, W. Brady, R. West, and J. Downs. 1995. Forest plant associations management guide: Chatham Area, Tongass National Forest. General Technical Report R10-TP-57. U.S. Department of Agriculture, Forest Service, Alaska Region. 328 pps.

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).

Poulenard, J. and P. Podwojewski. 2004. Alpine soils. In: Lal, R (ed.). Encyclopedia of Soil Science. Marcel Dekker, Inc. New York, New York.

PRISM Climate Group. 2018. Alaska – average monthly and annual precipitation and minimum, maximum, and mean temperature for the period 1981-2010. Oregon State

University, Corvallis, Oregon. https://prism.oregonstate.edu/projects/alaska.php. (Accessed 4 September 2019).

Scenarios network for Alaska and arctic planning (SNAP). Historical Monthly Temperature – 1km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. (Accessed 5 May 2021).

SNAP. Historical monthly and derived precipitation products downscaled from CRU TS data via the delta methods – 2km, 1901-2009. http://ckan.snap.uaf.edu/dataset/. (Accessed 5 May 2021).

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.

United States Department of Agriculture-Natural Resources Conservation Service. 2016. U.S. General Soil Map (STATSGO2). Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov. Accessed (Accessed 3 March 2021).

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. General Technical Report PNW-GTR-286. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 278 pps.

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	05/21/2025
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):**

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

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

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

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
