USDA Natural Resources
Conservation Service

Ecological site F220XY350AK
Subalpine Woodland Gravelly Dry Slopes

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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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 subalpine 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 to moderately well drained. The soils are gravelly Spodosols formed in colluvium over weathered residuum. Soils are shallow with bedrock typically occurring at a depth of 20 inches.

The reference plant community is a krummholz woodland, dominated by coniferous trees and ericaceous dwarf shrubs. Mountain hemlock is the dominant tree on the site. The understory vegetation is a mixture of species common in subalpine and alpine plant communities, including western moss heather, Alaska bellheather, crowberry, strawberryleaf raspberry, and reindeer lichen. The primary disturbance processes that maintain this plant community are exposure to cold temperatures, wind, and avalanches (NatureServe 2018).

Associated sites

R220XY358AK	**Subalpine Scrub Gravelly Dry Slopes** Occurs on similar bands of elevation on soils that slip or creep downslope.
F220XY205AK	**Subalpine Woodlands Gravelly Moist Slopes** Occurs on similar bands of elevation on wetter soils.

Similar sites

F220XY202AK	**Subalpine Woodlands Gravelly Dry Slopes, Limestone** Both sites occur in a similar band of elevation. Both sites have dry soils and a mountain hemlock dominant overstory. However, F220XY202AK has limestone parent material and supports a different understory community.
F220XY205AK	**Subalpine Woodlands Gravelly Moist Slopes** Both sites occur in a similar band of elevation and have similar overstory species. However, copperbush and wetland indicator species are common on F220XY205AK because it has wetter soils.
R220XY358AK	**Subalpine Scrub Gravelly Dry Slopes** While considered subalpine and below tree-line, R220XY358AK is a mosaic of tall shrubs and meadow vegetation. The process of soil creeping downslope and thick snowpack crushing woody plants maintains the site vegetation.

Table 1. Dominant plant species

Tree	(1) *Tsuga mertensiana*
Shrub	(1) *Cassiope* (2) *Empetrum nigrum*
Herbaceous	(1) *Rubus pedatus*

Physiographic features

Subalpine Dwarf Tree Scrub Gravelly Slopes ecological sites occur on alpine mountain slopes near treeline. They are situated on elevations ranging from approximately 1000 to 5000 feet ASL. The site does not experience flooding, but rather generates runoff to adjacent, downslope ecological sites.

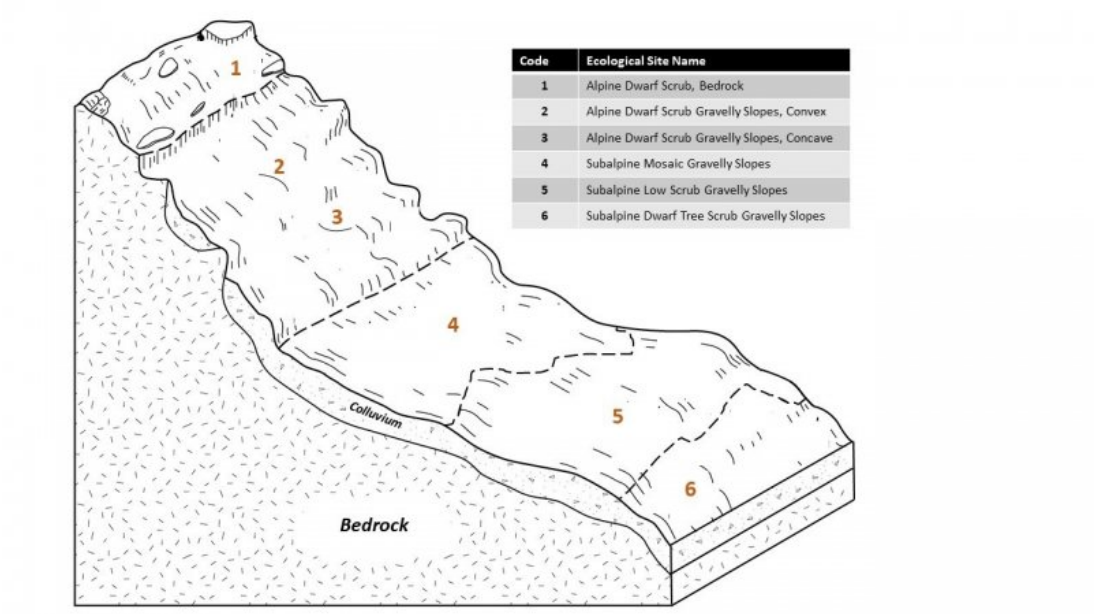

Figure 2. Representative block diagram of Subalpine Dwarf Tree Scrub Gravelly Slopes and associated ecological sites.

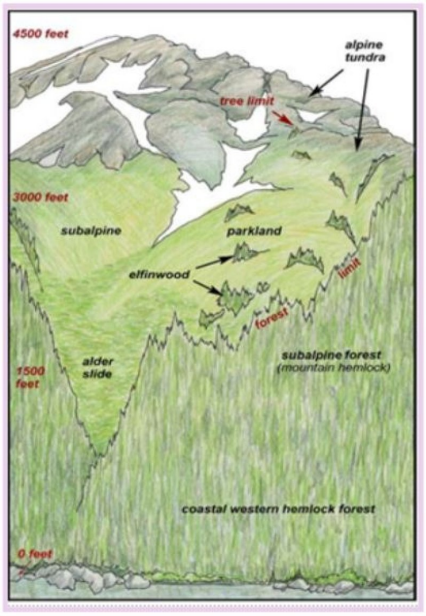

Figure 3.

Table 2. Representative physiographic features

Geomorphic position, mountains	(1) Upper third of mountainflank
Landforms	(1) Mountains
Elevation	305–1,524 m
Slope	20–50%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

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 3. 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

Climate stations used

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

Soils formed in gravelly colluvium and/or weathered residuum over shallow bedrock. The bedrock typically occurs within 10 to 20 inches of the soil surface. Rock fragments may occasionally occur on the soil surface but are limited to less than 5 percent surface cover. Rock fragments in the soil subsurface are abundant, ranging between 30 and 45 percent of the soil profile by volume.

The soil moisture regime for these dry soils is udic. The temperature regime for this site is classified as cryic, where the mean annual soil temperature is between 32°F and 46°F (USDA-NRCS 2006). Soils of this ecological site are in the Spodosols order, further classified as Lithic Humicryods.

Figure 10.

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Residuum
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Loamy-skeletal
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	41–66 cm
Soil depth	41–66 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	4.83–5.59 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–6

Subsurface fragment volume <=3" (0-50.8cm)	25–40%
Subsurface fragment volume >3" (0-50.8cm)	3–5%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	20–66 cm
Soil depth	20–66 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	0–3%
Available water capacity (0-101.6cm)	4.32–5.59 cm
Soil reaction (1:1 water) (0-25.4cm)	3.9–6
Subsurface fragment volume <=3" (0-50.8cm)	Not specified
Subsurface fragment volume >3" (0-50.8cm)	Not specified

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 (Carstensen 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 and

ericaceous dwarf shrubs. 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; Carstensen 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 / mountain heather - black crowberry / strawberryleaf raspberry

State 1
REFERENCE STATE

The reference plant community is a woodland, dominated by coniferous trees and ericaceous dwarf shrubs. 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 / mountain heather - black crowberry / strawberryleaf raspberry

Figure 11. This site at Skagway-Klondike Gold Rush National Historical Park.

The plant community is characterized as needleleaf woodland (10 to 25 percent cover) that is composed primarily of mountain hemlock. In areas near the coast, like Skagway, Sitka spruce and subalpine fir are a typical but small stand component. Trees can range in height from appearing as stunted prostrate shrubs to up to 45 feet tall (Martin et al. 1995). Regardless, the stand is krummholz. While stands are typically woodlands, tree cover can at times range up to 60% cover. Various dwarf shrubs, lichen, and moss are between clumps of stunted trees. Common shrub and forb species include western moss heather, Alaska bellheather, crowberry, blueberry, strawberryleaf raspberry, and dogwood. Lichen covers 0 to 50 percent of the ground surface. Commonly observed species include star reindeer lichen, greygreen reindeer lichen, and arctic kidney lichen.

Dominant plant species

- mountain hemlock (*Tsuga mertensiana*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- Sitka spruce (*Picea sitchensis*), tree
- western moss heather (*Cassiope mertensiana*), shrub
- Alaska bellheather (*Harrimanella stelleriana*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- yellow mountainheath (*Phyllodoce glanduliflora*), shrub
- blueberry (*Vaccinium*), shrub
- partridgefoot (*Luetkea pectinata*), shrub
- clubmoss mountain heather (*Cassiope lycopodioides*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), other herbaceous
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- star reindeer lichen (*Cladina stellaris*), other herbaceous
- arctic kidney lichen (*Nephroma arcticum*), other herbaceous
- snow lichen (*Stereocaulon*), other herbaceous

Additional community tables

Animal community

The subalpine parkland zone of MLRA 222 provides desirable habitat opportunities for many wildlife species. The matrix of herbaceous meadows, low and tall shrubs, and small stands of stunted trees offer foraging opportunities and thermal and protective cover. Herbivores – such as Sitka deer (Odocoileus hemionus sitkensis), mountain goats (Oreamnos americanus), and hoary marmot (Marmota calligata) – readily graze the herbaceous meadows. Grouse (Dendragapus spp.) and ptarmigan (Lagopus spp.) utilize these meadows and low shrub communities for hunting insects. A small portion of bears (Ursus sp.), mostly sows with cubs, forage in this zone throughout the summer. Lastly, various songbirds will utilize the tall shrubs and stunted trees for nesting cover (Carsten 2007).

Inventory data references

Tier 2 sampling plots used to develop the reference state, community phase 1.1:

Skagway-Klondike Gold Rush National Historical Park (National Park Service), Skagway, Alaska

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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	10/29/2018
Approved by	Marji Patz
Approval date	
Composition (Indicators 10 and 12) based on	

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):**

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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:**
