

Ecological site R222XY356AK Alpine Dwarf Scrub Dry Gravelly Slopes

Last updated: 2/18/2025
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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): 222X–Southern Alaska Coastal Mountains

This area is in the Southern Alaska Region and includes the higher elevations of the Coast, St. Elias, Chugach, and Kenai Mountains. The area makes up about 26,335 square

miles. The terrain consists of steep, rugged, high-relief mountains. Glaciers and ice fields make up about 54 percent of the area. Unglaciated portions of the area are deeply incised with narrow to broad valleys. Flood plains and stream terraces on valley floors rapidly give rise to steep alluvial fans and mountain footslopes. Elevation ranges from sea level at the base of tidewater glaciers and ice fields to 18,008 feet at the summit of Mt. St. Elias (USDA 2006).

During the Pleistocene epoch, the area was covered with glacial ice. As the glacial ice melted, sediments were deposited by the melting ice. However, most of the original glacial deposits have eroded away or have been buried by colluvium and slope alluvium, which covers more than 90 percent of the present unglaciated landscape. The remaining glacial and glaciofluvial deposits and recent fluvial deposits are generally restricted to the bottoms of the larger valleys. Paleozoic, Mesozoic, and Lower Tertiary stratified sedimentary rocks, and occasionally Paleozoic intrusive rocks, underlie much of the area and are exposed on steep mountain slopes and ridges (USDA 2006).

Miscellaneous (non-soil) areas make up more than 90 percent of this MLRA. The most common miscellaneous areas are rock outcrop, rubble land, chutes, and glaciers. The dominant soil orders in this area are Spodosols and Histosols. The soils in the area have a cryic soil temperature regime or a subgelic soil temperature class, a udic or aquic soil moisture regime, and mixed or amorphous mineralogy (USDA 2006).

The vegetation of this area lies in the true alpine life zone. Alpine vegetation consists of a variety of dwarf scrub and herbaceous communities. Willow scrub is common in drainages. Lichens, scattered herbs, and dwarf shrubs dominate bedrock exposures and very shallow soils. In general, there is little or no plant growth at elevations above about 7,500 feet (USDA 2006). At lower elevations, subalpine vegetation consists of a variety of mountain hemlock and tall scrub communities. These subalpine plant communities typically occur at elevations between 1500 to 3000 feet (Boggs et al. 2010, Carstensen 2007, Jaques 1983; Martin et al. 1995). The switch to subalpine vegetation marks the transition to the Alexander Archipelago-Gulf of Alaska Coast Area.

The area is almost entirely undeveloped wild land. Remote wild-land recreation is the principal land use in this area. The rugged, high mountains, extensive glaciers and ice fields, and wilderness qualities of the area attract visitors from around the world. Small rural communities along the road system are the only permanent settlements. Part of the Wrangell-St. Elias Bay National Park and Preserve, the Glacier Bay National Park and Preserve, the Misty Fjords National Monument, the Chugach National Forest, and the Tongass National Forest are in this MLRA.

Classification relationships

National Vegetation Classification – Ecological Systems: Alaskan Pacific Maritime Alpine Sparse Shrub and Fell-Field (CES204.318) (NatureServe 2015)

Ecological site concept

This alpine site occurs on dry and rocky soils of exposed mountain slopes with a harsh climate. The alpine is characterized as having very short growing seasons, cold temperatures, and high-winds. The soils are moderately well to well drained with bedrock typically occurring within 20 inches. The wind-scoured, linear to convex shaped slopes associated with this site shed snow to more protected positions on the mountain. These exposed slopes have the shallowest snowpack on the mountain. When compared to adjacent slopes in more protected positions, the shallower snowpack results in comparatively colder winter soil temperatures and a longer growing season. Slope shape, dry soils, and scouring winds in the area also combine to create harsh and desiccating growing conditions for vegetation. These exposed slopes support a unique assemblage of highly adapted alpine vegetation, which is markedly different from plant communities on more protected positions of these mountain slopes.

The reference plant community is ericaceous dwarf scrub. Exposed bedrock and surface rock fragments are common. Species diversity can be high with a diverse range of shrub, graminoid, and forb species. Common species include black crowberry, western moss heather, yellow mountain heath, Aleutian mountain heath, Alaska bellheather, longawn sedge, boreal sagebrush, clubmoss, Nootka lupine, and star reindeer lichen. The primary disturbance processes that maintain this plant community are exposure to cold temperatures, wind, and avalanches (NatureServe 2018).

Associated sites

R222XY352AK	Alpine Dwarf Scrub Dry Organic Slopes Occurs in similar landscape positions, but in areas where organic matter accumulates over bedrock.
R222XY360AK	Alpine Herbaceous Wet Organic Depressions Occurs in the alpine on wetter, organic-rich soils.
R222XY357AK	Alpine Dwarf Scrub Moist Gravelly Slopes Occurs in the alpine on protected slopes where snow accumulates.

Similar sites

R222XY352AK	Alpine Dwarf Scrub Dry Organic Slopes Both sites support ericaceous dwarf scrub plant communities. Site 352 typically has more lichen cover and occurs on soils less than 10 inches deep, whereas site 356 occurs on soils 10-20 inches deep on convex positions.
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R222XY357AK

Alpine Dwarf Scrub Moist Gravelly Slopes

Both sites occur in the alpine. Site 357 occurs on protected slopes where snow beds can persist well into the growing season. Partridgefoot and Alaska bellheather are both common and dominant species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Empetrum nigrum</i> (2) <i>Cassiope mertensiana</i>
Herbaceous	(1) <i>Carex macrochaeta</i>

Physiographic features

This site occurs on mountain summits, shoulders, and backslopes in the alpine, and typically occurs at elevations between 2000 to 4500 feet depending on slope and aspect. This site may occur at much higher elevations on warm southerly slopes and at much lower elevations on cold northerly slopes. Backslopes are very steep ranging from 40 to 90 percent slope, while summits and much less steep ranging from 0 to 30 percent slope. This site can be moderately well- to well-drained. A seasonally high-water table fed by snowmelt and subsurface water movement may be present or absent on this site. Free water may occur within six inches of the soil surface. This site does not experience flooding or ponding, but rather generates runoff to adjacent, downslope ecological sites.

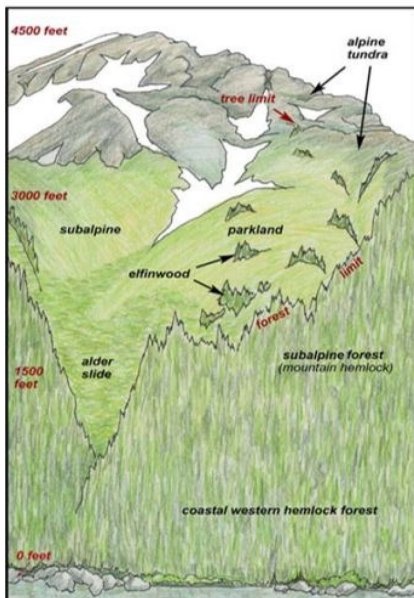


Figure 2. The influence of elevation on the vegetation life zones of a typical Southeast Alaska mountainside. Aspect and slope are additional factors that control vegetation life zones on a mountainside (Carstensen 2007).

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope
Landforms	(1) Mountains > Mountain (2) Mountains > Mountain slope
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	610–1,372 m
Slope	0–90%
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	305–1,372 m
Slope	0–100%

Climatic features

Cloudy conditions, high annual precipitation with long periods of snow cover, and moderate to cold temperatures characterize the climate of this area. The average annual precipitation throughout most of this area is 120 to 200 inches and can reach 250 inches or more at the highest elevations (USDA-NRCS 2006). The average annual snowfall in this area ranges from about 200 to 800 inches and can greatly exceed the annual snowmelt in many places, as evidenced by the abundance and extent of glaciers and ice fields (USDA-NRCS 2006). Site precipitation is at a minimum during the months of April through July and a maximum during the months of September through December.

At higher elevations, freezing temperatures are likely to occur during any month of the year. For this site, the growing season occurs over a short duration of time. For instance, July and August are the only months in which the representative low minimum monthly temperatures are not below freezing.

Table 4. Representative climatic features

Frost-free period (characteristic range)	35-80 days
Freeze-free period (characteristic range)	55-85 days

Precipitation total (characteristic range)	3,607-4,928 mm
Frost-free period (actual range)	35-120 days
Freeze-free period (actual range)	40-105 days
Precipitation total (actual range)	3,048-6,350 mm
Frost-free period (average)	65 days
Freeze-free period (average)	70 days
Precipitation total (average)	4,267 mm

Influencing water features

Due to its landscape position, this site has dry soil. However, there is a potential for seasonally high free water related to snowmelt and subsurface water movement in some slope positions. This site is neither associated with nor 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.

Wetland description

n/a

Soil features

Soils typically formed in gravelly colluvium and/or weathered residuum and are shallow with bedrock less than 20 inches below the soil surface. Seldomly, soils can be deep or formed in till. Soil textures are gravelly or very gravelly silt loams to sandy loams. Surface rock fragments are highly variable ranging from 0 to 30 percent cover. Rock fragments in the soil subsurface are abundant, typically ranging between 30 and 60 percent of the soil profile by volume.

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



Figure 9. A typical soil profile for this site. The soil is dry, gravelly, and bedrock controlled. This photograph was taken in proximity to Glacier Bay National Park and Preserve.

Table 5. Representative soil features

Parent material	(1) Colluvium (2) Residuum (3) Till
Surface texture	(1) Gravelly loam (2) Gravelly silt loam (3) Gravelly sandy loam (4) Very gravelly sandy loam (5) Very gravelly loam (6) 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	25–51 cm
Soil depth	25–51 cm
Surface fragment cover ≤3"	0–2%
Surface fragment cover >3"	0–30%
Available water capacity (0-101.6cm)	0.76–11.68 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–6
Subsurface fragment volume ≤3" (0-50.8cm)	20–40%

Subsurface fragment volume >3" (0-50.8cm)	10–20%
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Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	15–152 cm
Soil depth	15–152 cm
Surface fragment cover ≤3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	0.51–15.24 cm
Soil reaction (1:1 water) (0-25.4cm)	3.6–8.4
Subsurface fragment volume ≤3" (0-50.8cm)	15–40%
Subsurface fragment volume >3" (0-50.8cm)	0–65%

Ecological dynamics

This MLRA has a harsh climate where glaciers and other miscellaneous areas are the dominant land cover. The non-glaciated areas are inhabited by a vegetative matrix resulting from a complex interaction among elevation, varying microclimates resulting from landscape topography, and natural disturbance regimes. The result is a heterogeneous landscape of ericaceous dwarf shrubs, low shrubs, tall shrubs, and forested plant communities. This site forms an aspect of this vegetative continuum. This ecological site occurs on mountain slopes on dry soils in the alpine.

Located in the alpine life zone, this site is exposed to a variety of harsh environmental conditions. Since this site is under snow for most of the year, plants have a short season to grow and reproduce. When the site is snow-free, cold temperatures and high winds also inhibit plant growth and performance. This harsh climate maintains vegetation within this site and prevents the establishment and growth of dominant subalpine species like mountain hemlock and Sitka alder.

State and transition model

Ecosystem states

1. REFERENCE
STATE

State 1 submodel, plant communities

1.1. black crowberry -
western moss heather
/ longawn sedge

State 1 REFERENCE STATE

The reference plant community is categorized as a sparse dwarf scrub-herbaceous vegetative community interspersed with bedrock and surface rock. The one community phase within the reference state is maintained by exposure to cold temperatures, wind, and a short growing season. 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.

Community 1.1 black crowberry - western moss heather / longawn sedge



Figure 10. A typical ericaceous dwarf scrub community associated with this site. This photograph was taken in the Skagway-Klondike Gold Rush National Historic Park, Area (Flagstad and Boucher 2015).

The reference plant community is ericaceous dwarf scrub. Exposed bedrock and surface rock fragments are common. Species diversity can be high with a diverse range of shrub, graminoid, and forb species. Common species include black crowberry, western moss heather, yellow mountain heath, Aleutian mountain heath, Alaska bellheather, longawn sedge, boreal sagebrush, clubmoss, Nootka lupine, and star reindeer lichen.

Dominant plant species

- black crowberry (*Empetrum nigrum*), shrub
- western moss heather (*Cassiope mertensiana*), shrub
- yellow mountainheath (*Phyllodoce glanduliflora*), shrub
- Aleutian mountainheath (*Phyllodoce aleutica*), shrub
- Alaska bellheather (*Harrimanella stelleriana*), shrub
- partridgefoot (*Luetkea pectinata*), shrub
- alpine azalea (*Loiseleuria procumbens*), shrub
- longawn sedge (*Carex macrochaeta*), grass
- greygreen reindeer lichen (*Cladina rangiferina*), other herbaceous
- star reindeer lichen (*Cladina stellaris*), other herbaceous
- boreal sagebrush (*Artemisia arctica*), other herbaceous
- clubmoss (*Lycopodium*), other herbaceous
- Nootka lupine (*Lupinus nootkatensis*), other herbaceous
- Sitka valerian (*Valeriana sitchensis*), other herbaceous
- woolly geranium (*Geranium erianthum*), other herbaceous

Additional community tables

Animal community

To be determined.

Hydrological functions

To be determined.

Recreational uses

To be determined.

Wood products

To be determined.

Other products

To be determined.

Other information

To be determined.

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 – Plot numbers as recorded in NASIS: 11DM02401, 11DM02402, 11DM02403, 11DM02404, 11DM06303, 11DM06801, 11DM06803, 11NP01705, 11NP06602, 11NP06603, 11NP06706, 11NP06902, 11NP07201.

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Other references

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Approval

Marji Patz, 2/18/2025

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	08/16/2024
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:**
