USDA Natural Resources
Conservation Service

Ecological site F220XY200AK
Subalpine Forest 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.

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.

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 within the area. 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.

Classification relationships

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

Ecological site concept

This subalpine site occurs on mountain slopes at the lowest subalpine bands of elevation and represents a transition from warmer coastal rainforests to colder subalpine forests. This site has a harsh climate where tree species from lower elevations like western hemlock are present but no longer dominant. The soils are dry for much of the growing season and are well to moderately well drained. These dry soils are gravelly Spodosols typically formed in colluvium and/or weathered residuum. Bedrock typically occurs within 20 inches.

The reference plant community is an open forest (25-60% cover) dominated by coniferous trees and ericaceous shrubs. While mountain hemlock is the dominant tree species, western hemlock can also be a common stand component. Common understory species include oval-leaf blueberry, Alaska blueberry, strawberryleaf raspberry, fernleaf goldthread, and bunchberry dogwood. The primary disturbance processes that maintain this plant community are exposure to cold temperatures, wind, blowdown, and avalanches (NatureServe 2018).

Associated sites

R220XY349AK	**Subalpine Scrub Gravelly Dry Chutes** Occurs on similar bands of elevation on avalanche chutes.
F220XY338AK	**Subalpine Forests Dry Organic Slopes** Occurs on similar bands of elevation on dry, organic soils.
F220XY204AK	**Subalpine Forests Organic Wet Slopes** Occurs on similar bands of elevation on wetter soils.

Similar sites

F220XY338AK	**Subalpine Forests Dry Organic Slopes** Both sites occur in a similar band of elevation and have similar overstory and understory species. However, site 338 has organic soil and less productive stands of trees.

Table 1. Dominant plant species

Tree	(1) *Tsuga mertensiana*
Shrub	(1) *Vaccinium ovalifolium* (2) *Vaccinium alaskaense*

Herbaceous	(1) *Rubus pedatus* (2) *Coptis aspleniifolia*

Physiographic features

This site occurs on mountain backslopes and shoulders at the lowest subalpine bands of elevation, which typically occurs at 1350 to 2250 feet depending on slope and aspect. This site likely occurs at much higher elevations on warm southerly slopes and at much lower elevations on cold northernly slopes. Slopes are moderately steep to very steep ranging from 20 to 85 percent. This site does not experience flooding or ponding, but rather generates runoff to adjacent, downslope ecological sites.

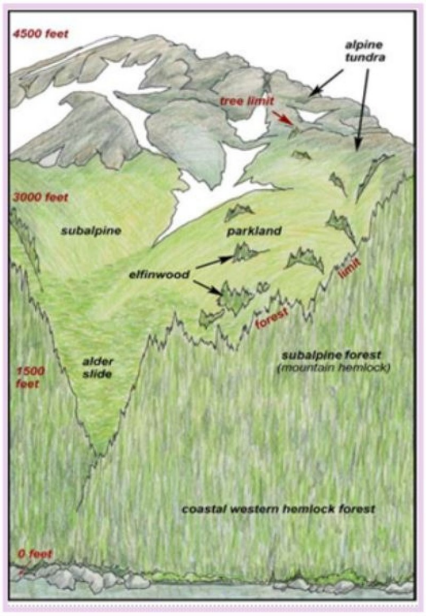

Figure 1.

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Shoulder
Geomorphic position, mountains	(1) Mountainflank
Landforms	(1) Mountains > Mountain
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	411–686 m
Slope	20–85%

Water table depth	20–51 cm

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	None to frequent
Ponding frequency	Not specified
Elevation	305–914 m
Slope	5–100%
Water table depth	20–51 cm

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)	95-130 days
Freeze-free period (characteristic range)	141-185 days
Precipitation total (characteristic range)	1,626-3,734 mm
Frost-free period (actual range)	83-170 days
Freeze-free period (actual range)	118-218 days
Precipitation total (actual range)	1,295-4,445 mm
Frost-free period (average)	118 days
Freeze-free period (average)	167 days
Precipitation total (average)	2,642 mm

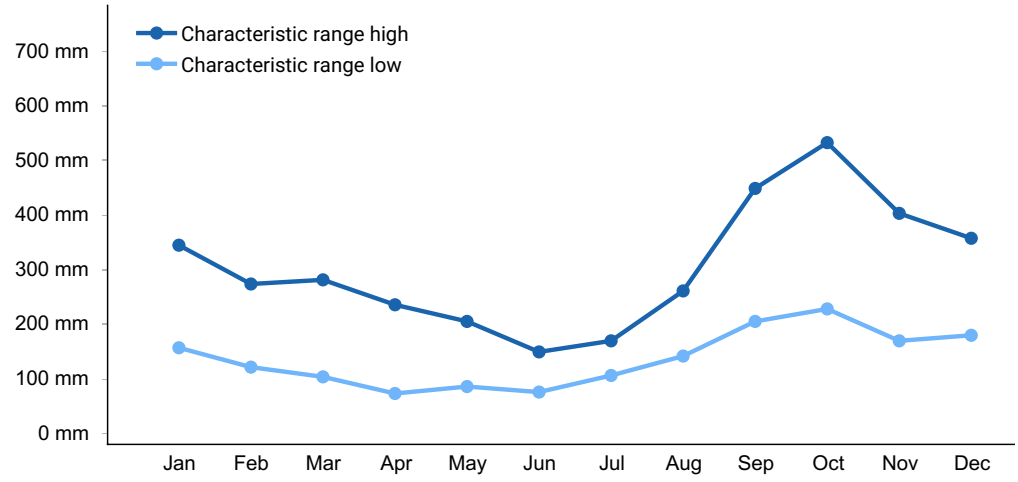

Figure 2. Monthly precipitation range

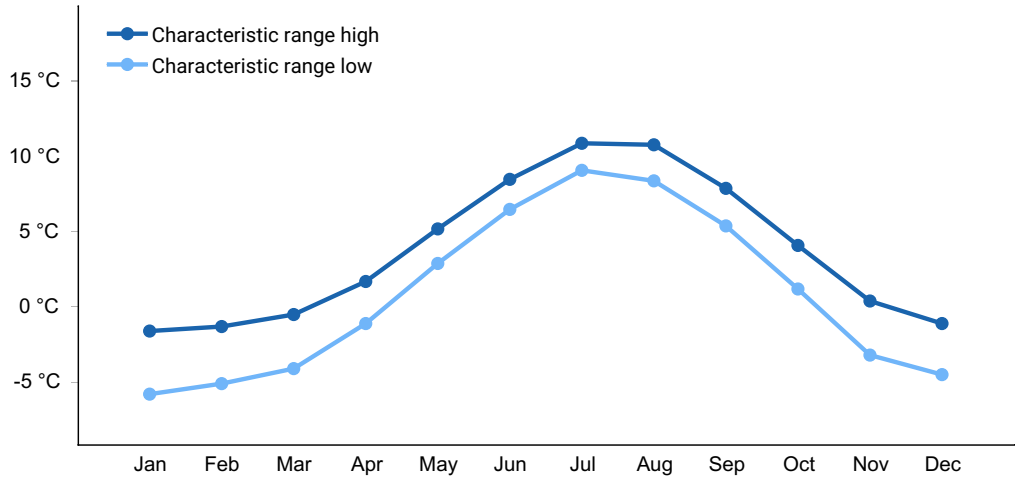

Figure 3. Monthly minimum temperature range

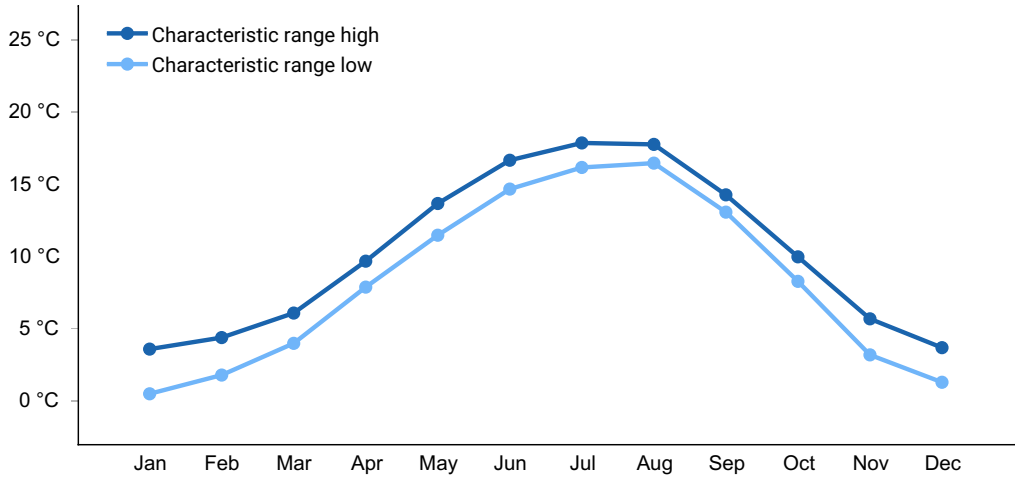

Figure 4. Monthly maximum temperature range

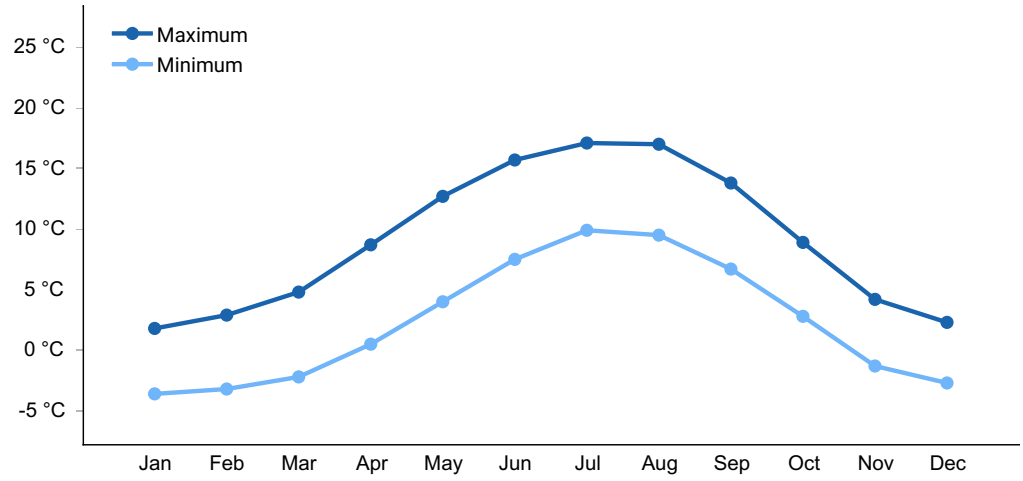

Figure 5. Monthly average minimum and maximum temperature

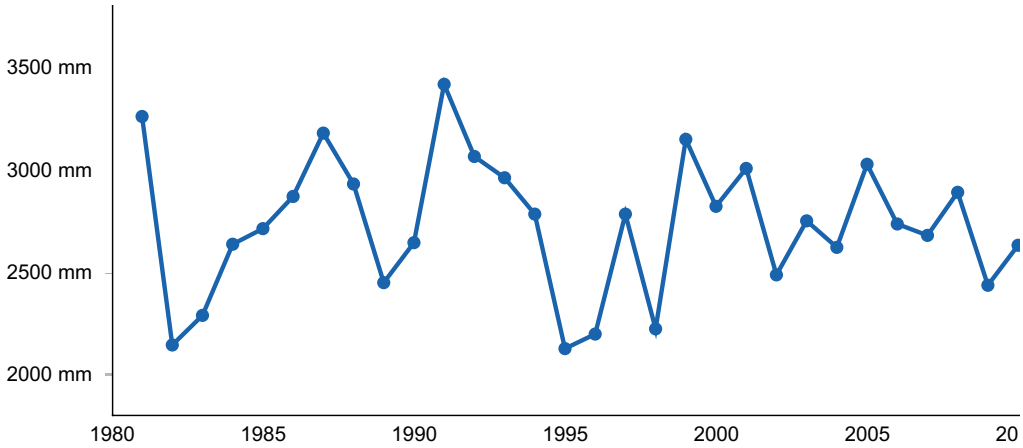

Figure 6. Annual precipitation pattern

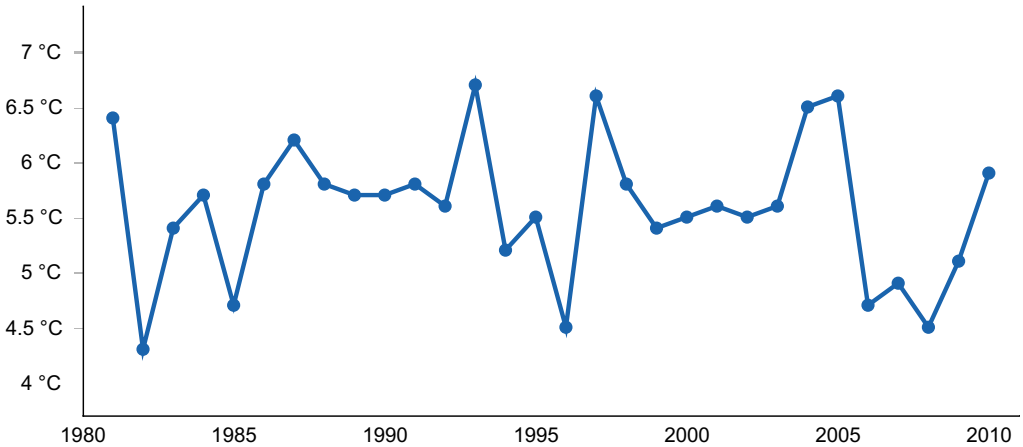

Figure 7. Annual average temperature pattern

Climate stations used

- (1) YAKUTAT STATE AP [USW00025339], Yakutat, AK
- (2) GLACIER BAY [USC00503294], Gustavus, AK
- (3) GUSTAVUS [USW00025322], Gustavus, AK
- (4) JUNEAU INTL AP [USW00025309], Juneau, AK

- (5) PELICAN [USC00507141], Hoonah, AK
- (6) HOONAH [USC00503695], Hoonah, AK
- (7) SITKA AIRPORT [USW00025333], Sitka, AK
- (8) PETERSBURG 1 [USW00025329], Petersburg, AK
- (9) ANNETTE ISLAND AP [USW00025308], Metlakatla, AK
- (10) CORDOVA M K SMITH AP [USW00026410], Cordova, AK
- (11) MAIN BAY [USC00505604], Valdez, AK
- (12) SELDOVIA AP [USW00025516], Homer, AK
- (13) KETCHIKAN INTL AP [USW00025325], Ketchikan, 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

This site almost always occurs on bedrock-controlled soils but does seldomly occur on deeper ash-influenced soils. Bedrock controlled soils typically formed in gravelly colluvium and/or weathered residuum. The bedrock typically occurs within 20 inches. The deeper soils formed in volcanic ash. Rock fragments do not typically occur on the soil surface. Rock fragments in the soil subsurface are variable, typically ranging between 30 and 60 percent of the soil profile by volume.

The soil moisture regime for these dry soils is udic. 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 8. A typical soil profile associated with this ecological site. Soils are

commonly Spodosols with bedrock occurring within 20 inches of the soil surface. This photo was taken in the Skagway-Klondike Gold Rush National Historic Park, Area.

Table 5. Representative soil features

Parent material	(1) Colluvium (2) Residuum (3) Volcanic ash
Surface texture	(1) Loam (2) Sandy loam (3) Silt loam (4) Fine sandy loam (5) Highly organic fine sandy loam
Family particle size	(1) Loamy-skeletal (2) Medial
Drainage class	Moderately well drained to well drained
Permeability class	Moderate to rapid
Depth to restrictive layer	38–51 cm
Soil depth	38–51 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-50.8cm)	3.3–5.59 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–6
Subsurface fragment volume <=3" (0-50.8cm)	25–35%
Subsurface fragment volume >3" (0-50.8cm)	2–30%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	36–183 cm
Soil depth	36–183 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-50.8cm)	3.3–50.04 cm
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (0-50.8cm)	11–37%
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 lowest subalpine bands of elevation. 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. This site occurs in the subalpine forest subzone (Carstensen 2007) just above coastal forests dominated by western hemlock and just below the subalpine parkland.

Mountain hemlock is the tree species best adapted to the cold temperatures, bitter wind, and deep snowpack associated with the subalpine in this MLRA. 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 in this site (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 forest 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 / oval-leaf blueberry - Alaska blueberry / strawberryleaf raspberry-fernleaf goldthread

State 1
Reference State

The reference plant community is an open forest (25-60% cover) dominated by coniferous trees and ericaceous 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 / oval-leaf blueberry - Alaska blueberry / strawberryleaf raspberry-fernleaf goldthread

The plant community is characterized as an open needleleaf forest (25-60 percent cover) that is composed primarily of mountain hemlock. Western hemlock commonly occurs in the canopy but is not dominant. In areas near the coast, subalpine fir and Sitka spruce are present, typically as small stand components. While stands are typically open forest, tree cover can at times range down to 15% cover and up to 65% cover. Stand height is commonly 75 or less feet in height (Martin et al. 1995). Common understory species include oval-leaf blueberry, Alaska blueberry, strawberryleaf raspberry, fernleaf goldthread, and bunchberry dogwood.

Dominant plant species

- mountain hemlock (*Tsuga mertensiana*), tree
- western hemlock (*Tsuga heterophylla*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- Sitka spruce (*Picea sitchensis*), tree
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- Alaska blueberry (*Vaccinium alaskaense*), shrub

- rusty menziesia (*Menziesia ferruginea*), shrub
- devilsclub (*Oplopanax horridus*), shrub
- strawberryleaf raspberry (*Rubus pedatus*), other herbaceous
- fernleaf goldthread (*Coptis aspleniifolia*), other herbaceous
- deer fern (*Blechnum spicant*), other herbaceous
- bunchberry dogwood (*Cornus canadensis*), other herbaceous
- spreading woodfern (*Dryopteris expansa*), other herbaceous
- western oakfern (*Gymnocarpium dryopteris*), other herbaceous
- Schreber's big red stem moss (*Pleurozium schreberi*), other herbaceous
- splendid feather moss (*Hylocomium splendens*), other herbaceous

Additional community tables

Other references

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Contributors

Lisa Kluesner, Blaine Spellman, Jamin Johanson, Nathan Parry

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:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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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):

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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:**
