USDA Natural Resources Conservation Service

Ecological site R222XY360AK
Alpine Herbaceous Wet Organic Depressions

Last updated: 2/18/2025
Accessed: 05/11/2025

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): 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, avalanche 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 amorphic mineralogy (USDA 2006).

Alpine plant communities characterize the vegetation in this area. Alpine vegetation consists of a variety of dwarf scrub and herbaceous communities. Low 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) and are associated with the Alexander Archipelago-Gulf of Alaska Coast area (MLRA 220X).

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

Biophysical Settings: Alaskan Pacific Maritime Alpine Wet Meadow (BpS 7816730) (LANDFIRE 2009)

Ecological site concept

This high-elevation site has wet and shallow soils and a harsh alpine climate. The alpine is characterized as having very short growing seasons, cold temperatures, and high winds. Associated soils are very wet, organic-rich, and bedrock controlled. The harsh alpine climate and shallow, wet soils combine to prevent the growth and dominance of common subalpine species like mountain hemlock.

The reference plant community is wet graminoid herbaceous meadow that is primarily composed of dwarf sedges. Common species include tufted bulrush, grassy slope arctic sedge, black alpine sedge, Merten's rush, white marsh marigold, and deer cabbage (Jaques 1983, Landfire 2009, and Flagstad and Boucher 2015). The primary disturbance processes that maintain this plant community are exposure to cold temperatures, ponding, wind, and avalanches (NatureServe 2018).

Associated sites

R222XY352AK	**Alpine Dwarf Scrub Dry Organic Slopes** Both sites occur in the alpine where organic matter accumulates, however, site 352 is dry organic matter over bedrock.
R222XY356AK	**Alpine Dwarf Scrub Dry Gravelly Slopes** Occurs in the alpine on exposed slopes with drier soils.
R222XY357AK	**Alpine Dwarf Scrub Moist Gravelly Slopes** Occurs in the alpine on drier soils where snow accumulates.

Similar sites

R220XY362AK	**Subalpine Sedge Wet Flood Plain** Sites 360 and 362 both have wet graminoid herbaceous meadow communities. However, site 362 occurs in subalpine flood plain, while site 360 occurs in wet depressions on mountains which do not flood.
R222XY352AK	**Alpine Dwarf Scrub Dry Organic Slopes** Both sites occur in the alpine where organic matter accumulates. However, site 352 is dry organic matter over bedrock.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Trichophorum cespitosum* (2) *Carex*

Physiographic features

This site is associated with depressions on mountains and other wet concave slopes in the alpine, which typically occurs at 1500 to 4500 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 northerly slopes. Slope is variable and commonly ranges from 5 to 50 percent but can go as high as 120 percent. This site does not experience flooding or ponding. Soils are saturated at a shallow depth for the entire growing season.

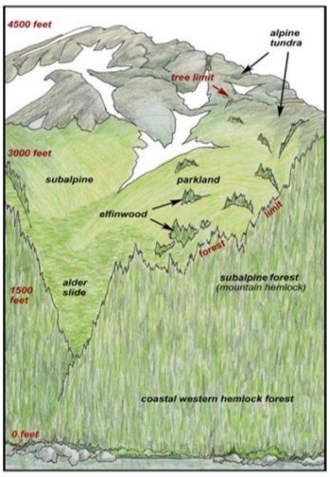

Figure 1. The influence of elevation on the vegetation life zones of a typical Southeast Alaska mountainside. Aspect and slope are additional factors that control vegetation life zones on a mountainside (Carstensen 2007).

Table 2. Representative physiographic features

Hillslope profile	(1) Backslope (2) Footslope
Slope shape across	(1) Concave
Landforms	(1) Mountains > Mountain (2) Mountains > Depression
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,500–4,500 ft
Slope	5–50%
Water table depth	0–10 in
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Frequent to none
Ponding frequency	Not specified
Elevation	1,000–6,500 ft
Slope	0–100%
Water table depth	0–18 in

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)	90-185 days
Freeze-free period (characteristic range)	55-190 days
Precipitation total (characteristic range)	142-194 in
Frost-free period (actual range)	50-185 days
Freeze-free period (actual range)	50-200 days
Precipitation total (actual range)	120-250 in
Frost-free period (average)	140 days
Freeze-free period (average)	70 days
Precipitation total (average)	168 in

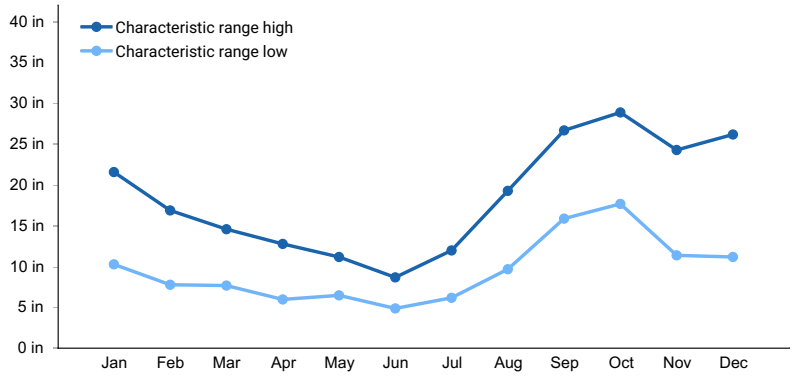

Figure 2. Monthly precipitation range

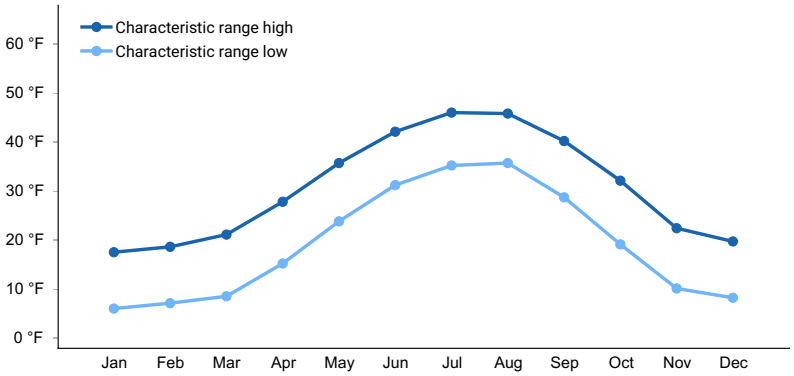

Figure 3. Monthly minimum temperature range

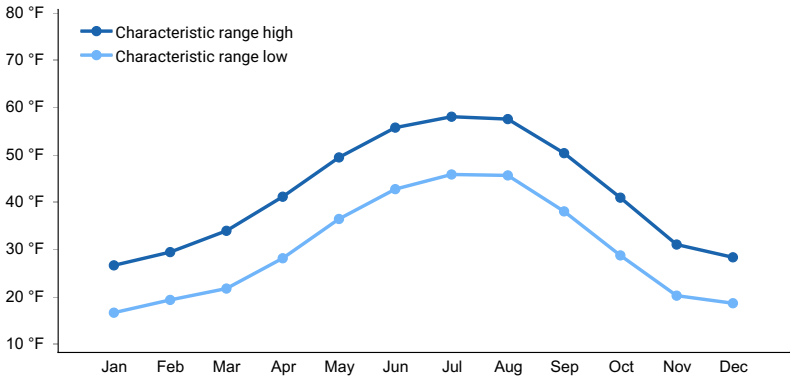

Figure 4. Monthly maximum temperature range

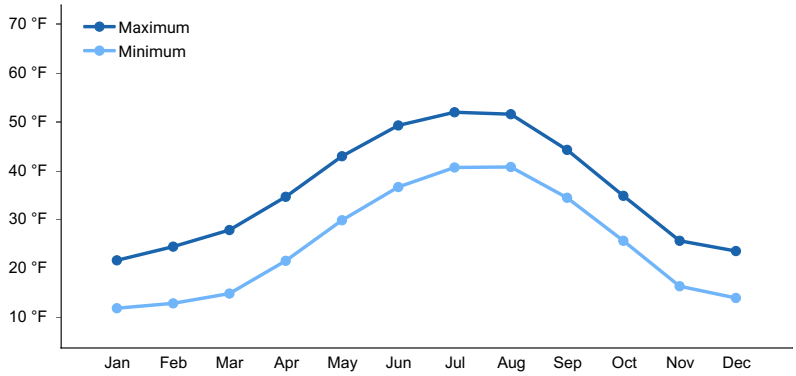

Figure 5. Monthly average minimum and maximum temperature

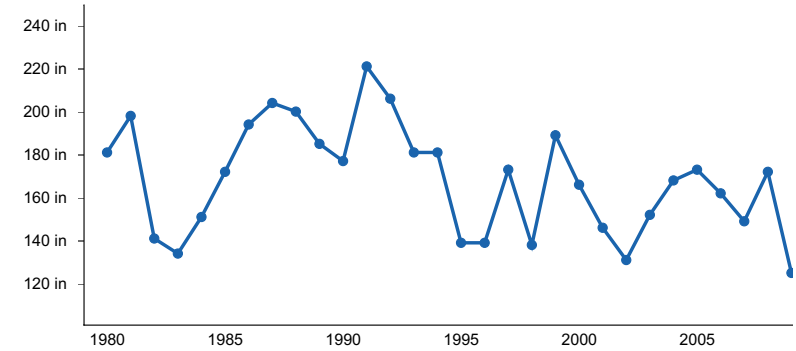

Figure 6. Annual precipitation pattern

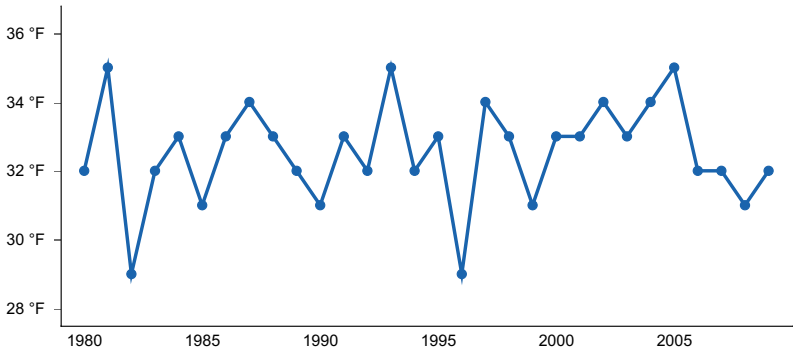

Figure 7. Annual average temperature pattern

Influencing water features

This site is very poorly drained because a water table persists in the soil profile for most of the growing season. This water table commonly occurs at 0 to 10 inches. Depth to the water table may decrease following summer storm events or spring snowmelt and increase during extended dry periods.

Due to the perceived depth and persistence of a water table, wetland indicator plants are thought to be common in the reference state.

Wetland description

n/a

Soil features

Soils formed in organic material and are typically peat or mucky peat over shallow bedrock. At times, gravelly residuum and/or colluvium occur in the subsoil, just above the bedrock. Bedrock typically occurs within 20 inches but can be as deep as 40 inches. Surface rock fragments are not present. Subsurface rock fragments are variable,

typically ranging between 0 and 60 percent of the soil profile by volume.

The soil moisture regime for these wet soils is aquic. The temperature regime for this site is cryic, where the mean annual soil temperature is between 32°F and 46°F (USDA-NRCS 2006). Soils are in the Histosols order and commonly classify as Lithic Cryosaprists or Lithic Cryohemists.

Table 5. Representative soil features

Parent material	(1) Organic material (2) Residuum (3) Colluvium
Surface texture	(1) Peat (2) Mucky peat
Drainage class	Very poorly drained
Permeability class	Slow to moderately rapid
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3.8–10.2 in
Soil reaction (1:1 water) (0-10in)	3.5–6
Subsurface fragment volume <=3" (0-40in)	20–40%
Subsurface fragment volume >3" (0-40in)	10–20%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	0–40 in
Soil depth	0–40 in
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	0.7–11.3 in
Soil reaction (1:1 water) (0-10in)	2–6
Subsurface fragment volume <=3" (0-40in)	15–40%
Subsurface fragment volume >3" (0-40in)	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 very wet soils in the alpine.

Located in the alpine life zones, this site has wet and shallow soils and a harsh climate. Few plant species can grow in wet organic mats over shallow bedrock. Even fewer can grow in the high elevations associated with this site. This site experiences very short growing seasons, cold temperatures, and high winds. These climatic factors combined with the limiting soils maintain site vegetation, preventing the establishment and growth of dominant alpine and subalpine species like black crowberry, Alaska bellheather, mountain hemlock, and Sitka alder.

State and transition model

Ecosystem states

1. REFERENCE STATE

State 1 submodel, plant communities

1.1. Tufted bulrush - sedge

State 1
REFERENCE STATE

The reference plant community is wet graminoid herbaceous. The one community phase within the reference state is maintained by cold temperatures, wet soils, wind, and avalanches (Landfire 2009). 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
Tufted bulrush - sedge

Figure 8. A typical wet, organic-rich depression associated with this site. This photograph was taken in the Skagway-Klondike Gold Rush National Historic Park, Area (Flagstad and Boucher 2015).

This plant community is characterized as wet graminoid herbaceous. The dominant graminoids are a mixture of dwarf sedges. While less dominant, various wetland shrubs and forbs are common. Commonly observed species include tufted bulrush, grassy slope arctic sedge, black alpine sedge, Merten’s rush, white marsh marigold, and deer cabbage.

Dominant plant species

- tufted bulrush (*Trichophorum cespitosum*), grass
- grassyslope arctic sedge (*Carex anthoxanthea*), grass
- black alpine sedge (*Carex nigricans*), grass
- Mertens' rush (*Juncus mertensianus*), grass
- white marsh marigold (*Caltha leptosepala*), other herbaceous
- deercabbage (*Nephrophyllidium crista-galli*), 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

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

Boggs, K.W., S.C. Klein, J.E. Grunblatt, G.P. Streveler, and B. Koltun. 2008. Landcover Classes and Plant Associations of Glacier Bay National Park and Preserve. Natural Resource Technical Report NPR/GLBA/NRTR-2008/093. National Park Service, Fort Collins, CO. 254 pps.

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.

Flagstad, F. and T. Boucher. 2015. Klondike Gold Rush National Historic Park Landcover Classes and Plant Associations. Natural Resource Report NPS/KLGO/NRR-2015/917. Fort Collins, Colorado.

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

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).

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.

Zouhar, K. 2017. Fire regimes in Alaskan mountain hemlock ecosystems. In: Fire Effects Information System (Online). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/fire_regimes/AK_mountain_hemlock/all.html. (Accessed 23 October 2018).

Contributors

Nathan Parry
Lisa Kluesner
Blaine Spellman
Jamin Johanson

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:**