Ecological site F057XY015MN
Wet Mixed Forest

Last updated: 10/03/2023
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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.

MLRA notes

Major Land Resource Area (MLRA): 057X–Northern Minnesota Gray Drift

The Northern Minnesota Gray Drift (57) is located within the Northern Lakes Forest and Forage Region. This area is entirely in north-central Minnesota and makes up about 9,785 square miles (Figure 1). The entire area is covered by Wisconsin-age glacial drift. The glacial deposits are from four major ice lobes-Des Moines, Rainy, Superior, and Wadena. The landscape developed through a series of glaciations and the subsequent retreating and wasting of the ice sheets, which resulted in a complex pattern of moraines, outwash plains, drumlins, lake plains and drainages. Lakes, ponds and marshes are common. The thickness of the glacial till ranges from 90 to 185 meters. Some areas of these deposits are overlain by outwash or lacustrine sediments. Some depressional areas have an accumulation of organic matter. The organic deposits are more than 2.5meters thick in some areas. Elevation ranges from 300 to 500 meters across the area. (USDA-NRCS 2006)

The dominant soil orders in this MLRA are Alfisols, Entisols, and Histisols, with some Mollisols in the westernmost part of the area. The soils in the area have a frigid soil temperature regime; aquic or udic soil moisture regime, and mixed mineralogy. Their natural drainage class is related to landscape position. In general, the Alfisols formed in till on moraines, Entisols formed in outwash on moraines and outwash plains, and Histosols formed in organic material over outwash or till on moraines or outwash plains. (USDA-NRCS 2006)

Classification relationships

Major Land Resource Area (MLRA): Northern Minnesota Gray Drift (57) (USDA Handbook 296, 2006)

USFS Subregions: Northern Minnesota Drift & Lake Plain Section (212N); Chippewa Plains Subsection (212Na), Pine Moraines & Outwash Plains Subsections (212Nc), St. Louis Moraines Subsection (212Nb); Minnesota & NE Iowa Morainal Section (222M); Hardwood Hills Subsection (222Ma); Northern Superior Uplands Section (212L); Nashwauk Uplands Subsection (212Lc); Northern Minnesota & Ontario Peatlands Section (212M); Littlefork-Vermillion Uplands Subsection (212Ma) (Cleland et al. 2007).

US EPA Level IV Ecoregion: Itasca and St. Louis Moraines (50q); Chippewa Plains (50r); Nashwauk/Marcell Moraines and Uplands (50s); Alexandria Moraines and Detroit Lakes Outwash Plain (51j); McGrath Till Plain and Drumlins (51k); Wadena/Todd Drumlins and Osakis Till Plain (51l)(U.S. Environmental Protection Agency, 2013)

Ecological site concept

Wet Mixed Forest are widespread throughout the entire MLRA 57, and typically occur on footslope and toeslope hillslope positions, drainageways surrounded by uplands or on the edge of uplands grading to very poorly drained peatland soils. These sites typically exist on loamy and occasionally sandy moraines and till plains.

Associated sites

F057XY016MN	**Flood Plain Forest** These sites occur on occasionally or annually flooded sites on terraces and floodplains of streams and rivers. Soils consist of stratified alluvium which vary widely from silty to fine sandy soils on the occasionally flooded river terraces to coarser textured alluvium on the active floodplain sites.
F057XY002MN	**Wet Depressional Forest** These sites occur in shallow wetland basins, closed depressions and along drainage ways, and are generally in narrow transition zones between mineral uplands and peatlands. Soil surface layers are typically mucky-modified surface textures or muck less than 8” thick over variable parent materials.

Similar sites

F057XY021MN	**Loamy Upland Moist Hardwood Forest** These sites occur on summit, shoulders and backslope hillslope positions on moraines and till plains. These sites typically exist on soils with loamy textures of loam, sandy loam, sandy clay loam or fine sandy loam within a depth of 50 centimeters. The underlying parent material is generally medium textured till, sandy loam till or stratified materials with generally less than 35 percent rock fragments within a depth of 100 centimeters.

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides* (2) *Fraxinus nigra*
Shrub	(1) *Corylus cornuta* (2) *Prunus virginiana*
Herbaceous	(1) *Maianthemum canadense* (2) *Aralia nudicaulis*

Physiographic features

Wet Mixed Forest are widespread throughout the entire MLRA 57, and typically occur on footslope and toeslope hillslope positions, drainageways surrounded by uplands or on the edge of uplands grading to very poorly drained peatland soils. These sites typically exist on loamy and occasionally sandy moraines and till plains.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope
Landforms	(1) Peninsula > Moraine (2) Till plain (3) Drainageway
Flooding frequency	None
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Occasional to frequent
Elevation	875–1,261 ft
Slope	0–6%
Ponding depth	0–8 in
Water table depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

In general, MLRA 57 has cold winters and warm summers. About 65 percent of the annual precipitation falls as rain during the 5-month growing season (May through September), and an additional 18 percent falls as snow.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-108 days
Freeze-free period (characteristic range)	126-136 days
Precipitation total (characteristic range)	27-28 in
Frost-free period (actual range)	79-112 days
Freeze-free period (actual range)	122-140 days
Precipitation total (actual range)	26-30 in
Frost-free period (average)	98 days
Freeze-free period (average)	131 days
Precipitation total (average)	28 in

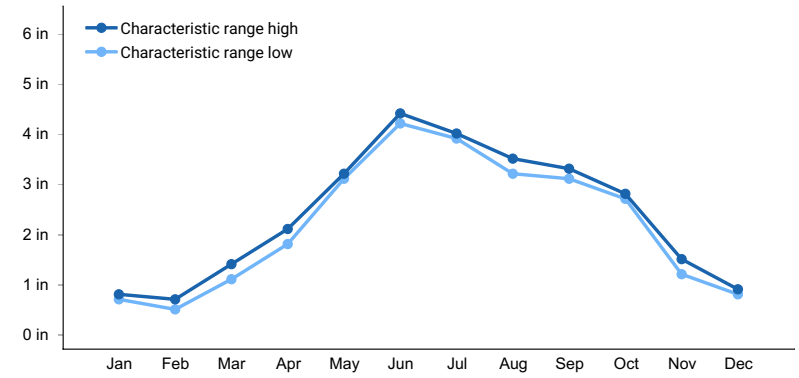


Figure 1. Monthly precipitation range

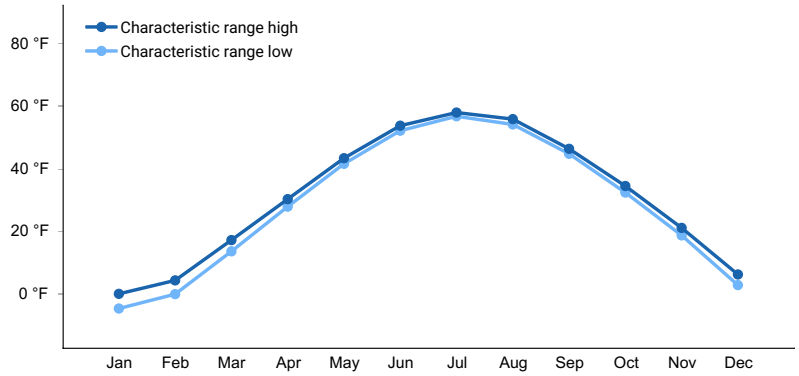


Figure 2. Monthly minimum temperature range

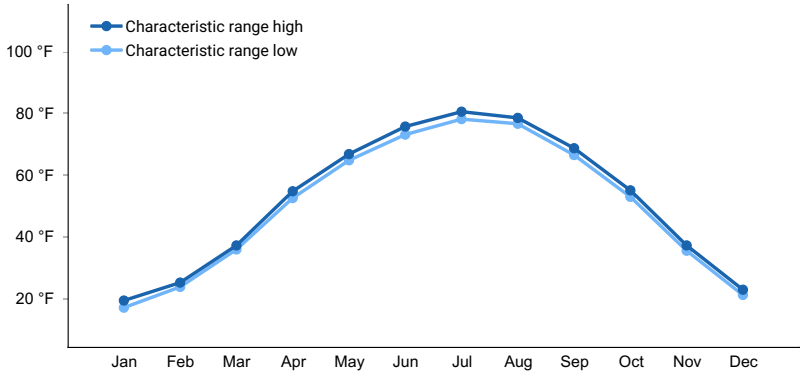


Figure 3. Monthly maximum temperature range

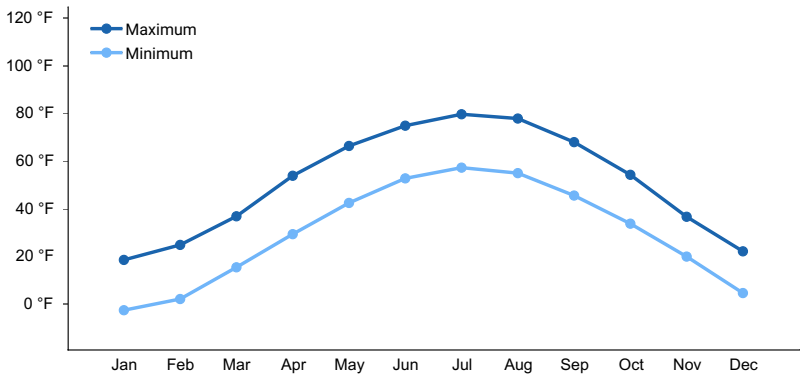


Figure 4. Monthly average minimum and maximum temperature

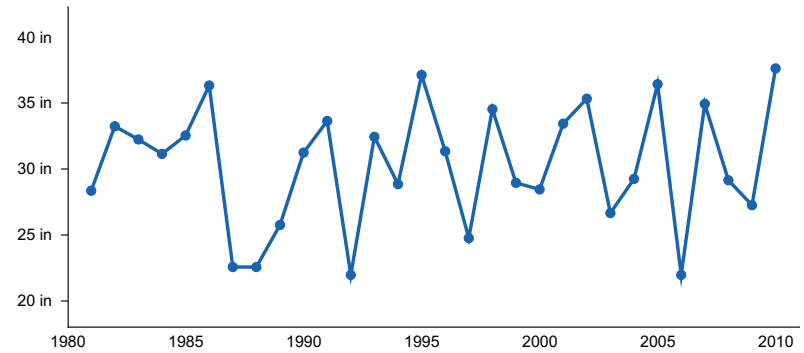


Figure 5. Annual precipitation pattern

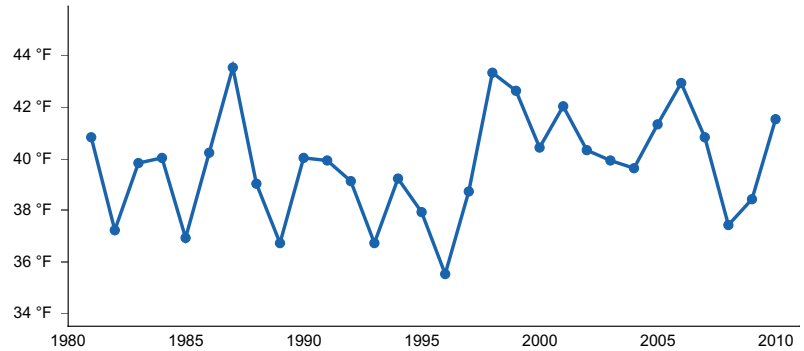


Figure 6. Annual average temperature pattern

Climate stations used

- (1) LONG PRAIRIE [USC00214861], Long Prairie, MN
- (2) NEW YORK MILLS [USC00215902], New York Mills, MN
- (3) BEMIDJI [USC00210643], Bemidji, MN
- (4) BLACKDUCK [USC00210809], Blackduck, MN
- (5) DEEP PORTAGE [USC00212050], Backus, MN

Influencing water features

This site is influenced by precipitation and runoff from adjacent sites, causing seasonal ponding after heavy rainfall and snowmelt.

Wetland description

Not Applicable.

Soil features

These sites typically exist on loamy and occasionally sandy moraines and till plains. Parent material is calcareous fine to loamy textured glacial till, stratified material and occasionally sandy. Soils are somewhat poorly to poorly drained soils with grey soil color or grey-mottles shallow within the soil profile indicative of high local water tables. Soils are occasionally ponded with standing water in spring and after heavy rainfall events for brief to long duration not exceeding 30 days. This site is represented by the Egglake, Spooner, Staples, Roscommon, and Talmoon soil series, among others.

Table 4. Representative soil features

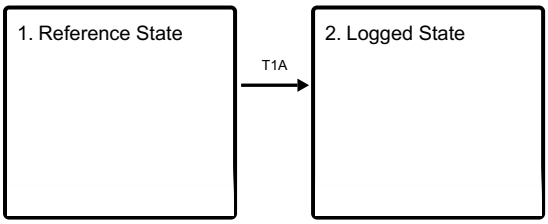
Parent material	(1) Till (2) Not specified
Surface texture	(1) Muck (2) Loam (3) Sandy loam (4) Silt loam
Drainage class	Poorly drained to very poorly drained
Permeability class	Slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0–6%
Surface fragment cover >3"	0–1%
Available water capacity (0-60in)	5–8.8 in
Soil reaction (1:1 water) (0-40in)	5.1–7.3
Subsurface fragment volume <=3" (0-40in)	4–7%
Subsurface fragment volume >3" (0-40in)	0–1%

Ecological dynamics

The reference state consists of three communities in varying successional levels depending natural disturbances. Plant species remain mostly consistent but can be found in different canopy layers depending on community phase. Plant community 1.1 is characterized by young forests after a disturbance event (i.e fire or windthrow). Dominant tree species would be quaking aspen, paper birch, and balsam fir. Community 1.2 represents the time frame where quaking aspen is declining and the confers are increasing due to lack of disturbance. Community 1.3 represents the mature forest with no disturbance with a fire return interval of 95 or more years. Paper birch and quaking aspen may be present in the overstory in 1.3 but maple will be more dominant in a late successional stand. State 2 represents a state that is managed for timber production.

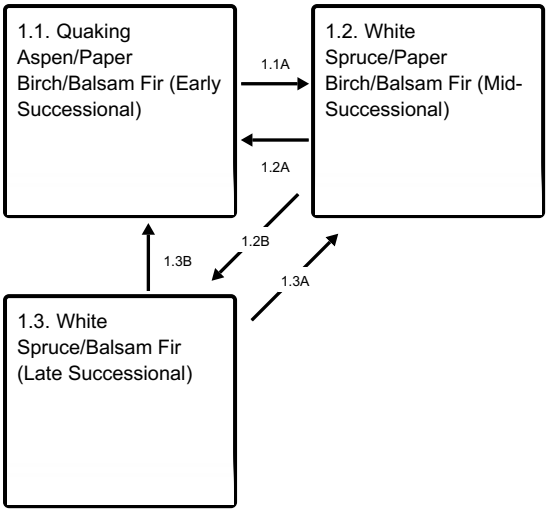
State and transition model

Ecosystem states



T1A - Mechanical removal of tree species for timber harvest.

State 1 submodel, plant communities



1.1A - Lack of fire/blow downs (35-95 years)

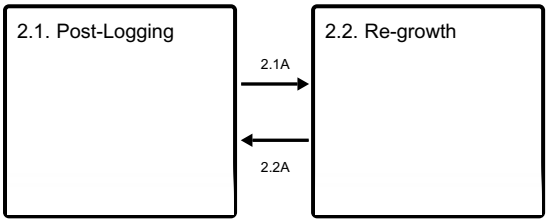
1.2A - Increased low intensity fire frequency and blow downs (<35 years)

1.2B - Lack of fire/blow downs (95-195 years)

1.3B - Stand replacing fire

1.3A - Increased low intensity fire frequency and blow downs (<95 years)

State 2 submodel, plant communities



2.1A - Planting of desired species and herbicide use.

2.2A - Harvest of tree species upon desired growth stage.

State 1
Reference State

The reference state of the Wet Mixed Forest ecological site consists of three communities in varying successional levels depending on fire, grazing and land use regimes. Plant species remain mostly consistent but can be found in different canopy layers depending on community phase.

Community 1.1
Quaking Aspen/Paper Birch/Balsam Fir (Early Successional)

Young forests recovering from fire or wind, notable quaking aspen dominance (0-35 years).

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- fragrant bedstraw (*Galium triflorum*), other herbaceous
- dwarf raspberry (*Rubus arcticus ssp. acaulis*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.2
White Spruce/Paper Birch/Balsam Fir (Mid-Successional)

A transitional period marked with a decline in quaking aspen stand replacement. Along with development of understory coniferous species (35-95 years).

Dominant plant species

- white spruce (*Picea glauca*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- quaking aspen (*Populus tremuloides*), tree
- eastern white pine (*Pinus strobus*), tree
- Canada mayflower (*Maianthemum canadense*), other herbaceous
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- dwarf raspberry (*Rubus arcticus ssp. acaulis*), other herbaceous
- bigleaf aster (*Eurybia macrophylla*), other herbaceous

Community 1.3
White Spruce/Balsam Fir (Late Successional)

Mature forest with prominent mixed canopy (95+ years).

Dominant plant species

- white spruce (*Picea glauca*), tree
- balsam fir (*Abies balsamea*), tree
- red maple (*Acer rubrum*), tree
- black ash (*Fraxinus nigra*), tree

Pathway 1.1A
Community 1.1 to 1.2

Lack of fire/blow downs (35-95 years)

Pathway 1.2A
Community 1.2 to 1.1

Increased low intensity fire frequency and blow downs (<35 years)

Pathway 1.2B
Community 1.2 to 1.3

Lack of fire/blow downs (95+ years)

Pathway 1.3B
Community 1.3 to 1.1

Stand replacing fire

Pathway 1.3A
Community 1.3 to 1.2

Increased low intensity fire frequency and blow downs (<95 years)

State 2
Logged State

Removal of tree species for timber harvest leaves an open canopy with very disturbed understory vegetation.

Community 2.1
Post-Logging

Removal of tree species for timber harvest leaves an open canopy with very disturbed understory vegetation. Shrubs dominate immediately post logging and often prevent tree's from re-establishing quickly.

Community 2.2
Re-growth

Practices, such as re-seeding desired species and allowing broadleaved trees to coppice to gain with desired timber species. Other practices may occur which favors re-growth of timber species.

Pathway 2.1A
Community 2.1 to 2.2

Planting of desired species for future timber harvest and herbicide use to prevent shrubs from dominating.

Pathway 2.2A
Community 2.2 to 2.1

Harvest of tree species upon desired growth stage.

Transition T1A
State 1 to 2

Mechanical removal of tree species for timber harvest.

Additional community tables

Inventory data references

Information presented was derived from Minnesota Department of Natural Resources Field Guide to the Native Plant Communities of Minnesota, USDA-NRCS soil survey information, and USDA Plants Database.

Relationship to Other Established Classifications:
MN DNR Native Plant Community (MN DNR, 2003); the reference community of this Provisional Ecological Site is most similar to:
MHn44 Northern Wet-Mesic Boreal Hardwood- Conifer Forest

Other references

Cowardin, L. M., V. Carter, F. C. Golet, and E.T. LaRoe. 1979 (Revised 2013). Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, U.S. Department of Interior-Fish and Wildlife Service, Washington, D.C.

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USDA, NRCS. 2018. The PLANTS Database (http://plants.usda.gov, 27 March 2018). National Plant Data Team, Greensboro, NC 27401-4901 USA.

U.S. Environmental Protection Agency. 2013. Level III and IV ecoregions of the continental United States: Corvallis, Oregon, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000, https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states.

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Approval

Suzanne Mayne-Kinney, 10/03/2023

Acknowledgments

MLRA 57 technical team completed in 2022.

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	10/03/2023
Approved by	Suzanne Mayne-Kinney
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:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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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):**

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:**