

Ecological site F057XY006MN Forested Peatland

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 2.5 meters 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 Histisols 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

Forested Peatland sites are widespread throughout the entire MLRA 57, and typically occur on level to gently sloping surfaces on all landforms through the area. Soils have greater than 16" of organic material and soil pH values are greater than 4.5.

Associated sites

R057XY005MN	Open Peatland Open Peatland occurs on level to gently sloping surfaces. Soils have greater than 16" of organic material and soil pH values are greater than 4.5. This site has a high water table that remain near the surface throughout the growing season, preventing the establishment of significant tree cover.
F057XY003MN	Peatland Peatland occurs in shallow wetland basins, closed depressions, and along drainage ways. Soils are occasionally ponded with standing water in spring but tend to recede by late summer. Soil surface layers are typically muck 8 to 16" thick over variable parent materials.

Similar sites

F057XY003MN	Peatland Peatland occurs in shallow wetland basins, closed depressions, and along drainage ways. Soils are occasionally ponded with standing water in spring but tend to recede by late summer. Soil surface layers are typically muck 8 to 16" thick over variable parent materials.
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Table 1. Dominant plant species

Tree	(1) <i>Thuja occidentalis</i> (2) <i>Picea mariana</i>
Shrub	(1) <i>Rhamnus alnifolia</i> (2) <i>Alnus incana</i>
Herbaceous	(1) <i>Caltha palustris</i> (2) <i>Rubus pubescens</i>

Physiographic features

These sites occur on level to gently sloping surfaces. This area is in the Western Lake Section of the Central Lowland Province of the Interior Plains. The landscape developed through a series of glaciations and subsequent retreating and wasting of the ice sheets. A complex pattern of moraines, outwash plains, drumlins, lake plains, and drainages characterizes the area. The rest of the area is drained by the Mississippi River, southward into the Gulf of Mexico. The headwaters of the Mississippi River are in the northern part of the area. The Mississippi River and its tributaries drain most of the area.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain (2) Till plain (3) Moraine (4) Depression
Runoff class	Low to negligible
Ponding duration	Very brief (4 to 48 hours) to very long (more than 30 days)
Ponding frequency	None to occasional
Elevation	180–620 m
Slope	0–2%
Ponding depth	0–254 cm
Water table depth	0–203 cm
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)	94-110 days
Freeze-free period (characteristic range)	123-140 days
Precipitation total (characteristic range)	686-711 mm
Frost-free period (actual range)	80-114 days
Freeze-free period (actual range)	120-144 days
Precipitation total (actual range)	635-737 mm
Frost-free period (average)	101 days
Freeze-free period (average)	132 days
Precipitation total (average)	711 mm

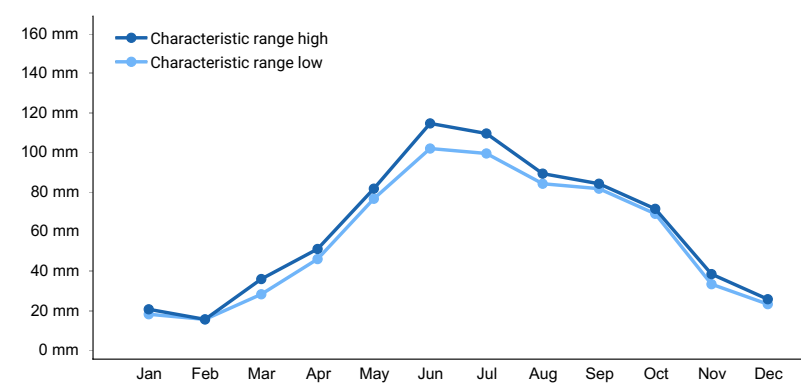


Figure 1. Monthly precipitation range

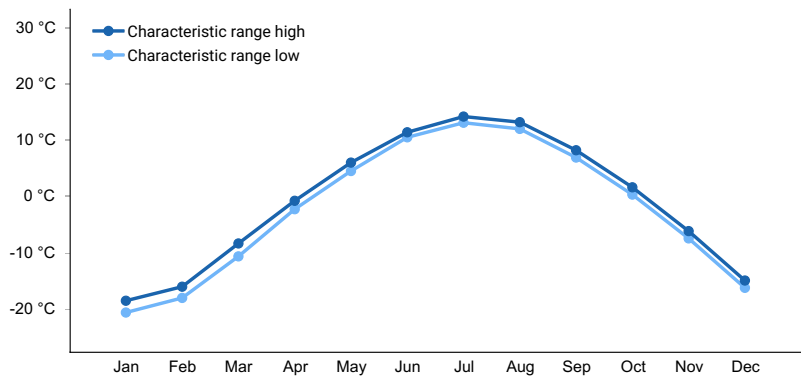


Figure 2. Monthly minimum temperature range

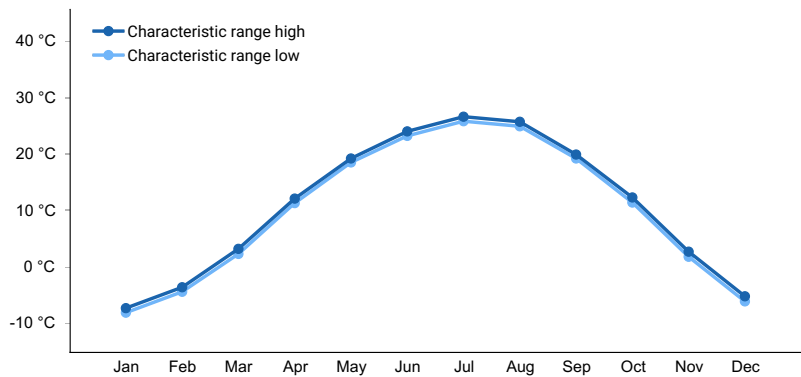


Figure 3. Monthly maximum temperature range

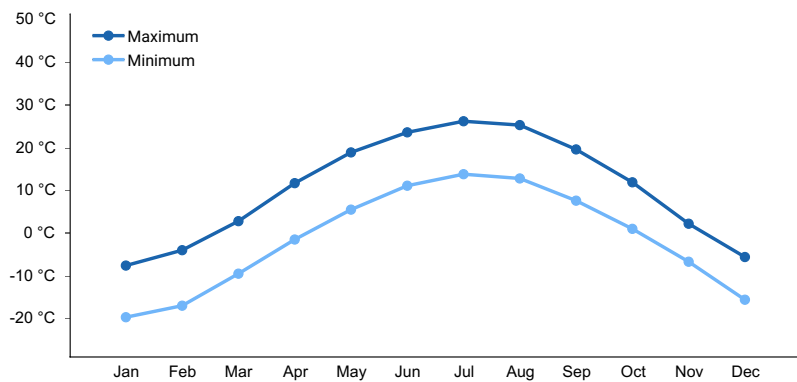


Figure 4. Monthly average minimum and maximum temperature

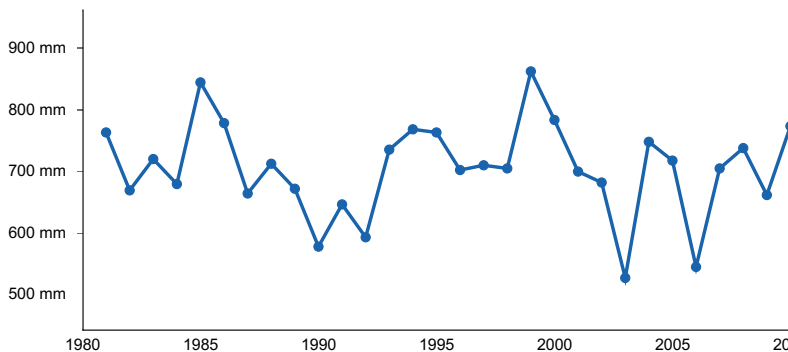


Figure 5. Annual precipitation pattern

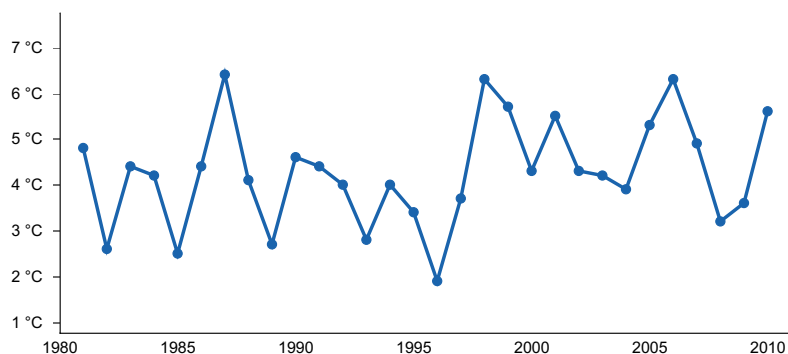


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ITASCA UNIV OF MINN [USC00214106], Park Rapids, MN
- (2) DEEP PORTAGE [USC00212050], Backus, MN
- (3) CASS LAKE [USC00211374], Cass Lake, MN
- (4) BLACKDUCK [USC00210809], Blackduck, MN
- (5) RED LAKE INDIAN AGCY [USC00216795], Ponemah, MN
- (6) POKEGAMA DAM [USC00216612], Cohasset, MN
- (7) WALKER AH GWAH CHING [USC00218618], Walker, MN
- (8) GRAND RPDS FOREST LAB [USC00213303], Grand Rapids, MN
- (9) MARCELL 5NE [USC00215175], Bigfork, MN

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and subsurface flow. Seasonal variation in water table is the most important site factor defining Forested Peatlands. Water levels are greatly influenced by ground water, precipitation rates and runoff from upland sites. Water tables limit the amount of oxygen available to plant roots. Oxygen levels determine the extent to which root respiration can take place, the level of organic litter decomposition, and the release of important nutrients for uptake by plants (MN DNR, 2011). Forested Peatlands are

wetter, less hydrologically variable ecosystems when compared to the Wet Depressional ecological site which has a greater variety of species adapted to its variation in water saturation.

Wetland description

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), these sites could be classified as:

- 1) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
- 2) Palustrine, moss-lichen, saturated, or
- 3) Palustrine, scrub-shrub, broad-leaved evergreen, saturated, or
- 4) Palustrine emergent, persistent, saturated
- 5) Palustrine, forested, needle-leaved evergreen, saturated, or

Under the Hydrogeomorphic Classification System (HGM), these sites could be classified as:

- 1) Depressional, forested/organic, or
- 2) Depressional, scrub-shrub/organic

Permeability of the soil is moderately slow to slow

Hydrologic Group: A/D, B/D, C/D

Soil features

The central concept soil series are Typic and Terric Histosols like Lupton, Mooselake, Bullwinkle and Tawas but other series are included. Parent material is fibric and/or herbaceous organic material more than 40 centimeters thick. Where underlying impermeable layers minimize groundwater movement through the peat. The main source of water to the site is precipitation, since the site formed through a buildup of peat over thousands of years, causing the soil surface to develop a crest shape with sloping concave sides.

Table 4. Representative soil features

Parent material	(1) Organic material (2) Till
Surface texture	(1) Muck (2) Peat (3) Mucky peat
Drainage class	Very poorly drained
Permeability class	Slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–2%
Available water capacity (0-152.4cm)	30.48–50.8 cm
Soil reaction (1:1 water) (0-101.6cm)	5.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–7%
Subsurface fragment volume >3" (Depth not specified)	0–2%

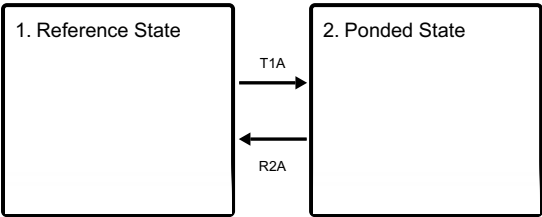
Ecological dynamics

Forested Peatland sites are widespread throughout the entire MLRA 57, and typically occur on level to gently sloping surfaces on all landforms through the area. Soils have greater than 16" of organic material and soil pH values are greater than 4.5. The organic material ranges in decomposition from muck, mucky peat to peat textures underlain by variable parent material. These sites are typically groundwater recharged.

Plant communities typical with Forested Peatland tend to be dominated by black spruce, tamarack, northern white cedar, and balsam fir; ericaceous shrubs such as Labrador tea, creeping snowberry, Speckled alder, and significant amounts of brown moss or minerotrophic Sphagnum cover.

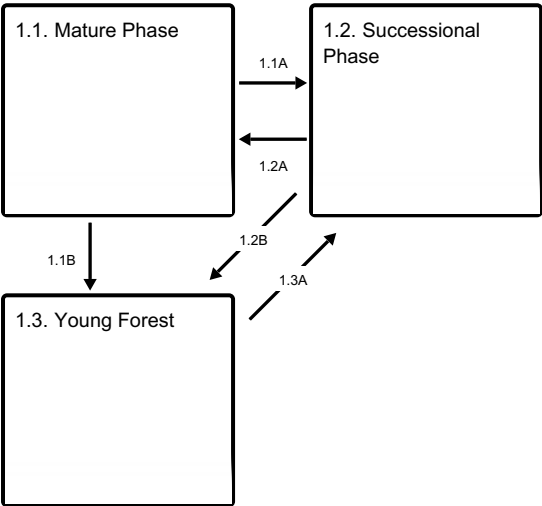
State and transition model

Ecosystem states



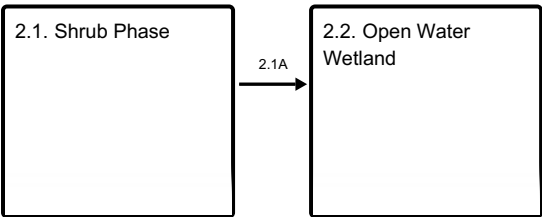
- T1A - Beaver activity, roads, drainage, and other alterations in hydrology.
- R2A - Draining or maintenance of water on-site causing alterations in hydrology.

State 1 submodel, plant communities



- 1.1A - A group or individual tree mortality
- 1.1B - Stand-replacing windthrow, disease, or pest outbreak.
- 1.2A - Succession/Time without major disturbance.
- 1.2B - Stand-replacing windthrow, disease, or pest outbreak.
- 1.3A - Succession/Time without major disturbance.

State 2 submodel, plant communities



- 2.1A - Beaver dam off-site restricts water flow or contributes to ponding on-site.

State 1
Reference State

Community phases within the Reference State are related to scattered small and moderate sized canopy openings from dead and/or windthrown trees. Windthrown trees were primarily dominant, above the canopy, and more

exposed to wind events.

Dominant plant species

- black spruce (*Picea mariana*), tree

Community 1.1

Mature Phase

Mature trees in the canopy story with 25-75% cover.

Dominant plant species

- tamarack (*Larix laricina*), tree
- black spruce (*Picea mariana*), tree
- paper birch (*Betula papyrifera*), tree
- arborvitae (*Thuja occidentalis*), tree

Community 1.2

Successional Phase

A transition period marked with an increase in canopy cover and reduction in graminoid/forb layers. Tree growth increased for some species as the dominant species start to outcompete the subcanopy species.

Dominant plant species

- tamarack (*Larix laricina*), tree
- black spruce (*Picea mariana*), tree
- red maple (*Acer rubrum*), tree
- paper birch (*Betula papyrifera*), tree
- balsam fir (*Abies balsamea*), tree
- arborvitae (*Thuja occidentalis*), tree
- alderleaf buckthorn (*Rhamnus alnifolia*), shrub
- bog willow (*Salix pedicellaris*), shrub
- bog birch (*Betula pumila*), shrub
- speckled alder (*Alnus incana* ssp. *rugosa*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- sedge (*Carex*), grass
- threeleaf false lily of the valley (*Maianthemum trifolium*), other herbaceous
- sphagnum (*Sphagnum*), other herbaceous
- dwarf red blackberry (*Rubus pubescens*), other herbaceous

Community 1.3

Young Forest

Recovering from severe disturbance such as windthrow where new growth occurs. Moss, graminoid, and forb layers dominate with shrubby layer emerging. Generally, in forested peatlands, the groundlayer doesn't look appreciably different than later successional phases. A lot of the same species occur. Total stand replacement is uncommon, but individual tree gaps are more common.

Dominant plant species

- dwarf red blackberry (*Rubus pubescens*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- fowl mannagrass (*Glyceria striata*), grass
- bristlystalked sedge (*Carex leptalea*), grass
- softleaf sedge (*Carex disperma*), grass
- sphagnum (*Sphagnum*), other herbaceous

Pathway 1.1A

Community 1.1 to 1.2

A group or individual tree mortality causing moderate to small canopy gaps that favor shrubby openings and greater vertical structural diversity.

Pathway 1.1B

Community 1.1 to 1.3

Stand-replacing windthrow, disease, or pest outbreak.

Pathway 1.2A

Community 1.2 to 1.1

Succession/Time without major disturbance.

Pathway 1.2B

Community 1.2 to 1.3

Stand-replacing windthrow, disease, or pest outbreak.

Pathway 1.3A

Community 1.3 to 1.2

Succession/Time without major disturbance.

State 2

Ponded State

Sites can transition to this state by relatively sudden and complete loss of the tree canopy. This can happen as a result of intensive logging, forest pests, or general forest decline.

Dominant plant species

- hairy sedge (*Carex lacustris*), grass

Community 2.1

Shrub Phase

This plant community results following disturbances that cause elimination of trees in forested swamps, enabling alder to become dominant. Potential disturbance are often logging, windthrow, or temporary changes in hydrology caused by beaver activity." Dominant shrub specie is speckled alder. Bluejoint and a variety of sedges are also dominant, along with a myriad of sun-loving wetland forb species. There may be scattered trees as well, but they comprise low cover and are not significant to the overall structure of the plant community. But even scattered trees have ecological value as nest trees and perches for birds or den trees for small mammals. With a continued lowering of the water table, it is possible for this phase to succeed to the Reference State if black ash and other trees can successfully establish.

Dominant plant species

- speckled alder (*Alnus incana ssp. rugosa*), tree
- dwarf red blackberry (*Rubus pubescens*), shrub
- redosier dogwood (*Cornus sericea*), shrub
- bluejoint (*Calamagrostis canadensis*), grass
- softleaf sedge (*Carex disperma*), grass
- fowl mannagrass (*Glyceria striata*), grass

Community 2.2

Open Water Wetland

The wetland community phase in this state is characterized as having dead or dying overstory trees, and being flooded and subsequently ponded by up to several feet of essentially permanent water (Figure 3). Depending on depth of water, there will be areas with emergent and submergent aquatic vegetation, as well as scattered remnants of the former vegetation.

Dominant plant species

- bluejoint (*Calamagrostis canadensis*), grass
- fowl mannagrass (*Glyceria striata*), grass
- upright sedge (*Carex stricta*), other herbaceous
- duckweed (*Lemna*), other herbaceous
- watershield (*Brasenia schreberi*), other herbaceous
- broadleaf arrowhead (*Sagittaria latifolia*), other herbaceous
- bulblet-bearing water hemlock (*Cicuta bulbifera*), other herbaceous
- northern water plantain (*Alisma triviale*), other herbaceous
- cattail (*Typha*), other herbaceous

Pathway 2.1A

Community 2.1 to 2.2

Beaver dam off-site restricts water flow or contributes to ponding on-site.

Transition T1A

State 1 to 2

Impoundment or maintenance of water on-site, and/or establishment of invasive species. Beaver activity, roads, drainage, and other alterations in hydrology can transition the Forest Peatland site out of Reference to an Ponded State, where water is ponded on site for longer durations from overland surface flow.

Restoration pathway R2A

State 2 to 1

Draining or maintenance of water on-site causing alterations in hydrology that can transition the Ponded state back to the Reference State, where water is on site for shorter durations and receives less nutrients from overland surface flow causing increased tree growth. Also, natural succession (albeit slow) where more trees get established and provide the evapotranspiration necessary to draw down the water table.

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:

FPn63 White Cedar Swamp

FPn73 Northern Alder Swamp

FPn82 Northern Rich Tamarack Swamp (Western Basin)

WFn53 Northern Wet Cedar Forest

Other references

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Contributors

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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	05/12/2025
Approved by	Suzanne Mayne-Kinney
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:**
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17. **Perennial plant reproductive capability:**
-