USDA Natural Resources Conservation Service

Ecological site F093BY002MI
Mucky Swamps

Last updated: 9/27/2023
Accessed: 05/03/2024

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): 093B–Superior Stony and Rocky Loamy Plains and Hills

The Wisconsin portion of this MLRA is a mixture of high-relief moraines and flat till plains with interspersed glacial meltwater deposits. It is bordered on the north by glaciolacustrine deposits of Glacial Lake Duluth and on the south by extensive pitted and unpitted outwash plains. The approximate land area is just under 600,000 acres (935 sq miles).

The Penokee-Gogebic Iron Range runs through the middle of the Wisconsin portion of this MLRA and into Michigan. The range is a hilly, bedrock-controlled moraine. The bedrock outcropping is composed of igneous and metamorphic materials and was created by inland folding and faulting of the ancient Superior continent when it collided with the Marshfield continent about 1.8 billion years ago (Dott & Attig, 2004). Volcanic and intrusive bedrock occurs in some places. This bedrock is overlain by a thin layer of glacial till deposited by the Chippewa Lobe.

To the north of the range is a former spillway for Glacial Lake Ontonagon. The flowing meltwater cut deep channels into the morainal systems. Glaciofluvial landforms here include old beaches and dunes. South of the range, along the southern edge of this MLRA, are rolling collapsed end moraines, pushed to their extent by the Chippewa and Ontonagon Lobes. The landscape is dotted with abundant kettle lakes and swamps, especially in the eastern portion. Ice-walled lake plains and eskers are also found along these collapsed moraines.

Classification relationships

Wetland Forest Habitat Types (Kotar, 2017): Some of these sites are not forested, but sites are best represented by *Fraxinus nigra* - Acer rubrum/Impatiens capensis (FnArI) habitat type, with some sites represented by the *Fraxinus nigra* - *Abies balsamea* – Acer rubrum/*Onoclea sensibilis* (FnAbArOn) and *Abies balsamea* – *Fraxinus nigra* – Thuja occidentalis/Osmunda cinnamomea (AbFnThOs) habitat types.

Biophysical Setting (Landfire, 2014): This ES is mapped as Boreal Acidic Peatland System, Laurentian-Acadian Northern Hardwoods Forest – Hemlock, Laurentian-Acadian Alkaline Conifer-Hardwood Swamp; though, it is best represented by the latter.
WDNR Natural Communities (WDNR (2015): This ES is most similar to the Northern Sedge Meadow for open sites, and the Northern Hardwood Swamp for forested sites.

Major Land Resource Area (MLRA): Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B)
USFS Subregions: Winegar Moraines (212Jc)
Small sections occur in the Gogebic-Penokee Iron Range (212Jb) subregion
Wisconsin DNR Ecological Landscapes: North Central Forest

Ecological site concept

The Mucky swamps ecological site is common throughout MLRA 93B in drainageways and depressions on till

plains, moraines, stream terraces, floodplains, and sometimes outwash plains. These sites are characterized by very deep, very poorly drained soils that formed in organic deposits overlying loamy drift and sandy or loamy alluvium. These sites are subject to occasional ponding or flooding. Water is received primarily from precipitation, runoff from adjacent uplands, groundwater inflow, and stream inflow. Sites remain saturated during the growing season and meet hydric soils requirements. Soils range from moderately acid to slightly alkaline. These are wetlands.

Mucky swamps receive significantly more groundwater and stream inflow than their Acidic poor fens counterparts, resulting in a higher pH. In addition, adjacent upland sites are usually comprised of finer, more calcareous parent materials (ie. loamy till) and the runoff and groundwater Mucky swamps receive from these sites further buffer their acidity. Mucky swamps have improved growing conditions over Acidic poor fens for most plant species.

Associated sites

F093BY004MI	**Wet Lowlands** Wet Lowlands occur on depressions and drainageways and form in loamy till or loamy alluvium underlain by dense sandy till or sandy and gravelly outwash. These sites are poorly drained and are higher up on the drainage sequence than Mucky swamps. They typically border Mucky swamps.
F093BY005MI	**Moist Lowlands** Moist Lowlands occur on footslope positions across the landscape. They are not subject to flooding nor ponding. Soils form in till, lacustrine deposits, or outwash deposits and may be loamy to sandy. These sites are somewhat poorly drained and occur higher on the drainage sequence than Mucky swamps.
F093BY011MI	**Dry Uplands** Dry Uplands are found in the sandiest, most permeable soils on the driest landscape positions. They are very deep and excessively drained and occupy the highest position on the drainage sequence, whereas Mucky swamps occupy the lowest.

Similar sites

F093BY001MI	**Acidic Poor Fens** Like Mucky swamps, Acidic poor fens consist of deep herbaceous organic material, are very poorly drained, and remain saturated throughout year. They also occupy landscape depressions and the lowest positions on their drainage sequences. Acidic poor fens are more acidic than Mucky swamps and, as a result, the vegetative communities on these two sites are quite different.
F093BY004MI	**Wet Lowlands** Wet Lowlands occur on depressions and drainageways and form in loamy till or loamy alluvium underlain by dense sandy till or sandy and gravelly outwash. The vegetative community of Mucky swamps may sometimes match that of Wet Lowlands. Wet Lowlands are not subject to flooding and are poorly (rather than very poorly) drained.
F093BY003MI	**Floodplains** These sites occur exclusively on Floodplains and form in sandy and loamy alluvium. The soils are subject to ponding and flooding. Mucky swamps may sometimes occur on floodplain landforms, but they are very poorly drained whereas Floodplains are poorly to moderately well drained.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Abies balsamea*
Shrub	(1) *Alnus incana* (2) *Spiraea tomentosa*
Herbaceous	(1) *Carex* (2) *Onoclea*

Physiographic features

These sites occur on toeslope positions in depressions, drainageways, and overflow channels on flood plains, outwash plains, till plains, stream terraces, and disintegration moraines. Slope ranges from 0 to 1 percent.

These sites are subject to occasional flooding and ponding. The ponding duration ranges from brief (2 to 7 days) to long (7 to 30 days) with depths up to 6 inches below the soil surface. Ponding usually occurs in the spring, but some sites may be ponded throughout the year. Some sites on flood plains may be flooded in the spring. Flooding duration ranges from brief to long. Runoff is negligible on these sites.

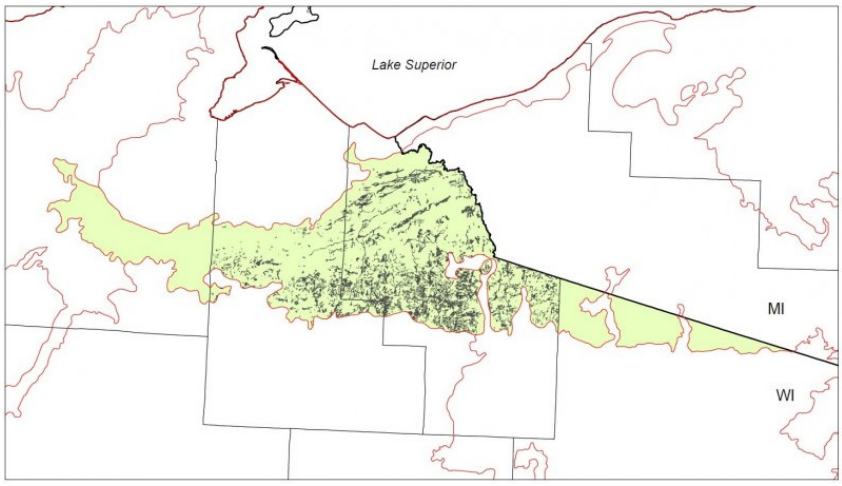


Figure 1. Distribution of Mucky swamps in the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part (93B).

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Depression
Runoff class	Negligible
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	None to occasional
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Elevation	656–984 ft
Slope	0–1%
Ponding depth	0–15 in
Water table depth	0–12 in
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Superior Stoney and Rocky Loamy Plains and Hills, Eastern Part MLRA is characterized by long, cold winters and short, warm summers where precipitation exceeds evapotranspiration. Neither average annual precipitation nor average annual minimum and maximum temperatures vary greatly within this MLRA, though the climate of the northern tip is somewhat affected by Lake Superior and receives higher annual precipitation in the form of lake effect snow.

Table 3. Representative climatic features

Frost-free period (characteristic range)	89-119 days
Freeze-free period (characteristic range)	123-149 days
Precipitation total (characteristic range)	29-34 in
Frost-free period (actual range)	84-121 days
Freeze-free period (actual range)	120-157 days
Precipitation total (actual range)	28-36 in

Frost-free period (average)	104 days
Freeze-free period (average)	137 days
Precipitation total (average)	32 in

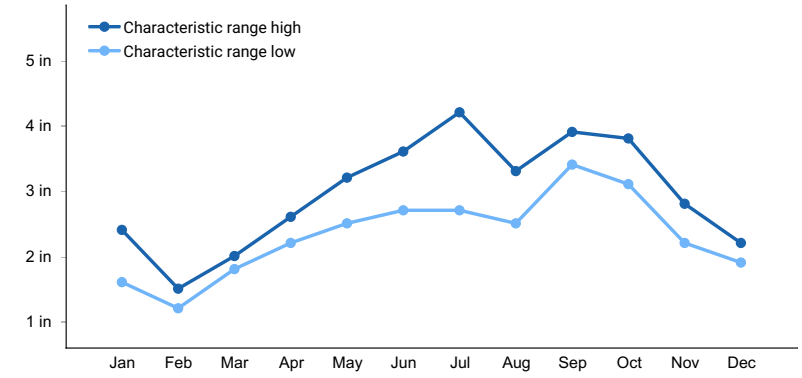


Figure 2. Monthly precipitation range

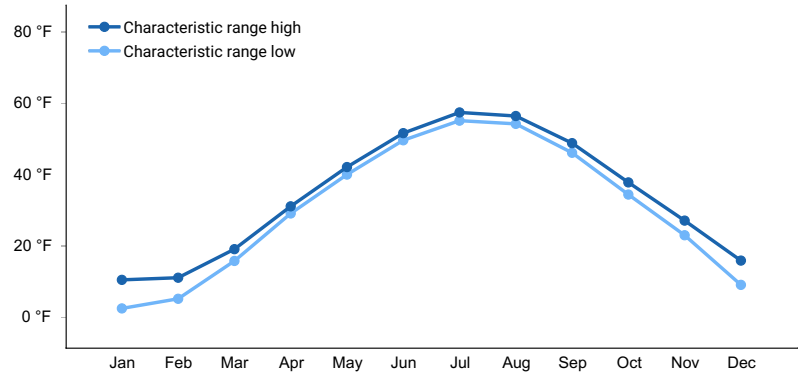


Figure 3. Monthly minimum temperature range

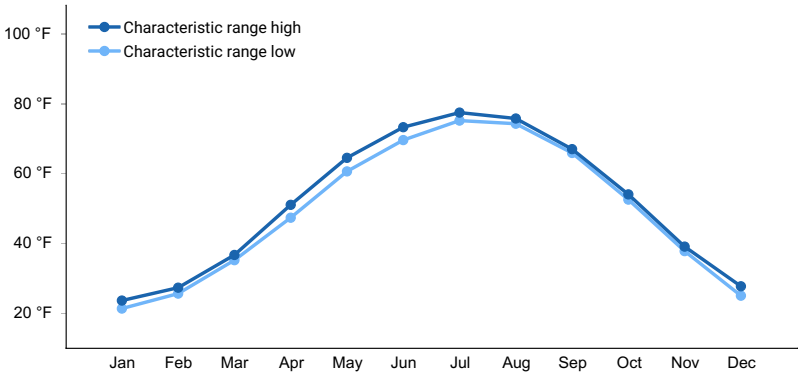


Figure 4. Monthly maximum temperature range

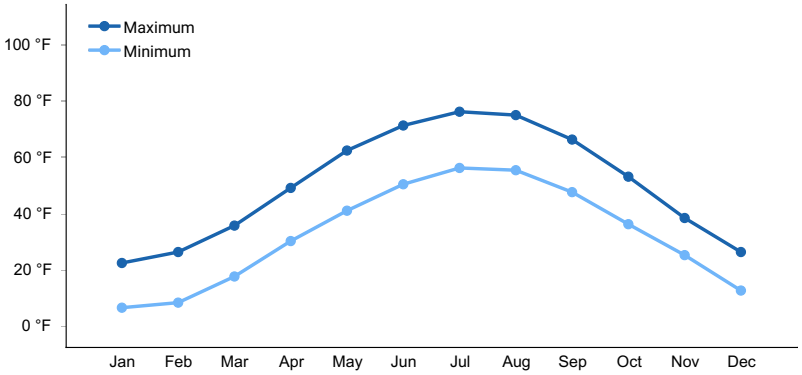


Figure 5. Monthly average minimum and maximum temperature

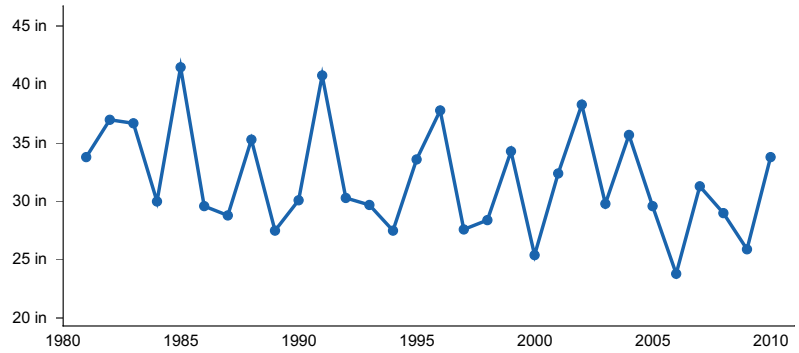


Figure 6. Annual precipitation pattern

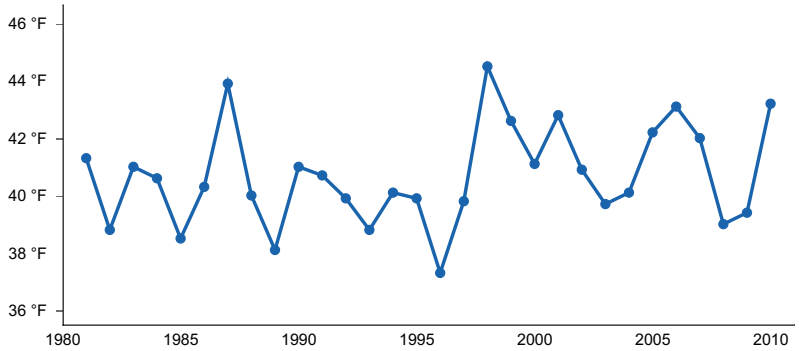


Figure 7. Annual average temperature pattern

Climate stations used

- (1) HURLEY [USC00473800], Ironwood, WI
- (2) MELLEN 4 NE [USC00475286], Mellen, WI
- (3) HANCOCK HOUGHTON CO AP [USW00014858], Calumet, MI
- (4) MARQUETTE [USW00014838], Marquette, MI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, stream inflow, and groundwater inflow. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water is lost from the site primarily through stream outflow, subsurface outflow, evapotranspiration, and groundwater recharge.

The hydrology of Organic sites significantly impacts their ecological development. These sites have a strong connection with groundwater as a primary source of water. The groundwater discharging to these sites may interact with surrounding calcareous materials that deliver dissolved carbonates to these sites. In addition, carbonates are present in the mineral substratum of some of these sites. The strong interaction with groundwater and presence of carbonates prevent drops in pH on these sites.

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:
1) Palustrine, forested, needle-leaved evergreen, saturated, or
2) Palustrine, forested, broad-leaved deciduous, saturated, or
3) Palustrine, scrub-shrub, broad-leaved evergreen, saturated, or
4) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, acid, forested/organic, or
2) Depressional, acid, scrub-shrub/organic
Permeability of the soil is slow. The hydrologic group of this site is A/D or B/D.

Hydrologic Group: A/D or B/D

Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic

Cowardin Wetland Classification: PFO1B, PFO4B, PSS1B, PEM1B

Soil features

These sites are represented by the Bowstring, Cathro, and Lupton soil series, which are classified as Fluaquentic Haplosaprists, Terric Haplosaprists, and Typic Haplosaprists, respectively.

These soils are formed in moderate to deep, highly decomposed herbaceous organic material, sometimes overlying sandy or loamy deposits. Sites on floodplains may have an irregular decrease in organic carbon throughout the profile and be underlain by sandy alluvial deposits with stratified gravel. The thickness of the organic material ranges from 24 inches to over 80 inches. These sites are very poorly drained and remain saturated throughout the year. These soils meet hydric soil requirements.

These soils are euic with soil pH ranging from 6.0 to 7.5. Surface fragments are absent in these soils. Subsurface horizons may be up to 20 percent gravel and up to 12 percent cobble. Carbonates are often present. Calcium carbonate equivalency may be up to 15 percent starting at 30 inches.

Table 4. Representative soil features

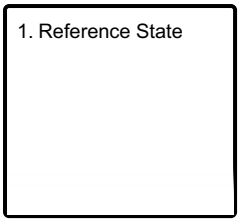
Parent material	(1) Herbaceous organic material–hornblende gneiss (2) Drift (3) Alluvium
Surface texture	(1) Silt loam (2) Loam
Drainage class	Very poorly drained
Permeability class	Slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	16–24 in
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

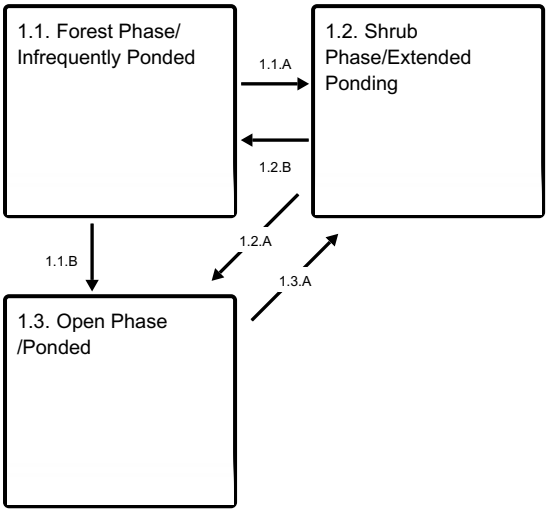
Because this Ecological Site is subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events create conditions temporarily favorable to a given species, or groups of species, and unfavorable to other species or groups. Species differ greatly in their ability to tolerate frequency of flooding and duration of ponding. Frequency and duration of flooding/ponding is the main driver as to which of these community phases will be achieved and maintained.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1.A - Increase -ponding frequency /duration

1.1.B - Increase ponding frequency/duration

1.2.B - Decrease - ponding frequency/duration

1.2.A - Increase - ponding frequency/duration.

1.3.A - Decrease - ponding frequency/duration

State 1
Reference State

Because of the dynamic nature of hydrological events affecting this Ecological Site, many different plant communities can be found at any given time. Three distinct community phases represent the Reference state: 1) a forested phase with seasonal, brief ponding, community phase, 2) shrub phase with extended ponding community phase, and 3) open phase ponded community phase.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- balsam fir (*Abies balsamea*), tree
- gray alder (*Alnus incana*), shrub
- spirea (*Spiraea*), shrub
- sedge (*Carex*), grass
- sensitive fern (*Onoclea sensibilis*), other herbaceous

Community 1.1
Forest Phase/ Infrequently Ponded

This community phase consists of forest communities tolerant of seasonal, brief ponding. Such forests are characterized by strong presence, or dominance of black ash (*Fraxinus nigra*), with balsam fir (*Abies balsamea*) as a common associate. The shrub layer may be well developed in some communities and often include tag alder (*Alnus incana*) and steeplebush (Spiraea, spp.). Characteristic understory plants include sedges, grasses, and sensitive fern (*Onoclea sensibilis*).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- balsam fir (*Abies balsamea*), tree
- gray alder (*Alnus incana*), shrub
- spirea (*Spiraea*), shrub
- sedge (*Carex*), grass
- sensitive fern (*Onoclea sensibilis*), other herbaceous

Community 1.2
Shrub Phase/Extended Ponding

This community phase is dominated by tag alder and steeplebush, two species tolerant of extended ponding. The understory is dominated by sedges and grasses.

Dominant plant species

- gray alder (*Alnus incana*), shrub
- spirea (*Spiraea*), shrub
- sedge (*Carex*), grass

Community 1.3
Open Phase /Ponded

This community is dominated by sedges and grasses with a few very tolerant associates and sporadic steeplebush and willows. These sites often have standing water throughout the growing season

Dominant plant species

- spirea (*Spiraea*), shrub
- willow (*Salix*), shrub
- sedge (*Carex*), grass

Pathway 1.1.A
Community 1.1 to 1.2

Increase in ponding frequency and duration. Mortality of canopy species. Lack of tree species may be cause of ponding duration with the loss of transpiration.

Pathway 1.1.B
Community 1.1 to 1.3

Increase in ponding frequency and duration. Mortality of canopy and shrub species.

Pathway 1.2.B
Community 1.2 to 1.1

Decrease in ponding frequency and duration. Establishment of black ash and balsam fir.

Pathway 1.2.A
Community 1.2 to 1.3

Increase in ponding frequency and duration.

Pathway 1.3.A
Community 1.3 to 1.2

Decrease in ponding frequency and duration. Establishment of tag alder and other species tolerant of some extended ponding events.

Additional community tables

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

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Approval

Suzanne Mayne-Kinney, 9/27/2023

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	09/27/2023
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:**

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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):**

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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:**
