Ecological site F105XY001WI
Mucky Swamp

Last updated: 2/23/2024
Accessed: 05/18/2024

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): 105X–Upper Mississippi River Bedrock Controlled Uplands and Valleys

The Northern Mississippi Valley Loess Hills area corresponds closely to the Western Coulees and Ridges and Southwest Savanna Ecological Landscapes. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources Ecological Landscape publication (2015).

Fifty-two percent of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is in Wisconsin; Iowa, Minnesota, and Illinois contain the rest. This region is the only area in Wisconsin that has not been covered by glaciers within the past 2.4 million years. The Wisconsin portion of this MLRA is approximately 7.4 million acres (11,600 square miles). The landscape is characterized by dissected topography with deeply-incised, steep-walled valleys between bedrock controlled ridges.

Though it’s called the “Driftless Region”, some glacial drift is found in the major river valleys of this region in the form of outwash, deposited by proglacial streams of glacial meltwater. Wisconsin’s most recent glaciations also impacted the sediment of the area through the deposition of loess. After the glacier receded and before vegetation established, the bare surfaces of the glaciated areas were highly susceptible to wind erosion. As a result, a veneer of loess (wind-blown silt) was deposited over the entire region. The thickest deposits—nearly five meters—are on ridges near the Mississippi River and gradually thin moving eastward. The loess caps in Dane and Green counties are generally 0.5-1.5 meters deep. Much of the loess has eroded downslope and collected in floodplains.

Bedrock is shallow throughout this MLRA and is a major influence on topography and hydrology. Most of the MLRA has bedrock within two meters, except in the deep river valleys that are filled with outwash and alluvium materials. Sandstone is the dominant bedrock type in MLRA 105, but the southernmost portion is dominated by dolomite. Military Ridge is an escarpment that straddles the boundary between sandstone and dolomite bedrock. The sandstone north of the ridge is weaker than the erosion-resistant dolomite south of the ridge. The sandstone is deeply cut and dissected into steep slopes and valleys. The dolomite-controlled ridges tend to be less dissected and broader with more gentle, south sloping topography. Geomorphic and fluvial processes formed these landscapes by way of sheet wash, soil creep, and flowage. These processes eroded the hillslopes, cut into bedrock, and transported the debris to streams, forming floodplains and terraces.

Underfit streams are common in MLRA 105, especially in the southern portion. These streams currently occupy large river valleys—especially those of the Black, Chippewa, Mississippi, and Wisconsin Rivers—that were carved by proglacial meltwater streams carrying much larger quantities of water than what’s present today. As the climate dried, waterflow decreased and the valleys filled with alluvial sediment. Narrow meanders were formed by the shrinking streams and are often dissimilar to the meanders of the larger valleys they occupy. Fluvial landforms – including terraces, oxbow lakes, sandbars, eroding bluffs, and large floodplain complexes – are found within these large valleys and are subject to varying flooding frequencies, intensities, and durations.

Karst topography formed in this region from dissolution of carbonate bedrock by surface and groundwater. Dolomite and limestone are more easily affected by dissolution, but karst topography also formed in sandstone. Erosion by

water (stream meanders, rain/runoff, and groundwater), wind, and frost weaken joints and bedding planes that can cause collapse. In addition, sandstone materials collapse into cavities in underlying dolomite or limestone.

Historically, MLRA 105 was dominated by oak forests and oak openings making up more than 50% of the area. Prairies were significant and covered 32% of the area south of Military Ridge. Maple-basswood forests covered 19% of the are north of Military Ridge. Dominant tree species were white oak (Quercus alba), bur oak (Quercus macrocarpa), black oak (Quercus velutina), and sugar maple (Acer saccharum).

Classification relationships

Relationship to Established Framework and Classification Systems:

Habitat Types of S. Wisconsin (Kotar, 1996): No habitat types exist for wetland forests in this area. When developed it is likely to be a *Fraxinus nigra*-Ulmus type.

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Central Interior and Appalachian Swamp Forest, Central Interior and Appalachian Floodplain Forest, and Central Interior and Appalachian Shrub Wetlands

Hierarchical Framework Relationships:
Major Land Resource Area (MLRA): Upper Mississippi River Bedrock Controlled Uplands and Valleys (105)

USFS Subregions: Menominee Eroded Pre-Wisconsin Till (222La), Melrose Oak Forest and Savannah (222Lb), Mississippi-Wisconsin River Ravines (222Lc), Kickapoo-Wisconsin River Ravines (222Ld)

Wisconsin DNR Ecological Landscapes: Western Coulee and Ridges

Ecological site concept

The Mucky Swamps ecological site accounts for approximately 71,000 acres in MLRA 105, or about 1% of total land area. The sites are scattered throughout the MLRA in depressions and drainageways amid outwash plains, moraines, and loess hills. They form in low positions on the landscape where bedrock is deep. The soils are very deep and very poorly drained and are characterized by deep organic deposits of primarily herbaceous origin. Precipitation, runoff from adjacent uplands, stream inflow, and groundwater discharge are the primary sources of water. These soils remain saturated throughout the year and meet hydric requirements.

Associated sites

F105XY002WI	**Wet Sandy Floodplain** These sites form in deep, sandy alluvium and outwash deposits in floodplains, especially those along the Chippewa, Black, and Wisconsin rivers. They support vegetation tolerant of seasonal flooding. They are sometimes saturated enough for hydric conditions to occur. These sites are sometimes wetlands and may sometimes host ecological communities similar to those supported by Mucky Swamps.
F105XY003WI	**Wet Loamy-Clayey Floodplain** These sites form in deep, loamy alluvium deposits along floodplains, especially those along smaller tributaries to the Chippewa, Black, and Wisconsin rivers. They support vegetation tolerant of seasonal flooding. They are sometimes saturated enough for hydric conditions to occur. These sites are sometimes wetlands and may sometimes host ecological communities similar to those supported by Mucky Swamps.
F105XY004WI	**Wet Sandy Lowland** These sites form in depressions and drainageway in deep, sandy outwash deposits. They are very poorly or poorly drained and are saturated long enough for hydric conditions to occur. Like Mucky Swamps, they often occupy landscape depressions and host vegetation tolerant of prolonged periods of wetness.
F105XY005WI	**Wet Loamy-Clayey Lowland** These sites form in depressions, drainageways, and swales in deep loamy alluvium deposits or in clayey residuum. They are very poorly or poorly drained and are saturated long enough for hydric conditions to occur. Like Mucky Swamps, they often occupy landscape depressions and host vegetation tolerant of prolonged periods of wetness.

Similar sites

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Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra*
Shrub	(1) *Alnus incana* (2) *Cornus*
Herbaceous	(1) *Carex* (2) *Impatiens capensis*

Physiographic features

These sites form in drainageways and depressions on outwash plains, floodplains, stream terraces, valley trains, and drumlin fields. Landform shape is concave or linear. Sites are in the footslope or toeslope position. These sites are subject to rare to frequent ponding. The ponding duration is brief to very long with depths up to 12 inches (30 cm) above the soil surface. Some sites may be subject to flooding. These soils have an apparent seasonally high water table (endosaturation) at the surface. The water table may drop during dry conditions. Runoff is negligible.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope
Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Outwash plain (2) Flood plain (3) Stream terrace (4) Valley train (5) Drumlin
Runoff class	Negligible
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Rare to frequent
Elevation	215–305 m

Slope	0–2%
Ponding depth	0–30 cm
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is typical of southern Wisconsin, with warmer winters, warmer summers, and higher precipitation rates than MLRA in northern Wisconsin. The MLRA stretches over about 2.9 degrees of latitude, or nearly 200 miles, from its northern tip in Barron county to its southern Wisconsin extent on the border of Illinois. This results in considerable variation in climate throughout the MLRA. The growing season ranges from 117 to 181 growing degree days, with longer growing seasons in the southern portion.

The average annual precipitation for this ecological site is 34 inches. The average annual snowfall is 43 inches. The annual average maximum and minimum temperatures are 56°F and 35°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	108-119 days
Freeze-free period (characteristic range)	130-145 days
Precipitation total (characteristic range)	864-889 mm
Frost-free period (actual range)	107-121 days
Freeze-free period (actual range)	125-150 days
Precipitation total (actual range)	813-889 mm
Frost-free period (average)	114 days
Freeze-free period (average)	136 days
Precipitation total (average)	864 mm

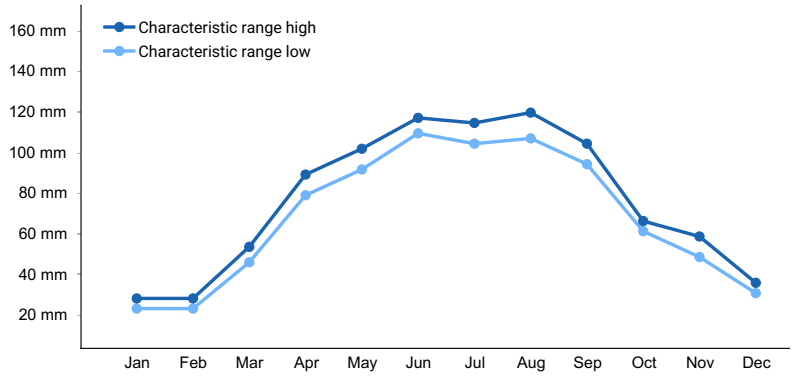


Figure 1. Monthly precipitation range

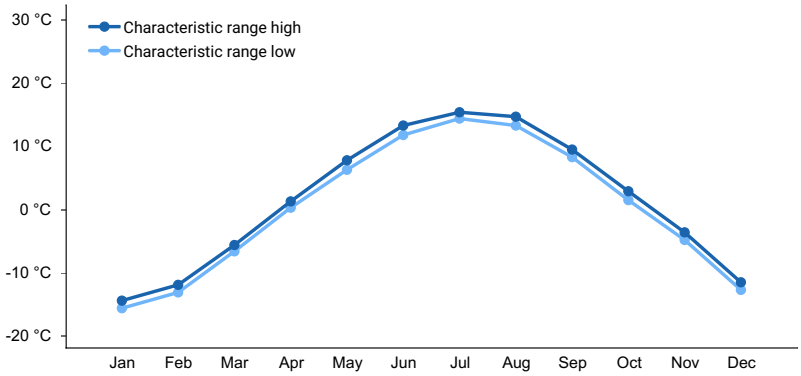


Figure 2. Monthly minimum temperature range

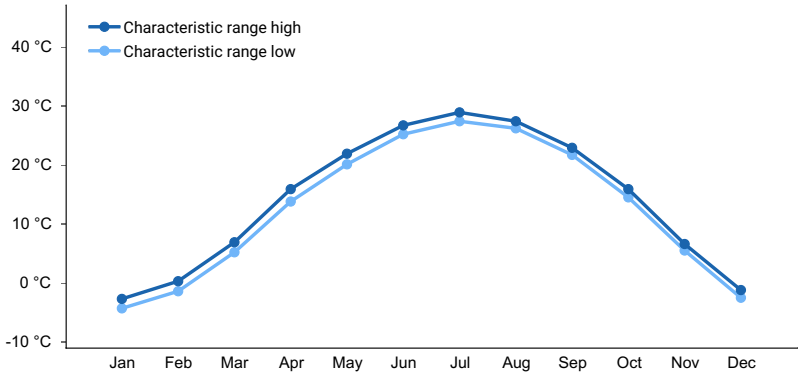


Figure 3. Monthly maximum temperature range

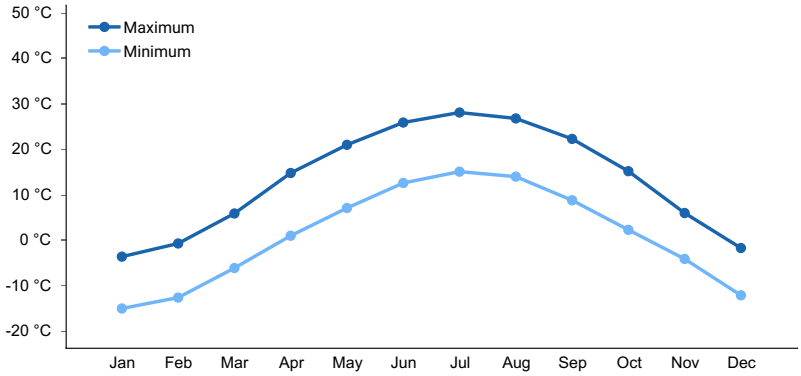


Figure 4. Monthly average minimum and maximum temperature

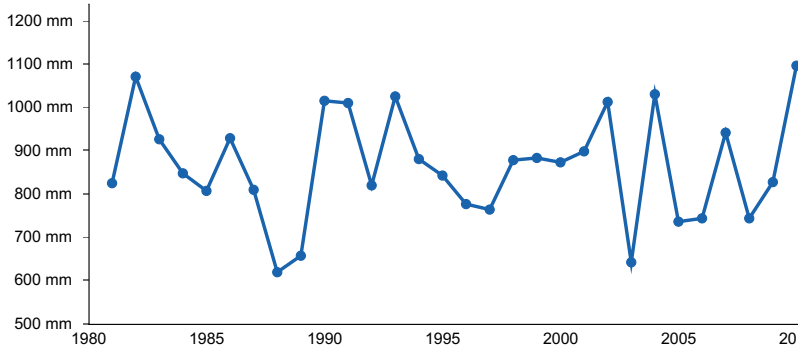


Figure 5. Annual precipitation pattern

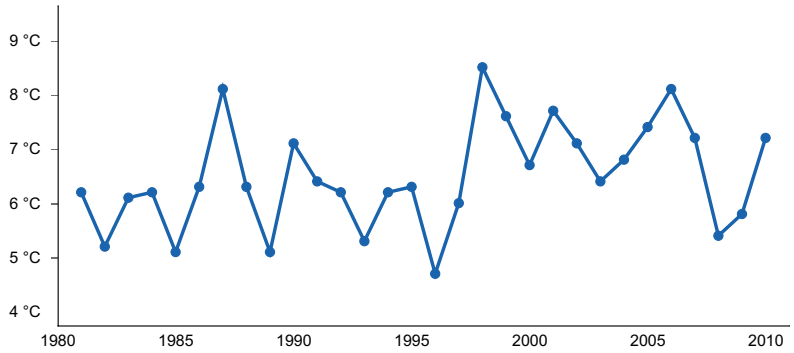


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIDGELAND 1 NNE [USC00477174], Dallas, WI
- (2) MONDOVI [USC00475563], Mondovi, WI
- (3) MENOMONIE [USC00475335], Menomonie, WI
- (4) DURAND [USC00472279], Durand, WI
- (5) DODGE [USC00472165], Arcadia, WI
- (6) HILLSBORO [USC00473654], Elroy, WI
- (7) BLAIR [USC00470882], Blair, WI

Influencing water features

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

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

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

Wetland description

Hydrogeomorphic Wetland Classification: Depressional, scrub-shrub/organic
Cowardin Wetland Classification: PEM1B, PSS1B, PFO1B, PFO4B

Soil features

The soils of this site are represented by the Adder, Houghton, Markey, Palms, and Seeleyville series. Terric Haplosaprists make up 85% of the acreage of this site. Typic Haplosaprists make up 15%.

These soils form herbaceous organic materials. They often have contact with mineral substratum within 39 inches (100 cm) of the soil surface. Bedrock contact is generally not found on these sites. Soils are very poorly drained and remain saturated for much of the year. They meet hydric soil requirements.

The surfaces of these soils are composed of herbaceous organic materials. When present, the mineral substratum may be composed of sandy or loamy alluvium or sandy and gravelly outwash. Subsurface fragments may

sometimes be found in the mineral substratum. Soils are moderately acid to slightly alkaline. Secondary carbonates are generally absent, though are sometimes found in the substratum of sites in the lake plains of Sauk County.

Table 4. Representative soil features

Parent material	(1) Herbaceous organic material (2) Drift (3) Alluvium (4) Outwash
Surface texture	(1) Mucky peat (2) Muck
Drainage class	Very poorly drained
Permeability class	Slow
Soil depth	201 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-150.1cm)	6.5–24.21 cm
Calcium carbonate equivalent (0-100.1cm)	0–10%
Soil reaction (1:1 water) (0-100.1cm)	5.8–7.5
Subsurface fragment volume <=3" (0-100.1cm)	0–12%
Subsurface fragment volume >3" (0-100.1cm)	0–1%

Ecological dynamics

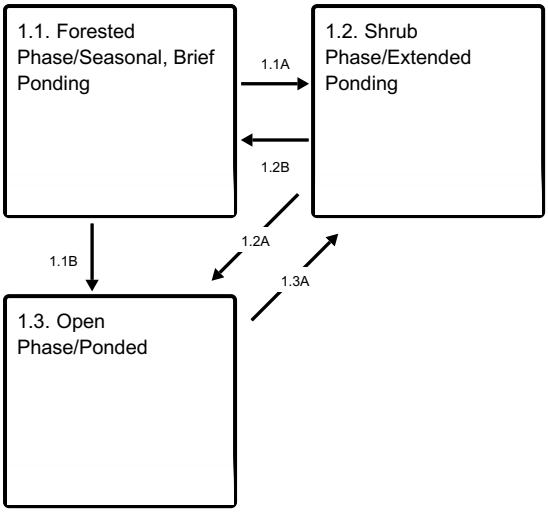
Because this Ecological Site is subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events 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

1. Reference State

State 1 submodel, plant communities



1.1A - Ponding frequency and duration increase.

1.1B - Ponding frequency and duration increase dramatically.

1.2B - Very infrequent ponding.

1.2A - Ponding frequency and duration increase moderately.

1.3A - Ponding frequency and duration decrease.

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.

Community 1.1
Forested Phase/Seasonal, Brief Ponding

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 various associates (elms). White cedar (*Thuja occidentalis*) may be present when seed source is present and deer browse is limited. The shrub layer may be well developed in some communities and often includes tag alder (*Alnus incana*) and Dogwood (Cornus spp.). Characteristic understory plants include sedges, grasses, and Jewelweed (*Impatiens capensis*).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- gray alder (*Alnus incana*), shrub
- dogwood (*Cornus*), shrub
- sedge (*Carex*), grass
- jewelweed (*Impatiens capensis*), other herbaceous

Community 1.2
Shrub Phase/Extended Ponding

This community phase is dominated by tag alder, dogwoods, and other species tolerant of extended ponding. The understory is dominated by sedges and grasses with a presence of marsh marigold.

Dominant plant species

- gray alder (*Alnus incana*), shrub
- dogwood (*Cornus*), shrub
- marsh marigold (*Caltha*), other herbaceous

Community 1.3
Open Phase/Ponded

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

Dominant plant species

- willow (*Salix*), tree
- sedge (*Carex*), grass

Pathway 1.1A
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 1.1B
Community 1.1 to 1.3

Forested Phase/Seasonal, Brief Ponding

Open Phase/Ponded

Ponding frequency and duration increase dramatically.

Pathway 1.2B
Community 1.2 to 1.1

Decrease in ponding frequency and duration. Establishment of black ash and associates.

Pathway 1.2A
Community 1.2 to 1.3

Ponding frequency and duration increase moderately.

Pathway 1.3A
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

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University of Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types.

Other references

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Approval

Suzanne Mayne-Kinney, 2/23/2024

Acknowledgments

NRCS contracted UWSP to write ecological sites in MLRA 105. Completed in 2021.

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	05/18/2024
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:**

17. **Perennial plant reproductive capability:**