

Ecological site R111XE003OH

Deep Muck

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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): 111X–Indiana and Ohio Till Plain

111E – Indiana and Ohio Till Plain, Eastern Part. Most of this area is in the Till Plains Section of the Central Lowlands Province of the Interior Plains. The northeast tip of the area is in the Southern New York Section of the Appalachian Highlands. The entire area has been glaciated. It is dominated by ground moraines that are broken in places by kames, lake plains, outwash plains, terraces, and stream valleys. Narrow, shallow valleys commonly are along the few large streams in the area. Elevation ranges from 580 to 1,400 feet (175 to 425 meters), increasing gradually from west to east. Relief is mainly a few meters, but in some areas hills rise as much as 100 feet (30 meters) above the adjoining plain.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Scioto (0506), 33 percent; Muskingum (0504), 31 percent; and Western Lake Erie (0410), 28 percent; Upper Ohio (0503), 5 percent; and Southern Lake Erie (0411), 3 percent. The headwaters of many rivers in central Ohio, including the Vermillion, Black Fork, Sandusky, Little Scioto, and Olentangy Rivers, are in this MLRA.

This MLRA is underlain by late Devonian shale and sandstone. Surficial materials include glacial deposits of till, glaciolacustrine sediments, and outwash from Wisconsin and older glacial periods.

Classification relationships

Major Land Resource Area (USDA-Natural Resources Conservation Service, 2006)

USFS Ecological Regions (USDA, 2007):

Sections –Central Till Plains, Beech Maple (222H), Western Glaciated Allegheny Plateau (221F)

Subsections – Allegheny Plateau (221Fa), Bluffton Till Plains (222Ha), Miami-Scioto Plain – Tipton Till Plain (222Hb)

NatureServe Systems anticipated (NatureServe, 2011): Agriculture - Cultivated Crops and Irrigated Agriculture, Agriculture – Pasture/Hay, Appalachian (Hemlock)-Northern Hardwood Forest, North-Central Interior Beech-Maple Forest, North-Central Interior Floodplain

LANDFIRE Biophysical Settings anticipated (USGS, 2010): Central Interior and Appalachian Floodplain Systems, North-Central Interior Beech-Maple

Ecological site concept

This site is a wetland site formed on very deep (51 to 80+ inches) herbaceous organic soil parent material in depressions on lake and till plains that are very poorly drained.

Fire was the historic disturbance mechanism of the site and was driven by the seasonal presence of water on the

site. In the spring and early summer, the site is often ponded or flooded to a depth of 15 inches for long stretches of time. The water table recedes as the summer progresses creating a much drier situation that increases the susceptibility of the site to fire. The seasonal flooding and fire return interval of about 15 years created a situation where the site is dominated by herbaceous vegetation.

The characteristic vegetation is herbaceous in nature, mostly dominated by bulrushes and cattails, with a number of sedge species being also being present. The influence of water via flooding and ponding along with fire maintain the herbaceous species dominance of the site. The absence of fire will lead this site to being converted to woodland and then potentially a closed canopy forest. The lack of fire will allow hydrophilic shrub species to get established, further altering the fire cycle. Continued absence of fire will have the site progress to a forest dominated by wetland tree species such as elm and ash. Currently, a large percentage of the site is in agricultural production, notably corn and soybean rotations, after the installation of drainage. These sites can be very productive, once drained, due in large part to the high amounts of organic matter. Invasive species, specifically phragmites, can invade and come to dominate the site in the absence of management to curtail or prevent its establishment and proliferation.

Associated sites

R111XE001OH	Mineral Muck Mineral Muck. Underlain by mineral soil
R111XE002OH	Limnic Muck Limnic Muck. Underlain by coprogenous earth
F111XE501OH	Till Depression Till Depression. On till parent material

Similar sites

R111XE001OH	Mineral Muck Mineral Muck
R111XE002OH	Limnic Muck Limnic Muck
R111XE401OH	Wet Outwash Mollisol Wet Outwash Mollisol.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Scirpus</i> (2) <i>Typha latifolia</i>

Physiographic features

This site is located in the 111E - Indiana and Ohio Till Plain, Eastern Part MLRA. This site was formed on herbaceous organic material that extends at least 51 inches. The underlying material is not limnic (coprogenous earth). It is located in closed depressions on bogs, depressions, and moraines.

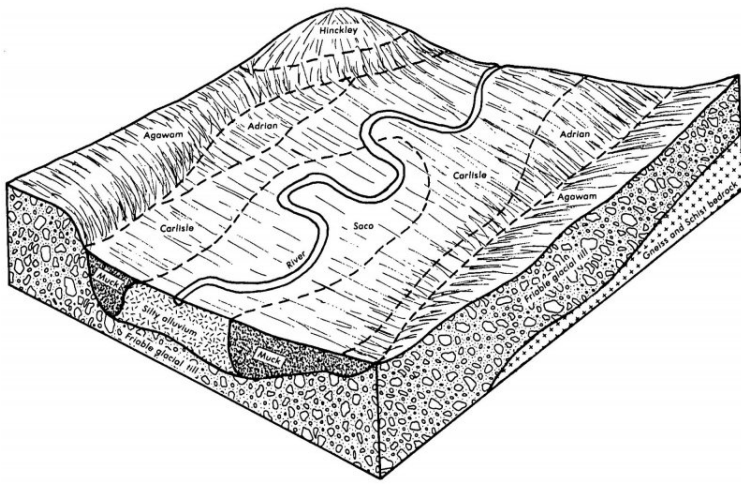


Figure 1. Block diagram showing soils on the landscape.

Table 2. Representative physiographic features

Landforms	(1) Bog (2) Depression (3) Moraine
Flooding frequency	None
Ponding duration	Long (7 to 30 days) to very long (more than 30 days)
Ponding frequency	Frequent
Elevation	183–427 m
Slope	0–2%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in this area is 35 to 41 (890 to 1,040 millimeters). Most of the rainfall occurs as convective thunderstorms during the growing season. About half or more of the precipitation occurs during the freeze-free period. Snowfall is common in winter. The average annual temperature is 48 to 52 degrees F (9 to 11 degrees C). The freeze-free period averages about 185 days and ranges from 165 to 205 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	149-152 days
Freeze-free period (characteristic range)	180-185 days
Precipitation total (characteristic range)	991-1,067 mm
Frost-free period (actual range)	149-154 days
Freeze-free period (actual range)	179-187 days
Precipitation total (actual range)	965-1,118 mm
Frost-free period (average)	151 days
Freeze-free period (average)	183 days
Precipitation total (average)	1,041 mm

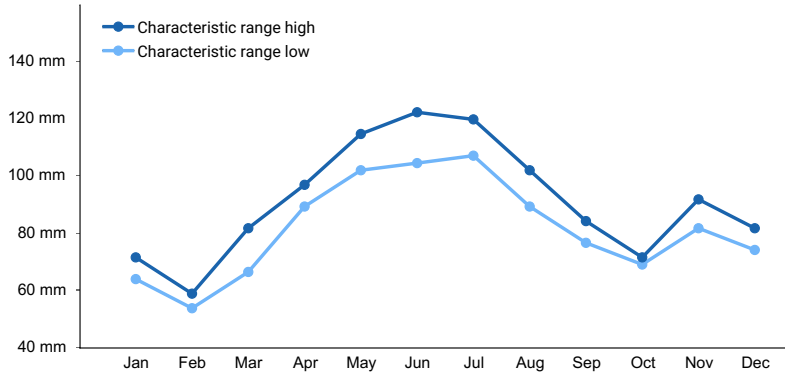


Figure 2. Monthly precipitation range

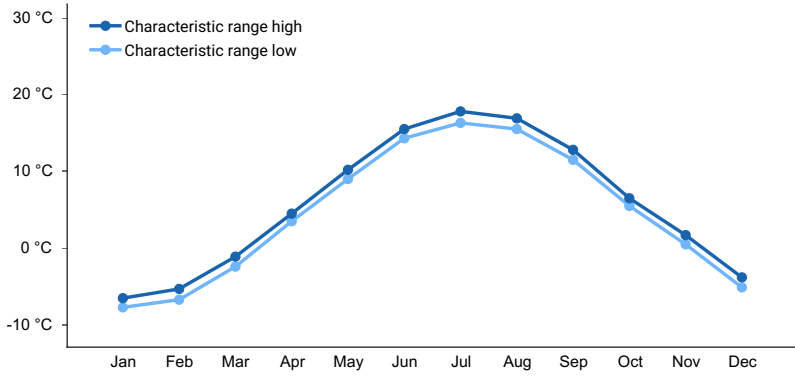


Figure 3. Monthly minimum temperature range

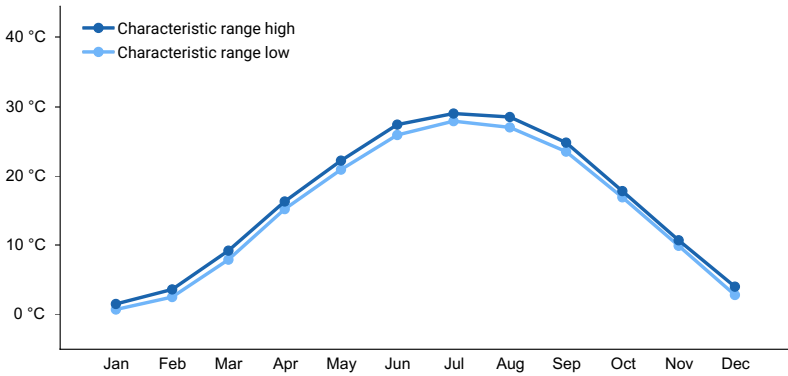


Figure 4. Monthly maximum temperature range

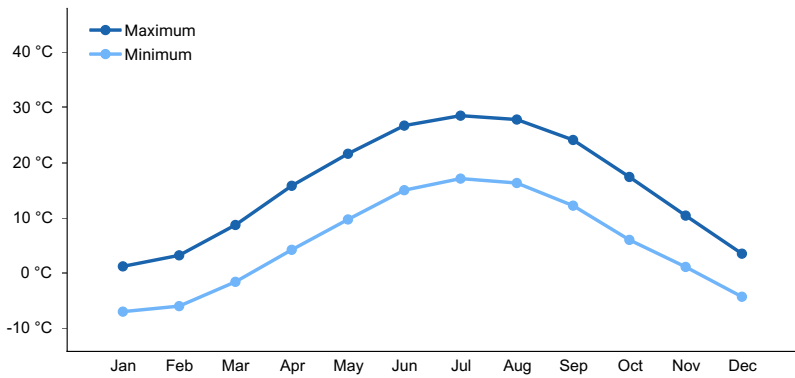


Figure 5. Monthly average minimum and maximum temperature

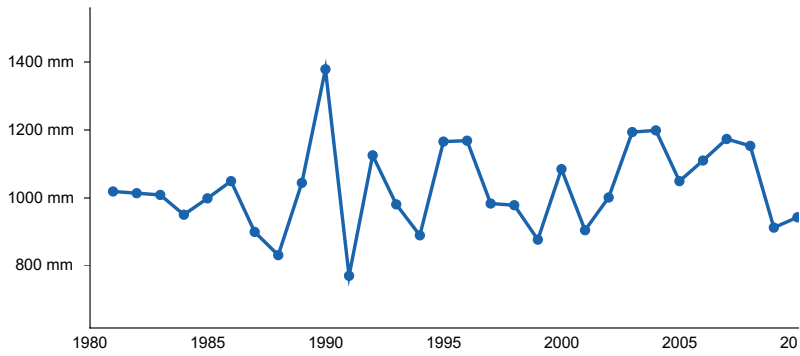


Figure 6. Annual precipitation pattern

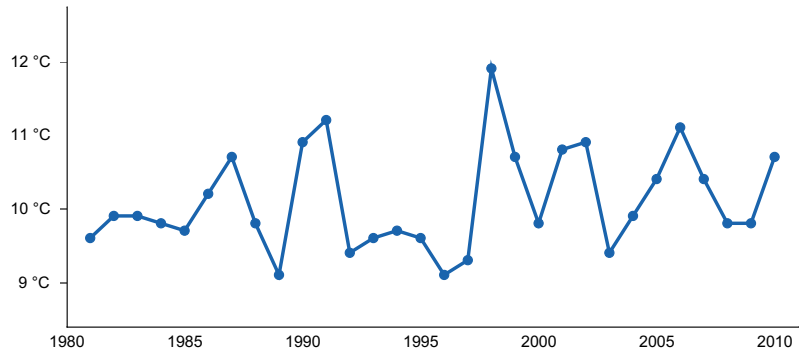


Figure 7. Annual average temperature pattern

Climate stations used

- (1) COLUMBUS PORT COLUMBUS INTL AP [USW00014821], Columbus, OH
- (2) NORWALK WWTP [USC00336118], Norwalk, OH
- (3) MANSFIELD LAHM MUNI AP [USW00014891], Mansfield, OH
- (4) GALION WTR WKS [USC00333021], Galion, OH

Influencing water features

These wetland systems are groundwater-dependent as well as being, generally, the lowest point in the landscape. Water levels fluctuate seasonally, reaching their peak in spring and lows in late summer. Ponding can occur on the site, generally in the spring, to a depth of 15 inches and can have a very long duration (> 30 days). Water levels typically remain at or near the soils surface throughout the year.

The hydrogeographic model classification for this site is DEPRESSION: Muck, Ground Water Influenced, Pondered; herbaceous. . This site has a Cowardin Classification of PEM1Eg; it is a Palustrine system with persistent, emergent vegetation that is seasonally flooded/saturated on organic soil.

Soil features

The soil series associated with this site are: Pinnebog and Carlisle. They are very deep, very poorly drained, and moderately rapid permeable soils, with very acidic soil reaction, that formed in herbaceous organic material, organic material, woody organic material.



Figure 8. location of mapunit in MRLA

Table 4. Representative soil features

Parent material	(1) Organic material (2) Woody organic material (3) Herbaceous organic material
Drainage class	Very poorly drained
Permeability class	Moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	41.15–42.93 cm
Calcium carbonate equivalent (Depth not specified)	0–3%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	5.4–6.7
Subsurface fragment volume <=3" (Depth not specified)	5–18%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The historic plant community of the Deep Muck ecological site is a deep muck wetland. This site is characterized by the soil parent material being composed of herbaceous organic matter. The plant community is dominated by bulrush species, cattails, and sedge species. The site is located in closed depression areas associated with bogs, depressions, and moraine landforms. Being the lowest portion of the local landscape, the site is dependent upon groundwater and its fluctuation, which reaches its peak in the spring and low in the late summer. This fluctuation and dominate herbaceous species create a fire dependent system. Replacement fires about every 15 years and seasonal flooding worked in concert to drive the species dominance and richness of the site.

State and transition model

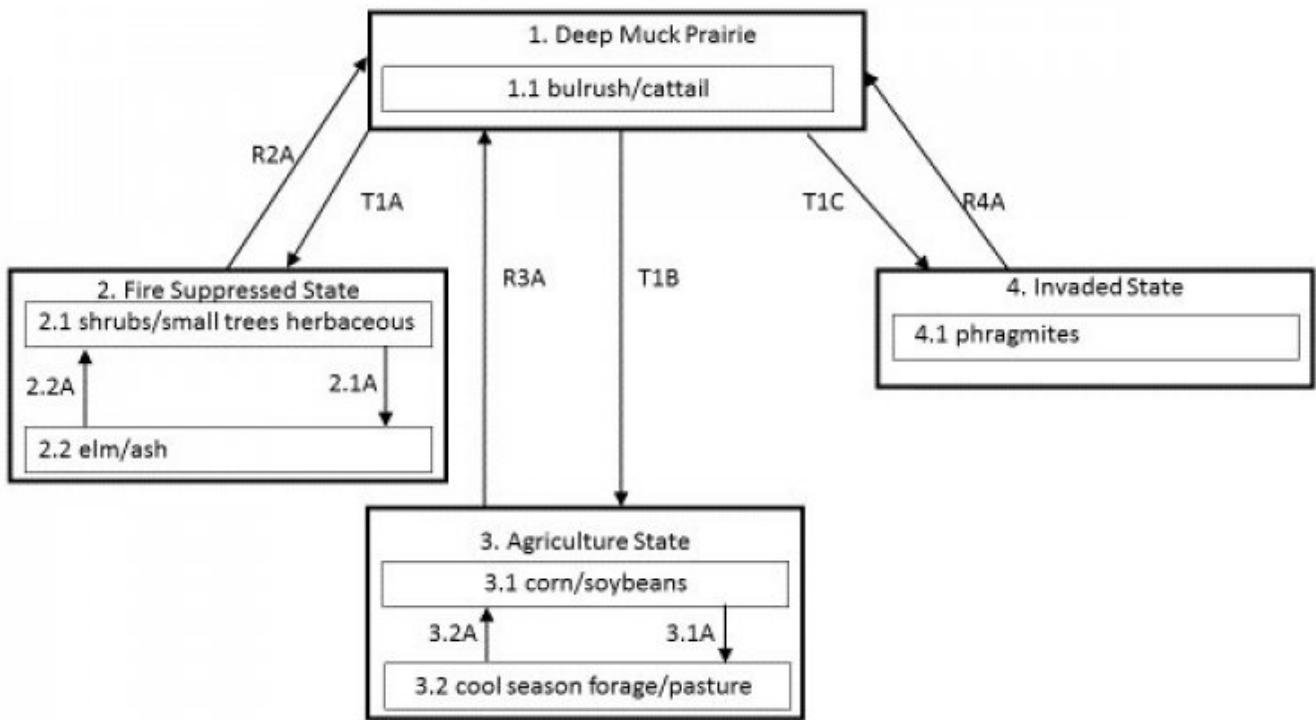


Figure 9. STM

Diagram Legend

T1A	No fire, no woody species management
T1B	Drainage, site preparation, planting, management
T1C	Invasion, no management
R2A	Tree removal, planting, fire
R3A	Drainage removal, planting, fire
R4A	Chemical/mechanical treatment of invasive species, fire
2.1A	No fire, no woody species management
2.2A	Tree removal, no fire
3.1A	Pasture/forage planting and maintenance
3.2A	Tillage/no-till planting and management of row crops.

Figure 10. Legend

State 1 Deep Muck Prairie

This is the reference or diagnostic plant community for this site. In reference conditions, this site was dominated by bulrush and cattails. Sedge species were also a component of this site along with bluejoint grass, but with much less production than the dominant species. This state was maintained by nearly seasonal flooding and a fire frequency of 15 years. The disturbance regime allowed for the site to be dominated by herbaceous species by inhibiting the establishment and production of woody species.

Dominant plant species

- sedge (*Carex*), grass
- bluejoint (*Calamagrostis canadensis*), grass

Community 1.1

bulrush - cattail

This is the reference or diagnostic plant community for this site. In reference conditions, this site was dominated by bulrush and cattail. Sedge species were also a large component of this site.

State 2

Fire Suppressed State

This state is characterized by a longer than normal fire return interval or the absence of fire as a disturbance agent. Absence of fire allows for a thick layer of leaf litter to accumulate which suppresses the production of the herbaceous species and allows the woody species to establish and flourish. Similarly, the woody species that colonize this site are generally intolerant of fire. The seasonal flooding and fire work in concert to help prevent woody species establishment.

Community 2.1

shrubs /small trees

This phase is characterized by the establishment and dominance shrubby species and small trees. Common species include dogwood, white sweetmeadow, and willow species.

Dominant plant species

- willow (*Salix*), tree
- dogwood (*Cornus*), tree

Community 2.2

elm - ash

This phase is characterized by the establishment and dominance tree species that convert the site to a forest. Common species include American elm, silver maple, and blue ash as dominate.

Pathway P2.1A

Community 2.1 to 2.2

Continued absence of fire and/or woody species management will move the site towards phase 2.2.

Pathway P2.2A

Community 2.2 to 2.1

Removal of most or all the trees without the application of fire will move the site towards phase 2.1.

State 3

Agricultural State

This site has largely been converted to agricultural use. Most of the historic acres are now in row crop agricultural use. Most common is a corn and soybean rotation of various types. A small portion of the site is now used to grow hay or cool season forage and used for grazing. The conversion of the site to agricultural use begins with the installation of a drainage system which most often employs either or both ditching and field tile.

Community 3.1

row crops (corn -soybean)

This phase is characterized by row crop agriculture of small grains, primarily corn and soybeans.

Community 3.2 **cool season forage -pasture**

This phase is characterized by forage or grazing agriculture. Different mixes of, generally, cool season grasses and forbs, largely clovers, are grown.

Pathway P3.1A **Community 3.1 to 3.2**

Planting of cool season pasture/forage species and management to maintain them.

Pathway P3.2A **Community 3.2 to 3.1**

Planting, either by conventional or no-till methods, of row crop. Management that keeps the site in row crop production

State 4 **Invaded State**

This site is characterized by the establishment of invasive species. Without management the invasive species come to be the dominant species to the exclusion of nearly all other species.

Dominant plant species

- common reed (*Phragmites australis*), grass

Community 4.1 **Invaded community**

This phase is characterized by the establishment and eventual dominance of phragmites.

Dominant plant species

- common reed (*Phragmites australis*), grass

Transition T1A **State 1 to 2**

No fire or woody species management will transition this site towards the fire suppressed state. This will result in a loss of herbaceous species production and richness.

Transition T1B **State 1 to 3**

The installation of drainage either through ditches or field tile or both facilitates the start of the transition to the agriculture state. Planting and management of the selected crop complete the transition.

Transition T1C **State 1 to 4**

The establishment of invasive species without management, to include the use of fire, move the site towards the invaded state. This results in a loss in species richness of the site.

Restoration pathway R2A

State 2 to 1

Addition of fire to the landscape.

Restoration pathway R3A

State 3 to 1

Removal of drainage system, site preparation, desired species planting, and regular application of fire move the site back to State 1.

Restoration pathway R4A

State 4 to 1

Chemical and mechanical treatment of the invasive species is the first restoration step. Sometimes biological treatment, to included grazing, can be helpful but is not common in this area. The reapplication of fire after seeding of the appropriate species move the site back to State 1.

Additional community tables

Inventory data references

Site concept developed through expert opinion, review of the literature, and field work.

Other references

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Approval

Chris Tecklenburg, 5/28/2020

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)	TYLER STAGGS
Contact for lead author	
Date	04/29/2024
Approved by	Chris Tecklenburg
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:**
