USDA Natural Resources Conservation Service

# Ecological site F098XA007MI
# Acidic Peaty Depressions

Last updated: 1/12/2024
Accessed: 04/30/2024

## 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.


**Figure 1. Mapped extent**

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

## MLRA notes

Major Land Resource Area (MLRA): 098X–Southern Michigan and Northern Indiana Drift Plains

"This area is in the Eastern Lake Section of the Central Lowland Province of the Interior Plains. It is a broad glaciated plain that is deeply mantled by till in the north and outwash to the south. Much of the area is nearly level to gently rolling. Elevation ranges from 183 to 391 m (600 to 1285 ft). Local topographic relief averages 9 m and ranges up to 74 m (30 to 245 ft). Highest relief occurs adjacent to river valleys eroded through moraines. Topography is more subdued south of the Atlantic/Gulf drainage divide near the Michigan/Indiana state line, elevations ranging from 185 to 280 m (605 to 920 ft). Local topographic relief in the south averages 4 m and ranges up to 49 m (10 to 160 ft).

The surface of this area is covered by 30 to 150 m (100 to 500 ft) of glacial drift in most areas. At the northern edge of the area, the drift is more than 100 meters (300 ft) thick. From the Grand River basin northward, most of the drift consists of till from the Saginaw Lobe of the Wisconsin Ice Sheet. From the Kalamazoo River basin southward, there are significant deposits of unconsolidated sand and gravel outwash formed between major lobes of the receding Wisconsin Ice Sheet. The outwash deposits are reworked as sand dunes in the Kankakee River basin.

The bedrock beneath the glacial deposits in this area is deformed in the shape of a basin. The center of this basin is in the north-central part of the area. Pennsylvanian-age sandstone are in the center of the basin, and Mississippian-age sandstone and shale beds form the outer rings of the basin. In a few areas the drift deposits are

less than 2 m (6 ft) thick, where glacial outwash channels have eroded to limestone bedrock in Grand Rapids, and where sandstone bedrock cuestas peak in elevation in near Hillsdale, Michigan. A sandstone cliff < 15 m high (<50 ft) occurs along a short stretch of the Grand River in Grand Ledge, Michigan.

Most of the rivers in this area are short because of their proximity to the Great Lakes east and west of the area. The largest watersheds, the St. Joseph River, Grand River, and Kalamazoo River drain into Lake Michigan. The southern extent of the MLRA is drained by the Kankakee River of the Mississippi River watershed."

## Classification relationships

Among the USFS ecoregional framework (Cleland et al., 2007), most of MLRA 98 is represented by the Humid Temperate Domain (200), Hot Continental Division (220), Midwest Broadleaf Forest Province (222), South Central Great Lakes Section (222J), subsections 222Jc, 222Jg, 222Jh, and 222Jf. Similar sites within the portion of MLRA 98 that overlap the Prairie Division (250) and Prairie Parkland Province
(251) are treated as separate ecological sites. MLRA 98 recently was adjusted to exclude portions of Warm Continental Division (210), Laurentian Mixed Forest Province (212) to the north, and subsections 222Ja and 222Jb to the northwest.

Among the EPA ecoregional framework (Omernik and Griffith, 2014), most of MLRA 98 falls within Eastern Temperate Forests (Level I: 8), Mixed Wood Plains (Level II: 8.1), Southern Michigan/Northern Indiana Drift Plains (Level III: 56), and Level IV: 56b, 56g, and 56h. Similar sites within the portion of MLRA 98 that overlap the Central USA Plains (Level II: 8.2) and Central Corn Belt Plains (Level III: 54) are treated as separate ecological sites. MLRA 98 recently was adjusted to exclude portions of Northern Forests (Level I: 5), Mixed Wood Shield (Level II: 5.2), Northern Lakes and Forests (Level III: 50) to the north, and level IV: 56d and 56f to the northwest.

## Ecological site concept

The central concept of the Acidic Peaty Depressions is organic soils (typically peat) of low pHs (usually <4.5). Generally associated with closed depressions with minimal groundwater or runoff influence on mineral and nutrient levels. Vegetation tends toward a short list of high fidelity acidophiles like Sphagnum spp., and various Ericaceae.

Site concept extends from southern Michigan into northwest Indiana with very minor floristic differences.

## Associated sites

| | |
|---|---|
| F098XA011MI | **Moist Loamy Drift Plains** |

## Similar sites

| | |
|---|---|
| F098XA006MI | **Mucky Depressions** |
| F097XA031MI | **Acidic Peaty Depression**<br>May be similar enough to merge site concepts across MLRA boundaries. Floristic differences not known to be significant. Difference in lake effect climate may be insignificant relative to similarity in soils. Limited in extent within MLRA 97, but widespread in MLRA 98. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Acer rubrum*<br>(2) *Nyssa sylvatica* |
| Shrub | (1) *Chamaedaphne calyculata*<br>(2) *Vaccinium corymbosum* |
| Herbaceous | (1) *Sphagnum* |

## Physiographic features

Site potentially occupies old lake beds and closed depressions, generally on fine till landscapes where rainwater accumulates in relative isolation from minerotrophic groundwater.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Depression |
| Runoff class | Negligible to low |
| Flooding frequency | None |
| Elevation | 177–389 m |
| Water table depth | 0 cm |
| Aspect | Aspect is not a significant factor |

## Climatic features

This ecological site experiences a humid continental climate with mild summers and cold winters. Precipitation is moderately well distributed through the year with higher amounts during the growing season than the winter. Temperature extremes are moderated by the Great Lakes compared to other inland continental locations, though not as much as MLRAs directly bordering the Great Lakes. Mean annual extreme minimum temperatures range from -26.6 to -20.8°C (-16 to -5°F), which falls within hardiness zones 5a to 6a. Annual snowfall is enhanced by the Great Lakes, mainly on the western half of the MLRA.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 118-133 days |
| Freeze-free period (characteristic range) | 152-165 days |
| Precipitation total (characteristic range) | 813-965 mm |
| Frost-free period (actual range) | 115-135 days |
| Freeze-free period (actual range) | 145-173 days |
| Precipitation total (actual range) | 813-1,041 mm |
| Frost-free period (average) | 127 days |
| Freeze-free period (average) | 159 days |
| Precipitation total (average) | 889 mm |

## Climate stations used

- (1) PRAIRIE HEIGHTS [USC00127102], LaGrange, IN
- (2) WANATAH 2 WNW [USC00129222], Valparaiso, IN
- (3) DOWAGIAC 1 W [USC00202250], Dowagiac, MI
- (4) FLINT 7 W [USC00202851], Flushing, MI
- (5) GREENVILLE 2 NNE [USC00203429], Greenville, MI
- (6) CHARLOTTE [USC00201476], Roscommon, MI
- (7) SAINT JOHNS [USC00207280], Saint Johns, MI
- (8) THREE RIVERS [USC00208184], Three Rivers, MI
- (9) BATTLE CREEK KELLOGG AP [USW00014815], Battle Creek, MI
- (10) FLINT BISHOP INTL AP [USW00014826], Flint, MI
- (11) LAPORTE [USC00124837], La Porte, IN
- (12) COLDWATER ST SCHOOL [USC00201675], Coldwater, MI
- (13) GULL LK BIOLOGICAL STN [USC00203504], Augusta, MI
- (14) HASTINGS [USC00203661], Hastings, MI
- (15) HILLSDALE [USC00203823], Hillsdale, MI
- (16) OWOSSO WWTP [USC00206300], Owosso, MI
- (17) ALMA [USC00200146], Alma, MI
- (18) EAST LANSING 4 S [USC00202395], Holt, MI
- (19) HOWELL WWTP [USC00203947], Howell, MI

- (20) IONIA 2SSW [USC00204078], Ionia, MI
- (21) JACKSON REYNOLDS FLD [USW00014833], Jackson, MI
- (22) LANSING CAPITAL CITY AP [USW00014836], Lansing, MI
- (23) GRAND RAPIDS [USW00094860], Grand Rapids, MI

## Influencing water features

Site remains saturated for most of the year, and may be seasonally ponded to shallow depths.

## Soil features

Soils are very poorly drained organics with low pH. They are commonly classified as Typic Haplohemists and Typic Haplosaprists, and commonly mapped as Napoleon, Greenwood, and Loxley series.

**Table 4. Representative soil features**

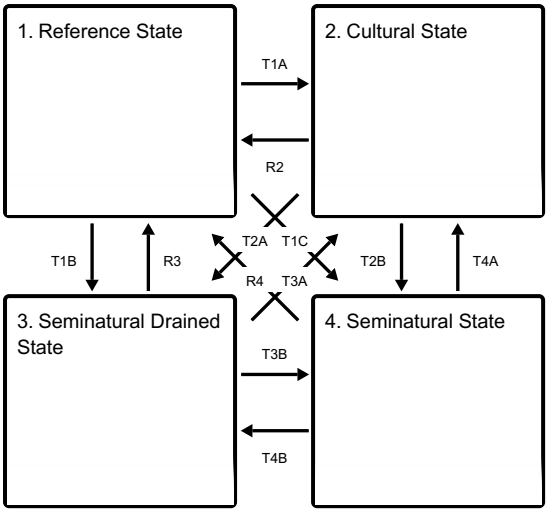
| | |
|---|---|
| Parent material | (1) Organic material |
| Surface texture | (1) Peat |
| Drainage class | Very poorly drained |
| Permeability class | Slow to moderately rapid |
| Soil depth | 201 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-100.1cm) | 35–54.99 cm |
| Soil reaction (1:1 water) (0-50cm) | 3.5–5.5 |
| Subsurface fragment volume <=3" (0-150.1cm) | 0% |
| Subsurface fragment volume >3" (0-150.1cm) | 0% |

## Ecological dynamics

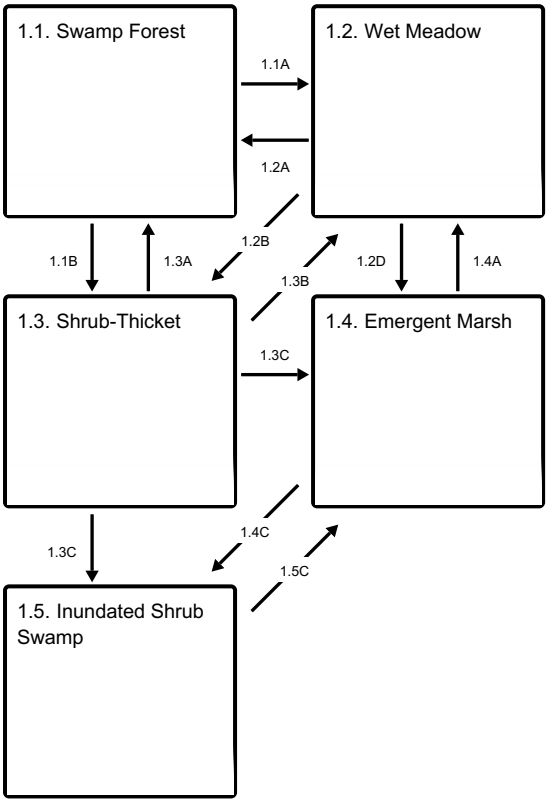
Fire was infrequent, allowing succession to fire sensitive species. Windthrow is a frequent disturbance due to shallow rooting in wet soils. Wet anoxic soils favor facultative and obligate wetland species. The acidic low nutrient status of the substrate favors red maple and black gum, insectivorous plants, and ericads. The floating mat of peat moss tends to maintain saturated conditions, wherein species intolerant of long term flooding are able to persist. Relict black spruce (*Picea mariana*) swamps occur in some locations. The reference community is dominated by red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*). Understory may include highbush blueberry (*Vaccinium corymbosum*). Open areas may have a dominant evergreen shrub layer with leatherleaf (*Chamaedaphne calyculata*) and peat moss (Sphagnum spp.).

## State and transition model

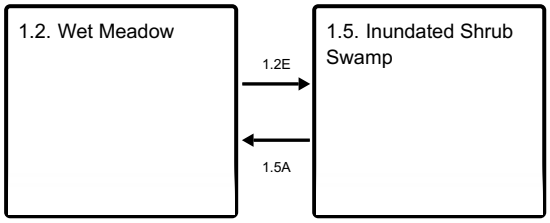
**Ecosystem states**



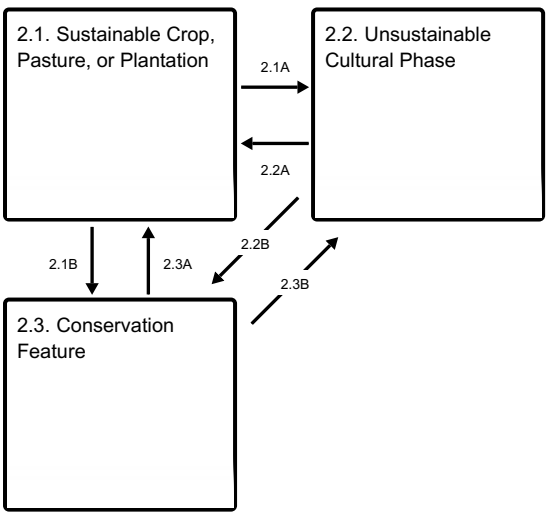

**State 1 submodel, plant communities**



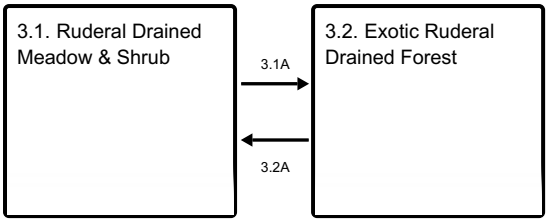

**Communities 2 and 5 (additional pathways)**



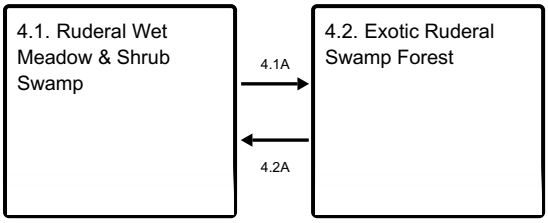

**State 2 submodel, plant communities**



**State 3 submodel, plant communities**




**State 4 submodel, plant communities**




## State 1
## Reference State

The Reference State consists of a range of low shrub leatherleaf bogs or bog forest.

**Dominant plant species**

- red maple (*Acer rubrum*), tree
- blackgum (*Nyssa sylvatica*), tree
- leatherleaf (*Chamaedaphne calyculata*), shrub
- highbush blueberry (*Vaccinium corymbosum*), shrub
- sphagnum (*Sphagnum*), other herbaceous

## Community 1.1
## Swamp Forest

## Community 1.2
## Wet Meadow

## Community 1.3
## Shrub-Thicket

## Community 1.4
## Emergent Marsh

## Community 1.5
## Inundated Shrub Swamp

## Pathway 1.1A
## Community 1.1 to 1.2

Temporary prolonged inundation.

## Pathway 1.1B
## Community 1.1 to 1.3

Clearcut/Blowdown.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |

| |
|---|
| Forest Stand Improvement |

### Pathway 1.2A
### Community 1.2 to 1.1

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.2B
### Community 1.2 to 1.3

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.2D
### Community 1.2 to 1.4

Permanent inundation.

### Pathway 1.2E
### Community 1.2 to 1.5

Shrub establishment; permanent inundation.

**Conservation practices**

| |
|---|
| Tree/Shrub Establishment |

### Pathway 1.3A
### Community 1.3 to 1.1

Succession.

**Conservation practices**

| |
|---|
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |

### Pathway 1.3B
### Community 1.3 to 1.2

Temporary prolonged inundation.

### Pathway 1.3C
### Community 1.3 to 1.4

Permanent inundation.

### Pathway 1.3C
### Community 1.3 to 1.5

Permanent inundation.

### Pathway 1.4A
### Community 1.4 to 1.2

Drop water table.

### Pathway 1.4C
### Community 1.4 to 1.5

Temporary drop water table; shrub establishment.

### Pathway 1.5A
### Community 1.5 to 1.2

Drop water table; shrub mortality.

**Conservation practices**

| |
|---|
| Brush Management |

### Pathway 1.5C
### Community 1.5 to 1.4

Temporary drought; shrub mortality.

## State 2
## Cultural State

[Alternative States to be developed; refer to component communities.]

### Community 2.1
### Sustainable Crop, Pasture, or Plantation

### Community 2.2
### Unsustainable Cultural Phase

### Community 2.3
### Conservation Feature

Can be a grassed waterway, conservation reserve, a small patch pollinator garden, or other land taken out of its primary cultural production to mitigate or reduce impacts of adjacent land use, and is not by itself a permanent restoration of a complete native biological community and associated ecosystem services.

### Pathway 2.1A
### Community 2.1 to 2.2

Revert to unsustainable cultural practices.

### Pathway 2.1B
### Community 2.1 to 2.3

Establish conservation feature.

**Conservation practices**

| |
|---|
| Conservation Cover |
| Grassed Waterway |

### Pathway 2.2A
### Community 2.2 to 2.1

Implement sustainable cultural practices.

**Conservation practices**

| |
|---|
| Conservation Crop Rotation |
| Cover Crop |
| Nutrient Management |
| Integrated Pest Management (IPM) |

### Pathway 2.2B
### Community 2.2 to 2.3

Establish conservation feature.

**Conservation practices**

| |
|---|
| Conservation Cover |
| Grassed Waterway |

### Pathway 2.3A
### Community 2.3 to 2.1

Implement sustainable cultural practices.

**Conservation practices**

| |
|---|
| Conservation Crop Rotation |
| Cover Crop |
| Nutrient Management |
| Integrated Pest Management (IPM) |

### Pathway 2.3B
### Community 2.3 to 2.2

Revert to unsustainable cultural practices.

## State 3
## Seminatural Drained State

[Alternative States to be developed; refer to component communities.]

### Community 3.1
### Ruderal Drained Meadow & Shrub

### Community 3.2
### Exotic Ruderal Drained Forest

### Pathway 3.1A
### Community 3.1 to 3.2

Succession

### Pathway 3.2A
### Community 3.2 to 3.1

Blowdown/clearcut.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |
| Forest Stand Improvement |

### State 4
### Seminatural State

[Alternative States to be developed; refer to component communities.]

### Community 4.1
### Ruderal Wet Meadow & Shrub Swamp

### Community 4.2
### Exotic Ruderal Swamp Forest

### Pathway 4.1A
### Community 4.1 to 4.2

Succession.

### Pathway 4.2A
### Community 4.2 to 4.1

Blowdown/clearcut.

**Conservation practices**

| |
|---|
| Early Successional Habitat Development/Management |
| Forest Stand Improvement |

### Transition T1A
### State 1 to 2

Drain; clear vegetation; cultivate domesticated species.

### Transition T1B
### State 1 to 3

Drain; clear vegetation, invasive species introduced.

### Transition T1C

### State 1 to 4

Clear vegetation, invasive species introduced.

### Restoration pathway R2
### State 2 to 1

Restore hydrology; remove domesticated species; restore native species.

**Conservation practices**

| |
|---|
| Brush Management |
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Wetland Restoration |
| Herbaceous Weed Control |

### Transition T2A
### State 2 to 3

Abandon, succession.

### Transition T2B
### State 2 to 4

Restore hydrology; abandon; succession.

**Conservation practices**

| |
|---|
| Wetland Restoration |

### Restoration pathway R3
### State 3 to 1

Restore hydrology; control invasive species; restore native species

**Conservation practices**

| |
|---|
| Brush Management |
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Wetland Restoration |
| Herbaceous Weed Control |

### Transition T3A
### State 3 to 2

Clear vegetation; cultivate domesticated species.

### Transition T3B
### State 3 to 4

Restore hydrology.

**Conservation practices**

| Wetland Restoration |
|---|

### Restoration pathway R4
### State 4 to 1

Control invasive species; restore native species.

**Conservation practices**

| Brush Management |
|---|
| Restoration and Management of Rare and Declining Habitats |
| Wetland Wildlife Habitat Management |
| Herbaceous Weed Control |

### Transition T4A
### State 4 to 2

Drain; clear vegetation; cultivate domesticated species.

### Transition T4B
### State 4 to 3

Drain.

## Additional community tables

## Inventory data references

Site Development and Testing Plan
Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

## Other references

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## Contributors

Greg Schmidt

## Approval

Nels Barrett, 1/12/2024

## Acknowledgments

Matt Bromley and Andy Henriksen reviewed the narratives. Matt Bromley reviewed associated soil map units.

## 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 | 01/12/2024 |
| Approved by | Nels Barrett |
| 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:**

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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:

---

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):**

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:**