USDA Natural Resources
Conservation Service

# Ecological site R103XY016MN
# Organic Marsh

Last updated: 10/04/2023
Accessed: 12/04/2024

## 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): 103X–Central Iowa and Minnesota Till Prairies

MLRA 103 is in Minnesota (56 percent) and Iowa (44 percent) and consists of approximately 18 million acres. It is in the Western Lake Section of the Central Lowland Province of the Interior Plains in an area known as the "Des Moines Lobe" of the Wisconsin-age ice sheet. The MLRA is mostly on a young, nearly level to gently rolling, glaciated till plain that has moraines and glacial lake plains in some areas. The plain is covered with glacial till, outwash, and glacial lake deposits. Recent alluvium consisting of clay, silt, sand, and gravel fill the bottoms of most of the major river valleys. Paleozoic bedrock sediments, primarily shale and limestone, underlie the glacial deposits in most of the area.

The annual precipitation increases from northwest to southeast. Most of the rainfall occurs as high-intensity, convective thunderstorms during the summer. Two-thirds or more of the precipitation falls during the freeze-free period. Snowfall is common in winter. Ground water supplies are adequate for the domestic, livestock, municipal, and industrial needs. Nearly all of this area is farmland, and about four-fifths is cropland.

## Classification relationships

Major Land Resource Area (MLRA): Central Iowa and Minnesota Till Prairies (103) (USDA Handbook 296, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Upper Minnesota River-Des Moines Lobe (251BA) and Southern Des Moines Lobe (251Be) Subsections (Cleland et al. 2007)

Relationship to Other Established Classifications:
The reference state shares similarities with Minnesota Department of Natural Resources MRp93-Prairie Bulrush-Arrowhead Marsh

## Ecological site concept

The Organic Marsh ecological site is characterized by very poorly drained organic soils, a high water table, ponding, and hydrophytic vegetation.

## Associated sites

| | |
|---|---|
| R103XY005MN | **Clayey Upland Prairies**<br>The Clayey Upland Prairies ecological site is located on uplands, including lakeplains, ground moraines, and till plains. Soils in this ecological site have a dark surface layer (mollic epipedon) and clayey textures. This site is not subject to flooding or ponding. Drainage class is somewhat poorly drained to well drained. |

| | |
|---|---|
| R103XY009MN | **Calcareous Rim Prairies**<br>The Calcareous Rim Prairies ecological site is characterized by landscape position (rim), calcareous soils, low slope (0-2%), and poorly drained soils. This site is hydrologically connected to adjacent ponded depressions. This site does not pond. |
| R103XY007MN | **Sandy Wet Prairies**<br>The Sandy Wet Prairies ecological site concept is areas on sandy, endosaturated soils located on outwash plains, valley trains, and glacial terraces associated with major river valleys. Soils contain sandy and gravelly outwash parent materials and often have a loamy mantle of 20 to 40 inches deep. Drainage class is poorly drained. |
| R103XY008MN | **Clayey Wet Prairies**<br>The Clayey Wet Prairie ecological site occurs predominately on till plains and glacial lake plains, particularly in the Glacial Lake Minnesota area. This site is characterized by soils that have a clayey texture and are poorly drained. These soils developed under prairie vegetation and have dark colored surface horizons. Common soil surface textures include clay, silty clay, and silty clay loam. This site is generally not ponded but has an inherent water table (i.e. endosaturated) and can have slow surface infiltration, causing seasonal perching. |
| R103XY022MN | **Loamy Wet Savannas**<br>The Loamy Wet Savannas ecological site is located on soils that are derived from fine loamy till. Soils are classified as poorly drained. This site occurs on morainal ridges or in slight concavities and linear segments with a slope of less than 2 percent. |

## Similar sites

| | |
|---|---|
| R103XY015MN | **Depressional Marsh**<br>The Depressional Marsh ecological site is in concave small- to medium-sized depressions. This site is very poorly drained and ponded throughout the early part of the growing season in most years (i.e. seasonal wetlands). Vegetation includes cattails, bulrushes, sedges and other emergent wetland species. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Schoenoplectus tabernaemontani*<br>(2) *Sparganium eurycarpum* |

## Physiographic features

The Organic Marsh ecological site is located on till plains, lake plains, moraines, and outwash plains. The term "depression" best describes the landform of this site. Slopes are linear to concave (depressional) and very low gradients. Terric organics, which are the majority of included concept soils, subside when drained; therefore, drained sites are generally more concave than the undrained sites. Water table depth ranges from 0-36” and ponding depth ranges from 0-12”.

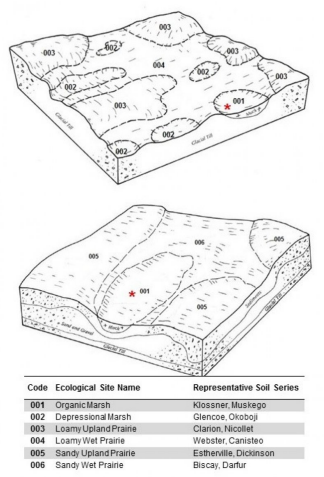


**Figure 1. Block diagrams of the representative Organic Marsh and associated ecological sites.**

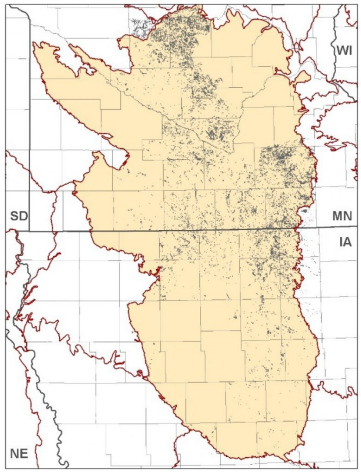



**Figure 2. Distribution of the Organic Marsh ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Till plain<br>(2) Moraine<br>(3) Lake plain<br>(4) Outwash plain |
| Ponding duration | Long (7 to 30 days) |
| Ponding frequency | Frequent |
| Elevation | 210–560 m |
| Slope | 0–1% |
| Ponding depth | 0–30 cm |
| Water table depth | 0–91 cm |
| Aspect | Aspect is not a significant factor |

## Climatic features

The soil temperature regime of MLRA 103 is classified as “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The average freeze-free period of this site is 156 days, while the frost-free period is 131 days. Mean annual precipitation is 32 inches, which includes rainfall plus the water equivalent from snowfall. Cold air drainage from above and the fact that wet soils are generally colder than dry soils make this site colder than adjacent, upslope areas. As a result, snow and frost remain longer in the spring, thus resulting in shorter growing seasons than the adjacent uplands.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 124-136 days |
| Freeze-free period (characteristic range) | 150-162 days |
| Precipitation total (characteristic range) | 762-864 mm |
| Frost-free period (actual range) | 123-142 days |
| Freeze-free period (actual range) | 149-163 days |
| Precipitation total (actual range) | 737-864 mm |
| Frost-free period (average) | 131 days |
| Freeze-free period (average) | 156 days |

| | |
|---|---|
| Precipitation total (average) | 813 mm |

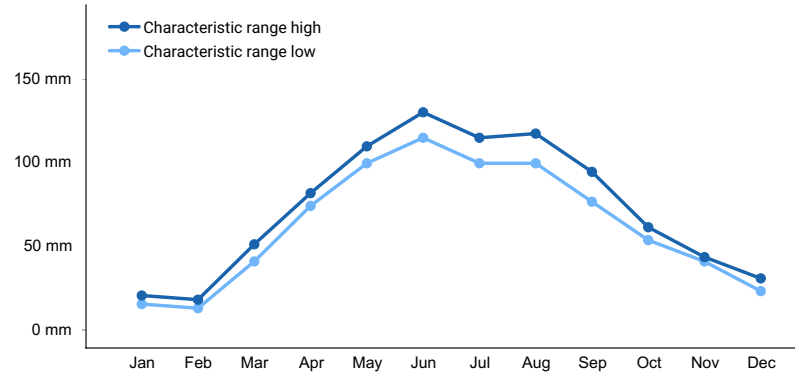



**Figure 3. Monthly precipitation range**

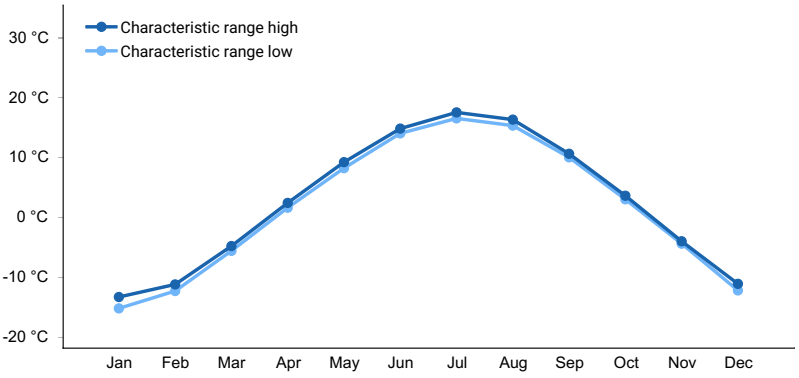



**Figure 4. Monthly minimum temperature range**

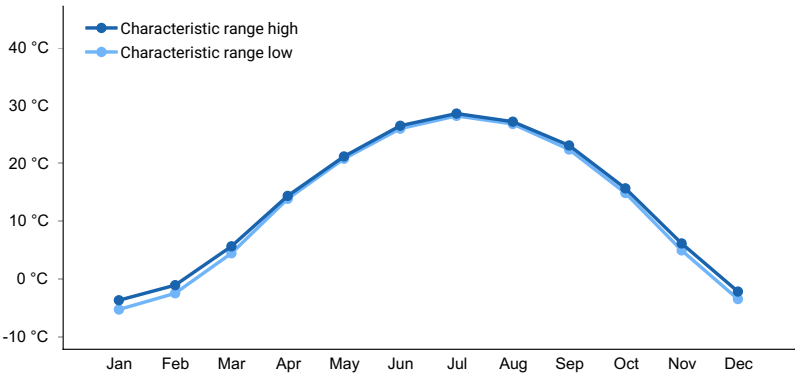



**Figure 5. Monthly maximum temperature range**

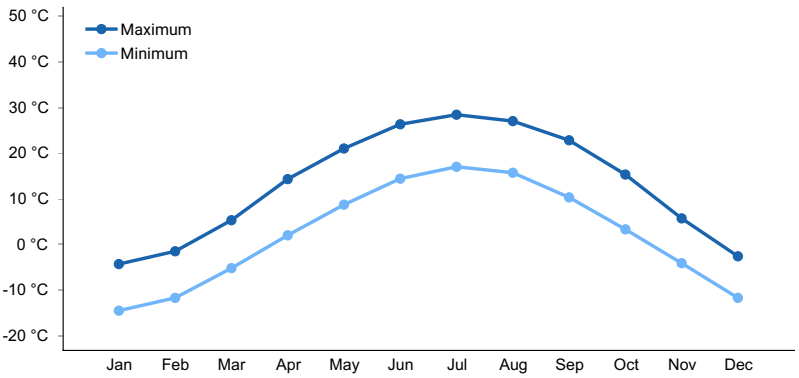



**Figure 6. Monthly average minimum and maximum temperature**

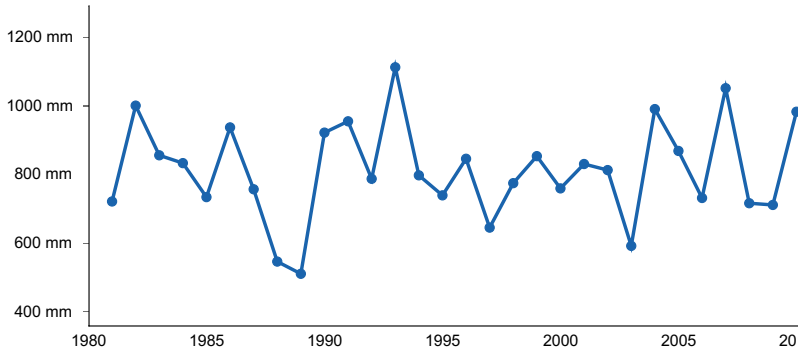



**Figure 7. Annual precipitation pattern**

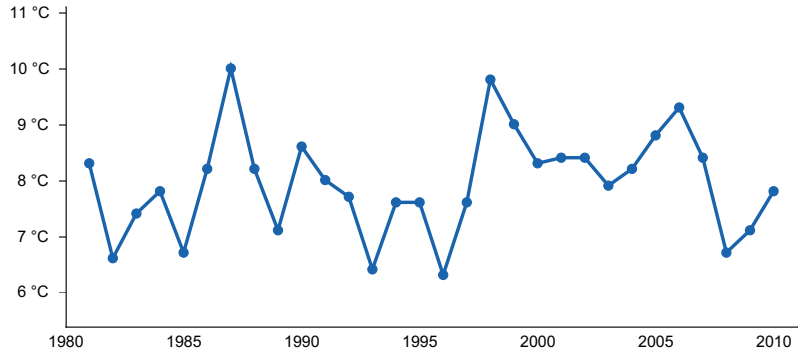



**Figure 8. Annual average temperature pattern**

## Climate stations used

- (1) WELLS [USC00218808], Wells, MN
- (2) DASSEL [USC00212023], Dassel, MN
- (3) OWATONNA [USC00216287], Owatonna, MN
- (4) SPIRIT LAKE [USC00137859], Spirit Lake, IA
- (5) SAC CITY [USC00137312], Sac City, IA

## Influencing water features

The Organic Marsh ecological site, with natural hydrology intact, receives water from subsurface flow or discharge, direct precipitation, and runoff from uplands. During most months, especially warmer ones, this site receives runoff. During the spring these soils are ponded. Organic Marsh soils are classified as endosaturated. In the hydrogeomorphic (HGM) classification system, the site is considered a part of a Depressional complex, receiving discharge from associated upslope ecological sites (USDA-NRCS, 2008; Gilbert et al., 2006). This site has a Palustrine, Emergent Wetland Persistent, Seasonally Saturated Cowardin Hydrologic classification, and has a United States Army Corps of Engineers Wetland Plant Community of E; Fresh (wet) Meadows, Sedge Meadows and Wet Prairies (Organic Soils)

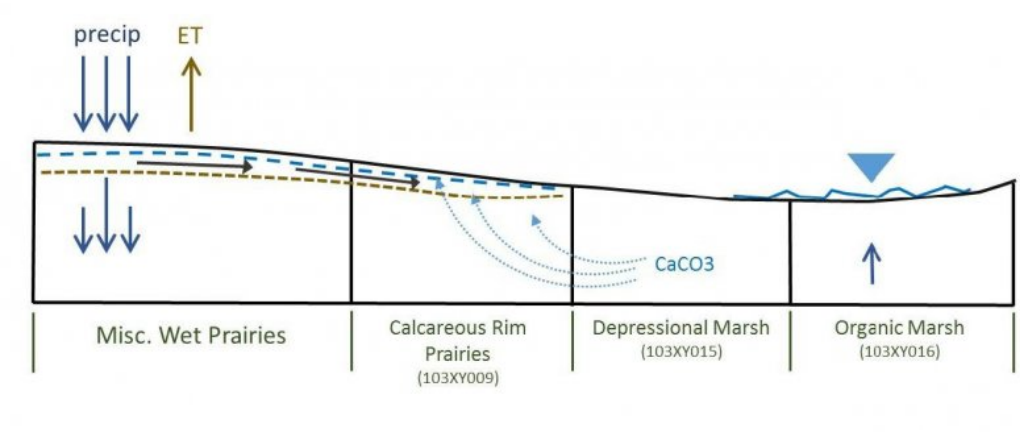



**Figure 9. Representation of hydrological factors in a typical area of the Organic Marsh and associated ecological sites on the Des Moines Lobe (MLRA 103).**

## Soil features

Organic Marsh soils are rich in organic matter and developed under ponded conditions which inhibited the decomposition of organic matter. Organic soils in MLRA 103 have thick, dark histic horizons composed mostly of the remains of plants. Terric Histosols are the central concept soils for this ecological site. These soils have a mineral substratum with the range of 16-51 inches. Soil drainage class is very poorly drained. The surface texture is muck, and organic horizons above the mineral soil substratum have around 65% organic matter. The subsurface group is formed in glaciofluvial material and is primarily classified as fine-loamy. (18-35% clay), but can also include coarse-loamy (less than 18% clay) or sandy (less than 15% clay and 30% silt). The soil order is Histosol, with the most common taxonomic class being Terric Haplosaprists. The soil series associated with this ecological site are Palms/Klossner, Medo, Muskego, Boots, and Houghton.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Organic material<br>(2) Glaciofluvial deposits |
| Drainage class | Very poorly drained |
| Permeability class | Slow to very rapid |
| Soil depth | 203 cm |
| Available water capacity (0-152.4cm) | 22.86–60.96 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0–80% |
| Soil reaction (1:1 water) (0-101.6cm) | 4.5–8.4 |
| Subsurface fragment volume <=3" (0-101.6cm) | 0–30% |
| Subsurface fragment volume >3" (0-101.6cm) | 0–5% |

## Ecological dynamics

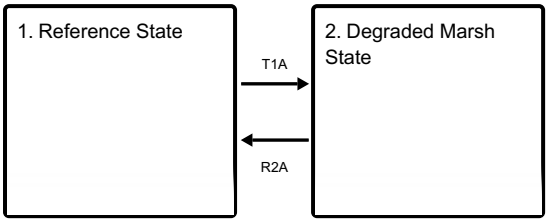
The Organic Marsh ecological site state and transition model (STM) has three states: the Reference State, the Degraded Marsh State, and the Tillage State. The Reference State describes a frequently ponded site on organic soils with native, hydrophytic plant species. This state is characterized by natural hydrology and no human disturbances. Plant community structure and composition will vary within this state depending on water depth. State 2 is a Degraded Marsh State in which disturbances have modified the plant community composition and structure. Grazing, invasive species, and hydrological modifications are common triggers. State 3 is the Tillage State which

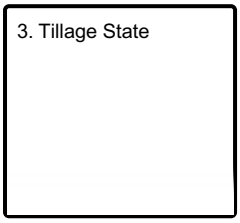
describes intensive agricultural production. This is the most common state in MLRA 103.

Historically, fire, drought, and grazing were the primary natural disturbances to this site. Currently, the dominant land use is corn and soybean production. Areas not in row crop agriculture most often exist as degraded marshes.

## State and transition model

**Ecosystem states**

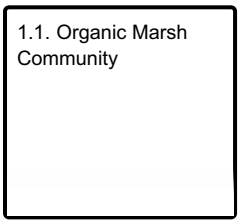


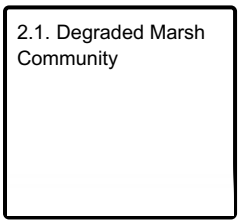

**T1A** - Disturbances such as hydrological modifications, cattle grazing, invasive species

**R2A** - Management inputs to restore natural functions of the site

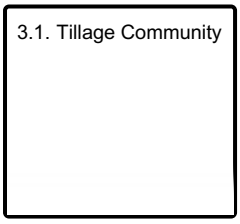
**State 1 submodel, plant communities**




**State 2 submodel, plant communities**




**State 3 submodel, plant communities**




## State 1
## Reference State

The Organic Marsh ecological site is characterized by organic soils and a native, wet-tolerant, plant community that was historically influenced by fire, drought, and grazing. Plant community structure and composition vary depending upon moisture and depth of ponding. Softstem bulrush (*Schoenoplectus tabernaemontani*) and broadfruit bur-reed (*Sparganium eurycarpum*) are dominant in deep marsh areas. Broadleaf cattail ( *Typha latifolia*) and river bulrush

(*Bolboschoenus fluviatilis*) are common in the shallow marsh environment. Numerous species of emergent forbs will be present in this community. Areas of longer-term ponding may exhibit floating-leaved and submergent forbs such as watermilfoil (Myriophyllum spp.), American white waterlily (*Nymphaea odorata*), pondweed (Potamogeton spp.), and water knotweed (*Polygonum amphibium*). High-quality, natural reference sites are now uncommon in MLRA 103. Most sites were transitioned to agricultural production prior to current wetland protection legislation. Of the Organic Marsh sites that still remain, many have altered hydrology due to adjacent tile drainage and ditching.

**Dominant plant species**

- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- broadleaf cattail (*Typha latifolia*), grass
- river bulrush (*Bolboschoenus fluviatilis*), grass
- American white waterlily (*Nymphaea odorata*), other herbaceous
- water knotweed (*Polygonum amphibium*), other herbaceous

## Community 1.1
## Organic Marsh Community

This site is characterized by ponding, very poorly drained soils, natural hydrology, and native, hydrophytic vegetation. The plant community composition and structure will depend on the depth and length of ponding. Natives such as softstem bulrush, broadfruit bur-reed, broadleaf cattail, and river bulrush are common within this ecological community. A variety of emergent, floating-leaved, and submergent forbs inhabit ponded areas.

**Dominant plant species**

- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- broadleaf cattail (*Typha latifolia*), grass
- river bulrush (*Bolboschoenus fluviatilis*), grass
- American white waterlily (*Nymphaea odorata*), other herbaceous
- water knotweed (*Polygonum amphibium*), other herbaceous

## State 2
## Degraded Marsh State

The Degraded Marsh State is characterized by non-native plants species, altered hydrology, cattle grazing, and/or long-term fire suppression which allows for an increase woody plant species. Plant community composition will be influenced by the duration and depth of ponding. Deep marsh areas will be dominated by softstem bulrush (*Schoenoplectus tabernaemontani* (C.C. Gmel.) Palla) and broadfruit bur-reed (*Sparganium eurycarpum* Engelm.). In shallow areas, broadleaf cattails (*Typha latifolia* L.) and river bulrush (*Bolboschoenus fluviatilis* (Torr.) Soják) are often dominant. Open water zones may contain American white waterlily (*Nymphaea odorata* Aiton) and shortspike watermilfoil (Myriophyllum exalbescens Kom.). Some areas in this state may be managed as set-aside conservation easements. Areas not in a conservation program are assumed to be jurisdictional wetlands, making it very unlikely they will be transitioned to agriculture due to various wetland programs and laws, including the Swampbuster provision of the Food Security Act of 1985 (P.L. 99-198, as amended by P.L. 115-25) and the Minnesota Wetland Conservation Act (WCA) of 1991 (M.R. 8420.0100, as amended in 2009).

**Dominant plant species**

- common reed (*Phragmites australis*), grass
- hybrid cattail (*Typha ×glauca*), grass
- narrowleaf cattail (*Typha angustifolia*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

## Community 2.1
## Degraded Marsh Community

The Degraded Marsh Community is characterized by a disturbed plant community. Disturbances may include non-

native invasive plants, grazing, hydrological modifications, and an increase in woody species due to an absence of natural fire. A variety of invasive woody plants and grasses can become dominant on these areas. Common species in this state include hybrid cattail, narrowleaf cattail, reed canarygrass, common reed, and various woody plants. Plant community composition will be influenced by the duration and depth of ponding.

**Dominant plant species**

- common reed (*Phragmites australis*), grass
- hybrid cattail (*Typha ×glauca*), grass
- narrowleaf cattail (*Typha angustifolia*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

## State 3
## Tillage State

Tillage and drainage are the primary mechanisms for transitioning to agriculture production. The majority of these sites were transitioned to agriculture prior to current wetland protection legislation. Most areas in this state will remain in crop production in the foreseeable future – primarily in an intensive corn and soybean rotation. Some areas within this ecological site may have been seeded to grass or have reverted to a scrubby woodland. However, this is a small percentage of acres within the MLRA, so these communities are not currently included in the state and transition model.

**Resilience management.** Resilience management practices include weed control (herbicide application), field cultivation, fertilizer application, and harvest management.

**Dominant plant species**

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

## Community 3.1
## Tillage Community

This plant community typically consists of intensively produced, traditional row crops. Tillage, tiling/ditching, and intentional plant establishment (planting crops) are the primary triggers for this community.

**Resilience management.** Resilience management practices include weed control (herbicide application), field cultivation, fertilizer application, and harvest management.

**Dominant plant species**

- corn (*Zea mays*), grass
- soybean (*Glycine max*), other herbaceous

## Transition T1A
## State 1 to 2

Disturbances such invasive species, hydrological modifications, and cattle grazing will alter the State 1 plant community composition and structure transitioning it to the Degraded Marsh State.

## Restoration pathway R2A
## State 2 to 1

Restoration activities may include the eliminate of invasive plant species, establishment of desired native species, and protection of the site from disturbances such as cattle grazing. Complete restoration is only possible if the natural hydrology exists.

## Additional community tables

## Other references

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Minnesota Rules, part 8420.0100, subpart 1, item A-D (2009).

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## Contributors

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## Approval

Suzanne Mayne-Kinney, 10/04/2023

## 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 | 12/04/2024 |
| 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:**