Ecological site R103XY017MN
Organic Wet Meadow/Carr

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Accessed: 05/05/2024

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)

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

The reference state shares similarities to Minnesota Department of Natural Resources WMn82 Northern Wet Meadow/Carr

Ecological site concept

The Organic Wet Meadow/Carr ecological site occurs predominantly in the northeastern section of MLRA 103 including parts of the Big Woods ecoregion. The ecology of this site is influenced by landscape position, hydrology, and soils. The landscape positions include linear to slightly concave landforms within depressions. Soils have a high water table (i.e.,endosaturated) and are classified as very poorly drained. Soils in this group are Histosols with high organic matter content that developed in shallow lakes and ponds. This site is ponded in a natural state.

Associated sites

F103XY030MN	**Wet Footslope/Drainageway Forests** The Wet Footslope/Drainageway Forests ecological site is on somewhat poorly drained to poorly drained soils located on base slopes, head slopes, footslopes, toeslopes, and drainageways.
F103XY025MN	**Loamy Upland Forests** The Loamy Upland Forests ecological site occurs on uplands and on soils which are derived from loamy till and have a thin or moderately thick dark (mollic) surface layer. The drainage class ranges from somewhat poorly drained to well drained.
F103XY027MN	**Loamy Wet Forests** The Loamy Wet Forests ecological site is located in drainageways or on footslopes, toeslopes and depression. Soils are poorly drained and classified as endosaturated. The site is characterized by a high water table during the spring months and very deep, loamy soils.
F103XY028MN	**Clayey Wet Forests** The Clayey Wet Forests ecological site occurs on clayey textured soils that have a seasonal depth to soil saturation of 0 to 30 cm. This site is located on concave or linear low-slope areas, but no flooding or ponding usually occurs.
F103XY036MN	**Depressional Wet Forests** The Depressional Wet Forests ecological site occurs in concave or linear and low slope gradient areas on end, lateral and ground moraines in in northeastern MLRA 103. This site is characterized by a water table that is typically above the soil surface (ponded) during the spring months and may drop to as low as three feet later in the growing season during dry periods. The soils developed under forest vegetation and have a thick accumulation of slope alluvium.

Table 1. Dominant plant species

Tree	(1) *Larix laricina* (2) *Alnus*
Shrub	Not specified
Herbaceous	(1) *Carex lacustris* (2) *Carex stricta*

Physiographic features

The Organic Wet Meadow/Carr ecological site is partially defined by the hydrological relationship with adjacent uplands. Although the site can be linear in shape, the term “depression” best describes the overall landform. Organic soils, especially when drained and subsidence occurs, will take on the topography of the depression they were formed in. Therefore, drained areas are more concave than the undrained areas.

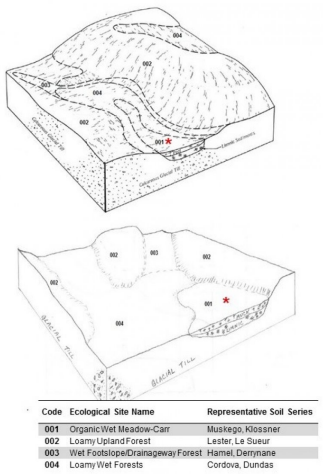


Figure 1. Block diagrams of the representative Organic Wet Meadow/Carr and associated ecological sites.

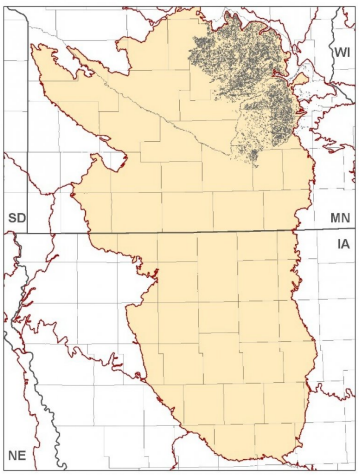


Figure 2. Distribution of the Organic Wet Meadow/Carr ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

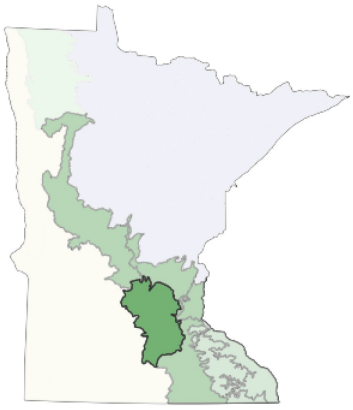


Figure 3. Diagram showing the boundary of the Big Woods region in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Moraine (3) Lake plain (4) Outwash plain
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	689–1,837 ft
Slope	0–1%
Water table depth	0–36 in
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 130 days, while the frost-free period is 152 days. Mean annual precipitation is 33 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)	126-133 days
Freeze-free period (characteristic range)	148-154 days
Precipitation total (characteristic range)	32-34 in
Frost-free period (actual range)	123-136 days
Freeze-free period (actual range)	147-159 days
Precipitation total (actual range)	32-35 in
Frost-free period (average)	130 days
Freeze-free period (average)	152 days
Precipitation total (average)	33 in

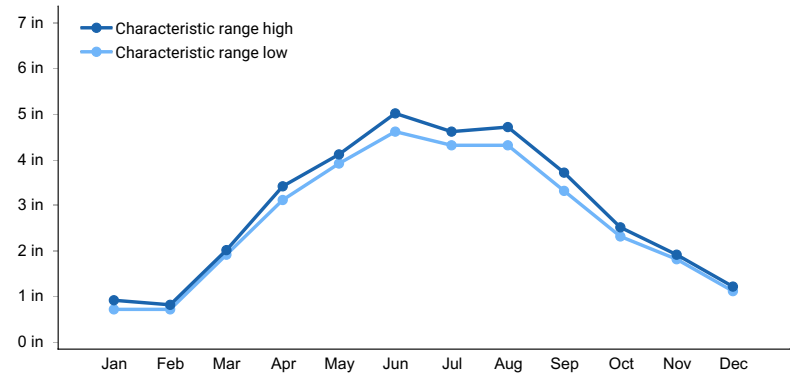


Figure 4. Monthly precipitation range

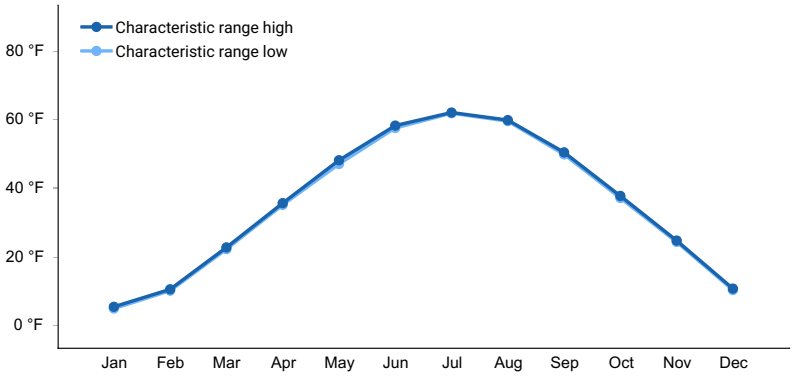


Figure 5. Monthly minimum temperature range

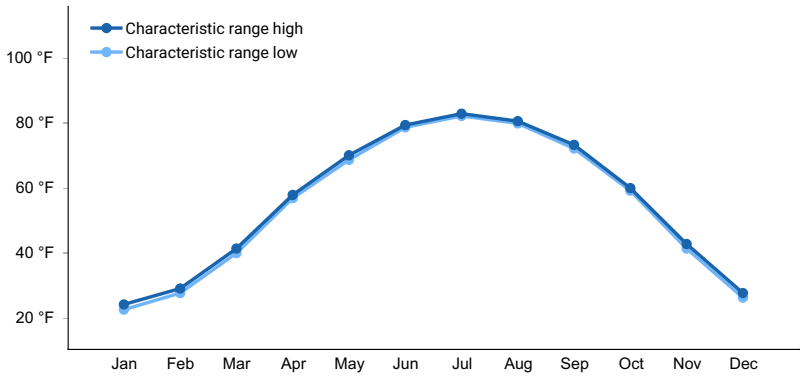


Figure 6. Monthly maximum temperature range

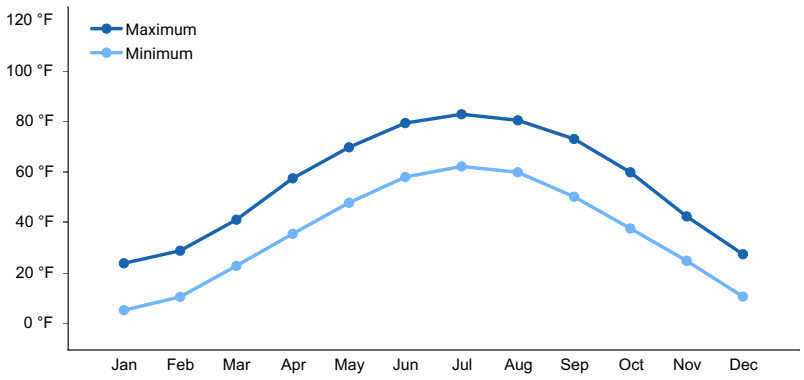


Figure 7. Monthly average minimum and maximum temperature

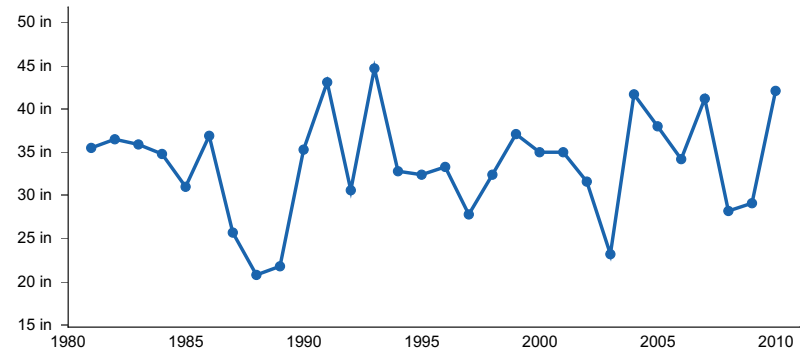


Figure 8. Annual precipitation pattern

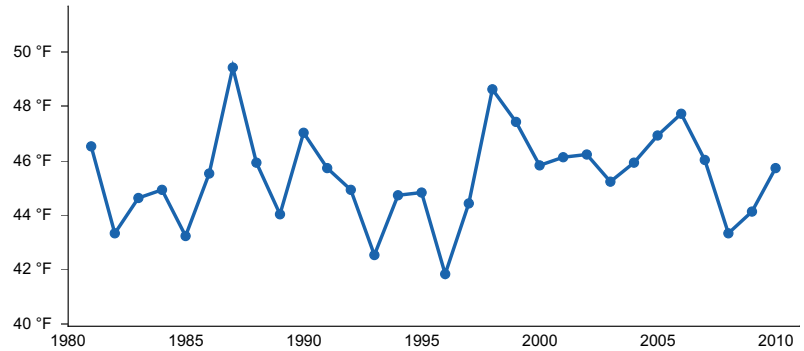


Figure 9. Annual average temperature pattern

Climate stations used

- (1) WELLS [USC00218808], Wells, MN
- (2) OWATONNA [USC00216287], Owatonna, MN
- (3) WASECA EXP STN [USC00218692], Waseca, MN
- (4) ALBERT LEA 3 SE [USC00210075], Albert Lea, MN
- (5) WINNEBAGO [USC00219046], Winnebago, MN

Influencing water features

With natural hydrology intact, the Organic Wet Meadow/Carr ecological site receives water from several sources: discharge or subsurface lateral flow, direct precipitation, and runoff from uplands. During most months, this site receives runoff. During the spring, this site is ponded.

The soils are classified as endosaturated. The water table is typically above the soil surface during the spring months and may drop to as low as three feet later in the growing season during dry periods. In the hydrogeomorphic (HGM) classification system, Organic Wet Meadows are considered a part of a depressional complex, receiving discharge from associated upslope sites (USDA-NRCS, 2008; Gilbert et al., 2006). This site has a Saturated Cowardin Hydrologic Regime Palustrine, Scrub-Shrub Wetland. It also has a United States Army Corps

of Engineers Wetland Plant Community of E; Fresh (wet) Meadows, Sedge Meadows and Wet Prairies (Organic Soils).

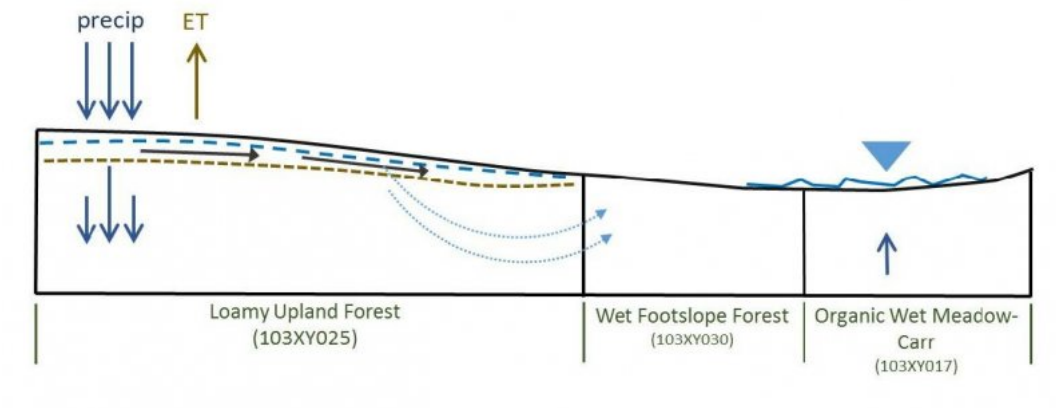


Figure 10. Representation of hydrological factors in a typical area of the Organic Wet Meadow/Carr and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

Soils of this ecological site are rich in organic matter and developed under ponded conditions and hydrophytic vegetation. The Organic Wet Meadow/Carr ecological site is predominantly located in the northeastern section of MLRA 103 including the Big Woods ecoregion. This area has rough terrain and a high concentration of wet depressions, ponds, lakes, and rivers. The topography and natural water features reduced the frequency and intensity of wildfires which allowed the accumulation of deep organic materials.

Organic soils have thick, dark histic horizons composed mainly of organic matter. Terric, Limnic, and Typic Histosols are the central concept of this ecological site. Terric Histosols have a mineral substratum within the range of 16-51 inches. Typic and Limnic Histosols have a mineral substratum below 51 inches. The surface texture is muck, and organic horizons above the mineral soil substratum have around 65 percent organic matter.
The soil drainage class is very poorly drained. The mineral subsurface group (when present in the control section of the profile) is classified as fine-loamy, coarse-loamy, or sandy. Klossner is the most extensive Terric Histosol in this group, while Houghton, Caron and Muskego are the more extensive deeper Histosols. Houghton is a Typic Haplosaprist and Muskego and Caron are Limnic Haplosaprists. Muskego and Caron have limnic materials (sedimentary, non-herbaceous peat) between 16 and 51 inches. Soil series associated with this ecological site are Muskego, Houghton, Klossner, and Caron.

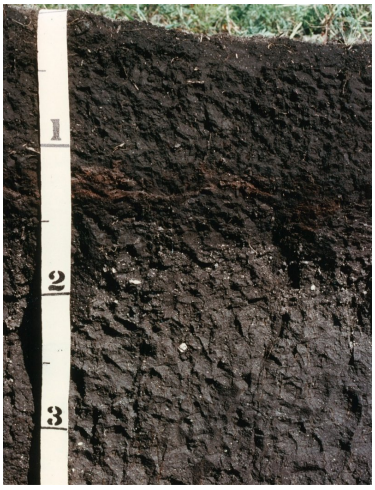


Figure 11. A Muskego soil profile

Table 4. Representative soil features

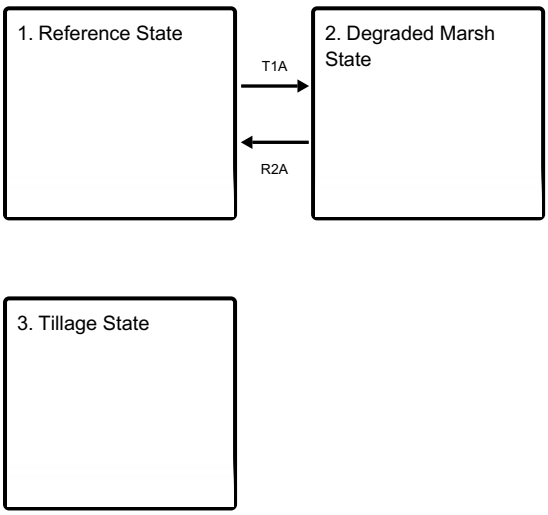
Parent material	(1) Organic material (2) Slope alluvium
Surface texture	(1) Muck
Drainage class	Very poorly drained
Permeability class	Slow to rapid
Soil depth	80 in
Available water capacity (0-60in)	15–21 in
Calcium carbonate equivalent (0-40in)	0–80%
Soil reaction (1:1 water) (0-40in)	6.6–8.4

Ecological dynamics

The Wet Meadow/Carr ecological site model has three states: the Reference State, the Degraded Marsh State, and the Tillage State. The Reference State describes a native, hydrophytic plant community on areas with natural hydrology and no human disturbance triggers such as cattle grazing or non-native vegetation. State 2 is a Degraded Marsh State in which disturbances have modified the plant community composition and structure. State 3 is the Tillage State which describes intensive agricultural production. Currently, the dominant land use for this site is corn and soybean production.

State and transition model

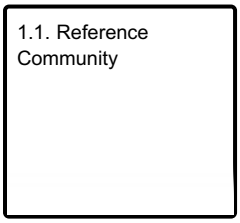
Ecosystem states



T1A - Disturbances alter plant community structure and composition

R2A - Restoration of native plant species and hydrological function

State 1 submodel, plant communities



State 2 submodel, plant communities

2.1. Degraded Marsh Community

State 3 submodel, plant communities

3.1. Tillage Community

State 1
Reference State

Figure 12. An Organic Wet Meadow/Carr at Wolsfeld Woods Preserve in Hennepin County, Minnesota. Photograph taken by Clayton Johnson.

The Reference State plant community is influenced by intermittent to fluctuating ponding during the wet months of the year. Dominant species include scattered tamarack, alder, willow, hairy sedge, and upright sedge. Increases in depth and duration of ponding will favor a transition to a shrub swamp with an increase in willows and dogwood. Tiling or ditching of adjacent areas can negatively impact the natural hydrology of this site. The reference state condition is uncommon in MLRA 103.

Dominant plant species

- tamarack (*Larix laricina*), tree
- alder (*Alnus*), tree
- willow (*Salix*), tree
- hairy sedge (*Carex lacustris*), grass
- upright sedge (*Carex stricta*), grass

Community 1.1
Reference Community

The Reference Community composition and structure will vary depending on the depth and length of flooding during the wet months of the year. Common species include scattered trees such as tamarack, alder, and willow. Increases in depth and duration of ponding will favor willow, dogwood, and hydrophytic sedges and forbs. Reference States are now uncommon in MLRA 103. Most sites have been transitioned to the Tillage State or have hydrological alterations from adjacent ditching and tiling.

Dominant plant species

- tamarack (*Larix laricina*), tree
- alder (*Alnus*), tree
- willow (*Salix*), tree
- hairy sedge (*Carex lacustris*), grass
- upright sedge (*Carex stricta*), grass

State 2
Degraded Marsh State

The Degraded Marsh State is characterized by one or more disturbance triggers. These disturbances could be hydrologic alterations, non-native plants species, cattle grazing, or long-term fire suppression which allows for an increase woody plant species. Common species include narrowleaf cattail (*Typha angustifolia*), hybrid cattail (Typha × glauca), reed canarygrass (*Phalaris arundinacea*), common reed (*Phragmites australis*), and various shrubs and tree saplings. Plant community composition will be influenced by the type, severity, and duration of disturbances as well as the depth of ponding. Variations in plant composition and structure may include a cattail community, a wet grassy community (reed canarygrass, common reed), or a mix of cattails and grasses with woody shrubs. Some sites in this state may be 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

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

Community 2.1
Degraded Marsh Community

The Degraded Marsh Community is characterized by various disturbances such as hydrological modifications, non-native invasive plants, cattle grazing, and an increase in woody species due to an absence of fire. A variety of invasive woody plants and grasses can become dominant on this site. Typical species include hybrid cattail, narrowleaf cattail, reed canarygrass, common reed, and various woody plants. Plant community composition will be influenced the duration and depth of ponding. Common communities include cattails, wet grasses, or a mix of these species along with woody shrubs.

Dominant plant species

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

State 3
Tillage State

Tillage and drainage are the primary mechanisms for transitioning this site to agriculture production. Most areas now utilized for agriculture were transitioned to State 3 prior to current wetland protection regulations. Soil tillage affects dynamic soil properties such as bulk density, structure, organic carbon content, and saturated hydraulic conductivity. Hydrological modifications (tiling and ditching) may be installed to improve drainage, so natural hydrology is also altered. Most areas in this state will remain in crop production in the foreseeable future – primarily in an intensive corn and soybean rotation. Conservation practices can mitigate the impacts of traditional agricultural practices on soil health. Conservation tillage minimizes soil disturbance and can improve soil structure and overall soil health. Corn or soybean plantings and a cover crop rotation can build soil structure, improve infiltration rates,

reduce runoff and erosion, and protect water quality. 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.

Dominant plant species

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

Community 3.1
Tillage Community

The Tillage Community site typically consists of intensively produced, traditional row crops. Tillage, tiling/ditching, and intentional plant establishment (planting crops) are the primary triggers for this community. The most common crops are corn and soybeans on an annual rotation.

Dominant plant species

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

Transition T1A
State 1 to 2

Disturbance triggers such as non-native vegetation, cattle grazing, or hydrological changes alter the native plant community.

Restoration pathway R2A
State 2 to 1

Restoration of the native plant community includes eradication of non-native vegetation and exclusion of grazing. Natural hydrology must exist for a complete restoration.

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

Clayton Johnson (Clayton.Johnson@usda.gov), Soil Survey Office Leader, USDA-NRCS, Albert Lea, MN
Myles Elsen (Myles.Elsen@usda.gov), Soil Scientist, USDA-NRCS, Albert Lea, MN
Anita Arends (Anita.Arends@usda.gov), USDA-NRCS, Springfield, IL

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	05/05/2024
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:**