USDA Natural Resources Conservation Service

Ecological site R103XY018MN
Shallow Lakes

Last updated: 10/04/2023
Accessed: 05/19/2024

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)

Ecological site concept

The Shallow Lakes ecological site is extensive (>100,000 acres) and occurs in the eastern and northeastern portion of MLRA 103. The majority of sites are located in the Big Woods ecoregion and the savanna areas surrounding Big Woods. This site is ponded in the natural state. Soils are poorly drained Histosols that are high in organic matter content and developed within shallow lakes.

Associated sites

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 occurs on loamy textures soils that have a seasonal depth to soil saturation of 0-30 cm. The site is on concave or linear low-slope areas, but no flooding or ponding usually occurs.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Nymphaea odorata* (2) *Ceratophyllum demersum*

Physiographic features

The Shallow Lakes ecological site is predominately mapped in eastern and northeastern portion of MLRA 103, especially in and surrounding the Big Woods ecoregion. These areas are characterized by a landscape with shallow bowl-type depressions which are conducive to the formation of deep organic soils. Ponding duration can be frequent and of a very long duration (more than 30 days). Even though this site can be quite linear in shape, the term "depression" best describes the overall landscape.

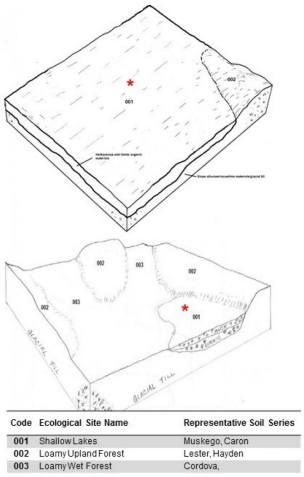


Figure 1. Block diagrams of the representative Shallow Lakes and associated ecological sites.

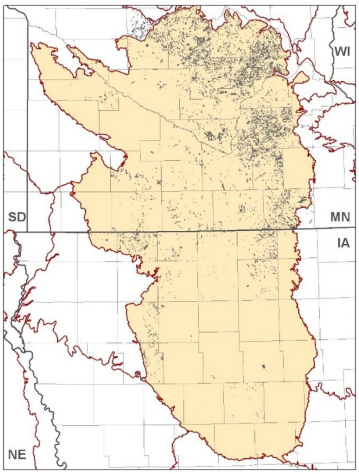


Figure 2. Distribution of the Shallow Lakes ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

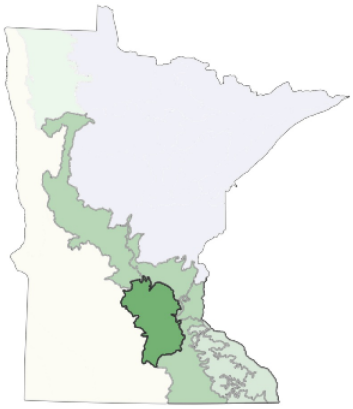


Figure 3. The Big Woods region shaded in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Moraine (3) Lake plain (4) Outwash plain
Runoff class	Negligible to very low
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	210–560 m
Slope	0–1%
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 150 days, while the frost-free period is 132 days. Average 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 sites. 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)	127-137 days
Freeze-free period (characteristic range)	146-154 days
Precipitation total (characteristic range)	762-864 mm
Frost-free period (actual range)	123-140 days
Freeze-free period (actual range)	142-161 days
Precipitation total (actual range)	762-889 mm
Frost-free period (average)	132 days
Freeze-free period (average)	150 days
Precipitation total (average)	813 mm

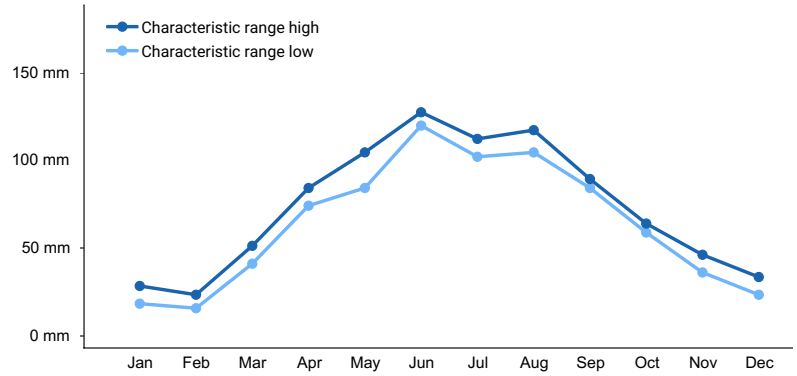


Figure 4. Monthly precipitation range

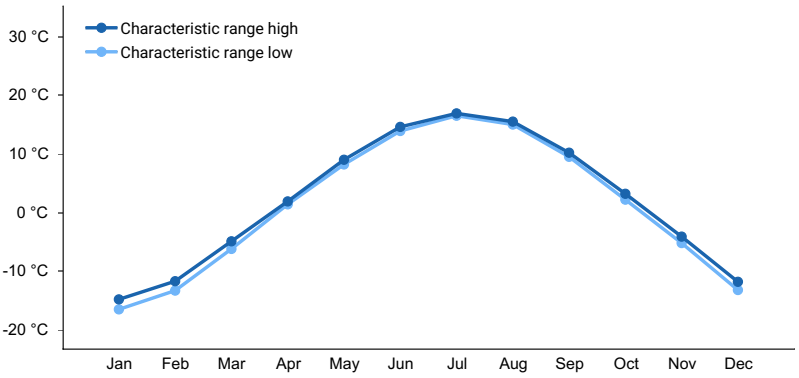


Figure 5. Monthly minimum temperature range

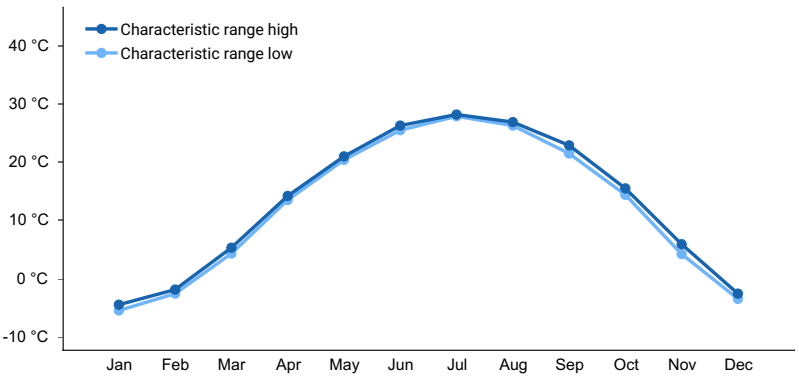


Figure 6. Monthly maximum temperature range

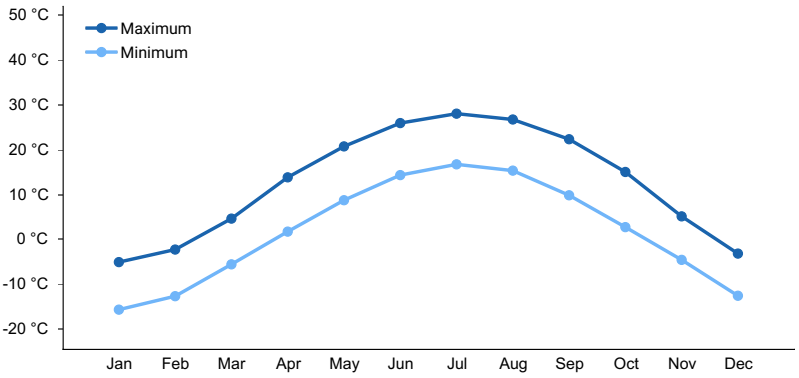


Figure 7. Monthly average minimum and maximum temperature

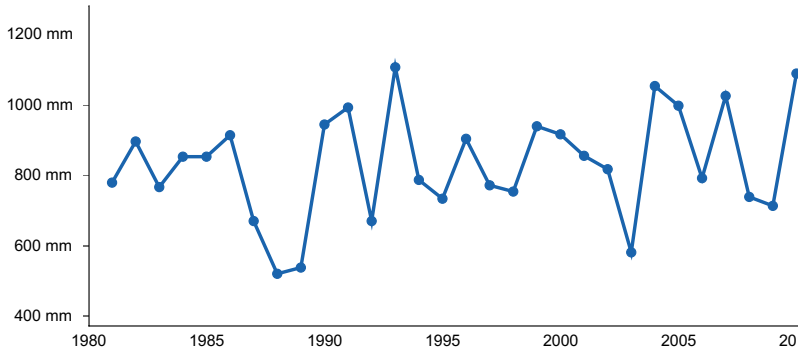


Figure 8. Annual precipitation pattern

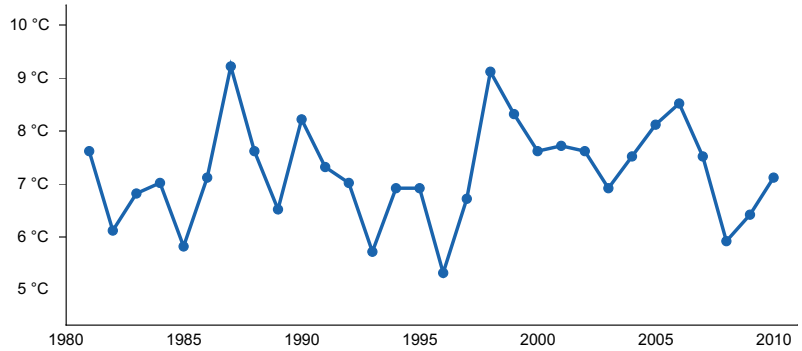


Figure 9. Annual average temperature pattern

Climate stations used

- (1) WELLS [USC00218808], Wells, MN
- (2) LITCHFIELD [USC00214778], Litchfield, MN
- (3) DELANO [USC00212088], Delano, MN
- (4) FOREST CITY 2 NNE [USC00132977], Forest City, IA
- (5) WASECA EXP STN [USC00218692], Waseca, MN

Influencing water features

With natural hydrology intact, the Shallow Lakes ecological site receives water from direct precipitation and runoff from uplands. During most months, especially the warmer months, this site receives runoff. During the spring, this site can be ponded frequently and for a very long duration. In a natural undrained state, this site was once a shallow lake.

Soils are classified as endosaturated as the water table is typically above the soil surface during wet periods. The water table may drop to as low as three feet from the surface during dry periods. This site is defined by its hydrologic relationship with a regional groundwater table. Water mostly enters the subsurface upslope and contributes to the regional groundwater table which is expressed by the level of water in the shallow lake, or if drained, the water table in the organic soil.

The site has a Cowardin Hydrologic classification of Lacustrine Limnetic or Palustrine, Emergent Wetland Persistent, Seasonally Saturated. It has a United States Army Corps of Engineers Wetland Plant Community of H; Deep Marshes.

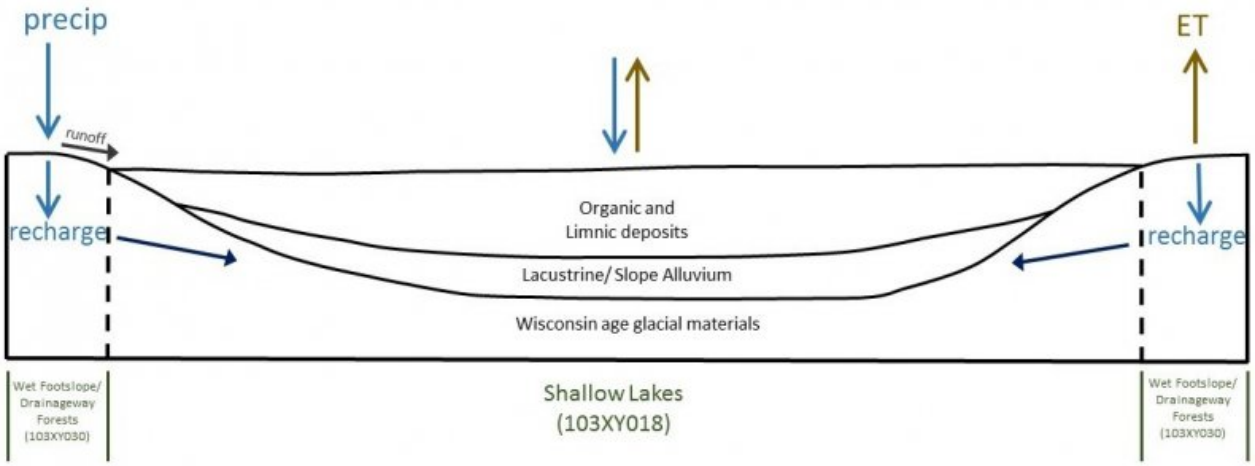


Figure 10. Representation of hydrological factors in a typical area of the Shallow Lakes and associated ecological sites.

Figure 11. A Shallow Lake ecological site that was formerly drained and farmed. This site is now under restoration.

Soil features

Soils of this ecological site are rich in organic matter and developed under emergent, hydrophytic vegetation and ponded conditions. Some areas were ponded too deep for emergent vegetation. Organic soils have thick, dark histic horizons composed mainly of organic matter, mostly the remains of plants. A histic horizon consists of organic material that: is saturated with water for 30 consecutive days or more in most years (unless it has been drained). Some of the histic materials in the soils included in this site are non-herbaceous organic marine sediments, or coprogenous earth. Typic Histosols are the central concept of this site. These soils have a mineral substratum greater than a depth of 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 percent organic matter. The majority of the Terric Histosols have a loamy substratum. Deep or Typic Haplosaprists like Muskego, Caron, and Houghton are the most extensive soil series for this site.

These soils formed under saturated conditions that produced anaerobic conditions during much of the year. The anaerobic conditions inhibit the decomposition of the organic matter which accumulates to form organic soils. Beneath the organic matter mantle, these soils have an organic-rich mineral A horizon which eventually grades into a 2C horizon. The A and 2C horizon, when present, typically do not represent the modal glacial till in MLRA 103 but are more representative of glaciofluvial or slope wash materials derived from original Des Moines lobe materials. Since this site formed in shallow lakes and ponds, a certain amount of sediment washed into the depressions before the organic material started to accumulate.

The soil series making up this site are Muskego, Caron, Klossner, and Blue Earth.

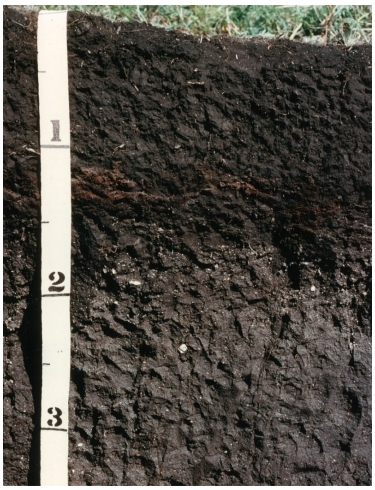


Figure 12. A Muskego soil profile.

Table 4. Representative soil features

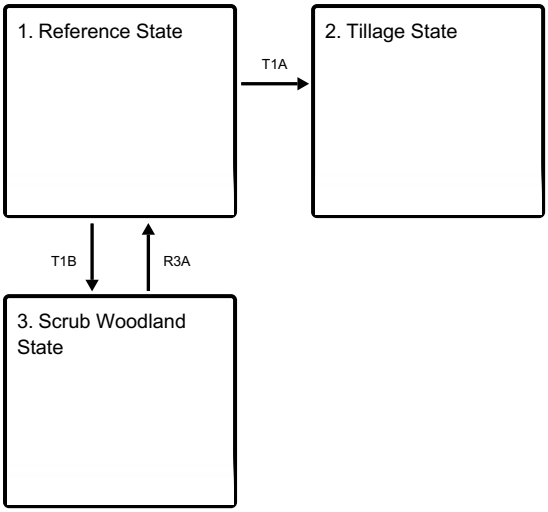
Parent material	(1) Organic material (2) Glaciofluvial deposits
Surface texture	(1) Muck
Drainage class	Very poorly drained
Permeability class	Slow to very rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	22.86–68.58 cm
Calcium carbonate equivalent (0-101.6cm)	0–80%
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

The Shallow Lakes ecological site is primarily located in eastern and northeastern MLRA 103 including the Big Woods ecoregion. The landscape in this areas is characterized by a topography with shallow bowl-type depressions which include this ecological site. The state and transition model (STM) consists of three states: Reference State, Tillage State, and the Scrub Woodland State. The Reference State describes a site with native, hydrophytic vegetation. State 2 is the Tillage State which describes land transitioned to agricultural production. State 3 is a Scrub Woodland State in which disturbances have modified the plant community composition and structure.

State and transition model

Ecosystem states

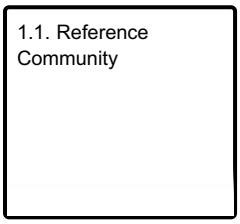


T1A - Transition to agriculture; tillage; seeding; continued management

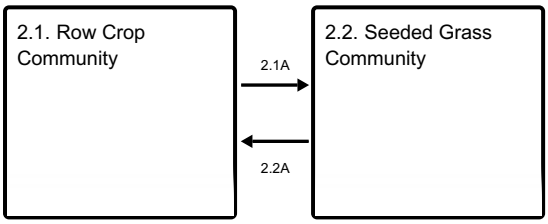
T1B - Hydrological alterations; invasive species

R3A - Restoration of site including hydrology and plant community

State 1 submodel, plant communities



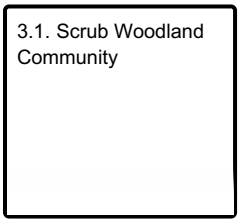
State 2 submodel, plant communities



2.1A - Seeding of desired grass species

2.2A - Row crop production

State 3 submodel, plant communities



State 1
Reference State

The Shallow Lakes ecological site reference state exhibits a diversity of hydrophytic native plant species. Plant community structure and composition within the reference state are variable and dependent upon depth of water. Open water areas will be dominated by American white waterlily and Coon's tail. Deep marsh areas will be dominated by softstem bulrush and broadfruit bur-reed. High-quality, undisturbed areas are uncommon in MLRA 103 as many sites have been transitioned to, or are impacted hydrologically, by human disturbance.

Dominant plant species

- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- coon's tail (*Ceratophyllum demersum*), other herbaceous
- American white waterlily (*Nymphaea odorata*), other herbaceous

Community 1.1
Reference Community

Plant community composition and structure on this ecological site is directly related to the hydrology. Area of open water will be dominated by American white waterlily and Coon's tail. With a reduction of water depth, species such as softstem bulrush and broadfruit bur-reed will increase. Numerous native, hydrophytic species are endemic to this site when natural hydrology exists.

Dominant plant species

- softstem bulrush (*Schoenoplectus tabernaemontani*), grass
- broadfruit bur-reed (*Sparganium eurycarpum*), grass
- coon's tail (*Ceratophyllum demersum*), other herbaceous
- American white waterlily (*Nymphaea odorata*), other herbaceous

State 2
Tillage State

Soil tillage and altered hydrology are the primary mechanisms transitioning a site to the Tillage State. Most sites in State 2 were transitioned to agricultural production prior to current wetland protection regulations. Areas converted to agriculture will likely remain as such for the foreseeable future. A few areas within this ecological site have been seeded to grass. This may occur under a NRCS conservation program. Other areas are utilized for pasture or hay production. Species selection will depend on the landowner’s objectives and site specifics.

Dominant plant species

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

Community 2.1
Row Crop Community

The Tillage Community typically consists of intensively produced, traditional row crops. Tillage, hydrological modifications, and intentional plant establishment (crop seeding) 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

Community 2.2
Seeded Grass Community

This community is a seeded grassland. Some areas may be included in a NRCS conservation program. Other areas are utilized for grazing or hay production. Reed canarygrass is a commonly planted cool season grass for pasture and hay production. Woody species and weeds, such as giant ragweed (*Ambrosia trifida* L.) and stinging nettle (*Urtica dioica* L.), will encroach, so continual management is required to control weeds and shrubs. Although these sites are not ecological diverse, they do offer some benefits to water quality, soil health, and bird species.

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), grass

Pathway 2.1A
Community 2.1 to 2.2

Establishment of desired grass species.

Conservation practices

Forage and Biomass Planting

Pathway 2.2A
Community 2.2 to 2.1

Establish row crop agricultural production through tillage, seeding, fertilizing, weed control, and harvest management.

State 3
Scrub Woodland State

This State is characterized by woody vegetation and human disturbance. Often, non-native species may be present. Eastern cottonwood, black willow, boxelder, reed canarygrass and giant ragweed are common. Sites may be in 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 state and federal wetland protection laws.

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- boxelder (*Acer negundo*), tree
- reed canarygrass (*Phalaris arundinacea*), grass
- great ragweed (*Ambrosia trifida*), other herbaceous

Community 3.1
Scrub Woodland Community

This community is characterized by altered hydrology and woody vegetation. Some sites will exhibit a mix of native and non-native species. Trees often include eastern cottonwood, black willow, and boxelder. Groundcover composition varies depending on hydrology, shade levels, and site disturbance. Giant ragweed and reed canarygrass are common.

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), tree
- boxelder (*Acer negundo*), tree
- reed canarygrass (*Phalaris arundinacea*), grass
- great ragweed (*Ambrosia trifida*), other herbaceous

Transition T1A
State 1 to 2

Transition T1A is the conversion of the reference state to agriculture. The triggers are tillage and intentional plant establishment (crop seeding). Hydrological modifications, such as ditching and tiling, are often also installed. Resilience management practices include continual agricultural practices such as seeding, fertilizing, and managing invasive plants with herbicides or field cultivation.

Transition T1B

State 1 to 3

Hydrological alterations, invasion of non-native vegetation, and other human disturbances will transition a reference site to a scrubby woodland. Community structure and composition will vary depending on the hydrology and severity/type of disturbances.

Restoration pathway R3A
State 3 to 1

Complete restoration of wetland basin. Restoration of native plant community.

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC.

Cowardin, L. M., V. Carter, F. C. Golet, and E.T. LaRoe. 1979 (Revised 2013). Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, U.S. Department of Interior-Fish and Wildlife Service, Washington, D.C.

Gleason, R. A., N. H. Euliss Jr., D. E. Hubbard, and W. G. Duffy. 2004. Invertebrate Egg Banks of Restored, Natural, and Drained Wetlands in the Prairie Pothole Region of the United States. Wetlands 24:3, 562-572.

H.R. 2100 – 99th Congress: Food Security Act of 1985, Pub. L. No. 99-198, Stat 1504, Sec. 1221-1223.

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

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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	05/19/2024
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):

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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:

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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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
