USDA Natural Resources Conservation Service

Ecological site F103XY027MN
Loamy Wet Forests

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

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

U.S. Department of Agriculture (USDA)
Land Resource Regions and Major Land Resource Areas (USDA_NRCS, 2006)
Major Land Resource Area (MLRA): Central Iowa and Minnesota Till Prairies (103)

U.S. Forest Service (USFS)
National Hierarchical Framework of Ecological Units (Cleland et al., 2007)
Section: North central Glaciated Plains (251B)
Subsections: Upper Minnesota River-Des Moines Lobe (251BA) and Southern Des Moines Lobe (251Be)

International Vegetation Classification Hierarchy
Class: 1 Forest & Woodland
Subclass: 1.B Temperate & Boreal Forest & Woodland
Formation: 1.B.2 Cool Temperate Forest & Woodland

The reference state shares similarities to the Minnesota Department of Natural Resources MHs49 Southern Wet-Mesic Hardwood Forest

Ecological site concept

The Loamy Wet Forests ecological site occurs on loamy textured soils that have a seasonal depth to soil saturation of 0 to 30 cm. This site is located on end and lateral moraines in the Northeastern portion of MLRA 103. No flooding

or ponding usually occurs. Landforms include lake plains and lateral end and ground moraines.

Associated sites

R103XY018MN	**Shallow Lakes** The Shallow Lakes ecological site is ponded in the natural state. Soils are poorly drained Histosols that are high in organic matter content and developed in shallow lakes.
F103XY025MN	**Loamy Upland Forests** The Loamy Upland Forests ecological site occurs on upland 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.
R103XY017MN	**Organic Wet Meadow/Carr** The Organic Wet Meadow/Carr ecological site occurs in low wetland areas. These sites are usually ponded, have a high water table (i.e. endosaturated), and are classified as very poorly drained. Water-tolerant vegetation such as cattails, bulrushes, and sedges are dominant.
F103XY036MN	**Depressional Wet Forests** The Depressional Wet Forests ecological 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 during dry periods. The included soils are classified as Cumulic Endoaquolls that developed under forest vegetation and have a thick accumulation of slope alluvium.
F103XY024MN	**Sandy Upland Forests** The Sandy Upland Forests ecological site is located on soils that have a surface texture of loam, sandy loam, or sand and have a layer of sandy or gravelly material below the surface horizon. These soils were formed predominantly under forest vegetation.

Similar sites

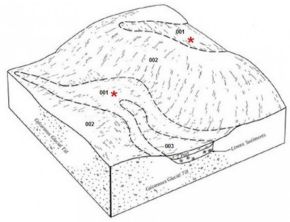
F103XY030MN	**Wet Footslope/Drainageway Forests** The Wet Footslope/Drainageway Forests ecological site is located on lower footslopes or in wet drainageways. The soils are derived from loamy or clayey colluvium, slope alluvium, alluvium, or a combination of these parent materials. Soil drainage class is somewhat poorly drained to poorly drained.

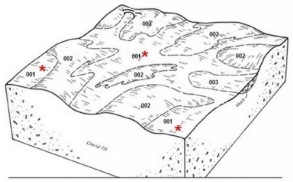
Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Fraxinus nigra*
Shrub	(1) *Celtis occidentalis*
Herbaceous	(1) *Laportea canadensis*

Physiographic features

The Loamy Wet Forests ecological site occurs on end and lateral moraines in the northeastern part of MLRA 103 including the Big Woods ecoregion in Minnesota. Landform positions include drainageways, footslopes, toeslopes, depressions, or low slope gradient linear segments. The landform positions are linear to slightly concave both horizontally and vertically.





Code	Ecological Site Name	Representative Soil Series
001	Loamy Wet Forest	Cordova, Dundas
002	Loamy Upland Forest	Lester, Hayden
003	Organic Wet Meadow/Carr	Klossner, Muskego

Figure 1. Block diagrams of representative Loamy Wet Forests and associated ecological sites.

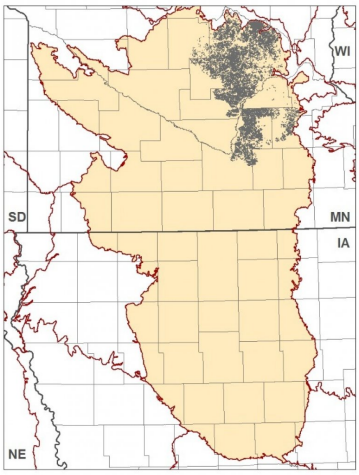


Figure 2. Distribution of the Loamy Wet Forests ecological site within MLRA 103. In many cases, the data set is not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.

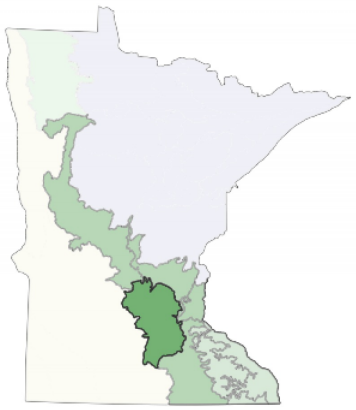


Figure 3. The state of Minnesota with the Big Woods ecoregion shaded in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope
Landforms	(1) End moraine (2) Lateral moraine (3) Drainageway (4) Depression

Runoff class	Negligible to low
Elevation	669–1,601 ft
Slope	0–3%
Water table depth	0–47 in
Aspect	Aspect is not a significant factor

Climatic features

The soil temperature regime of MLRA 103 is “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The average mean freeze-free period of this ecological site is 153 days, while the frost-free period is 134 days. The average mean annual precipitation total is 31 inches. Cold air drainage and the fact that wet soils are colder than dry soils make this site slightly colder than adjacent sloping landforms.

Table 3. Representative climatic features

Frost-free period (characteristic range)	133-135 days
Freeze-free period (characteristic range)	149-157 days
Precipitation total (characteristic range)	30-31 in
Frost-free period (actual range)	133-136 days
Freeze-free period (actual range)	148-159 days
Precipitation total (actual range)	30-31 in
Frost-free period (average)	134 days
Freeze-free period (average)	153 days
Precipitation total (average)	31 in

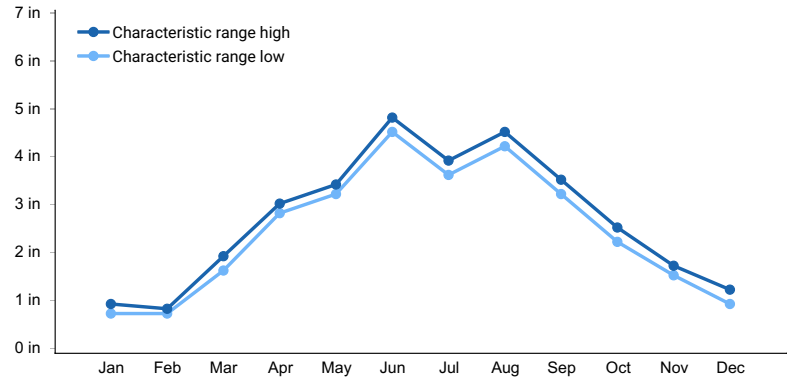


Figure 4. Monthly precipitation range

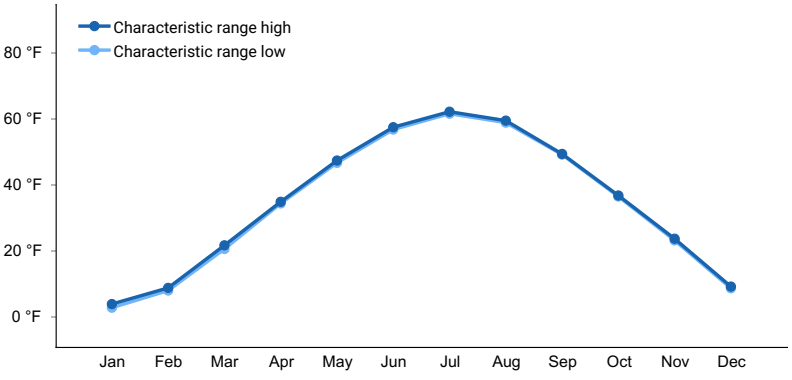


Figure 5. Monthly minimum temperature range

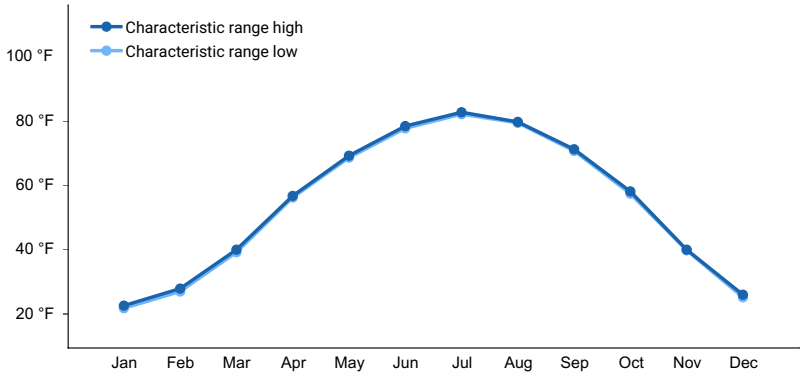


Figure 6. Monthly maximum temperature range

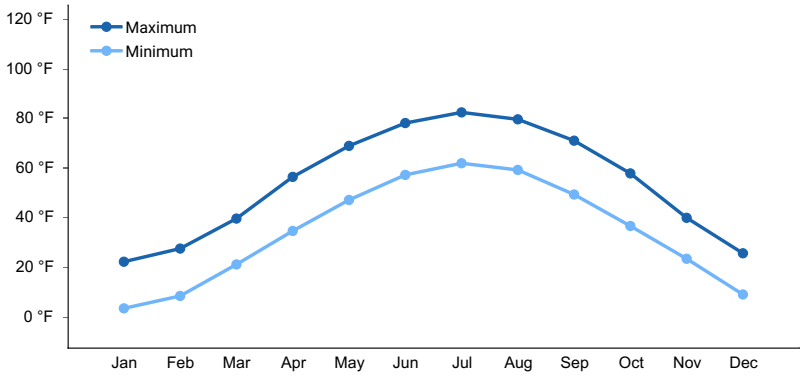


Figure 7. Monthly average minimum and maximum temperature

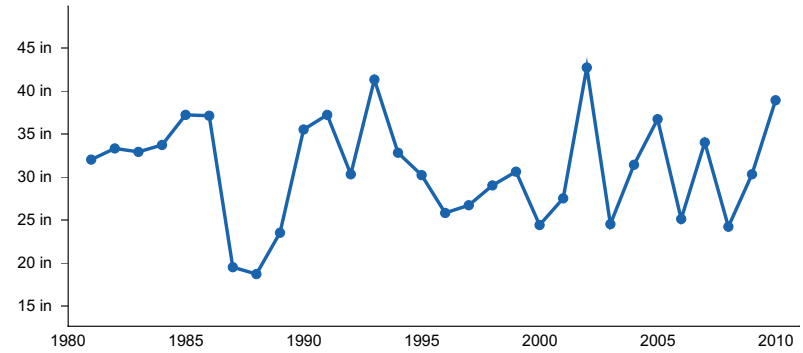


Figure 8. Annual precipitation pattern

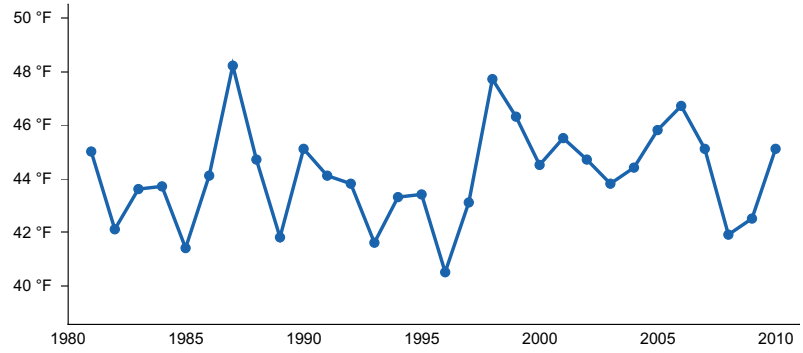


Figure 9. Annual average temperature pattern

Climate stations used

- (1) BUFFALO 2NE [USC00211107], Buffalo, MN
- (2) DELANO [USC00212088], Delano, MN
- (3) GAYLORD [USC00213076], Gaylord, MN

Influencing water features

The Loamy Wet Forests ecological site receives water through precipitation, runoff, and lateral subsurface flow. For some areas, direct precipitation may be the only water source they receive, and they serve as groundwater recharge areas. Spring is the wettest time of the year. The soils of this ecological site are classified as endosaturated. The soil saturation is at or very near the soil surface during the spring months and may drop to as low as six feet or more later during dry periods. In the hydrogeomorphic (HGM) classification system, the Loamy Wet Forests ecological site is considered a Mineral Flat wetland, producing recharge to adjacent ecological sites (USDA-NRCS, 2008; Gilbert et al., 2006). This ecological site also has a Saturated Cowardin Hydrologic Regime of Palustrine; Forested, Broad-Leaved Deciduous. It also has a United States Army Corps of Engineers Wetland Plant Community of C; Hardwood Swamps, Shrub-Carrs and Alder Thickets (Mineral Soils).

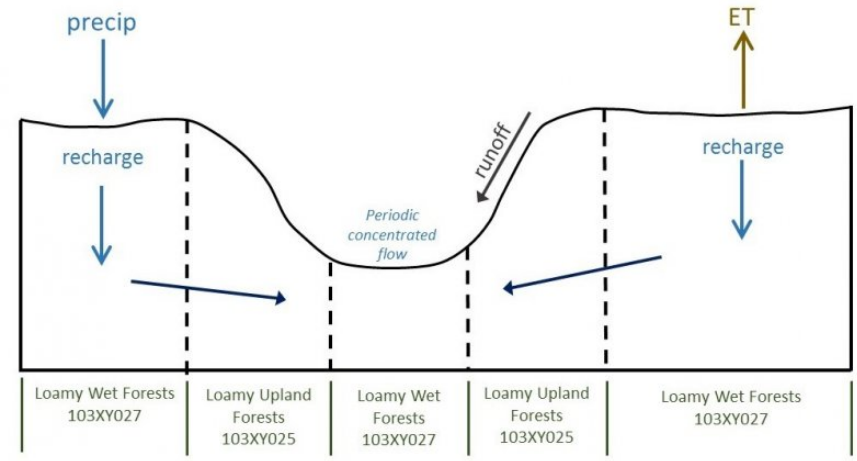


Figure 10. Representation of hydrological factors in a typical area of Wet Loamy Forests and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

The Loamy Wet Forests ecological site is located predominately on Cordova and Dundas soils. Parent material is loamy glacial till. Soils are loamy in texture (clay loam, loam, silty clay loam, or silt loam). Soil depth is very deep (>60 inches to bedrock). Coarse fragments are between 0 and 12 percent by volume. The drainage class is poorly drained, and the seasonal high water table is at or very near the surface. Soil pH classes are strongly acid to moderately alkaline throughout the series control section.

These soils formed under deciduous forest vegetation and classified as Typic Argiaquolls or Mollic Endoaqualfs. Since the site is often in a slight depression, they can accumulate slope alluvium. As a result of this accumulation, the soil profile may have a thick, dark, soil layer (mollic epipedon). These soils were formed under saturated conditions that produced anaerobic conditions during part of the year. Organic matter tends to mask the redoximorphic features that are used to determine seasonal high depth to saturation. The primary hydric soil indicator is a thick, dark surface (A12; USDA-NRCS, 2010).

Table 4. Representative soil features

Parent material	(1) Till
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam (4) Silt loam
Drainage class	Poorly drained
Permeability class	Very slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%

Surface fragment cover >3"	0–2%
Available water capacity (0-60in)	9.8–11.1 in
Calcium carbonate equivalent (0-40in)	0–30%
Soil reaction (1:1 water) (0-40in)	5.1–8.4
Subsurface fragment volume <=3" (0-40in)	0–5%

Ecological dynamics

The Reference State is a mixed, deciduous, mature forest with a diversity of both canopy and understory species. Canopy species include sugar maple, black ash, slippery elm, and hackberry. The groundcover layer is variable and includes numerous native forbs and sedges. This site is largely confined to the eastern and northeastern portion of MLRA 103 where fire has been historically suppressed by topography and density of waterbodies. This site is common within the Big Woods ecoregion of Minnesota.

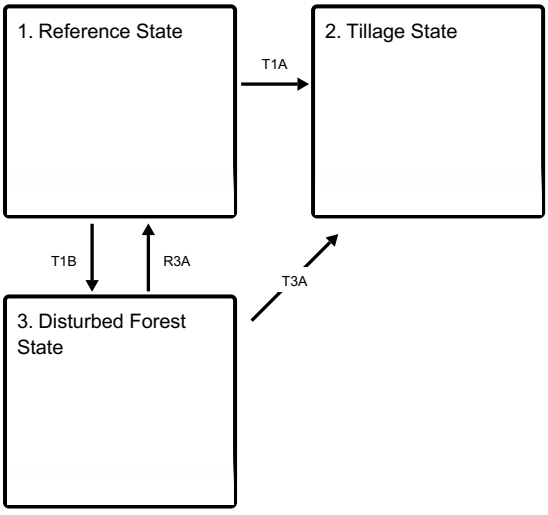
The Tillage State is characterized by tillage and agricultural crop production. The two communities under this state are the Row Crop Community and the Seeded Grassland Community.

The Disturbed Forest State is a wooded site that has undergone plant community changes due to human disturbances. Triggers include tree removal, invasive plants, and unmanaged grazing. These sites are dominated by various hardwoods along with invasive species, and do not have the ecological stability or native plant diversity of a reference state.

The current dominant land use is corn and soybean production. Areas not in row crop agriculture tend to exist as forested preserves or are in other miscellaneous land uses.

State and transition model

Ecosystem states



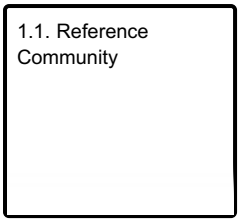
T1A - Site is cleared, tilled, seeded, and managed for crop production

T1B - Site incurs large-scale disturbance and altered plant community

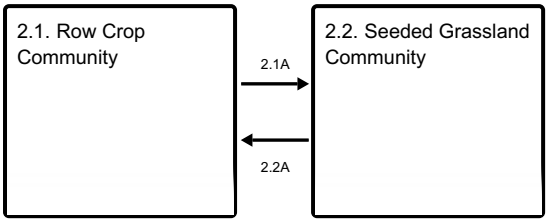
R3A - Restoration of natural hydrology; establishment of desired species; exclusion of anthropogenic disturbances; eradication of invasive species; long-term timber stand management

T3A - Site cleared, soil tillage, crop establishment, and continued agriculture management

State 1 submodel, plant communities



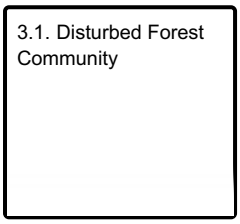
State 2 submodel, plant communities



2.1A - Seeding and management of warm or cool season grasses.

2.2A - Site preparation, soil tillage, crop establishment, weed control

State 3 submodel, plant communities



State 1
Reference State

This state is a mature deciduous forest with multiple tree species including sugar maple, black ash, slippery elm, and hackberry. The shrub layer density is variable and includes hardwood seedlings and saplings. The ground-layer consists of a variety of native forbs and sedges including Canadian woodnettle.

Resilience management. Resilience management practices include monitoring for invasive vegetation, applying herbicides as needed, and excluding grazing and logging.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- black ash (*Fraxinus nigra*), tree
- slippery elm (*Ulmus rubra*), shrub
- common hackberry (*Celtis occidentalis*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

Community 1.1
Reference Community

The Reference Community is characterized by a deciduous canopy species, a variable shrub layer, and a diverse ground cover of herbaceous species. Typical species include sugar maple, black ash, slippery elm, and hackberry. Historically, elms were dominant on this ecological site, but due to the Dutch elm disease, their number are now greatly reduced.

Resilience management. Resilience management practices include monitoring for invasive vegetation, applying weed control methods as needed, and excluding disturbances such as grazing and large-scale timber harvesting.

Dominant plant species

- sugar maple (*Acer saccharum*), tree
- black ash (*Fraxinus nigra*), tree
- slippery elm (*Ulmus rubra*), shrub
- common hackberry (*Celtis occidentalis*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

State 2
Tillage State

This State describes areas in crop production or areas that were tilled but now are seeded to grass. Pathway mechanisms include preparing the site, planting desired species, applying herbicide, applying fertilizer, and hydrological modifications (tiling and ditching) which are commonly installed to improve drainage. Soil tillage is the primary trigger to State 2. Tillage alters dynamic soil properties, including bulk density, structure, organic carbon content, and saturated hydraulic conductivity. Intensive tillage negatively impacts soil ecological functions. Conservation practices can help mediate these soil health impacts. Conservation tillage minimizes soil disturbance and improves soil health. A cover crop rotation builds soil structure, improves infiltration rates, and protects water quality. Some areas within this ecological site have been converted to a warm-season grasses under a NRCS conservation program. Plantings may include native grasses and forbs to benefit wildlife and pollinators. Species selection will depend upon hydrology and landowner objectives. Cool-season grasses are also feasible. Common species include reed canarygrass and Kentucky bluegrass. Seeded grasslands are not as biologically diverse as native grasslands; however, they still offer benefits for wildlife, water quality, and soil health.

Resilience management. Seeding, fertilizing, and controlling weeds and brush are resilience management practices for cool-season grasslands. Prescribed fire can be a resilience management practice on warm-season grasslands.

Dominant plant species

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

Community 2.1
Row Crop Community

Community 2.1 consists of intensive row crop agriculture. Soil tillage and intentional plant establishment are the primary triggers. The most common crops are corn and soybeans on an annual rotation. A secondary trigger is drainage modifications (ditching and tiling), which may be installed to improve soil drainage.

Resilience management. Resilience management practices include preparing the sites, planting, fertilizing, controlling weeds, and harvesting. The maintenance of the desired vegetation community is controlled by the intensity, frequency, duration, and timing of agricultural practices.

Dominant plant species

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

Community 2.2
Seeded Grassland Community

The Seeded Grassland Community grows in areas that were previously tilled and used for agricultural production, but have been transitioned to either warm-season or cool-season grasses. Management inputs include seeding, fertilizing, and controlling weeds and brush. Many of these areas are eventually transitioned to annual crop production.

Resilience management. The resilience management practices may include planting desired species, managing grazing, mowing, fertilizing, and controlling unpalatable plant species. Prescribed fire is a resilience management practice for warm-season grasslands. The controlled application of fire modifies vegetation structure and influence ecological processes.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass

Pathway 2.1A
Community 2.1 to 2.2

This pathway converts Community 2.1 (row crops) to Community 2.2 (seeded grassland). The primary mechanism of change is the seeding of desired grass species. Species selection will depend upon site characteristics including hydrology.

Conservation practices

Forage and Biomass Planting

Pathway 2.2A
Community 2.2 to 2.1

This pathway describes the site transitioning from a seeded grassland to row crop agriculture. This is a common pathway throughout MLRA 103 as sites are placed in crop production. The mechanisms of change are tillage and intentional plant establishment (crop seeding).

State 3
Disturbed Forest State

This state describes a wooded site that has been disturbed and exhibits altered forest species composition. Numerous ruderal woodland and forest plant communities may occur on this ecological site depending on the type and severity of disturbance, available seed sources, and management activities. Hardwood trees (maple, ash, elm) and non-native species are common.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- maple (*Acer*), tree
- elm (*Ulmus*), tree
- common buckthorn (*Rhamnus cathartica*), tree
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Disturbed Forest Community

Community 3.1 is an altered forest community caused by previous or ongoing human disturbances. Invasive species are common in this community. Canopy composition varies depending on the severity and type of disturbances, community age, and seed sources. Invasive, non-native species are common on these sites and will continue to increase without management intervention.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- maple (*Acer*), tree
- elm (*Ulmus*), tree
- common buckthorn (*Rhamnus cathartica*), tree
- Kentucky bluegrass (*Poa pratensis*), grass

Transition T1A
State 1 to 2

Transition T1A is the conversion of the Reference State to agriculture. The triggers are site clearing, soil tillage, and intentional plant establishment (crop seeding). Hydrological modifications, such as ditching and tiling, may be present.

Constraints to recovery. Site clearing and soil tillage preclude recovery of the former state.

Transition T1B
State 1 to 3

Transition T1B is a transition from a mature deciduous forest to a disturbed (ruderal) forest. Triggers include timber harvest, surface site disturbance, grazing, and introduction of non-native species. The native plant community is altered, and these areas do not exhibit the ecological function or vegetative composition of State 1.

Restoration pathway R3A
State 3 to 1

Restoration to the Reference State may be feasible for some sites. Management inputs include establishment of desired species, forest stand management, and control of invasive species. Natural hydrological function of the site is important.

Conservation practices

Brush Management

Transition T3A
State 3 to 2

Transition T3A is the transition of a disturbed forest state to agriculture production. This is a common pathway in MLRA 103. The mechanisms of change include timber harvest, site preparation, tillage, and intentional plant establishment (crop seeding). Continued resilience management practices are necessary to maintain the plant community and include weed control (herbicide application), disturbance management (field cultivating), and harvest management.

Constraints to recovery. Soils tillage and the transition to agriculture preclude recovery of the former state.

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

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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	05/04/2024
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:**

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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:

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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:**
