USDA Natural Resources
Conservation Service

# Ecological site F103XY024MN
# Sandy Upland Forests

Last updated: 10/04/2023
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

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
Division: 1.B.2.Na Eastern North American Forest & Woodland

Relationship to Other Established Classifications:
This ecological site shares similarities with the Minnesota Department of Natural Resources
MHs37 Southern Dry-Mesic Oak Forest, MHs38 Southern Mesic Oak-Basswood Forest

## Ecological site concept

The Sandy Upland Forests ecological site is located on upland soils that have a surface texture of loam, sandy

loam, or sand with a layer of sandy or gravelly material below the surface horizon. These soils were formed predominantly under forest vegetation.

## Associated sites

| | |
|---|---|
| F103XY025MN | **Loamy Upland Forests**<br>The Loamy Upland Forests ecological site is located on upland soils that are derived from loamy till and exhibit a dark surface layer (mollic epipedon). Soil texture is loam, sandy loam, or loamy sand. Soils are somewhat poorly drained to well drained. |
| F103XY027MN | **Loamy Wet Forests**<br>The Loamy Wet Forests ecological site is located on footslopes and toeslopes. The soils have a dark surface layer (mollic epipedon) and are poorly drained. The soils are derived from fine loamy till, so have a loamy surface texture. This site is located lower in the landscape than the Sandy Upland Forests ecological site. |

## Similar sites

| | |
|---|---|
| F103XY025MN | **Loamy Upland Forests**<br>The Loamy Upland Forests ecological site is located on upland soils that are derived from loamy till and exhibit a dark surface layer (mollic epipedon). Soil texture is loam, sandy loam, or loamy sand. Soils are somewhat poorly drained to well drained. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Quercus macrocarpa*<br>(2) *Acer saccharum* |
| Shrub | (1) *Prunus virginiana*<br>(2) *Sambucus racemosa* |
| Herbaceous | (1) *Circaea* |

## Physiographic features

The Sandy Upland Forests ecological site occurs primarily on end and lateral moraines, outwash plains, stream terraces, valleys and kames in northeastern MLRA 103. This site is primarily found in an area known as the Big Wood ecoregion in Minnesota. The most common landform positions include backslopes, depressions, low gradient linear slopes, shoulders, summits, and footslopes.

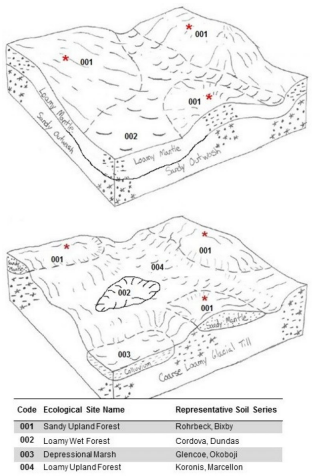



**Figure 1. Block diagrams of representative Sandy Upland Forests and associated ecological sites.**

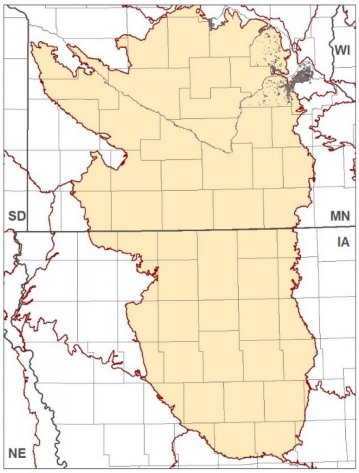



**Figure 2. Distribution of the Sandy Upland Forests ecological site within MLRA 103. In many cases, data are not spatially consistent across political boundaries due to the method by which soils were mapped; e.g. due to county subsets.**

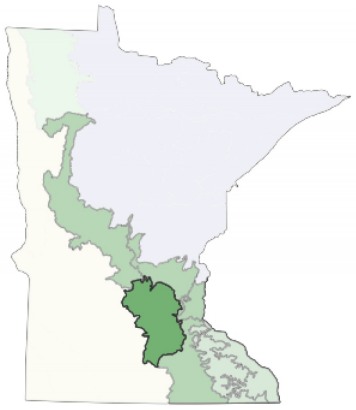


**Figure 3. The state of Minnesota with the Big Woods ecoregion shaded in deep green. (Minnesota Department of Natural Resources)**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Hillslope profile | (1) Backslope<br>(2) Shoulder<br>(3) Summit<br>(4) Footslope |
| Landforms | (1) Depression<br>(2) End moraine<br>(3) Lateral moraine<br>(4) Outwash plain<br>(5) Stream terrace<br>(6) Valley<br>(7) Kame |
| Runoff class | Negligible to high |
| Elevation | 984–1,499 ft |
| Slope | 1–40% |
| Water table depth | 20–80 in |
| Aspect | W, NW, N, NE, E, SE, S, SW |

## Climatic features

The soil temperature regime of MLRA 103 is “mesic” (i.e., mean annual soil temperature between 46 and 59°F). The mean annual precipitation average is 32 inches. The average frost free period is 128 days, and the average freeze free period is 154. This ecological site is warmer than adjacent downslope areas because of cold air

drainage and drier soils. Snow and frost melt sooner in the spring on these warmer soils, thus resulting in a longer growing season than in the adjacent, lower depressions.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 125-136 days |
| Freeze-free period (characteristic range) | 145-162 days |
| Precipitation total (characteristic range) | 31-34 in |
| Frost-free period (actual range) | 114-137 days |
| Freeze-free period (actual range) | 138-163 days |
| Precipitation total (actual range) | 31-34 in |
| Frost-free period (average) | 128 days |
| Freeze-free period (average) | 154 days |
| Precipitation total (average) | 32 in |

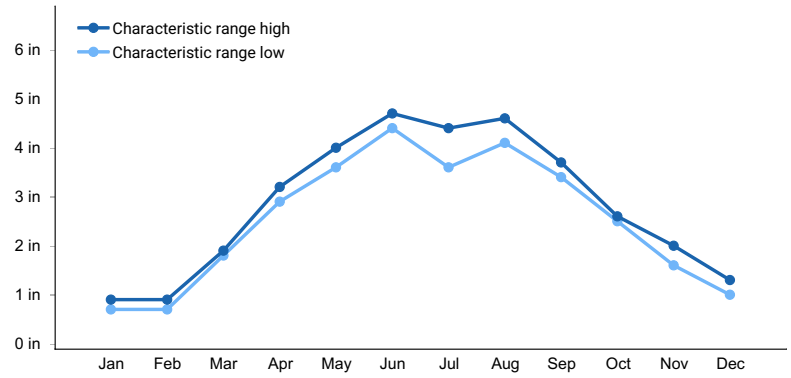



**Figure 4. Monthly precipitation range**

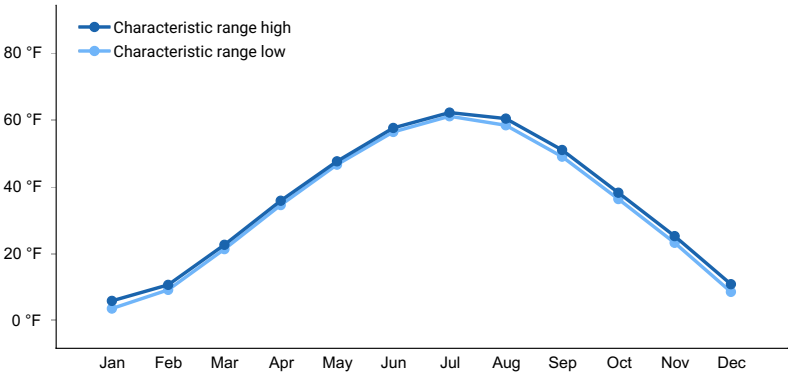



**Figure 5. Monthly minimum temperature range**

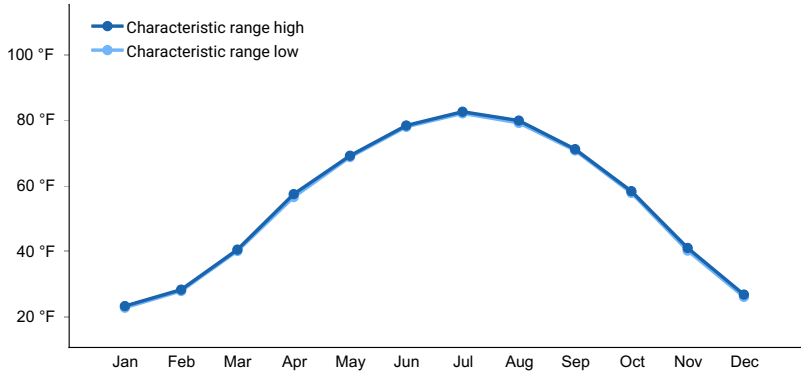



**Figure 6. Monthly maximum temperature range**

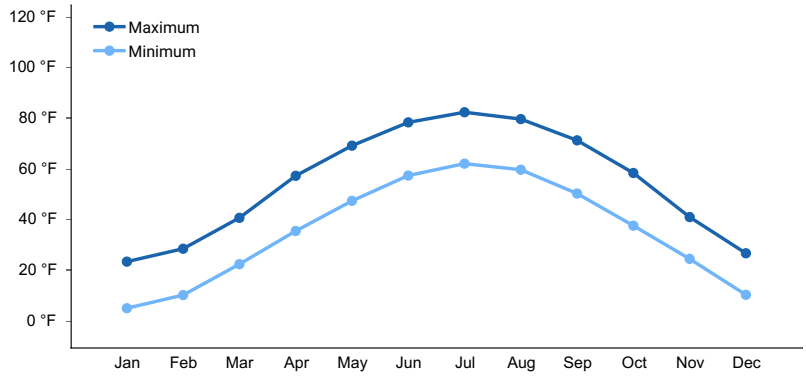



**Figure 7. Monthly average minimum and maximum temperature**

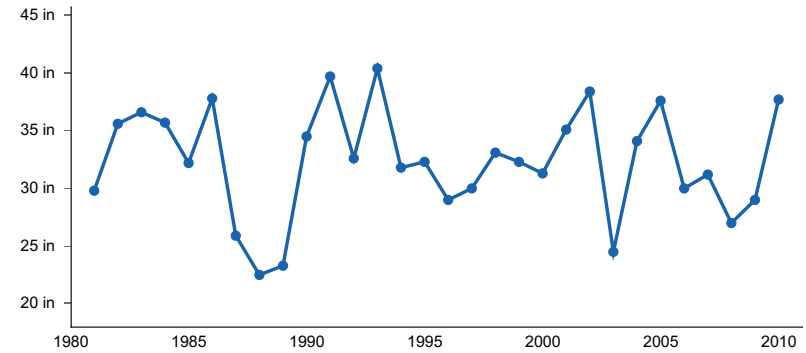



**Figure 8. Annual precipitation pattern**

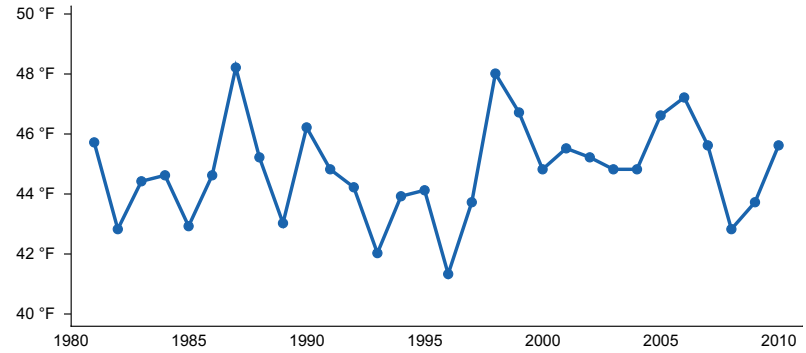



**Figure 9. Annual average temperature pattern**

## Climate stations used

- (1) NEW HOPE [USC00215838], Minneapolis, MN
- (2) CHANHASSEN WSFO [USC00211448], Chanhassen, MN
- (3) DELANO [USC00212088], Delano, MN
- (4) JORDAN 1SSW [USC00214176], Jordan, MN
- (5) ALBERT LEA 3 SE [USC00210075], Albert Lea, MN

## Influencing water features

The Sandy Upland Forests ecological site is endostaurated and receives water primarily from precipitation, lateral subsurface flow, and to a less extent, from runoff. Direct precipitation may be the only water source for some areas. Spring is the wettest time of the year for this site. Soil saturation on well-drained soils (Bixby, Burnsville) is not above 120 cm throughout the year. Soil saturation on moderately well-drained soils (Moon, Rohrbeck) is not above 50cm. The water holding capacity is lower compared to other soils that have a higher clay content.

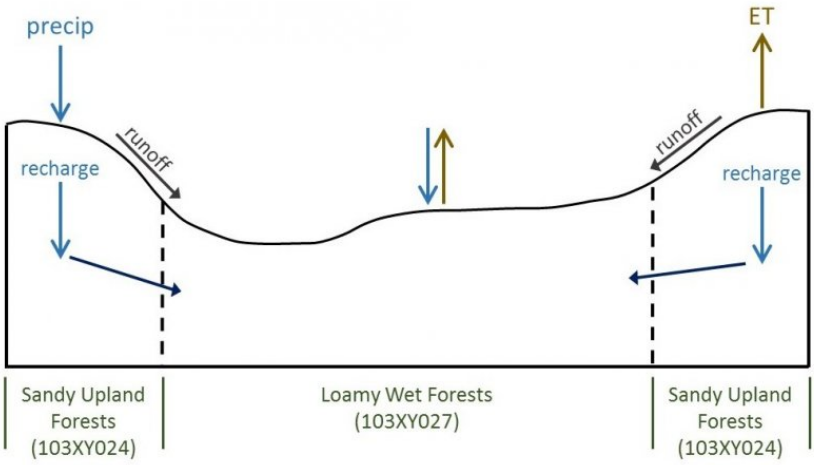



**Figure 10. Representation of hydrologic factors in a typical area of Wet Footslope /Drainageway and associated ecological sites on the Des Moines Lobe (MLRA 103).**

## Soil features

Soils associated with the Sandy Upland Forests ecological site developed predominantly under deciduous forests. Clay particles were illuviated from albic horizons higher in the soil profile and accumulated deeper. Argillic horizons form readily in Des Moines Lobe materials after leaching of all carbonates from the upper portion of the soil takes place (Grimm, 1984). These soils are very deep (>60 inches to bedrock) and are moderately well drained to well drained. The seasonal high depth to saturation stays below 50 centimeters from the surface.

Soil surface textures include sandy loam, loamy sand, or loam. Parent materials include loamy mantled outwash and outwash over loamy glacial till. The soil family particle size class is course loamy. Course fragments are between 0 and 42 percent by volume. Soil pH classes are strongly acid to moderately alkaline throughout the series control section. The dominant soil series are Moon, Bixby, Rohrbeck, and Burnsville.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Outwash<br>(2) Till |
| Surface texture | (1) Loamy sand<br>(2) Sandy loam<br>(3) Loam |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Moderate to rapid |
| Soil depth | 80 in |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-60in) | 4–8.5 in |
| Calcium carbonate equivalent (0-40in) | 0–20% |
| Soil reaction (1:1 water) (0-40in) | 5.7–8.4 |
| Subsurface fragment volume <=3" (0-40in) | 0% |
| Subsurface fragment volume >3" (0-40in) | 0–10% |

## Ecological dynamics

The Sandy Upland Forests Ecological Site has three states: the Reference State, the Tillage State, and the Disturbed Forest State.

The Reference State is a mature, deciduous forest with a substantial oak component. Small-gap disturbances occur naturally and result in a series of successional communities consisting of aspen, elm, sugar maple, elm, oak, and basswood. This ecological site can be affected by multiple natural triggers (disturbance processes) including wildfire, drought, insects, and windstorms. Wildfire intensity and frequency was historically reduced on this site due to topography and density of waterbodies.

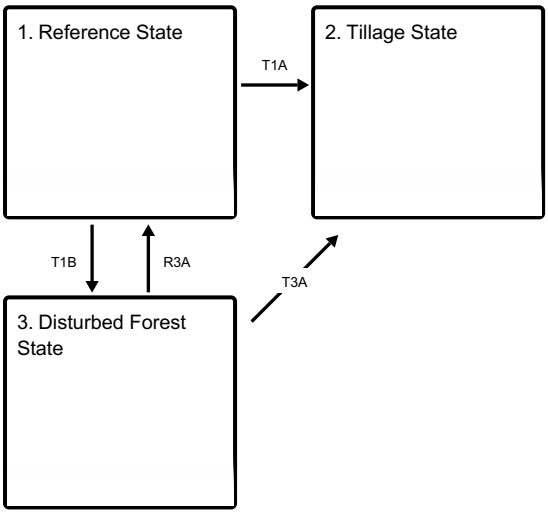
The Tillage State is characterized by tillage and agricultural crop production. The two communities under this state are the Row Crop Community and the Seeded Grassland Community. Management inputs include preparing the site, seeding, fertilizing, controlling weeds and brush, and harvesting. Slope is a limiting factor on many areas.

The Disturbed Forest State is a wooded site that has undergone plant community changes due to disturbance. Triggers include tree removal, invasive plants, and unmanaged grazing. Often, these areas have been disturbed and exhibit an understory with non-native vegetation. These sites do have some soil, water, and wildlife benefits, but do not have the ecological stability or native plant diversity of a reference state.

The most common triggers on this ecological site are timber harvest or the transition of lower slope areas to agriculture. Once a reference state has been transitioned to a tillage field, the reversibility class is irreversible.

## State and transition model

**Ecosystem states**



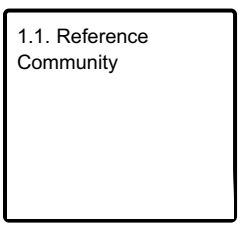

**T1A** - Site is cleared, tilled, seeded, and managed for crop production

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

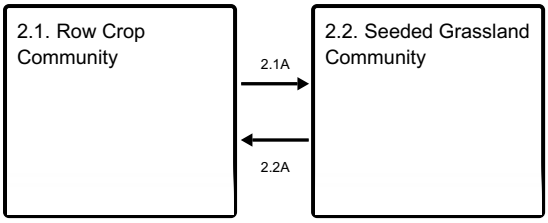
**R3A** - Restoration inputs including desired species establishment, disturbance exclusion, invasive species eradication, and stand management

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

**State 1 submodel, plant communities**



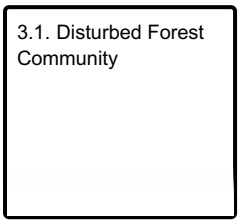
**State 2 submodel, plant communities**




**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

The Sandy Upland Forests Reference State is a mature deciduous forest with canopy coverage ranging from interrupted to continuous (50-100%). Oak species include bur oak on drier areas within this site. More mesic areas will have northern red oak (*Quercus rubra*). Other canopy species include sugar maple (*Acer saccharum*), basswood (*Tilia americana*), white oak (*Quercus alba*), and American elm (*Ulmus americana*). The shrub layer is patchy to interrupted (25%-75%) with variability influenced by soil characteristics, topography, and aspect. Common shrubs include chokecherry (*Prunus virginiana*), red elderberry (*Sambucus racemosa*), and prickly gooseberry (*Ribes cynosbati*). The ground-layer consists of a variety of native forbs, ferns, and fern allies. Few high-quality reference sites remain in MLRA 103.

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

**Dominant plant species**

- bur oak (*Quercus macrocarpa*), tree
- sugar maple (*Acer saccharum*), tree
- northern red oak (*Quercus rubra*), tree
- chokecherry (*Prunus virginiana*), shrub
- red elderberry (*Sambucus racemosa*), shrub
- enchanter's nightshade (*Circaea*), other herbaceous

## Community 1.1
## Reference Community

The Reference Community is characterized by multiple co-dominant canopy species, a substantial oak component, a moderate to dense shrub layer, and a diverse ground cover of native herbaceous species. Community composition will exhibit variation depending on slope, aspect, and available water capacity. Drier areas within this site will include bur oak. More mesic areas will include northern red oak. Other canopy species include sugar maple, basswood, white oak, and American elm. Natural small-gap disturbances within this community are filled with shrubs, tree seedlings, and tree saplings. These natural small-gap disturbances transition through successional plant communities. Oak, sugar maple, aspen, basswood, and elm are key successional species.

**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**

- bur oak (*Quercus macrocarpa*), tree
- sugar maple (*Acer saccharum*), tree
- northern red oak (*Quercus rubra*), tree
- chokecherry (*Prunus virginiana*), shrub
- red elderberry (*Sambucus racemosa*), shrub
- enchanter's nightshade (*Circaea*), other herbaceous

## State 2
## Tillage State

The Tillage State contains the Row Crop Community and the Seeded Grassland Community. This state describes areas currently 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 harvesting. Higher sloping areas within this ecological site are not appropriate for row crop production. When the slope gradient exceeds 20 percent, row crop production is unfeasible due to the farm machinery limitations. 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 help mediate soil health impacts. Conservation tillage minimizes soil disturbance and improves soil structure and soil health. A cover crop rotation builds soil structure, improves infiltration rates, reduces runoff and erosion, and protects water quality. Some areas within this ecological site have been converted to a warm-season grasses under the NRCS Conservation Reserve Program (CRP). Common species include big bluestem (*Andropogon gerardii* Vitman), switchgrass (*Panicum virgatum* L.), indiangrass (*Sorghastrum nutans*), and little bluestem (*Schizachyrium scoparium*). Plantings include perennial native forbs to benefit wildlife and pollinators. Leadplant (*Amorpha canescens*), common milkweed (*Asclepias syriaca*), butterfly weed (*Asclepias tuberosa*), hairy puccoon (*Lithospermum caroliniense*), asters (Aster spp.), gray goldenrod (*Solidago nemoralis*), New Jersey tea (*Ceanothus americanus*), and prairie clovers (Dahlia spp.) are native forbs suitable for sandy and loamy soils. Non-native, cool-season grasses are also feasible. Species include brome (Bromus spp.), reed canarygrass (Phalaris arunidinacea L.), and Kentucky bluegrass (*Poa pratensis* L.). Seed mix selection will depend on landowner goals and objectives. Seeded grasslands are not as species rich or biologically diverse as native grasslands; however, they still offer ecological benefits for wildlife, especially grassland birds, water quality protection, and soil health.

**Resilience management.** Resilience management practices include common agricultural practices such as seeding, fertilizing, and managing invasive plants with herbicides or field cultivation. Prescribed fire is a resilience management practice on warm-season grasslands. Seeding, fertilizing, and controlling weeds and brush are resilience management practices for cool-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. Many crops, however, are feasible for these areas. A secondary trigger is drainage modifications (ditching and tiling), which may be installed to improve soil drainage. Conservation tillage practices may be implemented to reduce soil erosion while still maintaining a crop rotation. These practices protect the soil surface from erosion and allow water to infiltrate instead of running off. Examples include no-till or ridge-till, which leave residue on the surface of the field. Additional soil health benefits can be gained by adding alternative crops to fields that are already in conservation tillage. By diversifying the crop rotation, landowners take additional management steps to improve soil health and protect water quality. Species may include legumes, clovers, beans, turnips, or small grains such as ryegrass, oats, rapeseed, winter wheat, winter rye, and buckwheat.

**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. The primary trigger is the intentional establishment of a grass species. Warm-season grasses are commonly planted through conservation programs, such as the NRCS Conservation Reserve Program (CRP) as reflected in the conservation practices for the 2.1. pathway. Species include big bluestem, switchgrass, and Indiangrass. Also included are native forbs that benefit wildlife and pollinators. Numerous native grasses and forbs are suitable for these areas. Seed mix selection depends on landowner objectives and site-specific characteristics. Poor grazing management practices on warm season grasslands can lead to soil erosion and invasion by cool-season grasses such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*). Resilience management practices include prescribed fire, invasive plant management, and a program of planned grazing that manages the intensity, frequency, and duration of grazing and the number of grazing animals. Less common than warm-season species, but still feasible, are cool-season grass species such as Kentucky bluegrass and reed canarygrass. Many cool-season grasses can be planted, depending on landowner goals. Management inputs include seeding, fertilizing, and controlling weeds and brush. Resilience management practices include invasive plant management and a program of planned grazing. 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
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- little bluestem (*Schizachyrium scoparium*), 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. This pathway is commonly triggered in conjunction with a conservation program such as the NRCS Conservation Reserve Program (CRP). The site is removed from crop production and seeded with warm-season grasses which benefit wildlife, soil health, and water quality. Cool-season grasses are also feasible. Numerous species may be planted. Legumes are commonly incorporated to improve forage nutrition. A small percentage of MLRA 103 currently supports cool-season grasses.

**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). Resilience management practices include weed control (herbicide

application), disturbance management (field cultivating), and harvest management.

## State 3
## Disturbed Forest State

The state has been disturbed and exhibits altered forest species composition. Numerous ruderal woodland and forest communities may occur on this ecological site depending on the type and severity of disturbances (selective harvest, grazing, invasive species), seed sources, and management activities. Fast-growing, shade tolerant tree species are typical in early successional communities. Numerous species of invasive plants may be present.

**Dominant plant species**

- maple (*Acer*), tree
- common buckthorn (*Rhamnus cathartica*), tree
- oak (*Quercus*), 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 disturbance, community age, slope, aspect, available water, and seed sources. Oak species are often reduced on these sites due to harvesting and/or lack of successful regeneration. Invasive, non-native species are common on these sites and will continue to increase without management intervention.

**Dominant plant species**

- maple (*Acer*), tree
- common buckthorn (*Rhamnus cathartica*), tree
- oak (*Quercus*), 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. Slope is a limiting factor for this transition on many areas.

**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 with long-term management inputs including establishment of desired species, forest stand management (selective thinning), and control of invasive species. Triggers include intentional plant establishment (planting desired species), absence of disturbance (site protected from grazing and other site altering disturbances), stand improvement inputs, and eradication of invasive plant species.

**Conservation practices**

| |
|---|
| Brush Management |
| Tree/Shrub Site Preparation |
| Tree/Shrub Establishment |
| Forest Stand Improvement |

### 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 site clearing, site preparation, tillage, and intentional plant establishment (crop seeding). Continued resilience management practices are necessary 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 | 05/05/2024 |
| 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:**