USDA Natural Resources Conservation Service

Ecological site F103XY036MN
Depressional Wet Forests

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) Subsections (Cleland et al. 2007)

Relationship to Other Established Classifications:
The reference state shares similarities to Minnesota Department of Natural Resources WFs57 Southern Wet Ash Swamp

Ecological site concept

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. These soils developed under forest vegetation and have a thick accumulation of slope alluvium.

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 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. Landforms include lake plains and lateral end and ground moraines.
R103XY017MN	**Organic Wet Meadow/Carr** The Organic Wet Meadow/Carr ecological site occurs in low wetland areas. These sites are often 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 common.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra*
Shrub	(1) *Prunus virginiana*
Herbaceous	(1) *Caltha palustris*

Physiographic features

The Depressional Wet Forests ecological site occurs primarily on end and lateral moraines in the northeastern part of MLRA 103 including the Big Woods ecoregion. The site also occurs on ground moraines and Glacial Lake Minnesota. The site is in depressions and on low gradient linear slopes. The slope shape is linear to concave both vertically and horizontally.

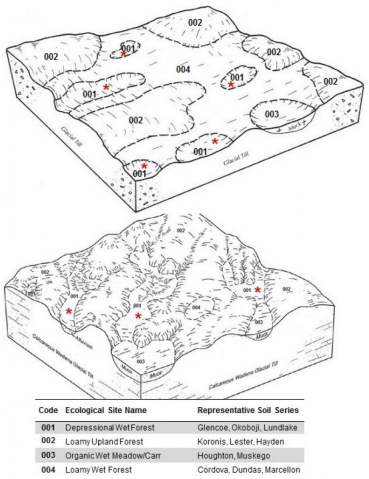


Figure 1. Block diagrams of the representative Depressional Wet Forests and associated ecological sites.

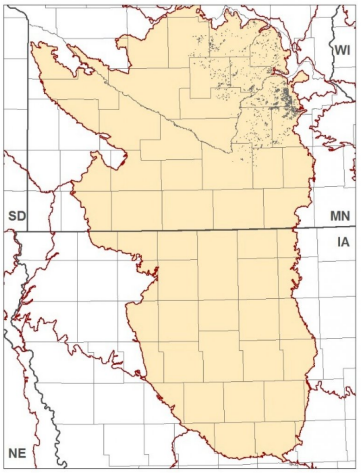


Figure 2. Distribution of the Depressional Wet Forests ecological site within

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.

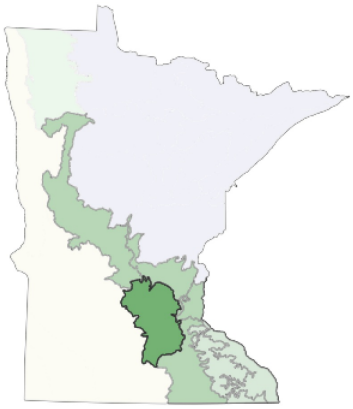


Figure 3. The Big Woods ecoregion shaded in dark green. (Minnesota Department of Natural Resources)

Table 2. Representative physiographic features

Landforms	(1) End moraine (2) Ground moraine (3) Lake plain (4) Depression (5) Lateral moraine
Runoff class	Negligible to low
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	210–560 m
Slope	0–1%
Water table depth	0–89 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 frost-free period for this site is 151 days, while the frost-free period is 124 days. The average mean annual precipitation is 31 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 ecological 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)	116-133 days
Freeze-free period (characteristic range)	142-160 days
Precipitation total (characteristic range)	787-813 mm
Frost-free period (actual range)	112-134 days
Freeze-free period (actual range)	138-161 days
Precipitation total (actual range)	762-813 mm
Frost-free period (average)	124 days
Freeze-free period (average)	151 days

Precipitation total (average)	787 mm

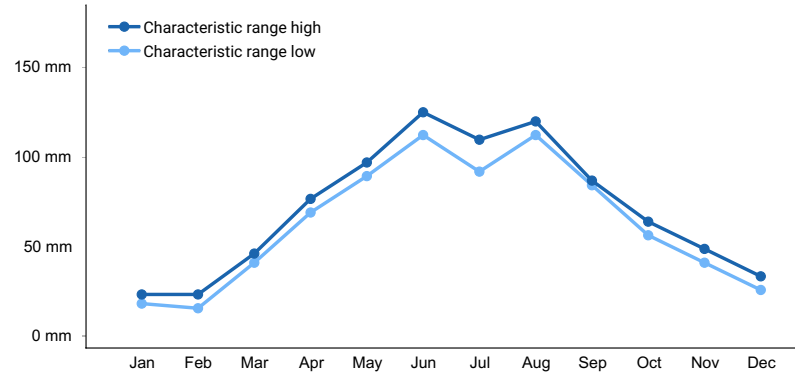


Figure 4. Monthly precipitation range

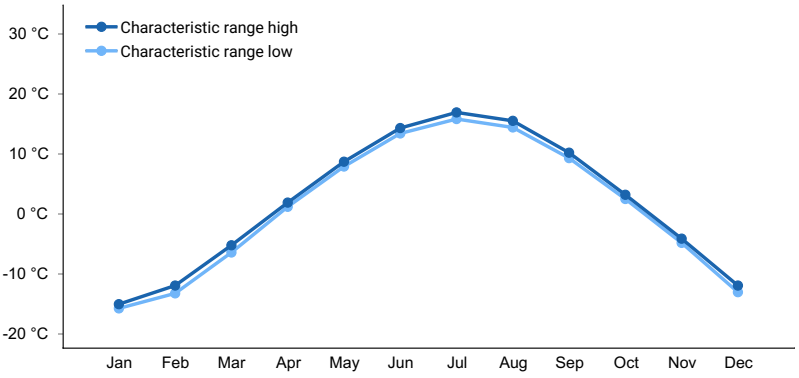


Figure 5. Monthly minimum temperature range

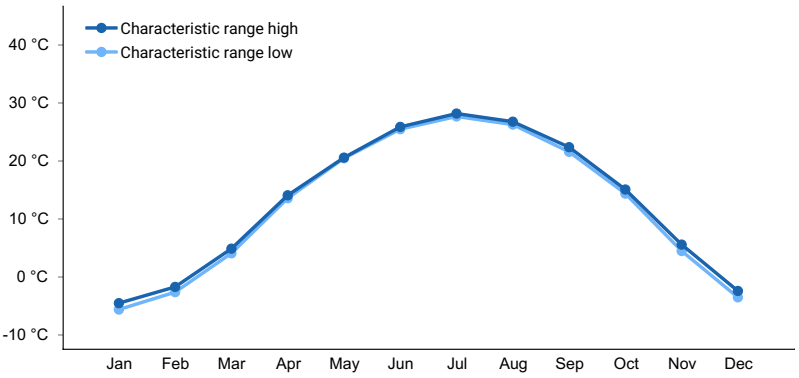


Figure 6. Monthly maximum temperature range

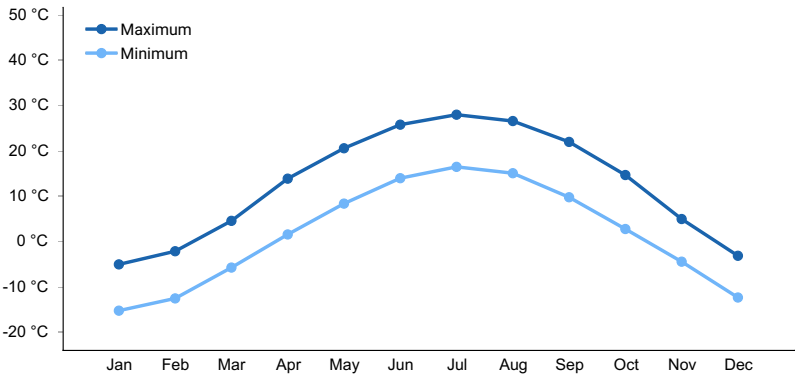


Figure 7. Monthly average minimum and maximum temperature

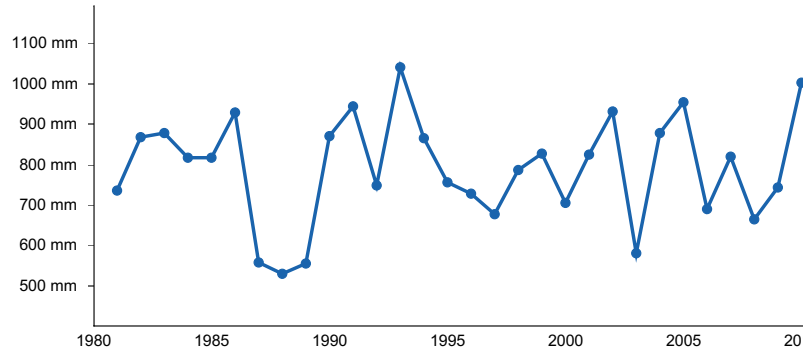


Figure 8. Annual precipitation pattern

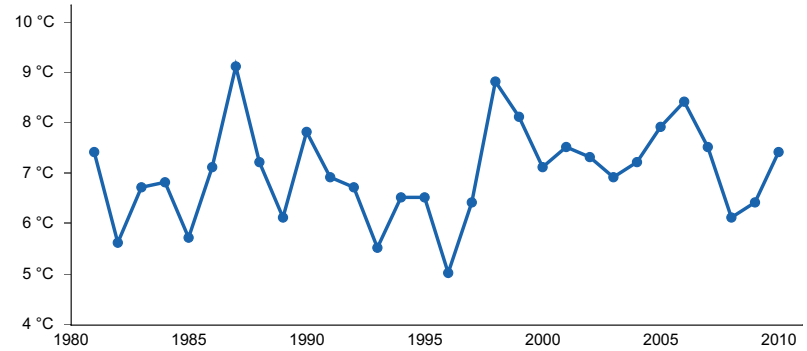


Figure 9. Annual average temperature pattern

Climate stations used

- (1) WELLS [USC00218808], Wells, MN
- (2) GAYLORD [USC00213076], Gaylord, MN
- (3) BUFFALO 2NE [USC00211107], Buffalo, MN
- (4) JORDAN 1SSW [USC00214176], Jordan, MN
- (5) CHANHASSEN WSFO [USC00211448], Chanhassen, MN
- (6) FARIBAULT [USC00212721], Faribault, MN

Influencing water features

The Depressional Wet Forests ecological site receives water via precipitation, runoff, and lateral subsurface flow. During most months, especially the warmer ones, this site receives runoff, and it is ponded during the spring months. Soils are classified as endosaturated. The water table 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. In the hydrogeomorphic (HGM) classification system, Depressional Wet Forests are considered a part of a depressional complex, receiving discharge from associated upslope ecological sites. (USDA-NRCS, 2008; Gilbert et al., 2006).

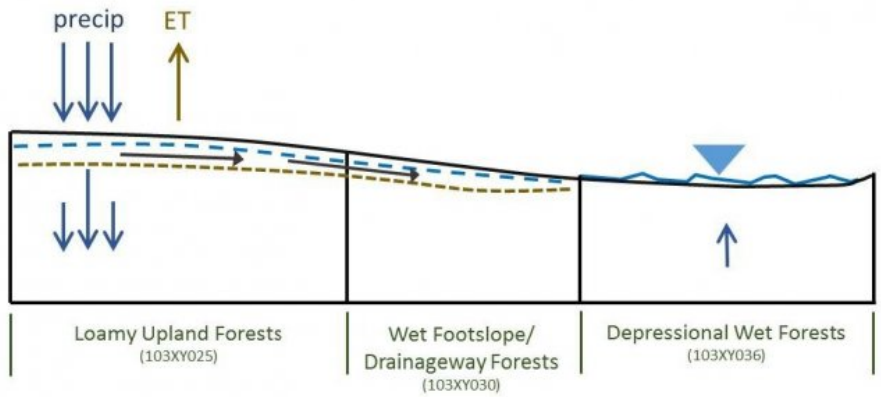


Figure 10. Representation of hydrological factors in a typical area of the Depressional Wet Forests and associated ecological sites on the Des Moines Lobe (MLRA 103).

Soil features

The Depressional Wet Forests ecological site is located on soils characterized by a high water table and seasonal ponding. The soils associated with this site formed under scattered trees or woodland vegetation and in low areas that accumulated slope alluvium. These soils also formed under saturated conditions that produced anaerobic conditions. These anaerobic conditions inhibit organic matter decomposition. Organic matter tends to mask the redoximorphic features (color patterns in the soil) that are used to determine seasonal high depth to saturation. The primary hydric soil indicator is Thick Dark Surface (A12; USDA-NRCS, 2010).

The soil series associated with this site are Glencoe, Shandep, and Lundlake. These soils are classified as Cumulic Endoaquolls. The parent material is slope alluvium or slope alluvium over loamy glacial till. Soils are very deep (>60 inches to bedrock). The drainage class is very poorly drained, and the water table is above the surface during the spring. The epipedon textures include silty clay loam, clay loam, loam, or their mucky analogues. The soil family particle size class is fine loamy. Coarse fragments are between 0 and 37 percent by volume. Soil pH classes are strongly acid to moderately alkaline throughout the series control section.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Till (3) Colluvium
Surface texture	(1) Silty clay loam (2) Clay loam (3) Loam
Family particle size	(1) Fine-loamy
Drainage class	Very poorly drained
Permeability class	Slow to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-152.4cm)	22.61–33.27 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4

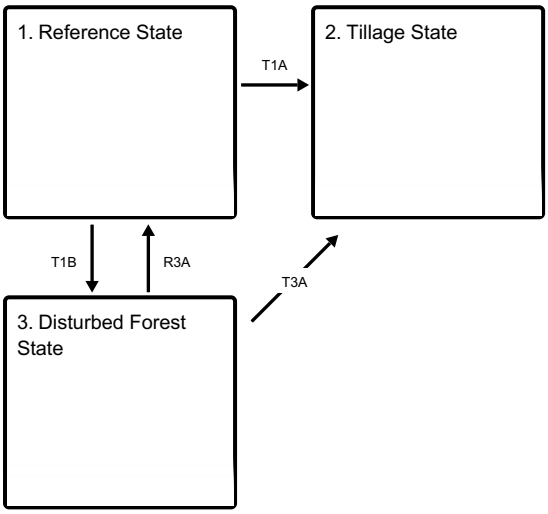
Subsurface fragment volume <=3" (0-101.6cm)	0–37%
Subsurface fragment volume >3" (0-101.6cm)	0–5%

Ecological dynamics

The Depressional Wet Forests ecological site has three states: the Reference State, the Disturbed Forest State, and the Tillage State which includes row crop production and seeded grasses. The Reference State is a wet depressional deciduous forest with a native, herbaceous ground layer. This ecological site can be affected by multiple natural triggers (disturbance processes) including ponding, insects, and windstorms. The Tillage State is characterized by tillage and hydrological modifications. Once a high-quality reference state has been drained and transitioned to a tillage field, the reversibility class is considered irreversible. The Disturbed Forest State is a wooded site that has undergone plant community changes due to human disturbance. Triggers include altered hydrology, logging/clearing, invasive plants, and unmanaged grazing. These wooded sites do not have the ecological stability or native plant diversity of a reference state.

State and transition model

Ecosystem states



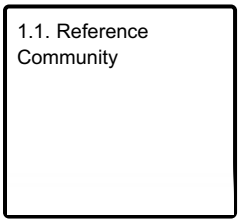
T1A - Site is cleared, tilled, seeded, and managed for crop production

T1B - Site incurs disturbance and altered plant community

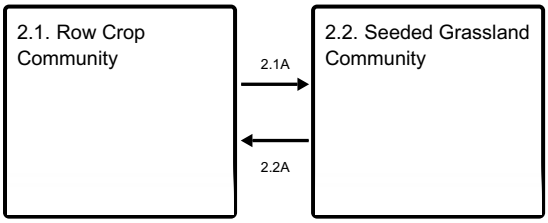
R3A - Restoration of native plant community

T3A - Site cleared, soil tillage,drainage, 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

3.1. Disturbed Forest Community

State 1
Reference State

The Reference Community is characterized by multiple canopy species, a variable shrub layer, and a diverse ground cover of native sedges and herbaceous species. Black ash is often the dominant canopy species. The shrub layer includes black ash seedlings and saplings, chokecherry, and wild black currant. The understory is a mosaic of wet to wet-mesic species including various species including common marsh marigold, touch me not, and Canadian woodnettle.

Resilience management. Resilience management practices include monitoring for invasive vegetation, applying herbicides as needed, and excluding grazing and logging. Maintenance of natural hydrology is key to the ecological communities of this site.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- chokecherry (*Prunus virginiana*), shrub
- American black currant (*Ribes americanum*), shrub
- yellow marsh marigold (*Caltha palustris*), other herbaceous
- touch-me-not (*Impatiens*), other herbaceous
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

Community 1.1
Reference Community

The Reference Community is characterized by a wet deciduous forest with somewhat sparse shrub layer, and a diverse ground cover of native sedges and herbaceous species. The canopy species include black ash and maple. The shrub layer density varies and is dominated by black ash seedlings and saplings with native shrubs.

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. Maintenance of natural hydrological functions are critical for this ecological site.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- chokecherry (*Prunus virginiana*), shrub
- American black currant (*Ribes americanum*), shrub
- yellow marsh marigold (*Caltha palustris*), other herbaceous
- touch-me-not (*Impatiens*), other herbaceous
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

State 2
Tillage State

The Tillage State contains the Row Crop Community and the Seeded Grassland Community. This state describes areas in crop production or areas that were re-seeded to grass. Pathway mechanisms include preparing the site,

planting desired species, applying herbicide, applying fertilizer, and harvesting. Hydrological modifications (tiling and ditching) are usually 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 will 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 or cool-season grasses. Seed mix selection will depend on site characteristics and landowner goals. Seeded grasslands are not as species rich or biologically diverse as native grasslands; however, they still offer ecological benefits for wildlife, water quality, and soil health.

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 is usually 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 is on areas that were previously tilled, 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 or cool-season grasses can be planted, depending on hydrology and landowner goals. Management inputs include seeding, fertilizing, and controlling weeds and brush.

Resilience management. The resilience management practices may include planting desired species, managing grazing, mowing, fertilizing, and controlling unpalatable plant species.

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), 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. A small percentage of MLRA 103 currently supports cool-season grasses. Resilience management practices for grass sites include planned grazing, invasive plant management, and harvest management (grazing or hay production).

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. 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

This state describes a shrub or wooded site that has been disturbed and exhibits altered vegetative species composition. Numerous ruderal shrub and tree plant communities may occur on this ecological site depending on the type and severity of disturbance, the length of disturbance, available seed sources, ongoing disturbances (selective harvest, grazing), and management activities. Common tree and shrub species include black ash, alder, and willow. Seed source availability (both native and non native) will greatly influence plant community composition on these sites. Understory species may include reed canarygrass and various sedges.

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- gray alder (*Alnus incana*), tree
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass

Community 3.1
Disturbed Forest Community

Community 3.1 is an altered forest community caused by previous or ongoing human disturbances. Canopy composition varies depending on the severity and type of disturbances, community age, and the availability of 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
- gray alder (*Alnus incana*), tree
- willow (*Salix*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass

Transition T1A
State 1 to 2

Transition T1A is the conversion of the Reference State to agriculture. The triggers are site clearing, hydrological modifications (tilling, ditching), soil tillage. and intentional plant establishment (crop seeding). Resilience management practices include common agricultural practices such as seeding, fertilizing, and managing invasive plants with herbicides or field cultivation.

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) shrub-woodland community. 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 with natural hydrology. Restoration inputs including establishment of desired native plant species, continued 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), forest stand improvement, 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 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, hydrological modification, and the transition to agriculture preclude a transition back to a true reference 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	05/19/2024
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):**

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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:**