USDA Natural Resources
Conservation Service

Ecological site F109XY019MO
Loess High Terrace Woodland

Last updated: 7/02/2024
Accessed: 05/13/2025

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.

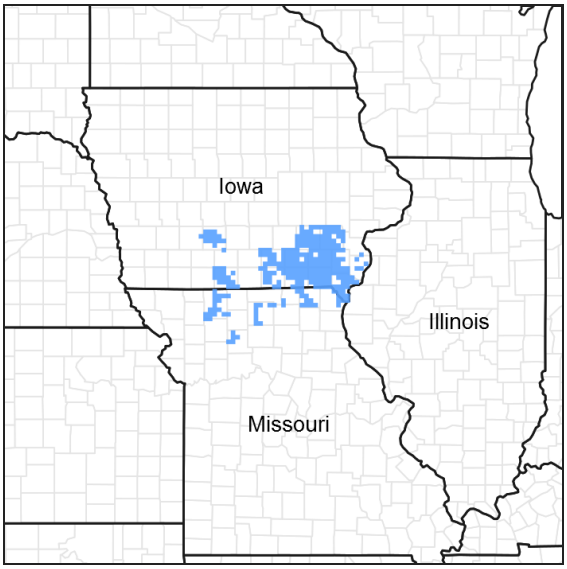


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 109X–Iowa and Missouri Heavy Till Plain

The Iowa and Missouri Heavy Till Plain is an area of rolling hills interspersed with interfluve divides and alluvial valleys. Elevation ranges from about 660 feet (200 meters) along the lower reaches of rivers, to about 980 feet (300 meters) on stable interfluve summits in southern Iowa. Relief is about 80 to 160 feet (25 to 50 meters) between major streams and adjacent interfluve summits. Most of the till plain drains south to the Missouri River via the Grand and Chariton River systems, but the northeastern portion drains southeast to the Mississippi River. Loess caps the pre-Illinoisan aged till on interfluves, whereas the till is exposed on side slopes. Mississippian aged limestone and Pennsylvanian aged sandstone and shale crop out on lower slopes in some areas.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Mesic Bottomland Woodland.

Missouri Department of Conservation Forest and Woodland Communities (Missouri Department of Conservation, 2006):
The reference state for this ecological site is most similar to a Mixed Hardwood Mesic Bottomland Forest.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest (CEGL002058).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs in several Land Type Associations, primarily within the following Subsections:
Chariton River Hills
Grand River Hills

Ecological site concept

NOTE: This is a “provisional” Ecological Site Description (ESD) that is under development. It contains basic ecological information that can be used for conservation planning, application and land management. As additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Loess High Terrace Woodlands occur in small delineations along river valleys, particularly in the northeastern part of the MLRA. Soils are very deep, with no rooting restrictions. The reference plant community is woodland with an overstory dominated by white oak, black oak, and American elm, and a ground flora of native grasses and forbs.

Associated sites

F109XY003MO	**Loess Upland Woodland** Loess Upland Woodlands are upslope, on upland summits, shoulders and backslopes.
F109XY030MO	**Loamy Floodplain Forest** Loamy Floodplain Forests are downslope.

Similar sites

F109XY004MO	**Loamy Upland Drainageway Woodland** Loamy Upland Drainageway Woodlands are similar in composition but experience periodic brief flooding.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Rhus aromatica*
Herbaceous	(1) *Bromus pubescens* (2) *Helianthus hirsutus*

Physiographic features

This site is on high stream terraces with slopes of 2 to 9 percent. The site receives runoff from adjacent upland sites, and generates runoff to adjacent, downslope sites. This site does not flood.

The following figure (adapted from Lockridge, 1979) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites of the stream terraces, floodplains, and adjacent uplands. The site is within the area labeled “2” on the figure, and is typically associated with the Loamy Terrace Forest ecological site of MLRA 108C. Floodplain sites are downslope, and Loess Upland sites are upslope.

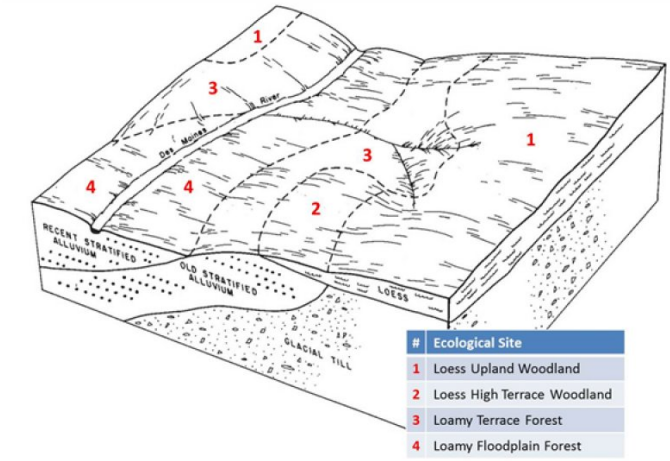


Figure 2. Landscape relationships for this ecological site

Table 2. Representative physiographic features

Landforms	(1) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	540–1,350 ft
Slope	2–9%
Water table depth	12–48 in
Aspect	Aspect is not a significant factor

Climatic features

The Iowa and Missouri Heavy Till Plain MLRA has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade reasonably humid air, snowfall and rainfall result. In summer, moist, warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce abundant amounts of rain, either by fronts or by convectional processes. In some summers, high pressure stagnates over the region, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

This MLRA experiences small regional differences in climates that grade inconspicuously into each other. The basic gradient for most climatic characteristics is along a line from north to south. Both mean annual temperature and precipitation exhibit fairly minor gradients along this line. Mean January minimum temperature follows the north-to-south gradient. However, mean July maximum temperature shows hardly any geographic variation in the region. Mean July maximum temperatures have a range of only two to three degrees across the region.

Mean annual precipitation varies along the same gradient as temperature – lower annual precipitation in the north, higher in the south. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages four to five times greater than January precipitation.

During years when precipitation comes in a fairly normal manner, moisture is stored in the top layers of the soil during the winter and early spring, when evaporation and transpiration are low. During the summer months the loss of water by evaporation and transpiration is high, and if rainfall fails to occur at frequent intervals, drought will result. Drought directly influences ecological communities by limiting water supplies, especially at times of high temperatures and high evaporation rates. Drought indirectly affects ecological communities by increasing plant and animal susceptibility to the probability and severity of fire. Frequent fires encourage the development of grass/forb dominated communities and understories.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. For example, air drainage at nighttime may produce temperatures several degrees lower in valley bottoms than on side slopes. At critical times during the year, this phenomenon may produce later spring or earlier fall freezes in valley bottoms. Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier, supporting more grass dominated communities than adjacent north- and-east-facing slopes that are cooler and moister that support more woody dominated communities. Finally, the cooler microclimate within a canopied forest is measurably different from the climate of a more open and warmer grassland or savanna area.

Source: University of Missouri Climate Center - http://climate.missouri.edu/climate.php; Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, United States Department of Agriculture Handbook 296 - http://soils.usda.gov/survey/geography/mlra/

Table 3. Representative climatic features

Frost-free period (characteristic range)	148-162 days
Freeze-free period (characteristic range)	178-192 days
Precipitation total (characteristic range)	39-40 in
Frost-free period (actual range)	143-170 days
Freeze-free period (actual range)	170-197 days
Precipitation total (actual range)	38-41 in
Frost-free period (average)	156 days
Freeze-free period (average)	185 days
Precipitation total (average)	40 in

Climate stations used

- (1) LAMONI [USC00134585], Lamoni, IA
- (2) KEOSAUQUA [USC00134389], Keosauqua, IA
- (3) KEOKUK LOCK DAM 19 [USC00134381], Keokuk, IA
- (4) BETHANY [USC00230608], Bethany, MO

Influencing water features

The water features of this upland ecological site include evapotranspiration, surface runoff, and drainage. Each water balance component fluctuates to varying extents from year-to-year. Precipitation and drainage are highly variable between years. Seasonal variability differs for each water component. Precipitation generally occurs as single day events. Evapotranspiration is lowest in the winter and peaks in the summer. The surface runoff pulse is greatly influenced by extreme events. Conversion to cropland or other high intensity land uses tends to increase runoff, but also decreases evapotranspiration. Depending on the situation, this might increase runoff discharge, and decrease baseflow in receiving streams.

Soil features

These soils have no rooting restriction. The soils were formed under forest vegetation, and have thin, light-colored surface horizons. Parent material is loess, underlain by alluvium. They have silt loam surface horizons, and clayey subsoils. They are affected by a seasonal high water table during the spring months. Soil series associated with this site include Alvin, Gorin, and Weller.

The accompanying picture of the Weller series shows a thin, light-colored surface horizon overlying the brown silty clay loam subsoil. Roots can be seen throughout the soil profile.

Figure 9. Weller series

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–6.1
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Information contained in this section was developed using historical data, professional experience, field reviews, and scientific studies. The information presented is representative of very complex vegetation communities. Key indicator plants, animals and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

The reference plant community is well developed woodland dominated by an overstory of white oak, along with black oak and American elm. A semi-open canopy and increased light causes a diversity of woodland ground flora

species to flourish. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth.

Given the juxtaposition to upland and lowland prairies, fire played an important role in the maintenance of these ecological sites. They likely burned at least once every 5 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

Loess High Terrace Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores, such as bison, elk, and white-tailed deer. Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. Grazing by native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and sun-loving ground flora species.

Today, this community has either been cleared and converted to agriculture use, or has grown dense in the absence of fire. Most occurrences today exhibit canopy closure of 80 to 100 percent. In addition, the sub-canopy and understory layers are better developed. Black oak and hickory now share dominance with white oak and there are considerably more saplings in the understory. Under these denser, more shaded conditions, the original sun-loving ground flora has diminished in diversity and cover. While some woodland species persist in the ground flora, many have been replaced by more shade-tolerant species.

In the long term absence of fire, woody species, especially hickory, hornbeam and gooseberry encroach into these woodlands. Once established, these woody plants can quickly fill the existing understory increasing shade levels, greatly diminishing ground flora. Opening the canopy, removing the younger understory and applying prescribed fire have proven to be effective restoration means.

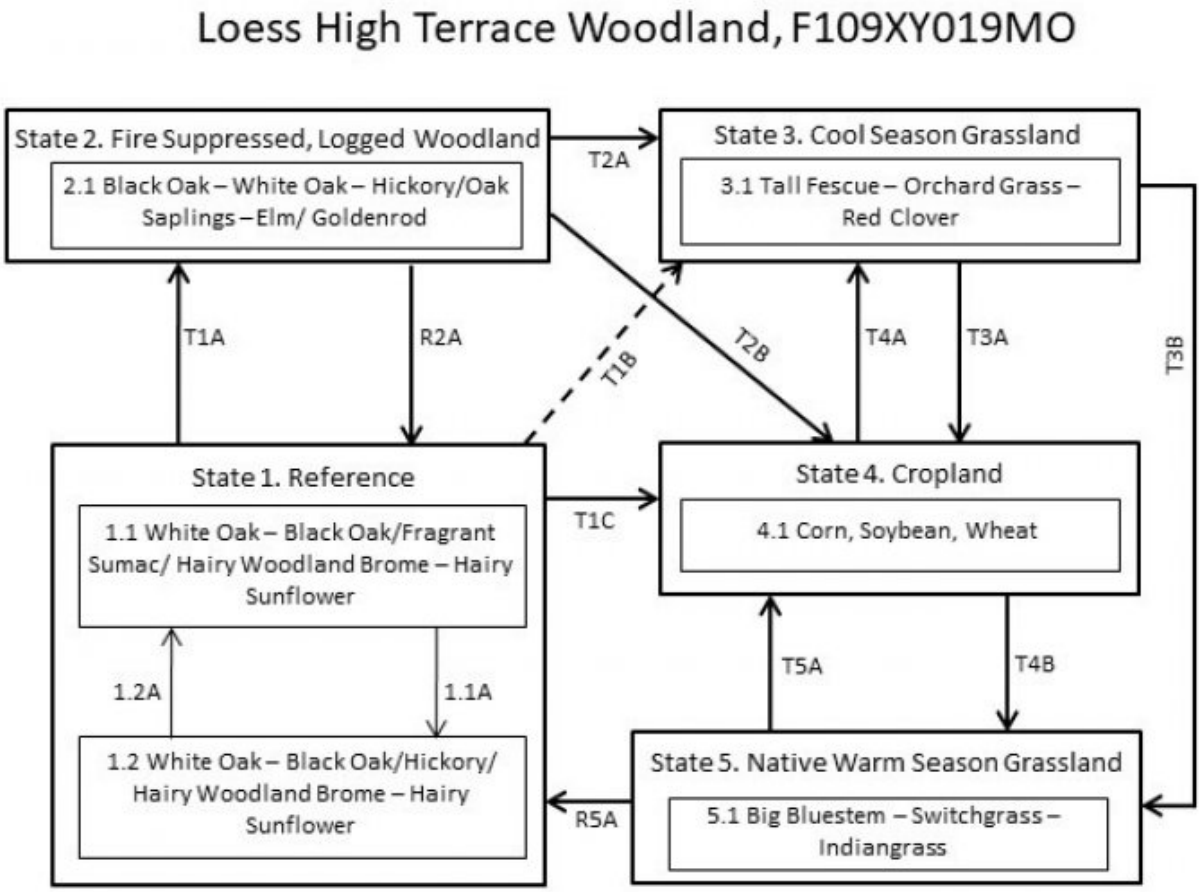
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and soil erosion can be a problem and lower productivity.

This ecological site, if managed properly, can be a valuable source for timber products especially white oak. Most areas on this ecological site have been repeatedly logged and high graded. Even-age management, using clearcut, or shelterwood and seed tree harvest systems without fire will perpetuate the overly dense, shaded conditions of current stands. Partial selective cutting and prescribed fire can, however, restore the more open structure and diversity of ground flora species.

Managed areas show an exceptional resiliency and production. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth. This type of management can provide timber products, wildlife habitat, and potential native forage.

A State and Transition Diagram follows. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

State and transition model



Code	Event/Activity/Process
T1A	Fire suppression > 20 years; repeated timber harvests
T3A, T5A	Tillage; conservation cropping system
T1B,T2A	Woody removal; tillage; vegetative seeding; grassland management
T1C, T2B	Woody removal; tillage; conservation cropping system
T4A	Vegetative seeding ; grassland management
T3B, T4B	Native vegetative seeding; prescribed fire; grassland management
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 2-5 years
R2A	Forest stand improvement; prescribed fire 2-5 years
R5A	Vegetative seeding; tree planting; long rotation (>100 years); prescribed fire

Figure 10. State and transition model for this ecological site

State 1

Reference

The historical reference state for this ecological site was old growth oak woodland. The woodland was dominated by white oak and black oak. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice as well as grazing by native large herbivores maintained the woodland structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species. Two community phases are recognized in the Reference State, with shifts between phases based on disturbance frequency. Reference states are very rare today. Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Most Reference States are currently altered because of timber harvesting, domestic grazing or clearing and conversion to grassland or cropland.

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- red hickory (*Carya ovalis*), tree
- fragrant sumac (*Rhus aromatica*), shrub
- hairy woodland brome (*Bromus pubescens*), other herbaceous
- hairy sunflower (*Helianthus hirsutus*), other herbaceous

Community 1.1
White Oak-Black Oak/Aromatic Sumac/Woodland Brome-Hairy Sunflower

This phase has an overstory that is dominated by white oak and black oak with hickory and post oak also present. This woodland community has a two-tiered structure with an open understory and a dense, diverse herbaceous ground flora. Periodic disturbances including fire, ice and wind create canopy gaps, allowing white oak and black oak to successfully reproduce and remain in the canopy.

Forest overstory. The Forest Overstory Species list is based on commonly occurring species listed in Nelson (2010).

Forest understory. The Forest Understory list is based commonly on occurring species listed in Nelson (2010).

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- fragrant sumac (*Rhus aromatica*), shrub
- hairy woodland brome (*Bromus pubescens*), other herbaceous
- hairy sunflower (*Helianthus hirsutus*), other herbaceous

Community 1.2
White Oak-Black Oak/Hickory/Woodland Brome-Hairy Sunflower

This phase is similar to community phase 1.1 but oak and hickory understory densities are increasing due to longer periods of fire suppression. Displacement of some grasses and forbs may be occurring due to shading and competition from the increased densities of oak and hickory saplings in the understory.

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- red hickory (*Carya ovalis*), tree
- hairy woodland brome (*Bromus pubescens*), other herbaceous
- hairy sunflower (*Helianthus hirsutus*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Fire-free interval 10+ years

Pathway 1.2A
Community 1.2 to 1.1

Fire interval 2-5 years

State 2
Fire Suppressed, Logged Woodland

Composition is altered from the Reference State depending on tree selection during harvest. This state will slowly increase in more shade tolerant species and white oak will become less dominant and is also dense because of fire suppression. Without periodic canopy disturbance, stem density and fire intolerant species, like hickory, will increase in abundance. Uncontrolled grazing if present will also have an impact on community composition and understory quality further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- red hickory (*Carya ovalis*), tree
- elm (*Ulmus*), shrub
- goldenrod (*Oligoneuron*), other herbaceous

Community 2.1
Black Oak-White Oak-Hickory/Oak Saplings-Elm/Goldenrod

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- red hickory (*Carya ovalis*), tree
- elm (*Ulmus*), shrub
- goldenrod (*Oligoneuron*), other herbaceous

State 3
Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue, orchard grass, and red clover has been common. Occasionally, these pastures will have scattered oaks. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the Reference State may be impossible, requiring a very long term series of management options and transitions.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), other herbaceous
- orchardgrass (*Dactylis*), other herbaceous
- red clover (*Trifolium pratense*), other herbaceous

Community 3.1
Tall Fescue-Orchard Grass-Red Clover

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), other herbaceous
- orchardgrass (*Dactylis*), other herbaceous
- red clover (*Trifolium pratense*), other herbaceous

State 4

Cropland

This is a State that exists currently with intensive cropping of corn, soybeans, and wheat occurring. Some conversion to cool season grassland occurs, especially when commodity prices are high, for a limited period of time before transitioning back to cropland. Limited acres are sometimes converted to native warm season grassland.

Dominant plant species

- corn (*Zea mays*), other herbaceous
- wheat (*Triticum*), other herbaceous
- soybean (*Glycine*), other herbaceous

Community 4.1
Corn, Soybean, Wheat

Dominant plant species

- corn (*Zea*), other herbaceous
- soybean (*Glycine*), other herbaceous
- wheat (*Triticum*), other herbaceous

State 5
Native Warm Season Grassland

Conversion from the Cool Season Grassland (State 3) or the Cropland (State 4) to this State is increasing due to renewed interest in warm season grasses as a supplement to cool season grazing systems or as a native restoration activity. Restoration to the Reference state will require substantial restoration time, money, and management inputs.

Dominant plant species

- big bluestem (*Andropogon gerardii*), other herbaceous
- switchgrass (*Panicum virgatum*), other herbaceous
- Indiangrass (*Sorghastrum*), other herbaceous

Community 5.1
Big Bluestem-Switchgrass-Indiangrass

Transition T1A
State 1 to 2

Fire suppression >20 years; repeated timber harvests

Transition T1B
State 1 to 3

Woody removal; tillage; vegetative seeding; grassland management

Transition T1C
State 1 to 4

Woody removal; tillage; conservation cropping system

Restoration pathway R2A
State 2 to 1

Forest stand improvement; prescribed fire 2-5 years

Transition T2A
State 2 to 3

Woody removal; tillage; vegetative seeding; grassland management

Transition T2B
State 2 to 4

Woody removal; tillage; conservation cropping system

Transition T3A
State 3 to 4

Tillage; conservation cropping system

Transition T3B
State 3 to 5

Native vegetative seeding; prescribed fire; grassland management

Restoration pathway T4A
State 4 to 3

Vegetative seeding; grassland management

Transition T4B
State 4 to 5

Native vegetative seeding; prescribed fire; grassland management

Restoration pathway R5A
State 5 to 1

Vegetative seeding; tree planting; long rotation (>100 years); prescribed fire

Restoration pathway T5A
State 5 to 4

Tillage; conservation cropping system

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white oak	QUAL	*Quercus alba*	Native	–	40–70	–	–
black oak	QUVE	*Quercus velutina*	Native	–	20–40	–	–
American elm	ULAM	*Ulmus americana*	Native	–	5–10	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	0–10	–	–
post oak	QUST	*Quercus stellata*	Native	–	5–10	–	–
bur oak	QUMA2	*Quercus macrocarpa*	Native	–	5–10	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	10–30
big bluestem	ANGE	*Andropogon gerardii*	Native	–	5–20
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	5–20
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	5–20
parasol sedge	CAUM4	*Carex umbellata*	Native	–	5–20
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	5–20
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	5–20
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	5–20
Forb/Herb					
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	10–30
smooth blue aster	SYLAC	*Symphyotrichum laeve var. concinnum*	Native	–	10–20
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	5–20
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	10–20
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	10–20
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	–	10–20
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	10–20
fourleaf milkweed	ASQU	*Asclepias quadrifolia*	Native	–	10–20
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	5–20
Culver's root	VEVI4	*Veronicastrum virginicum*	Native	–	5–10
bluejacket	TROH	*Tradescantia ohiensis*	Native	–	5–10
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	10–30
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	5–20
American hazelnut	COAM3	*Corylus americana*	Native	–	10–20

Animal community

Wildlife
Wild turkey, white-tailed deer, and eastern gray squirrel depend on hard and soft mast food sources and are typical upland game species of this type.

Oaks provide hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food; sedges and native cool-season grasses provide green browse; patchy native warm-season grasses provide cover and nesting habitat; and a diversity of forbs provides a diversity and abundance of insects.

Post-burn areas can provide temporary bare-ground – herbaceous cover habitat important for turkey poults and quail chicks.

Bird species associated with mature communities include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Eastern Wood-Pewee, Broad-winged Hawk, Great-Crested Flycatcher, Summer Tanager, and Red-eyed Vireo.

Reptile and amphibian species associated with this site include tiger salamander, small-mouthed salamander, ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, flat-headed snake, and rough earth snake. (MDC, 2006)

Other information

Forestry
Management: Estimated site index values range from 55 to 65 for oak. Timber management opportunities are good. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality, may not be fitting, or should be used with caution on a particular site if timber management is the primary objective.

Limitations: No major equipment restrictions or limitations exist. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35 percent, traction problems increase and equipment use is not recommended.

Other references

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Contributors

Doug Wallace
Fred Young

Approval

Suzanne Mayne-Kinney, 7/02/2024

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This site was originally approved on 07/28/2015 for publication.

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	05/13/2025
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:**