Ecological site R111XD011IN
Mollic Till Ridge

Last updated: 5/28/2020
Accessed: 05/09/2024

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): 111X–Indiana and Ohio Till Plain

A PROVISIONAL ECOLOGICAL SITE is a conceptual grouping of soil map unit components within a Major Land Resource Area (MLRA) based on the similarities in response to management. Although there may be wide variability in the productivity of the soils grouped into a Provisional Site, the soil vegetation interactions as expressed in the State and Transition Model are similar and the management actions required to achieve objectives, whether maintaining the existing ecological state or managing for an alternative state, are similar. Provisional Sites are likely to be refined into more precise group during the process of meeting the APPROVED ECOLOGICAL SITE DESCRIPTION criteria.

This PROVISIONAL ECOLOGICAL SITE has been developed to meet the standards established in the National Ecological Site Handbook. The information associated with this ecological site does not meet the Approved Ecological Site Description Standard, but it has been through a Quality Control and Quality Assurance processes to assure consistency and completeness. Further investigations, reviews and correlations are necessary before it becomes an Approved Ecological Site Description.

111D – Indiana and Ohio Till Plain, Western Part. This MLRA occurs in two separate areas. One area is in the west-central part of Indiana (73 percent), and the other is in southwestern Ohio (27 percent). The MLRA makes up 5,355 square miles (13,880 square kilometers). It includes the towns of Crawfordville, Delphi, Frankfort, Lafayette, and Liberty, Indiana, and Hamilton, Lebanon, Middletown, and Wilmington, Ohio. Interstates 65 and 74 cross the part of this area in Indiana, and Interstates 71 and 75 cross the part in Ohio. Shades and Turkey Run State Parks are in the part in Indiana, and Caesar Creek and Hueston Woods State Parks are in the part in Ohio. A small portion of the Wright-Patterson Air Force Base, in Ohio, is in the northern part of the area.

This area is in the Till Plains Section of the Central Lowland Province of the Interior Plains. It is dominated by loess hills and flats that are broken in places by moraines, kames, outwash plains, and stream terraces. Narrow, shallow valleys commonly are along the few large streams in the area. Elevation ranges from 530 to 1,050 feet (160 to 320 meters), increasing gradually from southwest to northeast. Relief is mainly a few meters, but in some areas hills rise as much as 100 feet (30 meters) above the adjoining plains.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Wabash (0512), 68 percent; Great Miami (0508), 15 percent; Middle Ohio (0509), 14 percent; Scioto (0506,) 2 percent; and Upper Illinois (0712), 1 percent. Wildcat Creek in Indiana and the Little Miami River in Ohio have been designated as National Wild and Scenic Rivers. Sugar Creek and Walnut Creek occur in the part of the area in northern Indiana, and the Whitewater River is in the part in southeastern Indiana. The Sevenmile, Fourmile, and Great Miami Rivers cross the part of the area in Ohio.

Most of the eastern part of this MLRA is underlain by Late Ordovician shale and limestone. The western part is underlain by shale, siltstone, sandstone, limestone, and dolostone ranging in age from Middle Pennsylvanian to Silurian. Surficial materials include glacial deposits of till, outwash, and lacustrine sediments from Wisconsin and

older glacial periods. A thin or moderately thick mantle of loess overlies much of the area.

Classification relationships

Major Land Resource Area (USDA-Natural Resources Conservation Service, 2006)

USFS Ecological Regions (USDA, 2007):
Sections –Central Till Plains, Beech Maple (222H), Interior Low Plateau-Shawnee Hills (223D), Interior Low Plateau-Bluegrass (223F), Central Till Plains-Oak Hickory (223G), Central Till Plains and Grand Prairies (251D)

Subsections -Bluffton Till Plains (222Ha), Miami-Scioto Plain-Tipton Till Plain (222Hb), Little Miami Old Drift Plain (222Hc), Mad River Interlobate Plains (222Hd), Crawford Uplands (223De), Crawford Escarpment (223Df), Northern Bluegrass (223Fd), Lower Wabash Alluvial Plain (223Gc), Southwest Indiana Glaciated Lowlands (223Ge), Eastern Grand Prairie (253Dd).

NatureServe Systems anticipated (NatureServe, 2011): Agriculture - Cultivated Crops and Irrigated Agriculture, Agriculture - Pasture/Hay, Allegheny-Cumberland Dry Oak Forest and Woodland, Central Interior Acidic Cliff and Talus, Central Interior Highlands Calcareous Glade and Barrens, Central Tallgrass Prairie, Clearcut - Grassland/Herbaceous, Introduced Upland Vegetation – Treed, Managed Tree Plantation, Mississippi River Riparian Forest, North-Central Interior and Appalachian Acidic Peatland, North-Central Interior Beech-Maple Forest, North-Central Interior Dry-Mesic Oak Forest and Woodland, North-Central Interior Dry Oak Forest and Woodland, North-Central Interior Floodplain, North-Central Interior Freshwater Marsh, North-Central Interior Maple-Basswood Forest, North-Central Interior Oak Savanna, North-Central Interior Wet Flatwoods, North-Central Interior Wet Meadow-Shrub Swamp, North-Central Oak Barrens, Northern Atlantic Coastal Plain Hardwood Forest ,Ruderal Forest, Ruderal Upland - Old Field, South-Central Interior / Upper Coastal Plain Wet Flatwoods, South-Central Interior Large Floodplain, South-Central Interior Mesophytic Forest, South-Central Interior Small Stream and Riparian, Southern Appalachian Oak Forest, Southern Interior Low Plateau Dry-Mesic Oak Forest, Successional Shrub/Scrub

LANDFIRE Biophysical Settings anticipated (USGS, 2010): Allegheny-Cumberland Dry Oak Forest and Woodland, Bluegrass Savanna and Woodland, Central Interior and Appalachian Floodplain Systems, Central Interior and Appalachian Riparian Systems, Central Interior and Appalachian Shrub-Herbaceous Wetland Systems, Central Interior and Appalachian Swamp Systems, Central Interior Highlands Calcareous Glade and Barrens, Central Interior Highlands Dry Acidic Glade and Barrens, Central Tallgrass Prairie, Great Lakes Coastal Marsh Systems, Mississippi River Alluvial Plain Dry-Mesic Loess Slope Forest, North-Central Interior Beech-Maple Forest, North-Central Interior Dry-Mesic Oak Forest and Woodland, North-Central Interior Dry Oak Forest and Woodland, North-Central Interior Maple-Basswood Forest, North-Central Interior Oak Savanna, North-Central Interior Wet Flatwoods, Paleozoic Plateau Bluff and Talus, Pennyroyal Karst Plain Prairie and Barrens, South-Central Interior Mesophytic Forest, South-Central Interior/Upper Coastal Plain Flatwoods, Southern Appalachian Oak Forest, Southern Interior Low Plateau Dry-Mesic Oak Forest

Ecological site concept

This site is an upland site formed on glacial till parent materials located in a swell (convex) landscape position. It is located on summits, shoulders and backslopes. The soil surface color is dark(3/2 Munsell or darker) but does not extend beyond 10 inches, making them taxonomically mollic integrades.

The characteristic vegetation of this site is that of an oak savanna. This site exhibits a co-dominance of woody and herbaceous species. Black oak is the most abundant woody species, with white oak also being present as well as a very few hickory trees. The herbaceous vegetation was dominated by little bluestem, big bluestem, switchgrass and strongly resembled the richness and diversity of species found in adjacent, more xeric prairies. Fire frequency and intensity were the principle drivers that maintained the site. Frequent low intensity ground fires kept the tree species from becoming more dominant and allowed the herbaceous species to be co-dominant on the site. Lengthening the fire return interval transitions this site to a woodland or forest state. Due to the productivity of the soils of this site as well as the gentle topography, the majority of this site is currently in agriculture production.

Associated sites

R111XD012IN	**Till Ridge Prairie** Located on an adjacent landscape position; dark soil surface color extends more than 10 inches
F111XD010IN	**Till Ridge** Located on an adjacent landscape position; soils surface color is lighter than 3/2 Munsell; soils are moderately well to well drained.
F111XD009IN	**Wet Till Ridge** Located on an adjacent landscape positon; soils surface color is lighter than 3/2 Munsell; soils are poorly to somewhat poorly drained.

Similar sites

R111XD006IN	**Mollic Till Depression** A savanna site, but with a greater tree influence. Located on till depressions. More overall production.
R111XD019IN	**Outwash Integrade** Savanna site with lesser amount of trees. Developed on outwash parent materials. Less overall production.
R111XD027IN	**Sand Dune** Drier savanna vegetation type due to lighter soils and increased drainage

Table 1. Dominant plant species

Tree	(1) *Quercus velutina* (2) *Quercus alba*
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Physiographic features

This ecosite is found till landscapes in MLRA 111D: Indiana and Ohio Till Plain, Western Part on swells or convex slopes.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Ground moraine (3) Recessional moraine
Flooding frequency	None
Ponding frequency	None
Elevation	470–940 ft
Slope	0–12%
Ponding depth	0 in
Water table depth	4–48 in
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The average annual precipitation in this area is 36 to 43 inches (915 to 1,090 millimeters). Most of the rainfall occurs as convective thunderstorms during the growing
season. About half or more of the precipitation occurs during the freeze-free period. Snowfall is common in winter. The average annual temperature is 49 to 54 degrees F (10 to 12 degrees C). The freeze-free period averages about 200 days and ranges from 180 to 215 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	133-136 days
Freeze-free period (characteristic range)	170-182 days
Precipitation total (characteristic range)	39-43 in
Frost-free period (actual range)	132-147 days
Freeze-free period (actual range)	168-186 days
Precipitation total (actual range)	39-44 in
Frost-free period (average)	137 days
Freeze-free period (average)	177 days
Precipitation total (average)	41 in

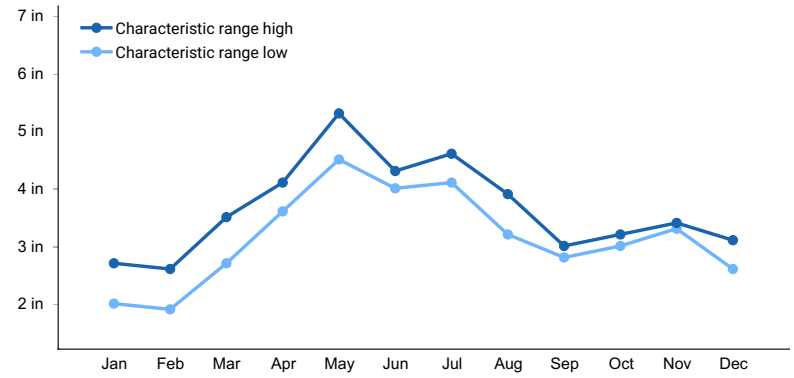

Figure 1. Monthly precipitation range

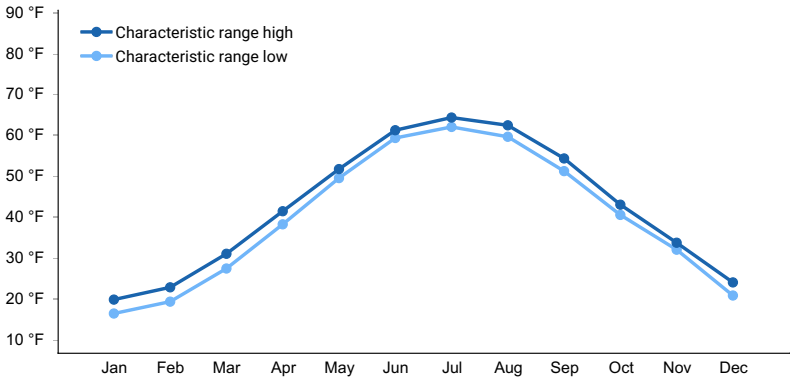

Figure 2. Monthly minimum temperature range

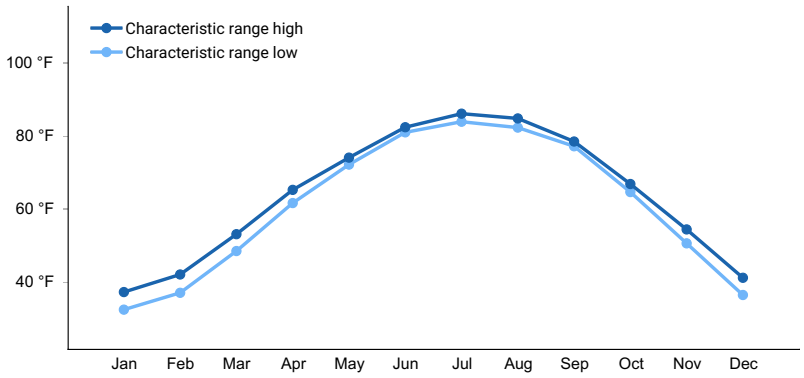

Figure 3. Monthly maximum temperature range

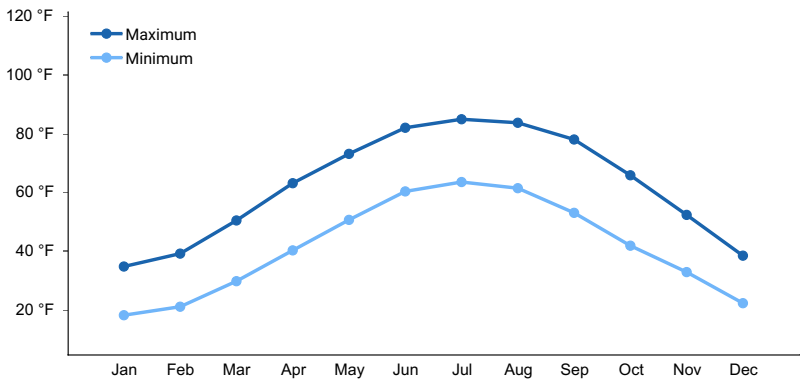

Figure 4. Monthly average minimum and maximum temperature

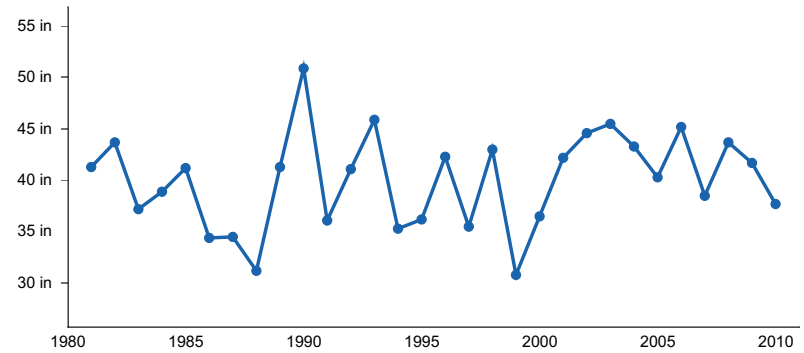

Figure 5. Annual precipitation pattern

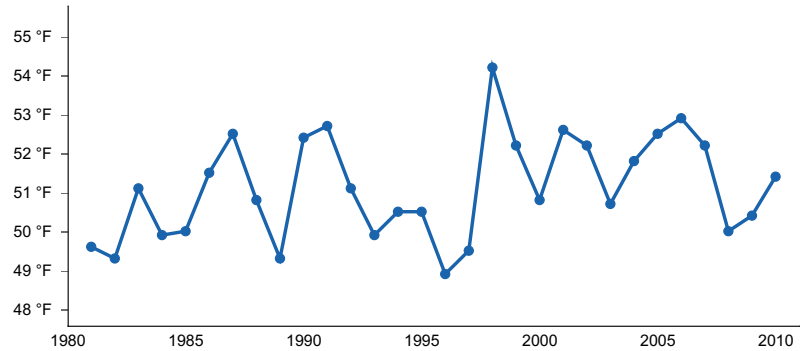

Figure 6. Annual average temperature pattern

Climate stations used

- (1) BOSWELL 4WNW [USC00120858], Fowler, IN
- (2) LAFAYETTE 8 S [USC00124715], Lafayette, IN
- (3) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN
- (4) WABASH [USC00129138], Wabash, IN
- (5) HAMILTON BUTLER CO RGNL AP [USW00053855], Fairfield, OH
- (6) WILMINGTON 3 N [USC00339219], Wilmington, OH
- (7) ATTICA 2E [USC00120331], Attica, IN

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

The soil series associated with this site are: Wingate, Toronto, Throckmorton, Octagon, Montmorenci, Mellott, Markham. They are very deep, somewhat poorly drained to well drained, and very slow to moderate permeable soils, with very strongly acidic to slightly alkaline soil reaction, that formed in Glaciofluvial deposits, Loess, Till from

Limestone.

Table 4. Representative soil features

Parent material	(1) Till–limestone
Surface texture	(1) Loam (2) Silty clay loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to moderate
Soil depth	28–58 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4.4–8.1 in
Calcium carbonate equivalent (0-40in)	0–28%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.3–7.9
Subsurface fragment volume <=3" (Depth not specified)	1–7%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The historic plant community of the Mollic Till Ridge ecological site is that of a savanna. This site is characterized by the ebb and flow of the co-dominant tall grass prairie species and oak species, primarily black and white oak. This dynamic was driven by the fire frequency and intensity. The canopy tree cover varied from about 10-60% and was dominated by black oak. Other prominent tree species included white oak and in some cases bur oak. The ground layer is dominated by graminoids principally big bluestem and little bluestem, but also included Indiangrass and switchgrass. Ground fires were the most common disturbance for this site. These frequent, but lower intensity fires, in conjunction with weather related tree mortality maintained the function of the site. Replacement fires occurred approximately every 200 years. Since settlement, the majority of this site has been converted to agricultural use with the majority being row crop agriculture where corn and soybean production is the most common practice.

State and transition model

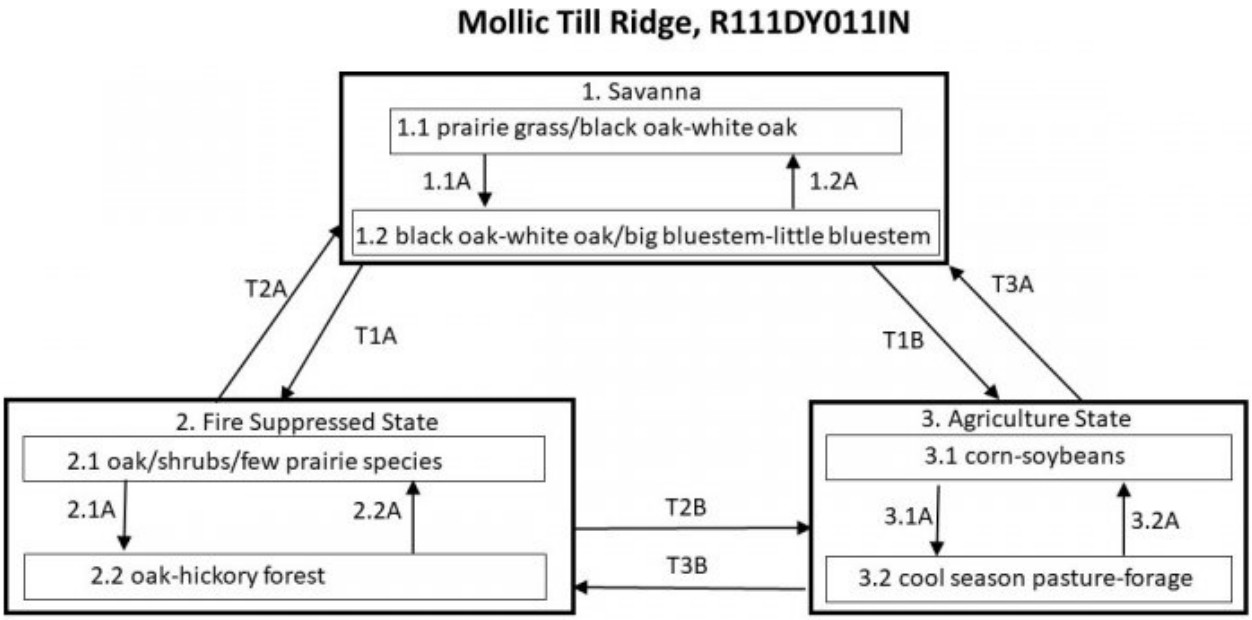

Figure 7. Mollic Till Ridge

Mollic Till Ridge, R111DY011IN
Diagram Legend

T1A	No fire, no management
T1B	Remove woody species, install drainage, site preparation, planting
T2A	Prescribed tree thinning, fire
T2B	Remove woody species, install drainage, site preparation, planting
T3A	Site preparation, seeding, fire
T3B	Site preparation, seeding/planting, no fire
1.1A	No fire, no woody species management
1.2A	More frequent/intense fire, tree removal
2.1A	No fire, no woody species management
2.2A	Tree thinning, seeding
3.1A	Pasture/forage planting and management
3.2A	Conventional/no-till planting and management of row crops

Figure 8. Legend

State 1
Savanna

This is the reference or diagnostic plant community for this site. In reference condition, this site was a co-dominance of prairie grass species and black oaks. Fire was the main disturbance agent that maintained the site. The more recent the fire the greater the dominance of grasses. Longer time between fire would sway dominance towards the trees. The removal of fire from the system and lack of tree management would move the site toward the fire suppressed state. Restoration back to the reference state could be accomplished with timber harvest, seeding

of appropriate species, and the application of fire. Plowing the prairie portions up,removing the trees, and preparation for seeding for would transition the site to the agriculture state. Cessation of tillage practices, seeding the proper species and the application of fire would allow the agriculture state to return to the reference state.

Community 1.1
big bluestem/black oak/white oak

This phase is characterized by recent or frequently occurring ground fires that shift the co-dominance towards the herbaceous species. Longer fire return intervals will move this towards phase 2.

Community 1.2
black oak/white oak/prairie grasses

This phase is characterized by protection from or longer time since the last fire. Trees and herbaceous species are co-dominant during this phase. More frequent/intense fire will shift this phase back to phase 1. Increased fire absence and no woody species management will move this site toward State 2, characterized by the marked increase in shrubs.

Pathway CP 1.1-1.2
Community 1.1 to 1.2

No fire or woody species management to remove some of the trees, especially younger age classes, from the site.

Pathway CP 1.2-1.1
Community 1.2 to 1.1

Regular application of fire and in some cases selective tree removal will move the phase back to phase 1.1

State 2
Fire Suppressed State

Absence of fire and/or lack of woody vegetation management will move this site to the fire suppressed state. This state is characterized by an increase in tree canopy concomitant with shrub species becoming the dominant growth form in the understory. White oaks and black oaks will still be the dominant tree species, but hickory becomes more prevalent in the canopy. Sub canopy and shrub species include the dogwood species, sassafras, and hazelnut species. Continued suppression of disturbance will lead to this site being a closed canopy oak-dominated forest at the higher end of the suggested canopy range.

Community 2.1
oaks/shrub/few prairie species

This phase is characterized by protection from or longer time since the last fire. Trees are the dominant growth form and shrubs are the secondary growth form. Timber cutting, more frequent/intense fire, and seeding will transition this phase back to State 1. Increased fire absence and no woody species management will move this site toward phase 2, characterized by shift in tree species.

Community 2.2
white oak/black oak/hickory forest

This phase is characterized by near lack of fire. Trees are the dominant growth form. Hickory species become more common/prevalent in the canopy. Timber cutting, more frequent/intense fire, and seeding will transition this phase back to phase 1.

Pathway CP 2.1-2.2
Community 2.1 to 2.2

No fire or woody species management allows, over time, for this phase to move to phase 2.2.

Pathway CP 2.2-2.1
Community 2.2 to 2.1

Selective tree harvest to remove some of the canopy level trees allow for more growth in the understory. The prairie species may need to be planted if they are completely absent from the understory.

State 3
Agriculture State

This site has largely been converted to agricultural use. Most of the historic acres are now in row crop agricultural use. Most common is a corn and soybean rotation of various types. Roughly 8% of the site is not used to grow hay or cool season forage and used for grazing.

Community 3.1
corn/soybeans

This phase is characterized by row crop agriculture of small grains, primarily corn and soybeans.

Community 3.2
cool season forage/pasture

This phase is characterized by forage or grazing agriculture. Different mixes of, generally, cool season grasses and forbs, largely clovers, are grown.

Pathway CP 3.1-3.2
Community 3.1 to 3.2

Planting of cool season pasture/forage species and management to maintain them.

Pathway CP 3.2-3.1
Community 3.2 to 3.1

Planting, either by conventional or no-till methods, of row crop. Management that keeps the site in row crop production

Transition T 1-2
State 1 to 2

No fire, no woody species management allow the site to transition to the fire suppressed state (#2).

Transition T 1-3
State 1 to 3

Tillage and/or spraying to kill the herbaceous understory species. Complete tree removal. Site preparation along with seeding will transition the site to the agriculture state (#3).

Restoration pathway R 2-1
State 2 to 1

Prescribed tree removal to allow for species, particularly white oak, competitive advantage. If the understory conditions warrant, it may be needed to also plant the herbaceous prairie species. Once established, regular application of fire will move the site back towards the reference state.

Transition T 2-3
State 2 to 3

Complete removal of the trees. Preparation of the site, tillage for seedbed preparation and seeding of the crop species. Agricultural practices will maintain the site in State 3.

Restoration pathway R 3-1
State 3 to 1

Site preparation, tree planting, and regular application of fire.

Restoration pathway R 3-2
State 3 to 2

Planting of both the tree species and understory plants, to include woody and prairie species. Forestry practices implemented to achieve desired species composition of the trees. No fire.

Additional community tables

Other references

Betz, R. (1973). The prairies of Indiana. Proceedings of the Fifth Midwest Prairie Conference (pp. 34-31). Ames: Iowa State University.

Braun, E. Lucy. 2001. Deciduous forests of eastern North America. Caldwell, N.J.: Blackburn Press.

Homoya, M. A., Abrell, D. B., Aldrich, J. R., & Post, T. W. (1985). The Natural Regions of Indiana. Indiana Academy of Science , 94, 245-269.

Kartesz, J. T. (2011). Density Gradient Map Samples Produced From BONAP's Floristic Synthesis. Retrieved 12 12, 2011, from Biota of North America Program: http://bonap.org/diversity/diversity/diversity.html

NatureServe. (2011). An online encyclopedia of life [web application]. NatureServe, Arlington, VA, USA [Online: www. natureserve. org/explorer] .

Jackson, Marion T. 1997. The Natural heritage of Indiana. Bloomington: Indiana University Press, published in association with the Indiana Department of Natural Resources and the Indiana Academy of Science.

Johnson, Paul S., Stephen R. Shifley, and Robert Rogers. 2002. The ecology and silviculture of oaks. Wallingford, Oxon: CABI

Transeau, E. (1935). The prairie peninsula. Ecology vol. 16 (3) , 423-437.

Upland Oak Ecology Symposium, and Martin A. Spetich. 2004. Upland Oak Ecology Symposium: history, current conditions, and sustainability : Fayetteville, Arkansas, October 7-10, 2002. [Asheville, NC]: [Southern Research Station].

USDA. (2007). Ecological Subregions: Sections and Subsections for the Conterminous United States. Washington, DC: USDA - Forest Service.

USDA. (2006). Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U. S. Department of Agriculture, Natural Resources Conservation Service. U. S. Department of Agriculture Handbook 296.

USGS. (2010). LANDFIRE Biophysical Settings. Retrieved from http://www.landfire.gov

Whitaker, John O., Charles J. Amlaner, Marion T. Jackson, George R. Parker, and Peter Evans Scott. 2012. Habitats and ecological communities of Indiana presettlement to present. Bloomington: Indiana University Press.

Contributors

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Approval

Chris Tecklenburg, 5/28/2020

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)	TYLER STAGGS
Contact for lead author	
Date	05/09/2024
Approved by	Chris Tecklenburg
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:**