USDA Natural Resources Conservation Service

# Ecological site R111XA022IN
# Sand Dune

Last updated: 4/17/2020
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): 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.

111A – Indiana and Ohio Till Plain, Central Part. This area is in the Till Plains Section of the Central Lowland Province of the Interior Plains. It is dominated by broad, nearly level ground moraines that are broken in some areas by kames, outwash plains, and stream valleys along the leading edge of the moraines. Narrow, shallow valleys commonly are along the few large streams in the area. Elevation ranges from 680 to 1,250 feet (205 to 380 meters), increasing gradually from west to east. 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), 46 percent; Great Miami (0508), 30 percent; Scioto (0506), 22 percent; and the Middle Ohio (0509), 2 percent. The major rivers in the area include the East and West Forks of the White River and the Whitewater River in Indiana and the Great Miami, Stillwater, Big Darby, Scioto, and Big Walnut Rivers in Ohio.

Surface deposits in this area include glacial deposits of till, lacustrine sediments, and outwash from Wisconsin and older glacial periods. A moderately thick mantle of loess covers much of the area. Most of this MLRA is underlain by Silurian and Devonian limestone and dolostone. Also, some areas of Late Ordovician shale and limestone are in the western part of the MLRA (USDA, 2006).

## Classification relationships

Major Land Resource Area (USDA-Natural Resources Conservation Service, 2006)
USFS Ecological Regions (USDA, 2007):
Sections – Southern Unglaciated Allegheny Plateau (221E), Central Till Plains, Beech Maple (222H), Interior Low Plateau-Transition Hills (223B), Interior Low Plateau-Bluegrass (223F)
Subsections - Lower Scioto River Plateau (221Eg), Bluffton Till Plains (222Ha), Miami-Scioto Plain-Tipton Till Plain

(222Hb), Little Miami Old Drift Plain (222Hc), Mad River Interlobate Plains (222Hd), Darby Plains (222He), Brown County Hills (223Ba), Northern Bluegrass (223Fd), Muscatatuck Flats and Valleys (223Fe), Scottsburg Lowlands (223Ff)

NatureServe Systems anticipated (NatureServe, 2011): Agriculture - Cultivated Crops and Irrigated Agriculture, Agriculture - Pasture/Hay, Allegheny-Cumberland Dry Oak Forest and Woodland, Appalachian (Hemlock)-Northern Hardwood Forest, Central Appalachian Pine-Oak Rocky 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 Floodplain, North-Central Interior Freshwater Marsh, North-Central Interior Oak Savanna, North-Central Interior Wet Flatwoods, North-Central Interior Wet Meadow-Shrub Swamp, North-Central Oak Barrens, Northeastern Interior Dry-Mesic Oak 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, Southern Ridge and Valley / Cumberland Dry Calcareous Forest, Successional Shrub/Scrub

LANDFIRE Biophysical Settings anticipated (USGS, 2010): Allegheny-Cumberland Dry Oak Forest and Woodland, Appalachian (Hemlock-) Northern Hardwood Forest, 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, 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 Oak Savanna, North-Central Interior Wet Flatwoods, 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 form on sandy, wind and water deposited, parent materials. It is located on the summits, shoulders, and steep back slopes of dune topography. The soils of the site somewhat coarser textured, very deep, and well drained to somewhat excessively well drained. The characteristic vegetation of this site is that of a dry sand savanna that is somewhat of a transition between the adjacent oak woodlands and dry tall-grass prairie. The relatively sparse trees are dominated mostly by black oak, but white oak was also common. 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. The herbaceous species that are most common are those found in dry tall grass prairies such as little bluestem, big bluestem, and diverse assemblage of prairie forb species. An increase in the fire return interval allows this site to transition to a woodland state by allowing more trees to reach maturity. Currently, the majority of this site is in the agriculture state and mostly used for corn and soybean production.

## Associated sites

| | |
|---|---|
| F111XA021IN | **Sandy Interdune**<br>Site is located in an interdunal landscape position (footslope and toeslope); soils are poorly to moderately well drained |

## Similar sites

| | |
|---|---|
| F111XA015IN | **Dry Outwash Upland**<br>Soil parent material is outwash; soils are well or excessively drained |
| R111XA017IN | **Dry Outwash Mollisol**<br>Soil parent material is outwash; soils are mollisols; soils are moderately well to excessively drained. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Quercus velutina* |
| Shrub | Not specified |

| | |
|---|---|
| Herbaceous | (1) *Andropogon gerardii*<br>(2) *Schizachyrium scoparium* |

## Physiographic features

This ecosite is found in unspecified landscape in MLRA 111A: Indiana and Ohio Till Plain, Central Part. This site was formed from Aeolian sand deposits. It is located on the summits, shoulders, and backslopes. The water table depth is greater than 60 inches.

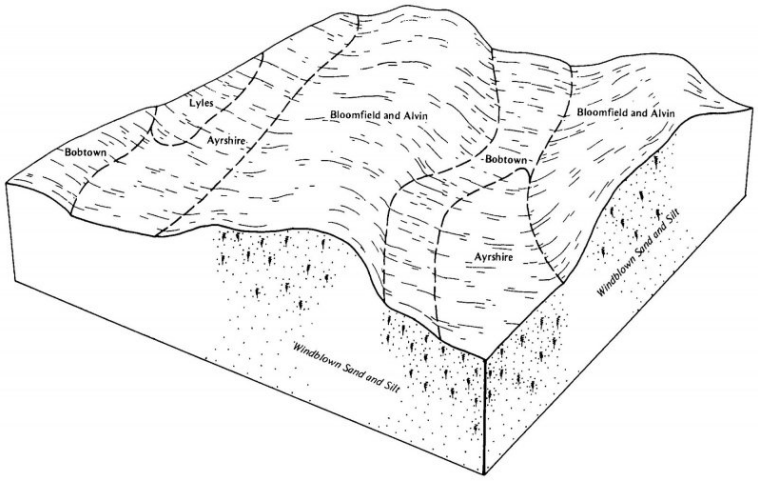


**Figure 1. Block diagram showing soils on the landscape.**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Dune<br>(2) Outwash terrace<br>(3) Stream terrace |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 107–381 m |
| Slope | 0–25% |
| Ponding depth | 0 cm |
| Water table depth | 152 cm |
| 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 53 degrees F (9 to 12 degrees C). The freeze-free period averages about 195 days and ranges from 175 to 215 days.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 141-156 days |
| Freeze-free period (characteristic range) | 172-189 days |
| Precipitation total (characteristic range) | 991-1,118 mm |
| Frost-free period (actual range) | 133-164 days |
| Freeze-free period (actual range) | 171-198 days |
| Precipitation total (actual range) | 991-1,143 mm |

| | |
|---|---|
| Frost-free period (average) | 148 days |
| Freeze-free period (average) | 181 days |
| Precipitation total (average) | 1,041 mm |

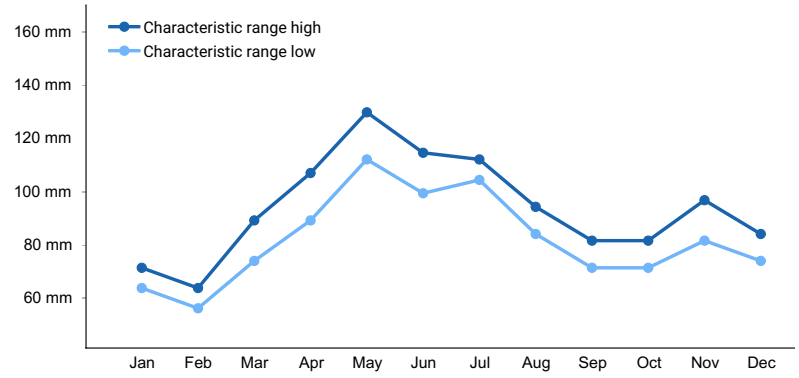


**Figure 2. Monthly precipitation range**

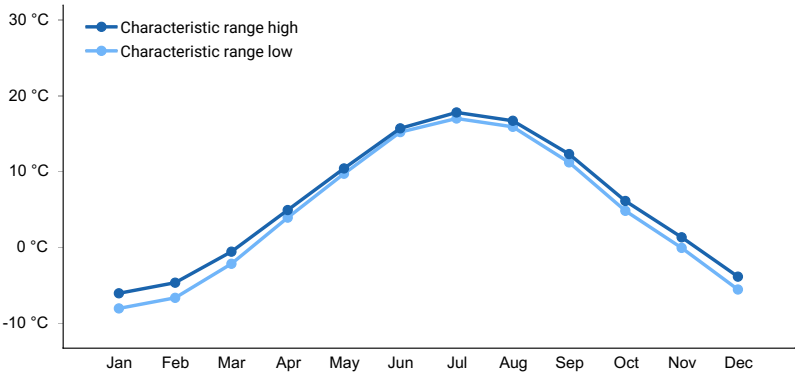


**Figure 3. Monthly minimum temperature range**

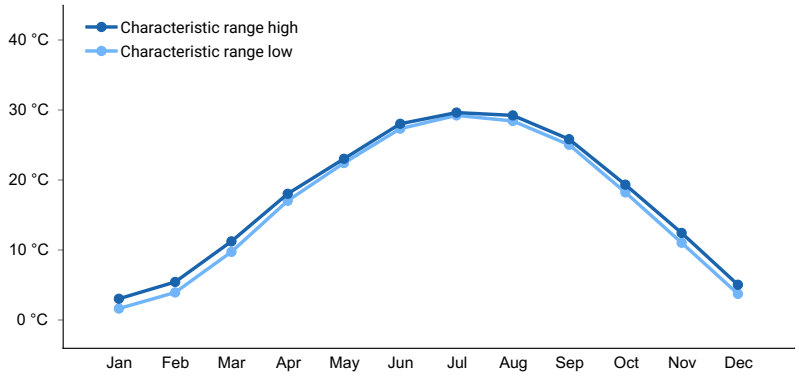


**Figure 4. Monthly maximum temperature range**

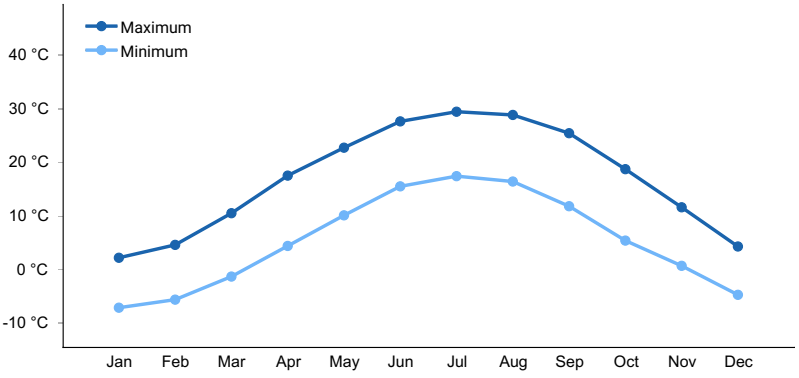


**Figure 5. Monthly average minimum and maximum temperature**

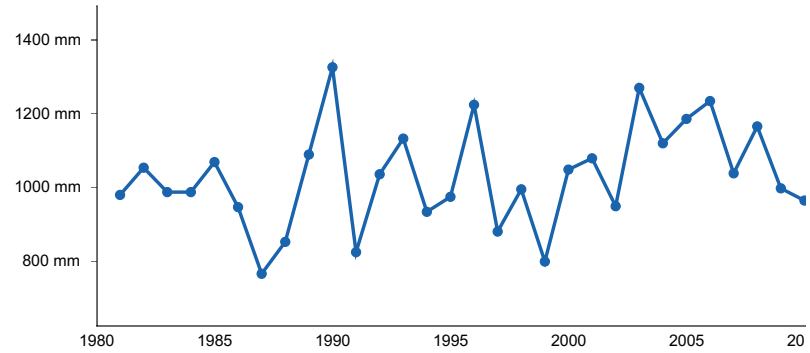


**Figure 6. Annual precipitation pattern**

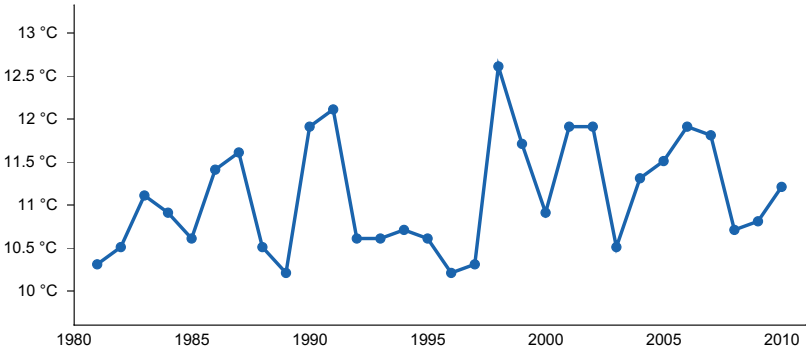


**Figure 7. Annual average temperature pattern**

## Climate stations used

- (1) RICHMOND WTR WKS [USC00127370], Richmond, IN
- (2) SIDNEY 1 S [USC00337693], Sidney, OH
- (3) CHILLICOTHE MOUND CITY [USC00331528], Chillicothe, OH
- (4) COLUMBUS OHIO STATE UNIV AP [USW00004804], Dublin, OH
- (5) COLUMBUS [USC00121747], Columbus, IN
- (6) MARTINSVILLE 2 SW [USC00125407], Martinsville, IN
- (7) CIRCLEVILLE [USC00331592], Circleville, OH
- (8) KOKOMO 3 WSW [USC00124662], Russiaville, 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: Princeton, Boyer, Bloomfield, Alvin. They are very deep, well drained to somewhat excessively drained, and moderate to very rapid permeable soils, with strongly acidic to moderately alkaline soil reaction, that formed in Eolian deposits, Eolian sands, and Outwash.

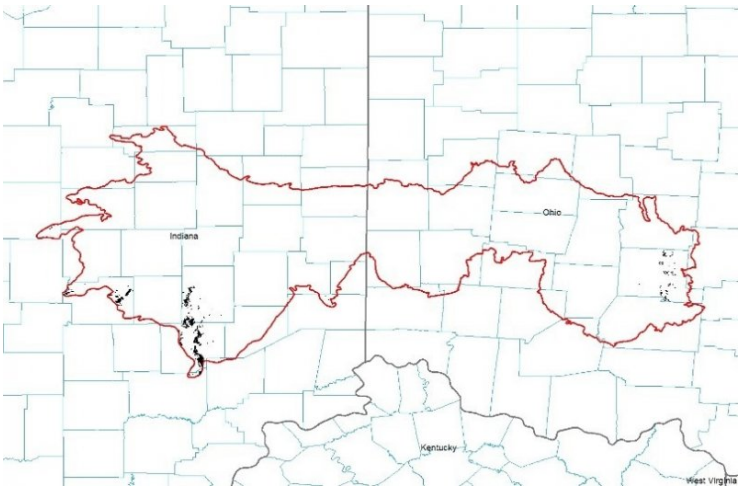


**Figure 8. Location of mapunits in the MLRA**

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Eolian deposits<br>(2) Outwash<br>(3) Eolian sands |
| Surface texture | (1) Gravelly loamy sand<br>(2) Sandy loam<br>(3) Fine sand |
| Family particle size | (1) Sandy |
| Drainage class | Well drained to somewhat excessively drained |
| Permeability class | Moderate to very rapid |
| Soil depth | 51–76 cm |
| Surface fragment cover <=3" | 0% |
| Surface fragment cover >3" | 0% |
| Available water capacity (0-101.6cm) | 8.89–17.53 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0% |
| Electrical conductivity (0-101.6cm) | 0 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0 |
| Soil reaction (1:1 water) (0-101.6cm) | 5.5–6.6 |
| Subsurface fragment volume <=3" (Depth not specified) | 7–14% |
| Subsurface fragment volume >3" (Depth not specified) | 2–3% |

## Ecological dynamics

The historic plant community of the Sand Dune ecological site is a dry sand savanna. This site is characterized by the ebb and flow of the co-dominant tall grass prairie species and oak species, primarily black oak. This dynamic was driven by the fire frequency and intensity.

The canopy tree cover varied from about 5 to 60 percent and dominated by black oak. Other prominent tree species include white oak, black cherry, and hickory species. The ground layer is dominated by graminoids with the most

common species being little bluestem, porcupine grass, and big bluestem.

Ground fires was the most common disturbance for this site. These frequent, but lower intensity fires, in conjunction with wind throw would maintain the function of the site. Replacement fires would have occurred roughly every 200 years.

Since settlement, the majority of this site has been converted to agricultural use with the majority being row crop agriculture. The most common practice involves grain rotations between corn and soybeans, with occasionally wheat being planted

## State and transition model

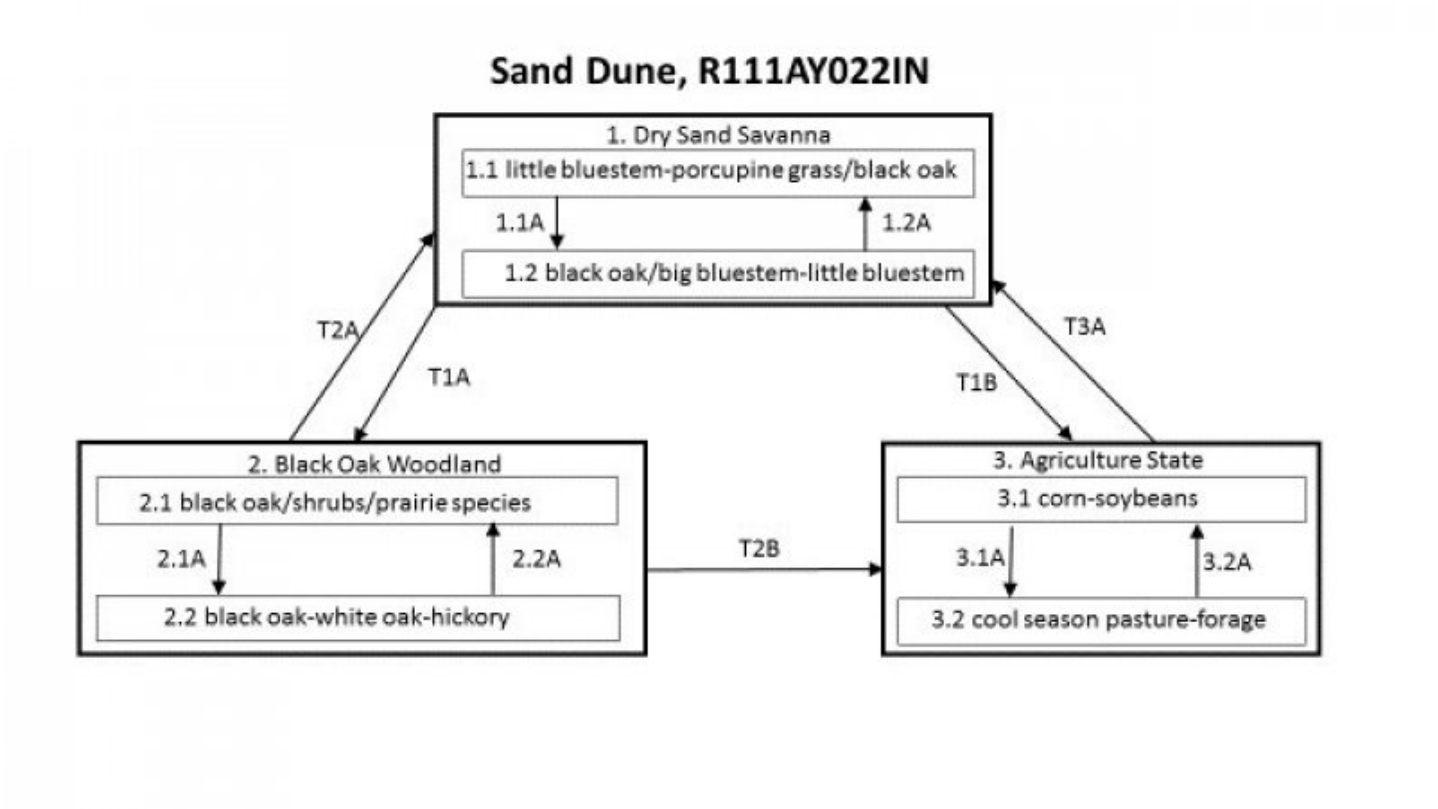


**Figure 9. STM**


**Figure 10. Legend**

## State 1
## Dry Sand Savanna

This site has largely been converted to agricultural use. Roughly 75% of the historic acres are now in row crop agricultural use. Most common is a corn and soybean rotation of various types. Roughly 5% of the site is not used to grow hay or cool season forage and used for grazing.

### Dominant plant species

- black oak (*Quercus velutina*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass

## Community 1.1
## little bluestem/black oak/porcupine grass

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.

### Dominant plant species

- black oak (*Quercus velutina*), tree
- little bluestem (*Schizachyrium scoparium*), grass

## Community 1.2
## black oak/little bluestem

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.

### Dominant plant species

- black oak (*Quercus velutina*), tree

- little bluestem (*Schizachyrium scoparium*), grass

### Pathway P1.1A
### Community 1.1 to 1.2

Succession, increase in fire return interval

### Pathway P1.2A
### Community 1.2 to 1.1

more frequent/ intense fires.

## State 2
## Black Oak Woodland

Absence of fire and/or lack of woody vegetation management will move this site to the black oak woodland state. This state is characterized by an increase in tree canopy (61-100%) concomitant with shrub species becoming the dominant growth form in the understory. Black oaks will still be the dominant tree species, but white oaks and hickory become more dominant. 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. White oak eventually becomes the dominant tree species with black oak, shagbark hickory and black cherry also in the canopy.

#### Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- shagbark hickory (*Carya ovata*), tree

### Community 2.1
### black oak/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.

#### Dominant plant species

- black oak (*Quercus velutina*), tree

### Community 2.2
### black oak/white oak/ hickory

This phase is characterized by near lack of fire. Trees are the dominant growth form. White oaks and 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.

#### Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- hybrid hickory (*Carya*), tree

### Pathway P2.1A
### Community 2.1 to 2.2

lack of fire. no woody species management

### Pathway P2.2A
### Community 2.2 to 2.1

tree removal and addition of fire on the landscape

### State 3
### Agriculture

This site has largely been converted to agricultural use. Roughly 75% of the historic acres are now in row crop agricultural use. Most common is a corn and soybean rotation of various types. Roughly 5% of the site is not used to grow hay or cool season forage and used for grazing.

### Community 3.1
### Row Crop Agriculture

This phase is characterized by row crop agriculture of small grains, primarily corn, soybeans, and occasionally wheat. Seeding and management could transition this phase to phase 2.

### 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. Tillage, seeding and management could transition this phase to phase 1.

### Pathway P3.1A
### Community 3.1 to 3.2

Pasture/forage planting and management

### Pathway P3.2A
### Community 3.2 to 3.1

Conventional or no till planting and management for row crops

### Restoration pathway R3A
### State 1 to 1

Site prep, seeding, fire

### Transition T1A
### State 1 to 2

Increase fire absence, no woody species mangement.

### Transition T1B
### State 1 to 3

Remove woody species, site preparation, planting

### Restoration pathway R2A
### State 2 to 1

Remove canopy trees, increase fire frequency /intensity, planting desired species.

### Transition T2B
### State 2 to 3

Remove woody species, site preparation, planting

### Restoration pathway R3A
### State 3 to 1

Site prep, seeding, fire

## Additional community tables

### Inventory data references

Site concept developed through expert opinion, review of the literature, and field reconnaissance.

### Other references


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## Contributors

Tyler Staggs

## Approval

Chris Tecklenburg, 4/17/2020

## 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 | 05/05/2024 |
| 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:**