

## Ecological site F111XD025IN Sandy Interdune

Last updated: 5/28/2020  
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### 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 in depressions on glacial till plains, land plains, on sandy parent material. It is located on the footslopes, toeslopes, and back slopes in an interdunal position. Drainage of the soils on this site ranges from very poorly to moderately well drained. The characteristic plant community for this site is an oak woodland that is dominated in the understory and canopy layers by oak species, mostly black and white oak. Pignut hickory, shagbark hickory, black cherry and sassafras are fairly common in the canopy level as well. Beneath the canopy, the understory is generally relatively dense as the wider spacing of the trees in a woodland allow for adequate sunlight to support a variety of species. Understory tree species include flowering dogwood and hop-hornbeam. The herbaceous portion of the understory contains many species that are more common in adjacent savannas and prairies like big bluestem, poverty oatgrass, and sedge species. Fire intensity and frequency was the principle driver for this site, with low intensity ground fires every (4-17) years being common. An increase in the fire return interval leads to a higher tree density and the concurrent increase in shade decreased the amount and diversity of species in the understory. This allows for shade tolerant species such as sugar maple and the invasive Asian honeysuckles to get established. Left unchecked these can come to dominant the site. Since settlement, most of this site has been converted to agriculture with the majority being row crop agriculture. The most common practice involves grain rotations between corn and soybeans.

## Associated sites

R111XD027IN	<b>Sand Dune</b> Located on dune landscape position; soil surface color is lighter than 3/2 Munsell.
R111XD026IN	<b>Sand Dune Prairie</b> Located on dune landscape position; soil surface color is 3/2 Munsell or darker and extends for more than 10 inches; soils are mollisols.

## Similar sites

R111XD027IN	<b>Sand Dune</b> Located on glacial till parent material; site is located on a concave landscape position; soil surface color is 3/2 Munsell or darker to less than 10 inches.
F111XD018IN	<b>Dry Outwash Upland</b> Located on glacial till parent material; site is located on a convex landscape position; soil surface color is 3/2 Munsell or darker to less than 10 inches.
R111XD019IN	<b>Outwash Integrate</b> Located on outwash parent material; soil surface color is lighter than 3/2 Munsell; soils are well to excessively drained.
R111XD006IN	<b>Mollic Till Depression</b> Located on outwash parent material; soil color is 3/2 Munsell or darker to less than 10 inches.
R111XD011IN	<b>Mollic Till Ridge</b> Located on dune landscape position; soil surface color is lighter than 3/2 Munsell

**Table 1. Dominant plant species**

Tree	(1) <i>Quercus velutina</i> (2) <i>Quercus alba</i>
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i>

## Physiographic features

This ecosite is found in unspecified landscape in MLRA 111D: Indiana and Ohio Till Plain, Western Part. This site is classified as an upland site located in depressions on outwash plains, lake plains, and developed on sandy material. Drainage is characterized somewhat poorly drained.

**Table 2. Representative physiographic features**

Landforms	(1) Interdune (2) Stream terrace
Flooding frequency	None
Ponding frequency	None
Elevation	104–305 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	15–76 cm
Aspect	Aspect is not a significant factor

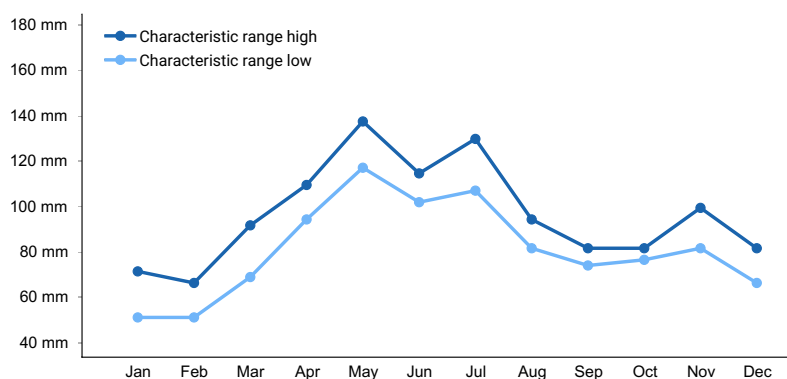
## Climatic features

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

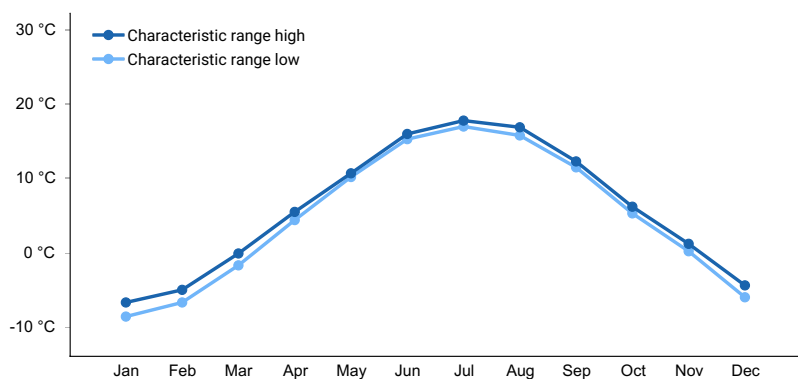
season. About half or more of the precipitation occurs during the freeze-free period. Snowfall is common in winter. The average annual temperature is 49 to 54 degrees F (10 to 12 degrees C). The freeze-free period averages about 200 days and ranges from 180 to 215 days.

**Table 3. Representative climatic features**

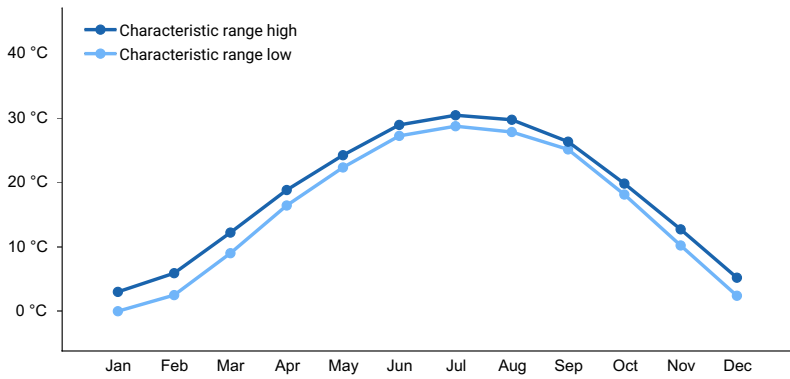
Frost-free period (characteristic range)	134-149 days
Freeze-free period (characteristic range)	176-182 days
Precipitation total (characteristic range)	991-1,118 mm
Frost-free period (actual range)	133-151 days
Freeze-free period (actual range)	171-186 days
Precipitation total (actual range)	991-1,194 mm
Frost-free period (average)	141 days
Freeze-free period (average)	179 days
Precipitation total (average)	1,067 mm



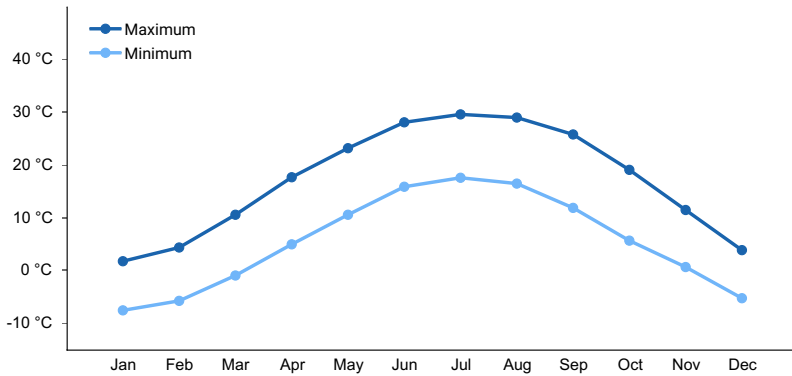
**Figure 1. Monthly precipitation range**



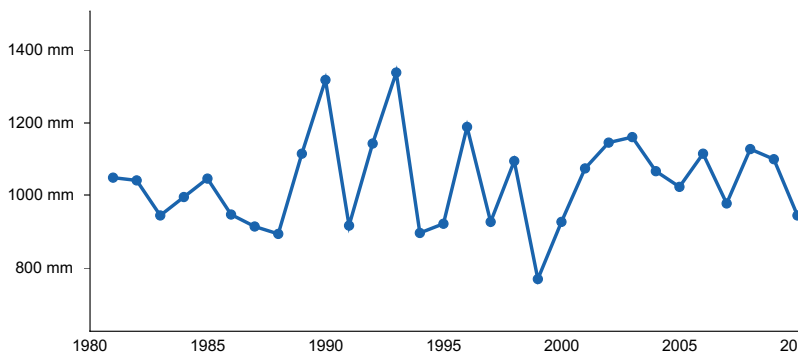
**Figure 2. Monthly minimum temperature range**



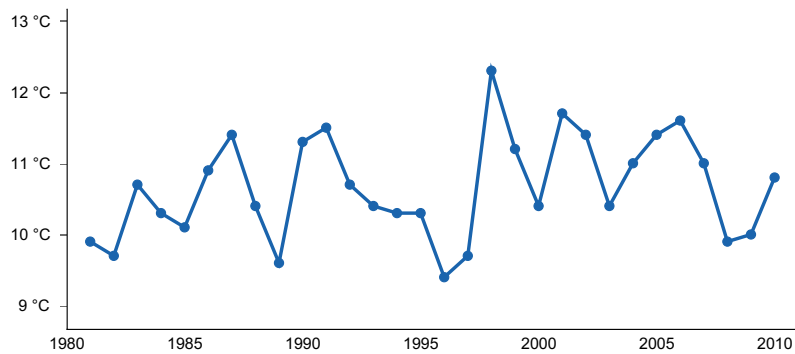
**Figure 3. Monthly maximum temperature range**



**Figure 4. Monthly average minimum and maximum temperature**



**Figure 5. Annual precipitation pattern**



**Figure 6. Annual average temperature pattern**

### Climate stations used

- (1) TERRE HAUTE INDIANA ST [USC00128723], Terre Haute, IN
- (2) ATTICA 2E [USC00120331], Attica, IN
- (3) ROCKVILLE [USC00127522], Rockville, IN

- (4) YOUNG AMERICA [USC00129905], Kokomo, IN
- (5) BOSWELL 4WNW [USC00120858], Fowler, IN
- (6) HAMILTON BUTLER CO RGNL AP [USW00053855], Fairfield, OH
- (7) WILMINGTON 3 N [USC00339219], Wilmington, OH

## 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: Ayrshire. They are very deep, somewhat poorly drained, and moderate to moderately rapid permeable soils, with strongly acidic to neutral soil reaction, that formed in Eolian deposits and Eolian sands.

**Table 4. Representative soil features**

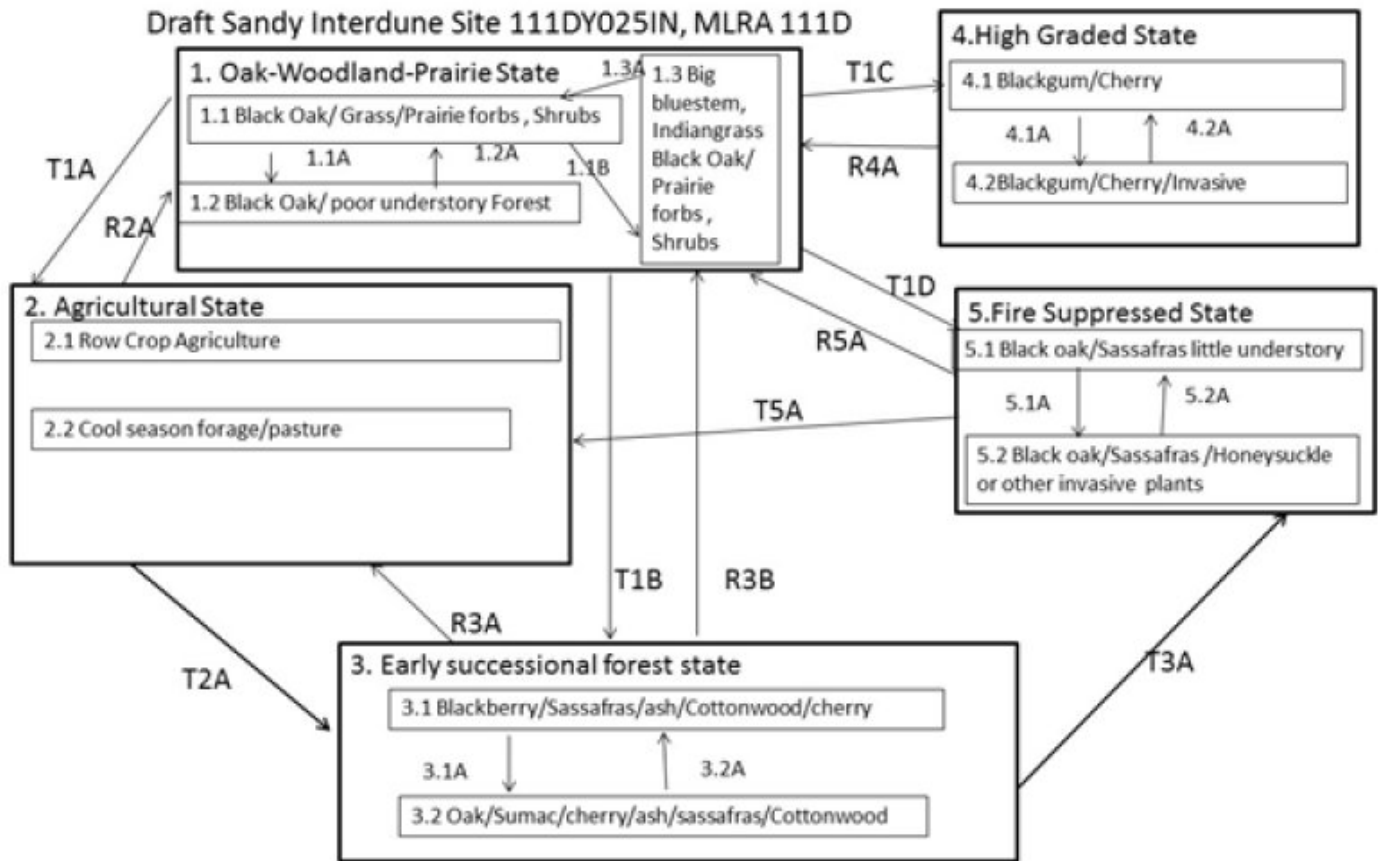
Parent material	(1) Eolian deposits (2) Eolian sands
Surface texture	(1) Fine sandy loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained
Permeability class	Moderate
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.27–17.53 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)	5.8–6.5
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

## Ecological dynamics

The historic plant community of the Sandy Interdune ecological site is an oak woodland. This site is characterized as being a mostly woody species dominated site adjacent to prairies and savannas and formed part of the continuum between prairie and forest. Fire intensity and frequency was the principle driver for this site, with low intensity ground fires every (4-17) years being common. Longer fire return intervals would lead the site to being a forest type. Canopy cover would range from 21-60% for the reference state community. Since settlement, most of this site has been converted to agriculture with the majority being row crop agriculture. The most common practice involves grain rotations between corn and soybeans.

## State and transition model

Draft Sandy Interdune Site 111DY025IN, MLRA 111D



Refer to narrative in the Plant Community Section for detailed descriptions of these transitions/pathways. **1.1A/1.3A/T1D** No management & no fire **1.1B-Fire**; **1.2A** Timber stand improvement (TSI); **T1A /R3A/T5A** Clearing, Site Prep & Seeding; **T1B** – Clear-cut & Succession; **T1C** Selective Harvest/no TSI. **R2A-** Planting & TSI; **T2A**– Abandonment/poor mgt; **R3B-** Long term succession & TSI measures; **3.1A** – Succession & planting oak if absent; **3.2A** Cutting or disturbance; **T3A/T4B** - Fire Suppression; **R4A** – TSI & Planting; **R5A** Prescribed harvest & fire

Figure 7. F111DY025IN Sandy Interdune State and Transition M

**Sandy Interdune, F111DY025IN**  
**Diagram Legend**

T1A	Woody species removal, site preparation, and planting of agricultural crop.
T1B	Clear cut of all trees and succession.
T1C	Selective harvest of marketable trees; no TSI
T1D	No woody species management; no fire.
T2A	Planting of desired species; TSI measures
T2B	No or poor management of tree species
T3A	Long term succession; TSI measures
T3B	Woody species removal, site preparation, and planting of agricultural crop.
T3C	Fire suppression
T4A	Planting of desired species; TSI measures



T5A	Prescribed tree harvest; fire
T5B	Woody species removal, site preparation, and planting of agricultural crop.
1.1A	No management; no fire
1.2A	TSI measures
3.1A	Succession and planting of oaks if needed
3.2A	Cutting or disturbance that removes overstory trees
4.1A	Succession; no management
4.2A	Cutting or disturbance that removes overstory trees; invasive species management
5.1A	No invasive species management; succession
5.2A	Chemical/mechanical removal of invasive species

## State 1

### Oak Woodland-Prairie State

This is the reference or diagnostic plant community for this site. In reference condition, this site was an oak woodland with the understory comprised largely of herbaceous prairie species. Fire intensity and frequency was the major disturbance factor for the maintenance of this site. Fires occurred about every 20 years. Tree canopy cover ranged from 21-60% and tree height maxed out at about 80ft. Black oak was the most dominant tree, but white oak, hickory species, and black cherry were also present. Removal of fire or the lengthening of the return interval would move this site toward state 5, a forested state. Tree harvest management would move this site to either state 3 or 4.

#### Dominant plant species

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

### Community 1.1

#### black oak/prairie herbaceous species woodland

This community phase was an oak woodland with the understory comprised largely of herbaceous prairie species. Fire intensity and frequency was the major disturbance factor for the maintenance of this site. Fires occurred about every 20 years. Tree canopy cover ranged from 21-60% and tree height maxed out at about 80ft. Black oak was the most dominant tree, but white oak, hickory species, and black cherry were also present.

### Community 1.2

## **black oak/poor understory**

This community phase was an oak woodland but at the higher limits for tree canopy cover. The lack of fire and increase in shade have reduced the diversity and abundance of the understory.

## **Community 1.3 prairie/black oak woodland**

This community phase was an oak woodland but at the lower limits for tree canopy cover. The short time since the last fire or more frequent fires or timber stand improvement have this phase closely resembling that of an oak savanna. Prairie grass species such as big bluestem and Indiangrass become more prominent and abundant.

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

no management, no fire

## **Pathway P1.1B Community 1.1 to 1.3**

management for less shrubs/trees

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

timber stand improvement

## **Pathway P1.3A Community 1.3 to 1.1**

Increase in trees

## **State 2 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 2.1 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 2.2 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 P2.1 Community 2.1 to 2.2**

Establishment and maintenance of forage/pasture species

## **Pathway P2.2**

## **Community 2.2 to 2.1**

Establishment and maintenance of row crops.

## **State 3**

### **Early Successional Forest State**

This state consists of early colonizing trees, shrubs, and herbaceous plants. This is the result of clear-cutting the reference state and succession with little to no management. The woodland and prairie phases of the reference community are lost in large part due to the lack of fire as disturbance. Long term succession and timber stand improvement measures can move this site back towards the reference state. Continued fire suppression will move this towards a forest state (#5).

## **Community 3.1**

### **blackberry/sassafras/ash**

This phase is characterized by early colonizing woody species, mostly shrubs and small trees. This is a result of clear cutting and succession without the use of fire. Species such as blackberry, sassafras, and ash become the dominant species. Some of the prairie herbaceous species will be present in the understory for a time, but will be eventually outcompeted.

## **Community 3.2**

### **oak/sumac/cherry/ash**

This phase is characterized by early colonizing woody species, but larger species start to dominate the canopy. Oak can become present again, if planted or less likely through natural distribution. Nearly all the herbaceous prairie species have disappeared from the understory and have been replaced by more shade tolerant woody species.

## **Pathway P3.1A**

### **Community 3.1 to 3.2**

succession and planting of oaks if needed

## **Pathway 3.2A**

### **Community 3.2 to 3.1**

Tree cutting or any other type of disturbance to remove some of the upper canopy trees.

## **State 4**

### **High Graded State**

This state is a forested state with increased tree cover (61-80%) over the reference state and the loss of most of the prairie species in the understory. The canopy tree species become dominated by less-marketable tree species that are fire intolerant. This is due to selective harvest without follow up timber stand improvement practices and lack of fire. Timber stand improvement, planting of desired tree species, and fire can restore this to the reference state.

### **Dominant plant species**

- blackgum (*Nyssa sylvatica*), tree
- black cherry (*Prunus serotina*), tree

## **Community 4.1**

### **blackgum/cherry**

This phase is characterized by two classes of trees. Those that have little market value as timber, such as black gum and those that are often small in numbers or size in the reference state like black cherry. The understory is still largely composed of prairie herbaceous species.

## **Community 4.2**

### **blackgum/cherry/invasive species**

This phase is characterized by two classes of trees. Those that have little market value as timber, such as black gum and those that are often small in numbers or size in the reference state like black cherry. The absence of disturbance or management have allowed this to develop into a forest phase with a canopy greater than 80% cover. Lack of management has the understory dominated by invasive shade tolerant species such as Asian bush honeysuckle and Callery pear

### **Pathway 4.1A**

#### **Community 4.1 to 4.2**

No management, especially invasive species management

### **Pathway 4.2A**

#### **Community 4.2 to 4.1**

Invasive species management. Cut and spray of non-native bush honeysuckle.

## **State 5**

### **Fire Suppressed State**

This state is an oak forest (81-100% canopy) state dominated by black oaks, with an increase in the amount of white oaks, hickories, and given enough time more mesophytic species like sugar maple present in the canopy. Nearly all the prairie herbaceous species are gone from the understory and replaced by more shade loving, fire intolerant woody species. Sassafras becomes common in the understory. With little to no management, the understory will often be invaded by and taken over by invasive honeysuckle species.

#### **Dominant plant species**

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

## **Community 5.1**

### **blackgum/cherry**

This phase is characterized by two classes of trees. Those that have little market value as timber, such as black gum and those that are often small in numbers or size in the reference state like black cherry. The understory is still largely composed of prairie herbaceous species.

## **Community 5.2**

### **blackgum/cherry/invasive species**

This phase is characterized by two classes of trees. Those that have little market value as timber, such as black gum and those that are often small in numbers or size in the reference state like black cherry. The absence of disturbance or management have allowed this to develop into a forest phase with a canopy greater than 80% cover. Lack of management has the understory dominated by invasive shade tolerant species such as Asian bush honeysuckle and Callery pear

### **Transition T1A**

#### **State 1 to 2**

Woody species removal, site prep and planting of crops

### **Transition T1B**

#### **State 1 to 3**

Clear cut of all trees and succession

## **Transition T1C**

### **State 1 to 4**

Selective harvest and no timber stand improvement

## **Restoration pathway R2A**

### **State 2 to 1**

extensive restoration efforts including planting, weed control, brush control, and timber stand improvement activities

## **Transition T2B**

### **State 2 to 3**

no management, reverting to successional forest

## **Restoration pathway R3A**

### **State 3 to 1**

long term succession with brush/weed control and timber stand improvement

## **Transition T3A**

### **State 3 to 2**

Establishment of agricultural crops

## **Restoration pathway R4A**

### **State 4 to 1**

Timber stand improvement and plantings

## **Additional community tables**

### **Inventory data references**

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

### **Other references**

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## Contributors

Tyler Staggs

## 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	05/05/2024
Approved by	Chris Tecklenburg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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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:**

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