USDA Natural Resources
Conservation Service

Ecological site F115XB017MO
Sandstone Protected Backslope Forest

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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.

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): 115X–Central Mississippi Valley Wooded Slopes

This MLRA is characterized by deeply dissected, loess-covered hills bordering well defined valleys of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers and their tributaries. It is used to produce cash crops and livestock. About one-third of the area is forested, mostly on the steeper slopes. This area is in Illinois (50 percent), Missouri (36 percent), Indiana (13 percent), and Iowa (1 percent) in two separate areas. It makes up about 25,084 square miles (64,967 square kilometers).

Most of this area is in the Till Plains section and the Dissected Till Plains section of the Central Lowland province of the Interior Plains. The Springfield-Salem plateaus section of the Ozarks Plateaus province of the Interior Highlands occurs along the Missouri River and the Mississippi River south of the confluence with the Missouri River. The nearly level to very steep uplands are dissected by both large and small tributaries of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers. The Ohio River flows along the southernmost boundary of this area in Indiana. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to undulating. Karst topography is common in some parts along the Missouri and Mississippi Rivers and their tributaries. Well-developed karst areas have hundreds of sinkholes, caves, springs, and losing streams. In the St. Louis area, many of the karst features have been obliterated

by urban development.

Elevation ranges from 90 feet (20 meters) on the southernmost flood plains to 1,030 feet (320 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 150 feet (15 to 45 meters) in the steep, deeply dissected hills bordering rivers and streams. The bluffs along the major rivers are generally 200 to 350 feet (60 to 105 meters) above the valley floor.

The uplands in this MLRA are covered almost entirely with Peoria Loess. The loess can be more than 7 feet (2 meters) thick on stable summits. On the steeper slopes, it is thin or does not occur. In Illinois, the loess is underlain mostly by Illinoian-age till that commonly contains a paleosol. Pre-Illinoian-age till is in parts of this MLRA in Iowa and Missouri and to a minor extent in the western part of Illinois. Wisconsin-age outwash, alluvial deposits, and sandy eolian material are on some of the stream terraces and on dunes along the major tributaries. The loess and glacial deposits are underlain by several bedrock systems. Pennsylvanian and Mississippian bedrock are the most extensive. To a lesser extent are Silurian, Devonian, Cretaceous, and Ordovician bedrock. Karst areas have formed where limestone is near the surface, mostly in the southern part of the MLRA along the Mississippi River and some of its major tributaries. Bedrock outcrops are common on the bluffs along the Mississippi, Ohio, and Wabash Rivers and their major tributaries and at the base of some steep slopes along minor streams and drainageways.

The annual precipitation ranges from 35 to 49 inches (880 to 1,250 millimeters) with a mean of 41 inches (1,050 millimeters). The annual temperature ranges from 48 to 58 degrees F (8.6 to 14.3 degrees C) with a mean of 54 degrees F (12.3 degrees C). The freeze-free period ranges from 150 to 220 days with a mean of 195 days.

Soils The dominant soil orders are Alfisols and, to a lesser extent, Entisols and Mollisols. The soils in the area have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They are shallow to very deep, excessively drained to poorly drained, and loamy, silty, or clayey.

The soils on uplands in this area support natural hardwoods. Oak, hickory, and sugar maple are the dominant species. Big bluestem, little bluestem, and scattered oak and eastern redcedar grow on some sites. The soils on flood plains support mixed forest vegetation, mainly American elm, eastern cottonwood, river birch, green ash, silver maple, sweetgum, American sycamore, pin oak, pecan, and willow. Sedge and grass meadows and scattered trees are on some low-lying sites. (United States Department of Agriculture, Natural Resources Conservation Service, 2022)

LRU notes

The Central Mississippi Valley Wooded Slopes, Western Part consists of deeply dissected, loess-covered hills bordering the Missouri and Mississippi Rivers as well as floodplains and terraces of these rivers. The Northern boundary runs along the South

Fabius River valley separating it from the broad rounded interfluves of the northern till plain. A major physiographic feature within the LRU (Land Resource Unit) includes the Lincoln Hills region. The Lincoln Hills extend along the Mississippi River in Missouri, starting about 40 miles (64 kilometers) northwest of St. Louis and extending north to Hannibal. The Lincoln Hills partially escaped the most recent glaciation in the region during the Pleistocene. In geology and biology, they resemble the rugged and forested hills of the Ozark Highlands (MLRA 116A) more than the rolling plains of northern Missouri. The underlying limestone bedrock has formed bluffs, glades, caves, springs, and sinkholes. Elevation ranges from about 420 feet (128 meters) along the Mississippi River near Cape Girardeau, Missouri to about 830 feet (253 meters) near Clarksville along the Mississippi River upstream from St. Louis. High ridges near Hillsboro, Missouri can reach over 1,000 feet (305 meters). Underlying bedrock is mainly Ordovician-aged dolomite and sandstone, with Mississippian-aged limestone north of the Missouri River. Loess caps both stream and glacial outwash terraces along the major rivers along with Pre-Illinoisan till near the edges of the area.

Classification relationships

Major Land Resource Area (MLRA) (USDA-NRCS, 2022):
115X–Central Mississippi Valley Wooded Slopes

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

Missouri Department of Conservation Forest and Woodland Communities (MDC, 2006):
The reference state for this ecological site is most similar to a Mixed Hardwood Mesic 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 of the following Subsections:
Inner Ozark Border
Outer Ozark Border

Ecological site concept

Sandstone Protected Backslope Forests occupy the northerly and easterly aspects of steep, dissected slopes, and are mapped in complex with the Sandstone Exposed Backslope Woodland ecological site. These sites are inextensive in uplands not adjacent to the Missouri or Mississippi River floodplains, and are associated with the St. Peter and

LaMotte sandstone formations. The St.Peter sandstone units are located on lower slopes below Limestone/Dolomite Glade and Woodland ecological sites, while the Lamotte sandstone units are part of a complex of sandstone glades, woodlands and forests. These ecological sites are often downslope from Loamy Upland Woodlands. Soils are typically moderately deep over sandstone bedrock, with an abundance of sandstone fragments in the subsoil.The reference plant community is forest dominated by white oak, with a well-developed understory and a rich herbaceous ground flora.

Associated sites

F115XB005MO	**Loamy Upland Woodland** Loamy Upland Woodland sites underlain by sandstone are often upslope.
F115XB016MO	**Sandstone Upland Woodland** Sandstone Upland Woodlands are on upper backslopes and shoulders
F115XB051MO	**Sandstone Exposed Backslope Woodland** Sandstone Exposed Backslope Woodlands are also on steep, dissected slopes but on southerly and westerly aspects.
R115XB052MO	**Shallow Sandstone Backslope Glade/Woodland** Shallow Sandstone Backslope Glade/Woodland sites are usually closely associated with this site

Similar sites

F115XB051MO	**Sandstone Exposed Backslope Woodland** Sandstone Exposed Backslope Woodlands are also on steep, dissected slopes but on southerly and westerly aspects.

Table 1. Dominant plant species

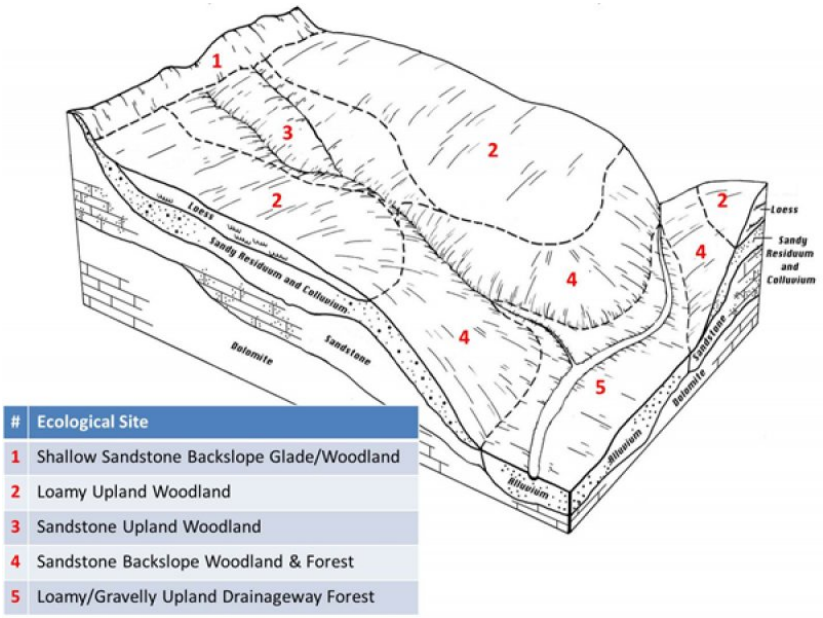
Tree	(1) *Quercus alba*
Shrub	(1) *Cornus florida*
Herbaceous	(1) *Polystichum acrostichoides* (2) *Podophyllum peltatum*

Physiographic features

This site is on upland backslopes with slopes of 15 to 40 percent. It is on protected aspects (north, northeast, and east), which receive significantly less solar radiation than the exposed aspects. The site receives runoff from upslope summit and shoulder sites, and generates runoff to adjacent, downslope ecological sites. This site does not flood.

The accompanying figure (adapted from Skaer, 2004) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in uplands that are underlain by sandstone. The site is within the area labeled “4”, on

northerly and easterly exposures of steep lower backslopes. Loamy Upland Woodland sites underlain by sandstone are often upslope (labeled “2” on the figure) on loess-covered benches and summits, and Sandstone Upalnd Woodland sites (labeled “3”) are on upper backslopes and shoulders. Shallow Sandstone Glade sites are usually closely associated with this site (labeled “1”), often as a narrow band or ledge.



#	Ecological Site
1	Shallow Sandstone Backslope Glade/Woodland
2	Loamy Upland Woodland
3	Sandstone Upland Woodland
4	Sandstone Backslope Woodland & Forest
5	Loamy/Gravelly Upland Drainageway Forest

Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Hillslope
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	152–274 m
Slope	15–40%
Water table depth	152 cm
Aspect	NW, N, NE, E

Climatic features

The Central Mississippi Valley Wooded Slopes, Western Part 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.

The Central Mississippi Valley Wooded Slopes, Western Part experiences regional differences in climates, but these differences do not have obvious geographic boundaries. Regional climates grade inconspicuously into each other. The basic gradient for most climatic characteristics is along a line diagonally crossing the MLRA from northwest to southeast. Both mean annual temperature and precipitation exhibit gradients along this line.

The average annual precipitation in most of this area is 38 to 48 inches. The average annual temperature is 53 to 57 degrees F. Mean January minimum temperature follows the northwest-to-southeast gradient. However, mean July maximum temperature shows hardly any geographic variation in the MLRA. Mean July maximum temperatures have a range of only two or three degrees across the area.

Mean annual precipitation varies along the same gradient as temperature. Seasonal climatic variations are more complex. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages three to four times greater than January precipitation. Most of the rainfall occurs as high-intensity, convective thunderstorms in summer. Snowfall is common in winter.

During years when precipitation is normal, moisture is stored in the soil profile 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 affects plant and animal life by limiting water supplies, especially at times of high temperatures and high evaporation rates.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. In regions of appreciable relief, 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. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these unvegetated surfaces create characteristic glade and cliff ecological sites. Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier than adjacent north- and-east-facing slopes. Finally, the climate within a canopied forest ecological site is measurably different from the climate of the more open grassland or savanna ecological sites.

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)	161-165 days
Freeze-free period (characteristic range)	186-192 days
Precipitation total (characteristic range)	1,067-1,143 mm
Frost-free period (actual range)	158-167 days
Freeze-free period (actual range)	182-192 days
Precipitation total (actual range)	1,067-1,143 mm
Frost-free period (average)	163 days
Freeze-free period (average)	189 days
Precipitation total (average)	1,092 mm

Climate stations used

- (1) FESTUS [USC00232850], Crystal City, MO
- (2) FULTON [USC00233079], Fulton, MO
- (3) PERRYVILLE WTP [USC00236641], Perryville, MO
- (4) NEW FRANKLIN 1W [USC00236012], Franklin, 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. Evapotranspiration remains the most constant. 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. Water stored as ice and snow decreases drainage and surface runoff rates throughout the winter and increases these fluxes in the spring. The surface runoff pulse is greatly influenced by extreme events. Conversion to cropland or other high intensities land uses tends to increase runoff, but also decreases evapotranspiration. Depending on the situation, this might increase groundwater discharge, and decrease baseflow in receiving streams (Vano 2005).

Soil features

These soils are underlain with sandstone bedrock at 20 to 60 inches deep. They have

subsoils that are not low in bases. The soils were formed under forest vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium and residuum weathered from sandstone, overlying sandstone bedrock. They have sandy loam or loam surface layers. Subsoils are loamy and are skeletal, with high amounts of sandstone fragments. These soils are not affected by seasonal wetness. Soil series associated with this site include Lily, Neotoma, and Pevely.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–sandstone (2) Residuum–sandstone
Surface texture	(1) Very gravelly fine sandy loam (2) Extremely cobbly sandy loam (3) Very cobbly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	51–152 cm
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	3–50%
Available water capacity (0-101.6cm)	10.16–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	20–50%
Subsurface fragment volume >3" (Depth not specified)	0–40%

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 historical reference state was dominated by white oak. These forest sites had a well-developed forest canopy (80 to 90 feet tall and 90 to 100 percent canopy cover), a structurally diverse understory and an abundant forest ground flora.

In this region flanked by historic fire-prone prairies, savannas and open woodlands, Sandstone Protected Backslope Forests occur in the most protected landscape positions on lower, steep slopes in the deeper valleys furthest from the prairie uplands. While the upland prairies and savannas had an estimated fire frequency of 1 to 3 years, Sandstone Protected Backslope Forests burned less frequently (10 to 25 years) and with lower intensity.

Historically, grazing by large native herbivores, such as bison, elk and white-tailed deer, affected understory conditions. In addition, Sandstone Protected Backslope Forests are subject to occasional disturbances from wind and ice, which periodically open the canopy up by knocking over trees or breaking substantial branches of canopy trees. Such canopy disturbances allow more light to reach the ground and favor reproduction of the dominant oak species.

Today, these communities have either been cleared or converted to pasture, or have undergone repeated timber harvest and domestic grazing. Most existing occurrences have a younger (50 to 80 years) canopy layer whose composition may have been altered by timber harvesting practices. An increase in hickories over historic conditions is common. The absence of periodic fire may have allowed more shade-tolerant tree species, such as sugar maple, white ash, or hickory to increase in abundance.

Uncontrolled domestic grazing has also diminished the diversity and cover of woodland ground flora species, and has often introduced weedy species such as gooseberry, coralberry, poison ivy and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and erosion related to grazing can lower site productivity.

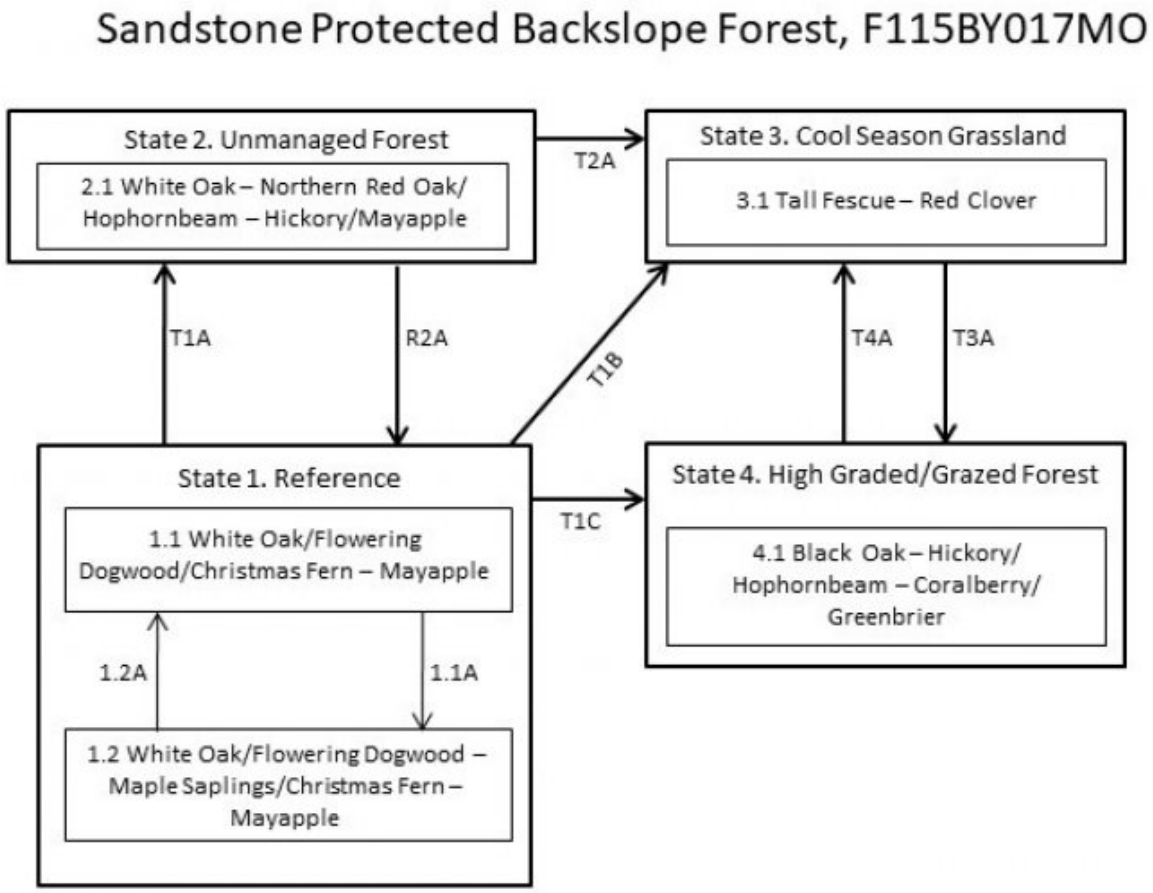
Sandstone Protective Backslope Forests are moderately productive timber sites. Timber harvest in this region typically is done using single-tree selection, and often results in removal of the most productive trees, thus high-grading the stand. This can result in poorer quality timber and a shift in species composition away from more valuable oak species. Carefully planned single tree selection or the creation of group openings can help regenerate more desirable oak species and increase vigor on the residual trees. Clear-cutting often occurs and results in dense, even-aged stands of primarily oak. This technique may be most beneficial for existing stands whose composition has been highly

altered by past management practices. However, without some thinning of the dense stands, the ground flora diversity can be shaded out and productivity of the stand may suffer.

Protected aspect forests did evolve with some fire, but their composition often reflects more closed, forested conditions, with fewer woodland ground flora species that can respond to fire. Consequently, while having protected aspects in a burn unit is acceptable, targeting them solely for woodland restoration is not advisable.

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	Ice and wind free disturbances >30 years; woody invasion; occasional logging
T1B	Clearing; tillage; vegetative seeding; grassland management
T1C	Logging; uncontrolled grazing
T2A	Woody removal; tillage; vegetative seeding; grassland management
T4A	Clearing; vegetative seeding ; grassland management
T3A	Abandonment >30 years; uncontrolled grazing
1.1A	Disturbance-free interval 15+ years
1.2A	Disturbance interval 10-15 years
R2A	Forest stand improvement; regular disturbances; long-term rotations

Figure 9. State and transition diagram for this ecological site

State 1
Reference

This state is native oak forest dominated by white oak with a structurally diverse understory and an abundant forest ground flora. Maximum tree age was likely 150 to 300 years. These sites were subject to occasional disturbances from wind and ice, which periodically open the canopy up by knocking over trees or breaking substantial branches of canopy trees. Such canopy disturbances allowed more light to reach the ground and favor reproduction of the dominant oak species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species.

Dominant plant species

- white oak (*Quercus alba*), tree
- flowering dogwood (*Cornus florida*), tree
- sugar maple (*Acer saccharum*), tree
- mayapple (*Podophyllum peltatum*), other herbaceous
- Christmas fern (*Polystichum acrostichoides*), other herbaceous

Community 1.1
White Oak/Flowering Dogwood/Christmas Fern – Mayapple

This phase is a forest dominated by an overstory of white oak. The canopy and understory are well developed with great structural and species diversity. This phase experienced some periodic burning (estimated 10 to 25 years) but with low intensity.

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

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

Community 1.2
White Oak/Flowering Dogwood – Maple Saplings/Christmas Fern – Mayapple

Long disturbance-free periods allowed an increase in more shade tolerant species such as northern red oak and sugar maple with increased canopy density, which has affected the abundance and diversity of ground flora.

Pathway P1.1A
Community 1.1 to 1.2

This pathway is the result of fire-free interval 15 to 20 years.

Pathway P1.2A
Community 1.2 to 1.1

This pathway is the result of a fire 10 to 15 year cycle being reestablished.

State 2
Unmanaged Forest

Unmanaged reference states that have experienced, occasional logging, a lack of natural disturbance, and woody invasion for 30 or more years will transition to this state. With a lack of disturbance, woody species such as northern red oak, hickory species, and eastern hophornbeam will begin to increase. Logging and woody invasion decreases the overall age and average diameter of the forest.

Dominant plant species

- white oak (*Quercus alba*), tree
- northern red oak (*Quercus rubra*), tree
- hophornbeam (*Ostrya virginiana*), tree
- bitternut hickory (*Carya cordiformis*), tree
- mockernut hickory (*Carya tomentosa*), tree
- mayapple (*Podophyllum peltatum*), other herbaceous

Community 2.1
White Oak – Northern Red Oak/ Hophornbeam – Hickory/Mayapple

This is the only phase in this state at this time. See the corresponding state narrative for details.

State 3
Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue and red clover has been common in this area. Occasionally, these pastures will have scattered oaks. Long term uncontrolled grazing and a lack of grassland management can cause significant soil erosion and compaction and increases in less productive species such as Kentucky bluegrass and weedy forbs such as ironweed.

Dominant plant species

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

Community 3.1
Tall Fescue – Red Clover

This phase is well managed grassland, composed of non-native cool season grasses and legumes. Grazing and haying is occurring. The effects of long-term liming on soil pH, and calcium and magnesium content, is most evident in this phase. Studies show that these soils have higher pH and higher base status in soil horizons as much as two feet below the surface, relative to poorly managed grassland and to woodland communities (where liming is not practiced).

State 4
High-Graded/Grazed Forest

Wooded sites subjected to repeated, high-graded timber harvests and uncontrolled domestic grazing transition to this State. This state exhibits an over-abundance of hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for livestock, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff.

Dominant plant species

- black oak (*Quercus velutina*), tree
- bitternut hickory (*Carya cordiformis*), tree
- mockernut hickory (*Carya tomentosa*), tree
- hophornbeam (*Ostrya virginiana*), tree
- coralberry (*Symphoricarpos orbiculatus*), shrub

Community 4.1
Black Oak – Hickory/ Hophornbeam – Coralberry/ Greenbrier

This is the only phase in this state at this time. See the corresponding state narrative for details.

Transition T1A
State 1 to 2

This transition is the result of ice and wind free disturbances greater than 30 years, woody invasion; and occasional logging.

Transition T1B
State 1 to 3

This transition is the result of clearing; tillage, vegetative seeding and grassland management.

Transition T1C

State 1 to 4

This transition is the result of high-grade logging and uncontrolled domestic livestock grazing.

Restoration pathway R2A
State 2 to 1

This restoration pathway is the result of forest stand improvement, regular disturbances and long-term rotations.

Transition T3A
State 3 to 4

This transition is the result of abandonment for greater than 30 years and uncontrolled grazing

Transition T4A
State 4 to 3

This transition is the result of clearing and conversion to non-native cool season grassland.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
white oak	QUAL	*Quercus alba*	Native	–	50–70	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	30–50	–	–
bitternut hickory	CACO15	*Carya cordiformis*	Native	–	20–30	–	–
red maple	ACRU	*Acer rubrum*	Native	–	5–20	–	–
sugar maple	ACSA3	*Acer saccharum*	Native	–	5–20	–	–
American basswood	TIAM	*Tilia americana*	Native	–	5–20	–	–
mockernut hickory	CATO6	*Carya tomentosa*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
eastern woodland sedge	CABL	*Carex blanda*	Native	–	5–10
Forb/Herb					
mayapple	POPE	*Podophyllum peltatum*	Native	–	10–30
toadshade	TRSE2	*Trillium sessile*	Native	–	5–20
jumpseed	POVI2	*Polygonum virginianum*	Native	–	5–20
soft agrimony	AGPU	*Agrimonia pubescens*	Native	–	5–20
bloodroot	SACA13	*Sanguinaria canadensis*	Native	–	5–20
Virginia snakeroot	ARSE3	*Aristolochia serpentaria*	Native	–	5–20
Virginia springbeauty	CLVI3	*Claytonia virginica*	Native	–	5–20
white fawnlily	ERAL9	*Erythronium albidum*	Native	–	5–20
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	5–20
goldenseal	HYCA	*Hydrastis canadensis*	Native	–	5–20
largeflower bellwort	UVGR	*Uvularia grandiflora*	Native	–	5–20
dutchman's breeches	DICU	*Dicentra cucullaria*	Native	–	5–20
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	0–10
Fern/fern ally					
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	–	5–20
brittle bladderfern	CYFR2	*Cystopteris fragilis*	Native	–	5–10
marginal woodfern	DRMA4	*Dryopteris marginalis*	Native	–	5–10
Shrub/Subshrub					
northern spicebush	LIBE3	*Lindera benzoin*	Native	–	10–20
alternateleaf dogwood	COAL2	*Cornus alternifolia*	Native	–	5–10
Tree					
flowering dogwood	COFL2	*Cornus florida*	Native	–	20–30
hophornbeam	OSVI	*Ostrya virginiana*	Native	–	10–20
common serviceberry	AMAR3	*Amelanchier arborea*	Native	–	10–20
pawpaw	ASTR	*Asimina triloba*	Native	–	10–20
Vine/Liana					
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	–	10–20

		quinquefolia			
summer grape	VIAE	*Vitis aestivalis*	Native	–	10–20

Animal community

Wildlife Species (MDC 2006):

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.

Birds associated with mid-successional stages include Whip-poor-will and Wood Thrush while birds associated with late-successional stages include Worm-eating warbler, Whip-poor-will, Great Crested Flycatcher, Ovenbird, Pileated Woodpecker, Wood Thrush, Red-eyed Vireo, Northern Parula, Louisiana Waterthrush (near streams), and Broad-winged Hawk.

Reptile and amphibian species associated with mature forests include ringed salamander, spotted salamander, marbled salamander, central newt, long-tailed salamander, dark-sided salamander, southern red-backed salamander, three-toed box turtle, western worm snake, western earth snake, and American toad.

Other information

Forestry (NRCS 2002, 2014):

Management: Field measured site index values average 54 for northern red oak. Timber management opportunities are moderate. 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, and should be used with caution on a site if timber management is the primary objective.

Limitations: Coarse fragments in profile; bedrock is within 60 inches. Disturbing the surface excessively in harvesting operations and building roads increases soil losses, which leaves a greater amount of coarse fragments on the surface. Hand planting or direct seeding may be necessary. Seedling mortality due to low available water capacity may be high. Mulching or providing shade can improve seedling survival. Mechanical tree planting will be limited. 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.

Inventory data references

Potential Reference Sites: Sandstone Protected Backslope Forest

Plot GRCASP06 – Pevely soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.908577
Longitude: -91.581018

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Approval

Suzanne Mayne-Kinney, 12/30/2024

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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	05/21/2025

Approved by	Suzanne Mayne-Kinney
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:**

   ---

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

   ---

7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

   ---

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:

---

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:**

17. **Perennial plant reproductive capability:**