Ecological site F115XB051MO
Sandstone Exposed Backslope Woodland

Last updated: 12/30/2024
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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 Woodland.

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

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland (CEGL002150).

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 Exposed Backslope Woodlands occupy the southerly and westerly aspects of steep, dissected slopes, and are mapped in complex with the Sandstone Protected Backslope Forest 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 woodland with an overstory dominated by black oak, with minor amounts of white oak and post oak, and a ground flora of native grasses and forbs.

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
F115XB017MO	**Sandstone Protected Backslope Forest** Sandstone Protected Backslope Woodlands are also on steep, dissected slopes but on northerly and easterly aspects.
R115XB052MO	**Shallow Sandstone Backslope Glade/Woodland** Shallow Sandstone Backslope Glade/Woodland sites are usually closely associated with this site.

Similar sites

F115XB017MO	**Sandstone Protected Backslope Forest** Sandstone Protected Backslope Woodlands are also on steep, dissected slopes but on northerly and easterly aspects.

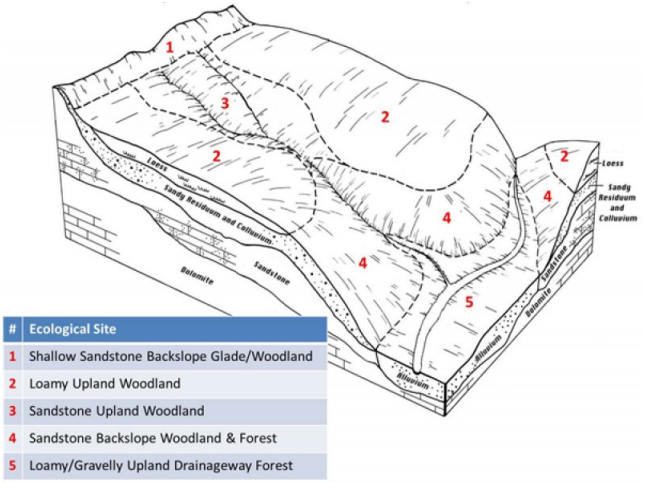
Table 1. Dominant plant species

Tree	(1) *Quercus velutina* (2) *Quercus alba*
Shrub	(1) *Vaccinium pallidum* (2) *Rhus aromatica*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Desmodium*

Physiographic features

This site is on upland backslopes with slopes of 15 to 40 percent. It is on exposed aspects (south, southwest, and west), which receive significantly more solar radiation than the protected 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 following 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 southerly and westerly 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 Upland 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	500–950 ft
Slope	15–35%
Water table depth	60 in
Aspect	W, SE, S, SW

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)	155-168 days
Freeze-free period (characteristic range)	185-191 days
Precipitation total (characteristic range)	44-47 in
Frost-free period (actual range)	152-169 days
Freeze-free period (actual range)	182-194 days
Precipitation total (actual range)	43-50 in
Frost-free period (average)	161 days
Freeze-free period (average)	188 days
Precipitation total (average)	46 in

Climate stations used

- (1) PERRYVILLE WTP [USC00236641], Perryville, MO
- (2) UNION [USC00238515], Union, MO
- (3) ANNA 2 NNE [USC00110187], Anna, IL
- (4) WATERLOO [USC00119002], Waterloo, IL

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 woodland 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 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	Very slow to moderate
Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	3–50%
Available water capacity (0-40in)	4–6 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–7.3
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.

Sandstone Exposed Backslope Woodlands are dominated by black oak with lesser amounts of white oak and post oak. In areas near the Ozark Highlands, shortleaf pine may occur on scattered sites. The canopy is moderately tall (65 to 80 feet) but less dense (65 to 85 percent closure) than protected slopes and the understory is poorly developed with less structural diversity. Periodic disturbances from fire, wind or ice maintained the woodland structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species, especially hickories. When located below calcareous geologic strata, it appears that sugar maple can also be an aggressive invader of fire free situations. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with

remnant open-grown old-age trees, and tree height growth.

Fire played an important role in the maintenance of this system. It is likely that this ecological site burned at least once every 5 to 10 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

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

Today, these ecological sites have been cleared and converted to pasture or have undergone repeated timber harvest and domestic grazing. Most existing wooded ecological sites have a younger (50 to 80 years) canopy layer whose species composition and quality has been altered by timber harvesting practices. In the long term absence of fire, woody species, especially hickory, encroach into these woodlands. Once established, these woody plants can quickly fill the existing understory increasing shade levels with a greatly diminished ground flora. Removal of the younger understory and the application of prescribed fire have proven to be effective restoration means.

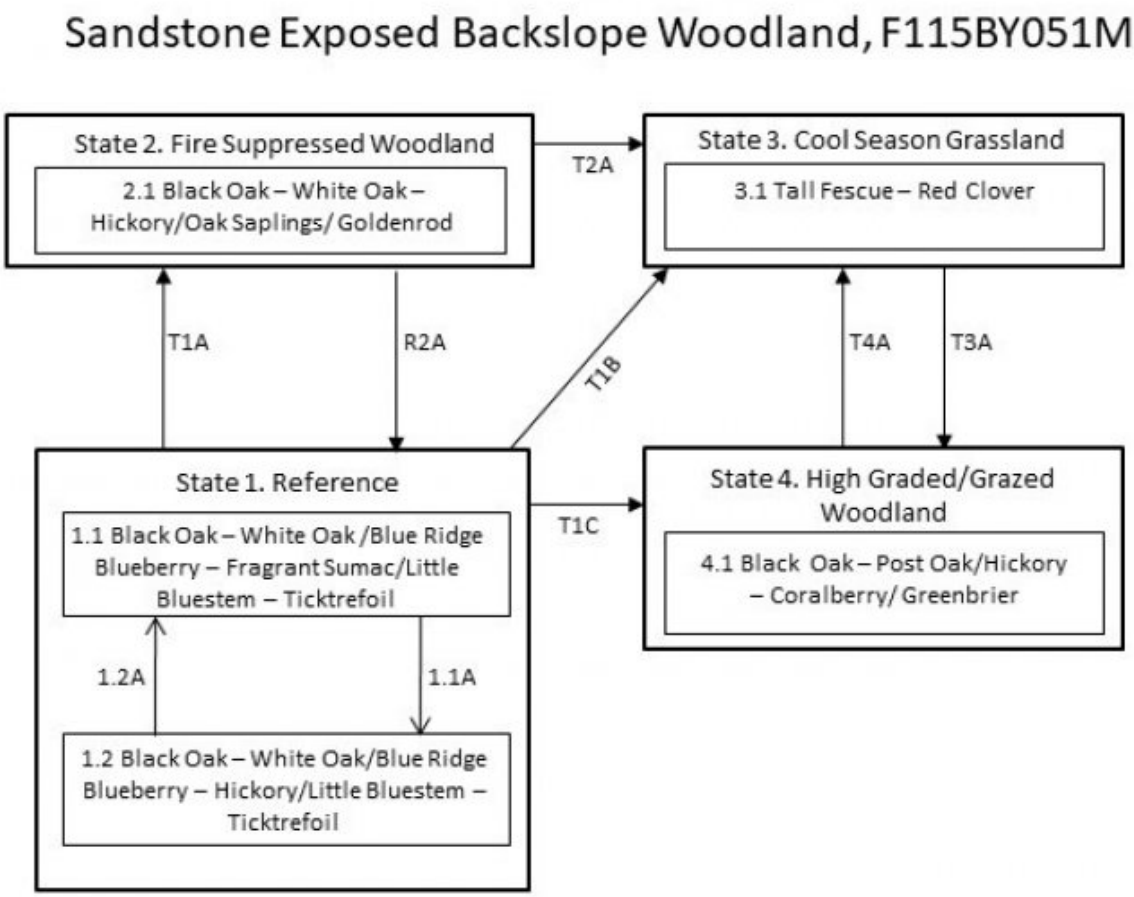
Uncontrolled domestic grazing has also impacted this community, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as coralberry, gooseberry, and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and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

This ecological site is moderately productive. Oak regeneration is typically problematic. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects. Single tree selection timber harvests are common in this community and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the creation of group openings can help regenerate and maintain more desirable oak species and increase vigor on the residual trees.

Clearcutting also occurs and results in dense, even-aged stands dominated by oak and hickory. This 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 and the application of prescribed fire, the ground flora diversity can be shaded out and diversity of the stand may suffer.

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

State and transition model



Code	Event/Activity/Process
T1A	Fire suppression > 30 years; woody invasion
T1C	Fire suppression; logging; grazing
T1B, T2A, T4A	Clearing; tillage; vegetative seeding; grassland management
T3A	Abandonment >30 years; uncontrolled grazing
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 5-10 years
R2A	Woody removal; prescribed fire 5-10 years; forest stand improvement

Figure 9. State and transition diagram for this ecological site

State 1

Reference

This state is native oak woodland dominated by white oak and black oak, with a variety of prairie forbs and grasses in the understory. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the woodland structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species. Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- shagbark hickory (*Carya ovata*), tree
- fragrant sumac (*Rhus aromatica*), shrub
- Blue Ridge blueberry (*Vaccinium pallidum*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- perplexed ticktrefoil (*Desmodium perplexum*), other herbaceous
- prostrate ticktrefoil (*Desmodium rotundifolium*), other herbaceous
- pointedleaf ticktrefoil (*Desmodium glutinosum*), other herbaceous

Community 1.1
Black Oak – White Oak /Blue Ridge Blueberry – Fragrant Sumac/Little Bluestem – Ticktrefoil

This phase is an old growth woodland with a black oak dominated, a semi-open overstory, with lesser amounts of white and post oaks and hickories. This woodland phase has a two-tiered structure with an open understory with scattered shrubs and a dense, diverse native herbaceous ground flora. Periodic disturbances including fire, ice and wind created canopy gaps, allowing oak species to successfully reproduce and remain in the canopy. It is likely that this phase burned at least once every 5 to 10 years.

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
Black Oak – White Oak/Blue Ridge Blueberry – Hickory/Little Bluestem – Ticktrefoil

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

Pathway P1.1A
Community 1.1 to 1.2

This pathway is the result of fire-free interval 10 to 20 years.

Pathway P1.2A
Community 1.2 to 1.1

This pathway is the result of a fire and other natural disturbances occurring on a 5 to 10 year cycle being reestablished.

State 2
Fire Suppressed Woodland

Degraded reference states that have experienced fire suppression and woody invasion for 20 or more years will transition to this state. With fire suppression, woody species such as black oak, post oak and hickory will begin to

increase. Some past logging has occurred reducing white oak densities. Native herbaceous ground cover will also decrease.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- shagbark hickory (*Carya ovata*), tree
- elmleaf goldenrod (*Solidago ulmifolia*), other herbaceous

Community 2.1
Black Oak – White Oak – Hickory/Oak Saplings/ Goldenrod

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

State 4
High-Graded/Grazed Woodland

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 coralberry, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for cattle, 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
- post oak (*Quercus stellata*), tree
- shagbark hickory (*Carya ovata*), tree
- coralberry (*Symphoricarpos orbiculatus*), shrub
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous

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

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

Transition T1A
State 1 to 2

This is a gradual transition that results from extended, disturbance fire free periods of roughly 30 years or longer. Selective logging may also be occurring.

Transition T1B
State 1 to 3

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

Transition T1C
State 1 to 4

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

Restoration pathway R2A
State 2 to 1

This restoration pathway is the result of the systematic application of prescribed fire with long term succession. Mechanical thinning may also be used along with understory removal and forest stand improvement.

Transition T2A
State 2 to 3

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

Transition T3A
State 3 to 4

This community pathway is the result of abandonment for greater than 30 years, woody regrowth, 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 (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white oak	QUAL	*Quercus alba*	Native	–	10–75	–	–
black oak	QUVE	*Quercus velutina*	Native	–	30–50	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	2–50	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	10–20	–	–
post oak	QUST	*Quercus stellata*	Native	–	5–10	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
whitetinge sedge	CAAL25	*Carex albicans*	Native	–	10–30
Muhlenberg's sedge	CAMU4	*Carex muehlenbergii*	Native	–	10–30
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	10–30
little bluestem	SCSC	*Schizachyrium scoparium*	Native		0.1–10

little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	0.1–10
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	5–10
sweet signalgrass	BRER	*Brachiaria eruciformis*	Native	–	2–5
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	2–5
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	2–5
Indian woodoats	CHLA5	*Chasmanthium latifolium*	Native	–	2–5
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	0.1–5
black edge sedge	CANI3	*Carex nigromarginata*	Native	–	1–2
eastern woodland sedge	CABL	*Carex blanda*	Native	–	0.1–1
Forb/Herb					
perplexed ticktrefoil	DEPE80	*Desmodium perplexum*	Native	–	10–25
birdfoot violet	VIPE	*Viola pedata*	Native	–	5–20
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	5–20
prostrate ticktrefoil	DERO3	*Desmodium rotundifolium*	Native	–	5–20
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	–	0.1–10
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	5–10
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	0.1–5
Parlin's pussytoes	ANPA9	*Antennaria parlinii*	Native	–	1–5
pale Indian plantain	ARAT	*Arnoglossum atriplicifolium*	Native	–	2–5
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	2–5
clustered blacksnakeroot	SAOD	*Sanicula odorata*	Native	–	2–5
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	–	2–5
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	2–5
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	0.1–5
largebract ticktrefoil	DECU	*Desmodium cuspidatum*	Native	–	2–5
late purple aster	SYPA11	*Symphyotrichum patens*	Native	–	0.1–2
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	0.1–1
wild quinine	PAIN3	*Parthenium integrifolium*	Native	–	0.1–1
wild blue phlox	PHDI5	*Phlox divaricata*	Native	–	0.1–1
common cinquefoil	POSI2	*Potentilla simplex*	Native	–	0.1–1
fringeleaf wild petunia	RUHU	*Ruellia humilis*	Native	–	0.1–1
violet lespedeza	LEVI6	*Lespedeza violacea*	Native	–	0.1–1
Virginia spiderwort	TRVI	*Tradescantia virginiana*	Native	–	0.1–1
St. Andrew's cross	HYHY	*Hypericum hypericoides*	Native	–	0.1–1
Fern/fern ally					
northern maidenhair	ADPE	*Adiantum pedatum*	Native	–	0.1–1
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	0.1–50
Blue Ridge blueberry	VAPA4	*Vaccinium pallidum*	Native	–	10–30
hophornbeam	OSVI	*Ostrya virginiana*	Native	–	1–25
coralberry	SYOR	*Symphoricarpos orbiculatus*	Native	–	2–5
Tree					
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	0.1–25
flowering dogwood	COFL2	*Cornus florida*	Native	–	5–25

common serviceberry	AMAR3	*Amelanchier arborea*	Native	–	0.1–1

Animal community

Wildlife (MDC 2006):

Oaks provide abundant hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food.

Sedges and native cool-season grasses provide green browse; native warm-season grasses provide cover and nesting habitat; and a diversity of forbs provides a diversity and abundance of insects.

Birds species associated with late successional to mature ecological sites are Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, Red-eyed Vireo, Rose-breasted Grosbeak, Yellow-billed Cuckoo, and Broad-winged Hawk.

Reptile and amphibian species associated with open woodlands include ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, six-lined racerunner, flat-headed snake, rough earth snake, and timber rattlesnake.

Other information

Forestry (NRCS 2002, 2014):

Management: Estimated site index values for oaks range from 50 to 55. Timber management opportunities are fair. Sandy and gravelly textures and lower available water affects tree growth and increases windthrow hazards. Harvest methods that leave some mature trees to provide shade and soil protection may be desirable. Restrict cuttings to group selection cuttings of 2 to 5 acres or single tree selections. These sites respond well to prescribed fire as a management tool.

Limitations: Low to moderate coarse fragments in soil profile; bedrock is within 60 inches. Surface stones and rocks are problems for efficient and safe equipment operation and will make equipment use somewhat difficult. 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 Exposed Backslope Woodland

Plot GRCASP13 – Pevely soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.905395
Longitude: -91.57174

Plot DABOCA_JK16 – Pevely soil
Located in Daniel Boone CA, Warren County, MO
Latitude: 38.772377
Longitude: -91.381727

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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	05/13/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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:**
