

## Ecological site F116BY039MO Fragipan Upland Flatwoods

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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.

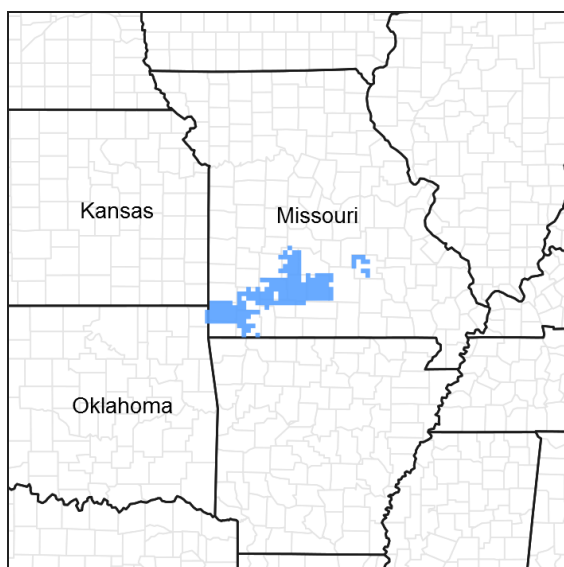


Figure 1. Mapped extent

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): 116B–Springfield Plain

The Springfield Plain is in the western part of the Ozark Uplift. It is primarily a smooth plateau with some dissection along streams. Elevation is about 1,000 feet in the north to over 1,700 feet in the east along the Burlington Escarpment adjacent to the Ozark Highlands. The underlying bedrock is mainly Mississippian-aged limestone, with areas of shale on lower slopes and structural benches, and intermittent Pennsylvanian-aged sandstone deposits on the plateau surface.

### Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):

The reference state for this ecological site is most similar to an Upland Flatwoods.

Missouri Department of Conservation Forest and Woodland Communities (Missouri Department of Conservation, 2006):

The reference state for this ecological site is most similar to a Post Oak Woodland.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):

The reference state for this ecological site is most similar to a *Quercus stellata* / *Cinna arundinacea* Flatwoods

Forest (CEGL002405).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):

This ecological site occurs primarily within the following Land Type Associations:

Seymour Highland Oak Savanna/Woodland Dissected Karst Plain

Spring River Prairie/Savanna Dissected Plain

Springfield Karst Prairie Plain

## Ecological site concept

NOTE: This is a “provisional” Ecological Site Description (ESD) that is under development. It contains basic ecological information that can be used for conservation planning, application and land management. After additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Fragipan Upland Flatwoods occur throughout the Ozark Highlands. Within the Springfield Plain they are confined mainly to the flat to gently rolling, loess covered dissected plains in the southern half of the region, particularly around the James River, and Finley and Shoal Creeks. Soils have root-restricting fragipans. The reference plant community is woodland with an overstory dominated by post oak and blackjack oak, and an understory of wet-tolerant grasses, sedges, and forbs.

## Associated sites

F116BY001MO	<b>Fragipan Upland Woodland</b> Fragipan Upland Woodlands are adjacent, on more convex summit positions.
F116BY003MO	<b>Chert Upland Woodland</b> Chert Upland Woodlands and other upland ecological sites are downslope, on shoulders and backslopes.

## Similar sites

F116BY001MO	<b>Fragipan Upland Woodland</b> Fragipan Upland Woodlands are adjacent, on more convex summit positions and not as wet.
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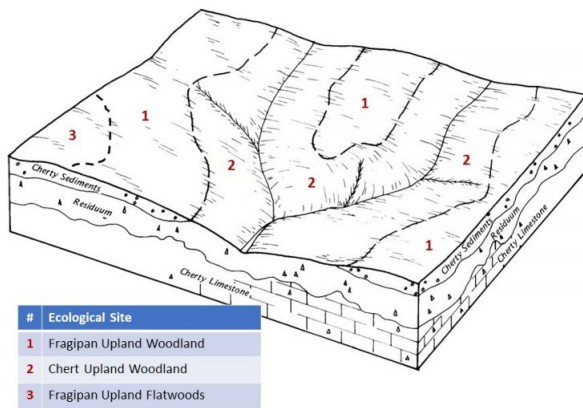
Table 1. Dominant plant species

Tree	(1) <i>Quercus stellata</i> (2) <i>Quercus marilandica</i>
Shrub	(1) <i>Rhus aromatica</i>
Herbaceous	(1) <i>Carex</i> (2) <i>Schizachyrium scoparium</i>

## Physiographic features

This site is on level upland summits that include broad shallow depressions in many areas. Slopes range from 0 to 3 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Aldrich, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “3”, on level upland summits. Fragipan Upland Woodlands labeled “1” are often adjacent on broadly convex upland summits. Chert Upland Woodland sites are often directly downslope and are included within the area labeled “2”.



**Figure 2. Landscape relationships for this ecological site.**

**Table 2. Representative physiographic features**

Landforms	(1) Plateau (2) Depression
Flooding frequency	None
Ponding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Ponding frequency	Occasional to frequent
Slope	0–3%
Water table depth	0–69 cm
Aspect	Aspect is not a significant factor

### Climatic features

The Springfield Plain 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 Springfield Plain experiences some regional differences in climates. The average annual precipitation in this area is 41 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 55 to 58 degrees F. The lower temperatures occur at the higher elevations. Mean July maximum temperatures have a range of only one or two degrees across the area.

Mean annual precipitation varies along a west to east gradient. 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.

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. Drought indirectly affects ecological communities by increasing plant and animal susceptibility to the probability and severity of fire. Frequent fires encourage the development of grass/forb dominated communities and understories.

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. Deep sinkholes often have a microclimate significantly cooler, moister, and shadier than surrounding surfaces that may result in a strikingly different vegetational composition and community structure. 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)	142-154 days
Freeze-free period (characteristic range)	180-186 days
Precipitation total (characteristic range)	1,168-1,194 mm
Frost-free period (actual range)	141-160 days
Freeze-free period (actual range)	180-189 days
Precipitation total (actual range)	1,168-1,219 mm
Frost-free period (average)	149 days
Freeze-free period (average)	184 days
Precipitation total (average)	1,194 mm

## Climate stations used

- (1) NEOSHO [USC00235976], Neosho, MO
- (2) MT VERNON M U SW CTR [USC00235862], Mount Vernon, MO
- (3) SPRINGFIELD [USW00013995], Springfield, MO

## Influencing water features

A seasonal high water table occurs, perched on the fragipan in the subsoil. Temporary ponding can occur following heavy rains. These areas are in the MINERAL FLAT class in the Hydrogeomorphic (HGM) system (Brinson, 1993), and are Forested Palustrine wetlands (Cowardin et al., 1979).

## Soil features

These soils have a root-restricting fragipan at about 24 inches. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. They have silt loam surface horizons, and silty clay loam subsoils. Soil materials in and below the fragipan may be very gravelly. Parent material is a thin layer of loess over residuum derived primarily from cherty limestone. These soils are affected by seasonal wetness in spring months from a water table perched on the fragipan. Soil series associated with this site include Bado and Needleeye.

The accompanying picture of the Needleeye series shows a thin, light-colored surface horizon and brown gravelly silty clay loam subsoil, over a fragipan at about 30 inches. The fragipan is a barrier to roots. Redoximorphic features in the subsoil above the fragipan are an indication of seasonal wetness. Scale is in feet. Picture courtesy of Dennis Meinert, Missouri Department of Natural Resources.



Figure 9. Needleeye series

Table 4. Representative soil features

Parent material	(1) Residuum—cherty limestone (2) Loess
Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Very slow
Soil depth	41–76 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
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)	4.5–6
Subsurface fragment volume <=3" (Depth not specified)	5–50%
Subsurface fragment volume >3" (Depth not specified)	0–5%

### 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.

Historically, Fragipan Upland Flatwoods were dominated by drought and fire-tolerant post oak and blackjack oak

that were also very tolerant of seasonal wetness. Their landscape position and juxtaposition to prairies lead to a high fire frequency (every 1 to 3 years). The Fragipan Upland Flatwoods ranged from open savannas near the prairie edge to open, park-like woodlands farther away. Canopy closure varied from 30 to 60 percent and tree height from 35 to 50 feet. Seasonal wetness created periods of time where standing water limited tree growth and ground flora development.

Native sedges along with prairie grasses dominated the open understory, along with a scattered mix of native legumes, asters, sunflowers and other forbs. Dense thickets of oak sprouts occurred during periods of less-frequent fire, but periodic fire would eventually clear them out. Grazing by native large herbivores, such as bison, elk, and white-tailed deer, also influenced the understory, keeping it more open and structurally diverse.

Today, this community has been cleared and converted to pasture, or has increased stand density in the absence of fire. Most occurrences exhibit canopy closure of 80 to 100 percent. In addition, the sub-canopy and understory layers are more developed. Post oak and blackjack oak share dominance with black oak and black hickory. Under these denser, more shaded conditions, the original sun-loving ground flora has diminished in diversity and cover. While some woodland species persist in the ground flora, many have been replaced by more shade-tolerant species.

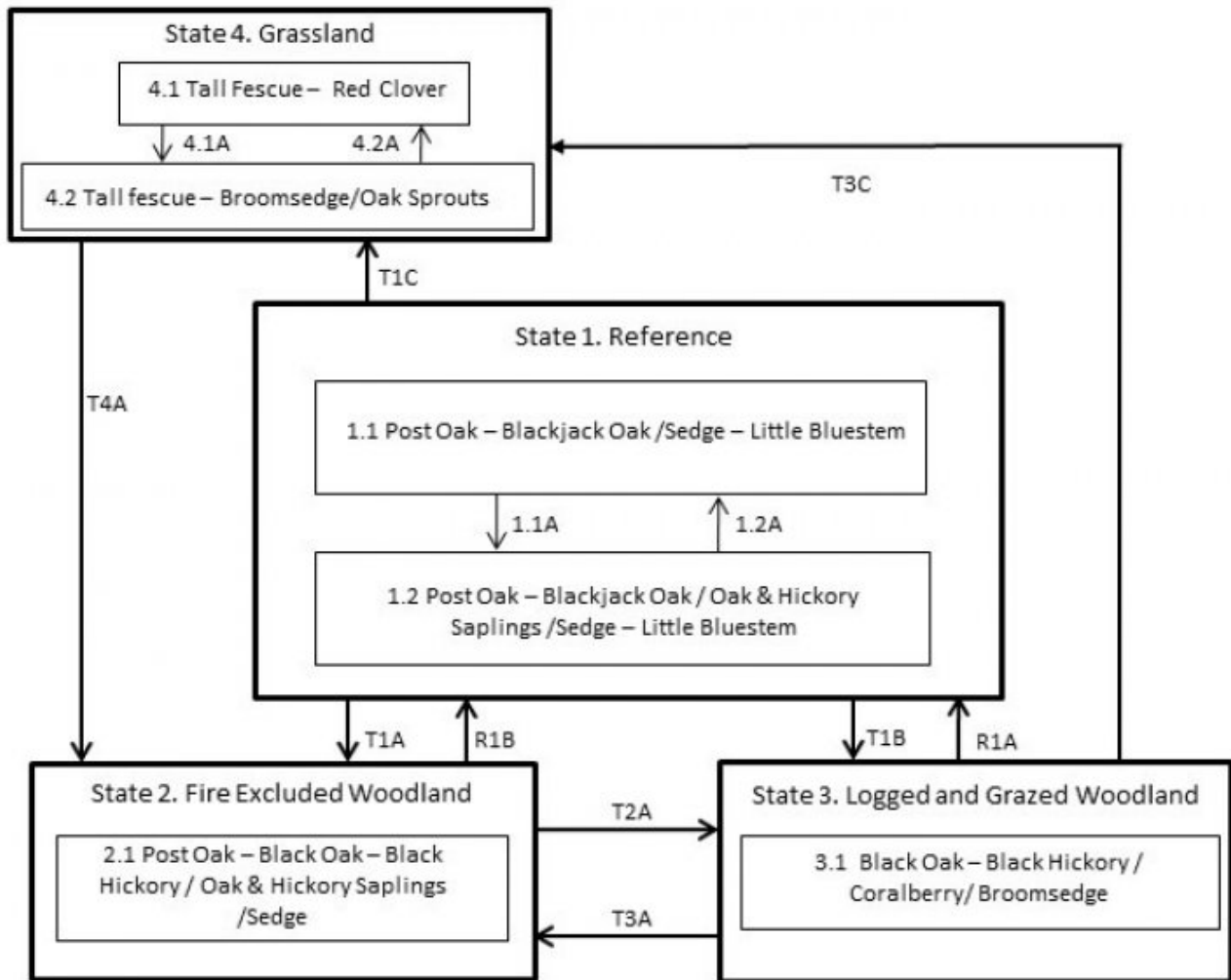
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing invasive species that are tolerant of grazing, such as coralberry, gooseberry, Virginia creeper and, in severely overgrazed situations, mosses and lichens.

Although timber products from flatwoods are of limited value, logging does occur, and influences the community. Occasional partial cuts provide sunlight to the woodland floor, stimulating native woodland ground flora. However, in the absence of fire and continual cultural treatments, oaks sprout and grow into a dense stand, again shading out the sun-loving ground flora. Partial cutting and prescribed fire can, however, restore the more open structure and diversity of ground flora species. Managed areas show an exceptional resiliency. This type of management may provide limited timber products, abundant wildlife habitat, and potential native forage.

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**

## Fragipan Upland Flatwoods, F116BY039MO



Code	Event/Activity/Process
T1A	Fire suppression; managed timber harvest
T1B	Fire suppression; high grading timber harvest; uncontrolled domestic grazing
T1C, T3C	Clearing; grassland planting; grassland management
T2A	Uncontrolled domestic grazing; high grading harvests
T3A	Exclude domestic grazing
T4A	Tree planting; forest stand improvement; no grazing

Code	Event/Activity/Process
1.1A	Fire-free interval, 5-10 years
1.2A	Fire 1-3 years
4.1A	Over grazing; no fertilization
4.2A	Brush management; prescribed grazing

Code	Event/Activity/Process
R1A	Exclude domestic grazing; thinning; prescribed fire - 1-3 years; forest stand improvement
R1B	Thinning; prescribed fire - 1-3 years

Figure 10. State and transition diagram for this ecological site

### State 1

## Reference

These open woodland communities were strongly influenced by fire and seasonal wetness. Herbivory by native (now expatriated) ungulates also played a role. Consequently, drought and fire-tolerant post and blackjack oaks over a ground flora of tallgrass prairie grasses, sedges and wildflowers made up the flatwood community. There are two phases associated with this reference state.

### Dominant resource concerns

- Ponding and flooding
- Seasonal high water table

## Community 1.1

### Post Oak – Blackjack Oak/Sedge – Little Bluestem

The overstory is dominated by post oak and blackjack oak, with scattered black oak and black hickory. This open woodland community typically has a two-tiered structure, with canopy height of 35 to 50 feet and 40 to 60 percent closure. The abundant herbaceous layer is dominated by little bluestem, big bluestem and Indiangrass.

**Forest overstory.** The Forest Overstory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

**Forest understory.** Forest Understory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

### Dominant resource concerns

- Ponding and flooding
- Seasonal high water table

## Community 1.2

### Post Oak – Blackjack Oak / Oak & Hickory Saplings /Sedge – Little Bluestem

The overstory is dominated by post oak and blackjack oak, with scattered black oak and black hickory. This brushy woodland community typically has a three-tiered structure, with 40 to 80 percent closure. It is characterized by a thick understory of oak saplings, and shrubs. The herbaceous layer is dominated by little bluestem.

**Forest overstory.** The overstory is dominated by post oak and blackjack oak, with scattered black oak and black hickory.

**Forest understory.** It is characterized by a thick understory of oak saplings, and shrubs. The herbaceous layer is dominated by little bluestem.

### Dominant resource concerns

- Ponding and flooding
- Seasonal high water table

## Pathway P1.1A

### Community 1.1 to 1.2

Fire-free interval, 5-10 years

## Pathway P1.2A

### Community 1.2 to 1.1

Controlled fire every 1-3 years

## State 2



## Fire Excluded Woodland

Most current areas of Fragipan Upland Flatwoods have experienced fire exclusion for decades. In the absence of fire, ongoing recruitment of trees into the canopy develops a closed canopy, shading out the rich herbaceous ground flora. Black oak and mid-story species increase. Herbaceous cover and diversity greatly diminishes, leaf litter builds up, and more shade-tolerant woodland species persist, such as elm-leaved goldenrod, panic grass and spreading aster. The understory also develops with oak and hickory saplings along with sassafras.

### Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates

## Community 2.1

### Post Oak – Black Oak – Black Hickory / Oak & Hickory Saplings /Sedge



Figure 11. Dry Upland Flatwoods restoration at the Fuson Cons

The overstory is dominated by post oak, black oak, and black hickory. Scattered blackjack oak and white oak occur in the canopy as well. This closed woodland community has a multi-tiered structure, with 80 to 100 percent canopy closure. The understory includes oak and hickory saplings along with sassafras and black cherry. Herbaceous cover is relatively sparse, with relatively low diversity. Shade-tolerant woodland species persist, such as elm-leaved goldenrod, panic grass and spreading aster.

## State 3

### Logged and Grazed Woodland

Although many of the closed Fragipan Upland Flatwoods are now fenced, most have been heavily grazed by domestic livestock at some point in their history. Grazing decreases the cover and abundance of saplings, shrubs and herbaceous ground flora, opening up the understory. Weedy native shrubs and vines, such as coralberry, gooseberry, poison ivy and Virginia creeper, often flourish after grazing, and exotic species like tall fescue and sericea lespedeza increase in abundance. Poorly managed grazing can cause compaction and denudation of the soil surface, allowing mats of lichens and mosses to flourish. Soil compaction may also further limit height growth of trees. With poorly managed grazing, this can result in an increase in weedy natives such as broom sedge, and exotics such as sericea lespedeza if they are present. Single-tree timber harvesting also occurred, resulting in a high grading of the canopy structure, creating many stands with poor quality trees.

### Dominant resource concerns

- Compaction
- Ponding and flooding
- Seasonal high water table
- Plant productivity and health
- Plant structure and composition

- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates

### **Community 3.1**

#### **Black Oak – Black Hickory / Coralberry/ Broomsedge**

The overstory is dominated by post oak, black oak, and black hickory. Scattered blackjack oak and white oak occur in the canopy as well. This closed woodland community has a two to three-tiered structure, and a 60 to 80 percent canopy closure. The understory includes weedy native shrubs and vines, such as buckbrush, gooseberry, poison ivy and Virginia creeper. Herbaceous cover is sparse and includes weedy natives such as broom sedge, and exotics such as sericea lespedeza. Mats of lichens and mosses occur on areas denuded by livestock.

### **State 4**

#### **Grassland**

Conversion of flatwood ecological sites to planted, non-native grassland species such as tall fescue and red clover has been common occurrence. Clearing is often done by bulldozing. This practice often strips the thin topsoil along with most of the native ground cover plants. Occasionally, clumps of trees will be left in small groves for shade, giving the structural appearance of historic woodlands. However, Fragipan Upland Flatwoods have most often been converted into tall fescue grasslands, adjacent to densely overgrown and grazed woodlots. A return from this condition to a flatwoods state requires enormous cost and management inputs.

### **Community 4.1**

#### **Tall Fescue – Red Clover**

##### **Dominant resource concerns**

- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates

### **Community 4.2**

#### **Tall fescue – Broomsedge/Oak Sprouts**

##### **Dominant resource concerns**

- Nutrients transported to surface water
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

### **Pathway P4.1A**

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

Over grazing; no fertilization

### **Pathway P4.2A**

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

Brush management; prescribed grazing; grassland management

### **Transition T1A**

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

Fire suppression; managed timber harvests

**Transition T1B****State 1 to 3**

Fire suppression; high grading timber harvest; uncontrolled domestic grazing

**Transition T1C****State 1 to 4**

Clearing; grassland planting; grassland management

**Restoration pathway R1B****State 2 to 1**

Thinning; prescribed fire - 1-3 years; forest stand improvement

**Transition T2A****State 2 to 3**

This transition is the result of poorly managed domestic grazing and improper logging activities.

**Transition T2B****State 2 to 4**

This transition is the result of clearcutting the hardwood canopy species and planting shortleaf pine.

**Restoration pathway R1A****State 3 to 1**

Exclude domestic grazing; thinning; prescribed fire - 1-3 years; forest stand improvement; extended rotations

**Transition T3A****State 3 to 2**

This transition results from the exclusion of domestic grazing and implementation of good forest management activities.

**Transition T3C****State 3 to 4**

Clearing; grassland planting; grassland management

**Transition T4A****State 4 to 2**

Tree planting; forest stand improvement; no grazing; brush management

**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)
<b>Tree</b>							
post oak	QUST	<i>Quercus stellata</i>	Native	–	20–40	–	–
blackjack oak	QUMA3	<i>Quercus marilandica</i>	Native	–	20–40	–	–
black hickory	CATE9	<i>Carya texana</i>	Native	–	10–30	–	–
black oak	QUVE	<i>Quercus velutina</i>	Native	–	10–30	–	–
sassafras	SAAL5	<i>Sassafras albidum</i>	Native	–	0–10	–	–

**Table 6. Community 1.1 forest understory composition**

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
little bluestem	SCSC	<i>Schizachyrium scoparium</i>	Native	–	5–30
eastern star sedge	CARA8	<i>Carex radiata</i>	Native	–	5–20
inland rush	JUIN2	<i>Juncus interior</i>	Native	–	5–20
Virginia wildrye	ELVI3	<i>Elymus virginicus</i>	Native	–	5–20
Indiangrass	SONU2	<i>Sorghastrum nutans</i>	Native	–	5–20
oval-leaf sedge	CACE	<i>Carex cephalophora</i>	Native	–	5–20
big bluestem	ANGE	<i>Andropogon gerardii</i>	Native	–	5–20
poverty oatgrass	DASP2	<i>Danthonia spicata</i>	Native	–	5–20
blue sedge	CAGL6	<i>Carex glaucoidea</i>	Native	–	5–20
broomsedge bluestem	ANVI2	<i>Andropogon virginicus</i>	Native	–	5–10
<b>Forb/Herb</b>					
late purple aster	SYPA2	<i>Symphyotrichum patens</i> var. <i>patens</i>	Native	–	1–10
queendevil	HIGR3	<i>Hieracium gronovii</i>	Native	–	1–10
hairy sunflower	HEHI2	<i>Helianthus hirsutus</i>	Native	–	1–10
smooth small-leaf ticktrefoil	DEMA2	<i>Desmodium marilandicum</i>	Native	–	1–10
panickedleaf ticktrefoil	DEPA6	<i>Desmodium paniculatum</i>	Native	–	1–10
slender lespedeza	LEVI7	<i>Lespedeza virginica</i>	Native	–	1–10
sidebeak pencilflower	STBI2	<i>Stylosanthes biflora</i>	Native	–	1–10
white wild indigo	BAAL	<i>Baptisia alba</i>	Native	–	1–10
elmleaf goldenrod	SOUL2	<i>Solidago ulmifolia</i>	Native	–	1–10
common cinquefoil	POSI2	<i>Potentilla simplex</i>	Native	–	1–10
Virginia tephrosia	TEVI	<i>Tephrosia virginiana</i>	Native	–	1–10
stiff tickseed	COPA10	<i>Coreopsis palmata</i>	Native	–	1–10
largeflower yellow false foxglove	AUGR	<i>Aureolaria grandiflora</i>	Native	–	1–10
pussytoes	ANTEN	<i>Antennaria</i>	Native	–	1–10
American hogpeanut	AMBR2	<i>Amphicarpaea bracteata</i>	Native	–	1–10
<b>Shrub/Subshrub</b>					
black huckleberry	GABA	<i>Gaylussacia baccata</i>	Native	–	5–10
fragrant sumac	RHAR4	<i>Rhus aromatica</i>	Native	–	5–10
New Jersey tea	CEAM	<i>Ceanothus americanus</i>	Native	–	5–10
American hazelnut	COAM3	<i>Corylus americana</i>	Native	–	5–10

Table 7. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
<b>Tree</b>							
post oak	QUST	<i>Quercus stellata</i>	Native	–	40–60	–	–
blackjack oak	QUMA3	<i>Quercus marilandica</i>	Native	–	30–50	–	–
black hickory	CATE9	<i>Carya texana</i>	Native	–	20–40	–	–
black oak	QUVE	<i>Quercus velutina</i>	Native	–	20–30	–	–
sassafras	SAAL5	<i>Sassafras albidum</i>	Native	–	0–20	–	–

Table 8. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
little bluestem	SCSC	<i>Schizachyrium scoparium</i>	Native	–	20–60
poverty oatgrass	DASP2	<i>Danthonia spicata</i>	Native	–	20–40
big bluestem	ANGE	<i>Andropogon gerardii</i>	Native	–	10–30
Indiangrass	SONU2	<i>Sorghastrum nutans</i>	Native	–	10–30
Virginia wildrye	ELVI3	<i>Elymus virginicus</i>	Native	–	10–20
broomsedge bluestem	ANVI2	<i>Andropogon virginicus</i>	Native	–	5–10
hirsute sedge	CACO9	<i>Carex complanata</i>	Native	–	5–10
blue sedge	CAGL6	<i>Carex glaucoidea</i>	Native	–	5–10
Leiberg's panicum	DILE2	<i>Dichanthelium leibergii</i>	Native	–	5–10
<b>Forb/Herb</b>					
stiff tickseed	COPA10	<i>Coreopsis palmata</i>	Native	–	5–20
largeflower yellow false foxglove	AUGR	<i>Aureolaria grandiflora</i>	Native	–	5–20
slender lespedeza	LEVI7	<i>Lespedeza virginica</i>	Native	–	5–20
pussytoes	ANTEN	<i>Antennaria</i>	Native	–	5–20
smooth small-leaf ticktrefoil	DEMA2	<i>Desmodium marilandicum</i>	Native	–	5–20
panicledleaf ticktrefoil	DEPA6	<i>Desmodium paniculatum</i>	Native	–	5–20
American hogpeanut	AMBR2	<i>Amphicarpaea bracteata</i>	Native	–	5–10
sidebeak pencilflower	STBI2	<i>Stylosanthes biflora</i>	Native	–	5–10
hairy hawkweed	HILO2	<i>Hieracium longipilum</i>	Native	–	5–10
trailing lespedeza	LEPR	<i>Lespedeza procumbens</i>	Native	–	5–10
<b>Shrub/Subshrub</b>					
New Jersey tea	CEAM	<i>Ceanothus americanus</i>	Native	–	0–20
American hazelnut	COAM3	<i>Corylus americana</i>	Native	–	0–20
black huckleberry	GABA	<i>Gaylussacia baccata</i>	Native	–	0–20
fragrant sumac	RHAR4	<i>Rhus aromatica</i>	Native	–	0–20

Table 9. Community 2.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
<b>Tree</b>							
black hickory	CATE9	<i>Carya texana</i>	Native	–	20–30	–	–
white oak	QUAL	<i>Quercus alba</i>	Native	–	10–30	–	–
post oak	QUST	<i>Quercus stellata</i>	Native	–	20–30	–	–
black oak	QUVE	<i>Quercus velutina</i>	Native	–	20–30	–	–
sassafras	SAAL5	<i>Sassafras albidum</i>	Native	–	10–20	–	–
rusty blackhaw	VIRU	<i>Viburnum rufidulum</i>	Native	–	10–20	–	–
black cherry	PRSE2	<i>Prunus serotina</i>	Native	–	5–20	–	–
blackjack oak	QUMA3	<i>Quercus marilandica</i>	Native	–	5–20	–	–
eastern redcedar	JUVI	<i>Juniperus virginiana</i>	Native	–	5–20	–	–

**Table 10. Community 2.1 forest understory composition**

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
little bluestem	SCSC	<i>Schizachyrium scoparium</i>	Native	–	5–20
Indiangrass	SONU2	<i>Sorghastrum nutans</i>	Native	–	0–10
poverty oatgrass	DASP2	<i>Danthonia spicata</i>	Native	–	5–10
Leiberg's panicum	DILE2	<i>Dichanthelium leibergii</i>	Native	–	5–10
Virginia wildrye	ELVI3	<i>Elymus virginicus</i>	Native	–	5–10
big bluestem	ANGE	<i>Andropogon gerardii</i>	Native	–	0–10
broomsedge bluestem	ANVI2	<i>Andropogon virginicus</i>	Native	–	0–5
<b>Forb/Herb</b>					
elmleaf goldenrod	SOUL2	<i>Solidago ulmifolia</i>	Native	–	10–20
pussytoes	ANTEN	<i>Antennaria</i>	Native	–	0–10
slender lespedeza	LEVI7	<i>Lespedeza virginica</i>	Native	–	5–10
smooth small-leaf ticktrefoil	DEMA2	<i>Desmodium marilandicum</i>	Native	–	5–10
panicledleaf ticktrefoil	DEPA6	<i>Desmodium paniculatum</i>	Native	–	5–10
<b>Shrub/Subshrub</b>					
fragrant sumac	RHAR4	<i>Rhus aromatica</i>	Native	–	0–10
<b>Vine/Liana</b>					
Virginia creeper	PAQU2	<i>Parthenocissus quinquefolia</i>	Native	–	0–10

**Table 11. Community 3.1 forest overstory composition**

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
<b>Tree</b>							
black oak	QUVE	<i>Quercus velutina</i>	Native	–	10–40	–	–
post oak	QUST	<i>Quercus stellata</i>	Native	–	20–40	–	–
blackjack oak	QUMA3	<i>Quercus marilandica</i>	Native	–	10–30	–	–
black hickory	CATE9	<i>Carya texana</i>	Native	–	10–30	–	–
eastern redcedar	JUVI	<i>Juniperus virginiana</i>	Native	–	0–20	–	–
black cherry	PRSE2	<i>Prunus serotina</i>	Native	–	0–10	–	–
white oak	QUAL	<i>Quercus alba</i>	Native	–	5–10	–	–
sassafras	SAAL5	<i>Sassafras albidum</i>	Native	–	0–10	–	–

**Table 12. Community 3.1 forest understory composition**

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
<b>Grass/grass-like (Graminoids)</b>					
broomsedge bluestem	ANVI2	<i>Andropogon virginicus</i>	Native	–	10–30
poverty oatgrass	DASP2	<i>Danthonia spicata</i>	Native	–	5–10
Virginia wildrye	ELVI3	<i>Elymus virginicus</i>	Native	–	5–10
little bluestem	SCSC	<i>Schizachyrium scoparium</i>	Native	–	5–10
<b>Forb/Herb</b>					
sericea lespedeza	LECU	<i>Lespedeza cuneata</i>	Introduced	–	10–30
pussytoes	ANTEN	<i>Antennaria</i>	Native	–	0–5
slender lespedeza	LEVI7	<i>Lespedeza virginica</i>	Native	–	0–5
<b>Shrub/Subshrub</b>					
buckbrush	CECU	<i>Ceanothus cuneatus</i>	Native	–	10–50
eastern prickly gooseberry	RICY	<i>Ribes cynosbati</i>	Introduced	–	10–30
fragrant sumac	RHAR4	<i>Rhus aromatica</i>	Native	–	5–10
<b>Tree</b>					
black cherry	PRSE2	<i>Prunus serotina</i>	Native	–	0–5
<b>Vine/Liana</b>					
eastern poison ivy	TORA2	<i>Toxicodendron radicans</i>	Native	–	10–30
Virginia creeper	PAQU2	<i>Parthenocissus quinquefolia</i>	Native	–	10–20

## Animal community

Wildlife (MDC 2006):

Oaks provide hard mast; numerous native legumes provide high-quality wildlife food; native warm-season grasses provide extensive cover and nesting habitat; and forbs provide a diversity and abundance of insects.

Bird species associated with early-successional Upland Flatwoods are Northern Bobwhite, Painted Bunting, Prairie Warbler, Field Sparrow, Blue-winged Warbler, Yellow-breasted Chat, Brown Thrasher, and Bachman's Sparrow. Birds associated with mid- to late successional sites are Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, and Red-eyed Vireo.

Reptiles and amphibians associated with Upland Flatwoods include ornate box turtle, northern fence lizard, five-

lined skink, coal skink, broad-headed skink, six-lined racerunner, western slender glass lizard, prairie ring-necked snake, flat-headed snake, rough earth snake, red milk snake, western pygmy rattlesnake, and timber rattlesnake.

## Other information

Forestry (NRCS 2002; 2014)

Management: Field measured site index values average 50 for post oak and 53 for black oak. Generally, the deeper the fragipan, the higher the site index values. Timber management opportunities are poor to fair. These sites have a root-restricting fragipan, which impedes rooting. Reduced rooting depth restricts tree growth and increases windthrow hazards. 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, group selection cuttings of ½ to 1 acre, or crop tree release are other options that can be used if clear cutting is not desired or warranted. These sites respond well to prescribed fire as a management tool.

Limitations: Restricted rooting depth; seasonal wetness. Unsurfaced roads and traffic areas tend to be slippery and form ruts easily when wet. Graveling roads facilitates year-round use. Equipment use when wet may compact soil and damage tree roots. Planting is difficult during wet spring periods. Seedling mortality may be high due to excess seasonal wetness, shallow effective rooting depths or sodium. Ridging the soil and planting on the ridges may increase survival. The use of equipment can become restricted in spring and other excessively wet periods.

**Table 13. Representative site productivity**

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
white oak	<i>QUAL</i>	43	65	25	35	50	—	—	
post oak	<i>QUST</i>	44	55	25	30	50	—	—	
shortleaf pine	<i>PIEC2</i>	49	66	25	30	50	—	—	
black oak	<i>QUVE</i>	44	78	25	30	50	—	—	

## Inventory data references

Potential Reference Sites: Fragipan Upland Flatwoods

Plot SARCA02 – Needleeye soil

Located in Sare CA, Greene County, MO

Latitude: 37.363352

Longitude: -93.327492

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## Contributors

Doug Wallace  
Douglas Wallace

## Approval

Nels Barrett, 10/07/2020

## Acknowledgments

Missouri Department of Conservation and Missouri Department of Natural Resources personnel provided significant and helpful field and technical support in the development of this ecological site.

## 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	05/18/2024
Approved by	Nels Barrett
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):**

---

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

---

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):**

---

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):**

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
- 

14. **Average percent litter cover (%) and depth ( in):**
- 

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**
- 

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**
- 

17. **Perennial plant reproductive capability:**
-