USDA Natural Resources Conservation Service

Ecological site F116AY004MO
Fragipan Upland Woodland

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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): 116A–Ozark Highland

The Ozark Highland constitutes the Salem Plateau of the Ozark Uplift. Elevation ranges from about 300 feet on the southeast edge of the Ozark escarpment, to about 1,600 feet in the west, adjacent to the Burlington Escarpment of the Springfield Plateau. The underlying bedrock is mainly horizontally bedded Ordovician-aged dolomites and sandstones that dip gently away from the uplift apex in southeast Missouri. Cambrian dolomites are exposed on deeply dissected hillslopes. In some places, Pennsylvanian and Mississipian sediments overlie the plateau. Relief varies, from the gently rolling central plateau areas to deeply dissected hillslopes associated with drainageways such as the Buffalo, Current, Eleven Point and White Rivers.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to Upland Flatwoods.

Missouri Department of Conservation Forest and Woodland Communities (MDC, 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 Quercus stellata - Quercus marilandica / Schizachyrium scoparium Wooded Herbaceous Vegetation (CEGL002391).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site is widespread across the Ozark Highlands Section.

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 Woodlands occur throughout the Ozark Highland on areas of the plateau that have not been deeply dissected by streams. Soils have root-restricting fragipans. The reference plant community is woodland with an overstory dominated by post oak and blackjack oak and a ground flora of native grasses and forbs.

Associated sites

F116AY011MO	**Chert Upland Woodland** Chert Upland Woodlands are typically downslope, on gently sloping shoulders and upper backslopes.
F116AY012MO	**Low-Base Chert Upland Woodland** Low-base Chert Upland Woodlands are often downslope, on gently sloping shoulders and upper backslopes.
F116AY066MO	**Fragipan Upland Flatwoods** Fragipan Upland Flatwoods are in level to broadly depressional areas on adjacent, summit positions.

Similar sites

F116AY066MO	**Fragipan Upland Flatwoods** Fragipan Upland Flatwoods are similar, but are restricted to level landscape positions and usually pond water for longer periods.

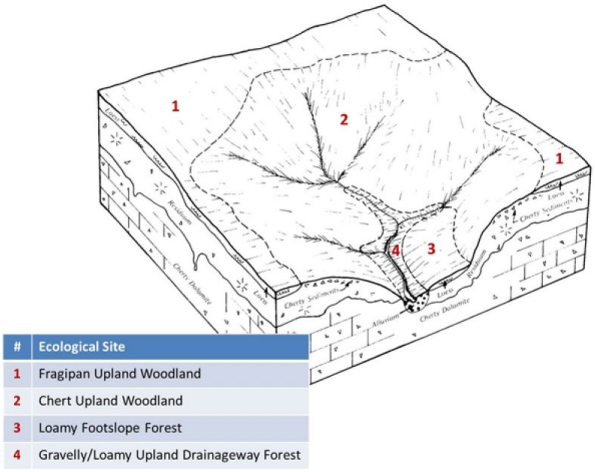
Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus velutina*
Shrub	(1) *Rhus aromatica*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Desmodium*

Physiographic features

This site is on convex upland summit crests and shoulders with slopes of 1 to 15 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from McBee, 1991) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “1”, on broadly convex upland summits. A variety of ecological sites may occur downslope, such as the Chert Upland Woodland sites within the area labeled “2”. In many areas, Low-base Chert Upland Woodland sites are downslope.



#	Ecological Site
1	Fragipan Upland Woodland
2	Chert Upland Woodland
3	Loamy Footslope Forest
4	Gravelly/Loamy Upland Drainageway Forest

Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Interfluve (3) Divide
Flooding frequency	None
Ponding frequency	None
Slope	1–15%
Water table depth	6–30 in
Aspect	Aspect is not a significant factor

Climatic features

The Ozark Highland 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 Ozark Highland 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 crossing the MLRA from northwest to southeast.

The average annual precipitation in almost all of this area is 38 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 53 to 60 degrees F. The lower temperatures occur at the higher elevations in the western part of the MLRA.

Mean January minimum temperature follows a stronger north-to-south gradient. However, mean July maximum temperature shows hardly any geographic variation in the MLRA.
Mean annual precipitation varies along a northwest to southeast 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.

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)	142-177 days
Freeze-free period (characteristic range)	177-202 days
Precipitation total (characteristic range)	45-50 in
Frost-free period (actual range)	141-186 days
Freeze-free period (actual range)	173-211 days
Precipitation total (actual range)	44-50 in
Frost-free period (average)	161 days
Freeze-free period (average)	190 days
Precipitation total (average)	47 in

Climate stations used

- (1) LEAD HILL [USC00034106], Lead Hill, AR
- (2) LAKESIDE [USC00234694], Lake Ozark, MO
- (3) MARBLE HILL [USC00235253], Marble Hill, MO
- (4) TAHLEQUAH [USC00348677], Tahlequah, OK
- (5) POCAHONTAS 1 [USC00035820], Pocahontas, AR
- (6) HOUSTON [USC00234019], Houston, MO

Influencing water features

Water features associated with this ecological site include a seasonal zone of saturation, perched on the fragipan in the subsoil. In broad depressional areas within this site, seasonal wetness and ponding can occur, resulting in a flatwoods woodland community. Where present, these depressional areas are in the MINERAL FLAT class in the Hydrogeomorphic (HGM) system (Brinson, 1993), and are Forested Palustrine wetlands (Cowardin et al., 1979).

Other water features associated with this upland ecological site are influenced by karst landscapes throughout the area (see diagram). Rainfall enters the groundwater system through the soil or by flowing into sinkholes and streams. Springs form where land drops low enough to meet underground water tables. Dissolution of carbonate rocks along fractures and faults has produced cave systems, sinkholes (closed and open), springs, and natural tunnels in the region. These sinkholes and losing streams can rapidly transfer water from upland recharge areas to spring outlets. The most common mechanism for groundwater recharge occurs by the relatively slow downward

movement of water through soil and carbonate bedrock over a large area known as diffuse recharge, which maintains a high storage volume providing a consistent supply of water to springs. In addition to diffuse recharge, aquifers in karst terrain receive the relatively rapid transfer of water through sinkholes or losing streams connected by subsurface conduits. Surface water entering the aquifer in this fashion has very little contact with soil or rock and consequently the chemical nature of the water changes little in route. Discharge variability does not seem to be controlled by drainage area, but rather the conduit capacity of losing stream sections that can transport the entire volume of base-flow during dry periods in the year. High variability in base flow shows the impact of karst in the form of losing and gaining stream sections (Owen and Pavlowsky 2010).

The following graphic depicts the distribution of these karst-related features in the state of Missouri. Relative cave density per USGS 7.5" quadrangle is depicted by shades of red, deeper red signifying a larger number of caves in the quadrangle. Stretches of losing streams are shown in yellow. Known springs are shown as blue dots.

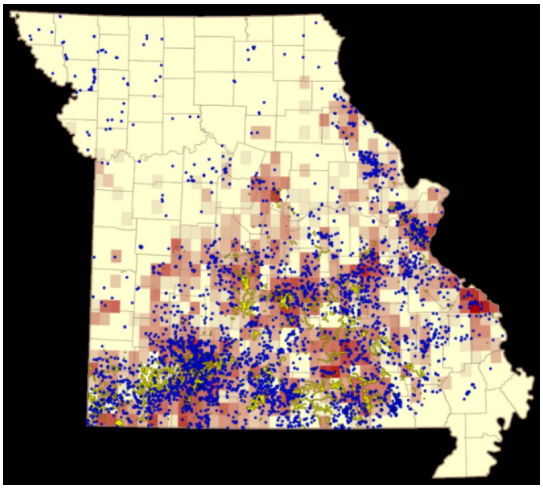


Figure 9. Distribution of karst-related features in Missouri. Image from Wikimedia Commons developed from the Missouri Department of Natural Resources, Division of Geology and Land Survey.

Soil features

Most of these soils have a root-restricting fragipan at about 24 inches. Some soils have an abrupt textural change, which impedes rooting. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. They have silt loam or loam surface horizons, and loamy subsoils that are generally gravelly to very gravelly with depth. Parent material is a thin layer of loess over pedisediment over residuum derived mostly from limestone and dolomite. A seasonal high water table is perched above the fragipan or abrupt textural change during the spring months in most years. Soil series associated with this site include include Captina, Hildebrecht, Hobson, Hogcreek, Jonca, Lebanon, Nicholson, Tonti, Union, Viraton, and Yelton.

The accompanying picture of the Tonti series shows a thin, light-colored surface horizon and reddish brown gravelly silt loam subsoil, over a fragipan at about 60 cm. The fragipan is a barrier to roots. Scale is in centimeters. Picture courtesy of John Preston, USDA.

Figure 10. Tonti series

Table 4. Representative soil features

Parent material	(1) Loess (2) Pedisediment (3) Residuum–limestone and dolomite
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained
Permeability class	Very slow
Soil depth	11–24 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
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)	3.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	15–60%
Subsurface fragment volume >3" (Depth not specified)	0–50%

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 Woodlands were dominated by drought and fire-tolerant post and black oaks. Their landscape position and juxtaposition to prairies lead to a high fire frequency (every 1 to 3 years). The woodlands ranged from open savannas near the prairie edge to open, park-like woodlands farther away. Canopy closure varied from 50 to 80 percent and tree height from 40 to 60 feet.

Native prairie grasses dominated the open understory, along with a diverse 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 and blackjack oak share dominance with black oak, black hickory and an occasional white oak. 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.

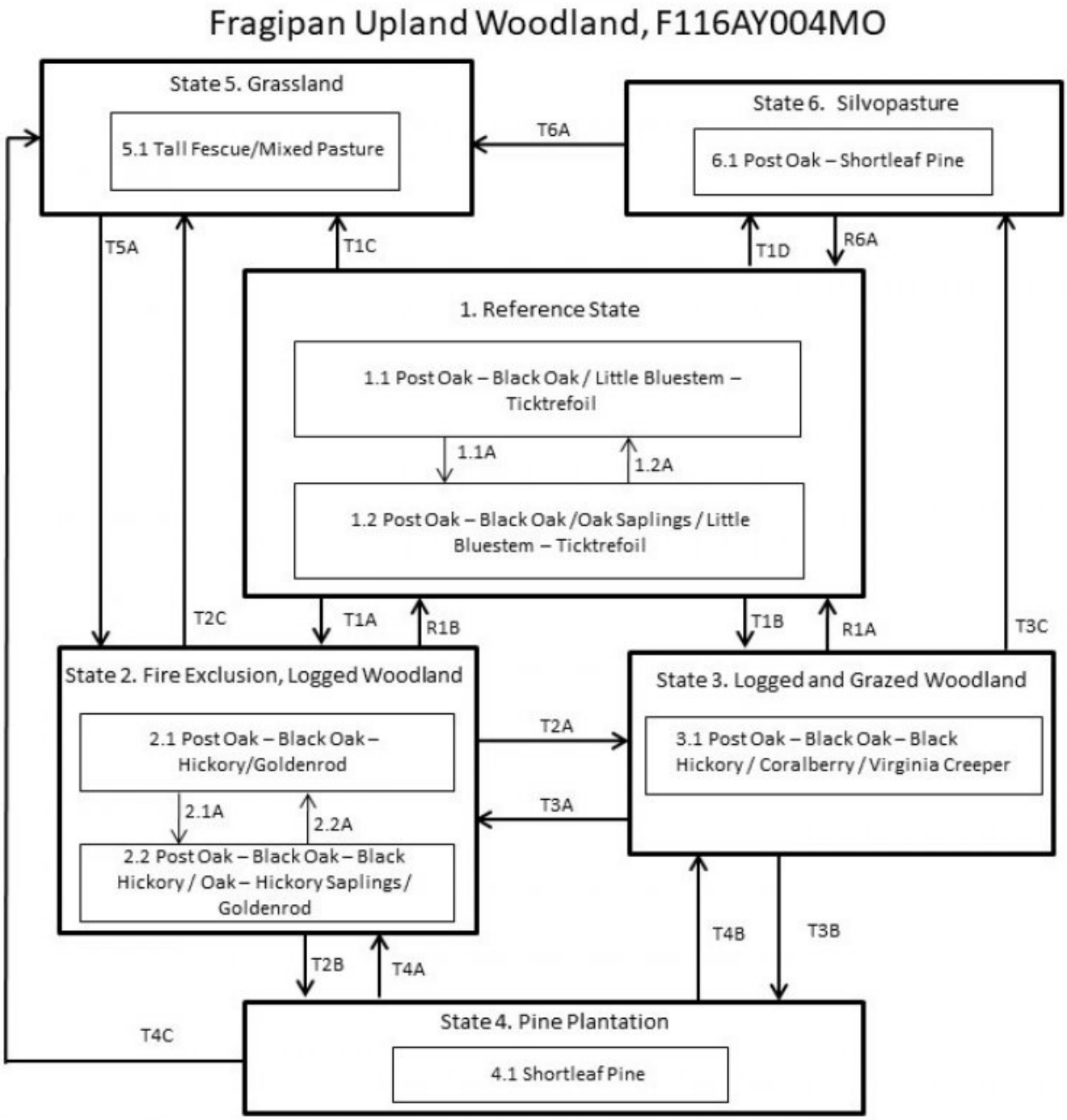
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing invasive species that are tolerant of grazing, such as eastern redcedar, coralberry, gooseberry, Virginia creeper and, in severely overgrazed situations, mosses and lichens.

Although timber products from these woodlands 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 timber products, wildlife habitat, and potential native forage.

A state-and-transition model 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	Activity/Action
T1A	Fire suppression; single tree selection timber harvest
T1B	Fire suppression; single tree selection timber harvest; domestic grazing
T1C, T2C, T4C, T6A	Clearing & pasture planting
T1D, T3C	Thinning; prescribed fire; managed grazing; pine planting
T2B, T3B	Clearcut & pine planting
T2A	Domestic grazing
T3A	Exclude domestic grazing
T4A	Pine harvest; fire exclusion
T4B	Pine harvest; fire exclusion; domestic grazing
T5A	Tree planting; long-term succession
T6A	Clearcutting; grassland planting; grazing

Code	Activity/Action
1.1A	Fire-free interval - 3-10 yrs
1.2A	Fire; Native grazers
2.1A	Single tree selection timber harvest
2.2A	No timber harvest 10-30 yrs

Code	Activity/Action
R1A	Exclude domestic grazing; thinning; prescribed fire - 2-5 yrs
R1B	Thinning; prescribed fire - 2-5 yrs
R6A	Exclude domestic grazing; prescribed fire 2-5 yrs

Figure 11. State and transition diagram for this ecological site.

State 1

Reference

These open woodland reference communities were strongly influenced by fire. Herbivory by native 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 post oak - blackjack oak/little bluestem woodland. There are two phases associated with this reference state.

Community 1.1
Post Oak – Black Oak / Little Bluestem - Ticktrefoil

Figure 12. Reference site at St. Francois State Park, St. Francois County, Missouri; photo credit - Dennis Meinert, MDNR

The overstory in this phase is dominated by post oak and black oak, with scattered blackjack oak and black hickory. This open woodland community typically has a two-tiered structure, with canopy height of 40 to 60 feet and 50 to 70 percent closure. The abundant herbaceous layer is dominated by little bluestem, big bluestem and Indiangrass. Fire frequency was likely every 1 to 3 years. This continued fire and natural native grazing would have maintained the more open canopy and profusion of ground flora species.

Forest overstory. The 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. The 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.

Community 1.2
Post Oak – Black Oak /Oak Saplings / Little Bluestem – Ticktrefoil

The overstory in this phase is dominated by post oak and black oak, with scattered blackjack oak and black hickory. This brushy woodland community typically has a three-tiered structure, with 50 to 80 percent closure. It is characterized by a thick understory of oak saplings, and shrubs. The herbaceous layer is dominated by little bluestem. Fire-free intervals ranged from 5 to 10 years.

State 2
Fire Excluded and Managed Woodland

Most current areas of Fragipan Upland Woodlands 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. This results in the formation of Post Oak – Black Oak – Black Hickory / Oak – Hickory Saplings / Goldenrod woodland. Black oak and midstory 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 and black cherry.

Community 2.1
Post Oak – Black Oak – Hickory/Goldenrod

Dominant resource concerns

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

Community 2.2
Post Oak – Black Oak – Black Hickory / Oak – Hickory Saplings / Goldenrod

Dominant resource concerns

- Ephemeral gully erosion
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates

State 3
Logged and Grazed Woodland

Although many of the closed Fragipan Upland Woodlands 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 buckbrush, gooseberry, poison ivy and Virginia creeper, often flourish after grazing, and exotic species like 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 poorly formed trees.

Community 3.1
Post Oak – Black Oak – Black Hickory/Coralberry/Virginia Creeper

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

State 4
Pine Plantation

The Pine Plantation state results from clearing the oak woodlands and planting shortleaf pine. Shortleaf pine grows well on less-productive sites, so the practice was common during reforestation of the Ozarks. The plantations are typically dense, mature stands of shortleaf pine with deep leaf litter and little understory or ground flora vegetation. A return from this condition to an oak woodland state requires enormous cost and management inputs.

Dominant resource concerns

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

Community 4.1
Shortleaf Pine

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

State 5
Grassland

Conversion of woodland 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 Woodlands have most often been converted into wide, open fescue grasslands, adjacent to densely overgrown and grazed woodlots. A return from this condition to a woodland state requires enormous cost and management inputs.

Community 5.1
Tall Fescue/Mixed Pasture

Conversion of woodland 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 Woodlands have most often been converted into wide, open fescue grasslands, adjacent to densely overgrown and grazed woodlots. A return from this condition to a woodland state requires enormous cost and management inputs.

Dominant resource concerns

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

State 6
Managed Silvopasture

Although this state is currently uncommon, Fragipan Upland Woodlands have the potential to support controlled grazing while maintaining a near-reference composition and structure. Short periods of rotational grazing, especially during the hot, dry summer season, along with thinning and prescribed fire, has the potential to create an open, diverse woodland with abundant native forage. Controlled grazing may emulate historical grazing by native herbivores and create a structural diversity in the ground flora that may be beneficial to ground-nesting birds. The Managed Silvopasture state has an open, two-tiered structure of black oak and shortleaf pine over native grasses and forbs. Canopy height is typically 60 to 70 feet, with canopy closure of 40 to 80 percent. Native grasses include little bluestem, big bluestem and Indiangrass.

Community 6.1
Oak-Shortleaf Pine/Little Bluestem

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

Fire suppression; single tree selection timber harvest

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							
post oak	QUST	*Quercus stellata*	Native	–	10–30	–	–
black oak	QUVE	*Quercus velutina*	Native	–	10–30	–	–
black hickory	CATE9	*Carya texana*	Native	–	10–30	–	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	10–30	–	–
shortleaf pine	PIEC2	*Pinus echinata*	Native	–	0–20	–	–
sassafras	SAAL5	*Sassafras albidum*	Native	–	0–20	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	5–20
big bluestem	ANGE	*Andropogon gerardii*	Native	–	5–20
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	5–20
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	5–20
blue sedge	CAGL6	*Carex glaucodea*	Native	–	5–20
hirsute sedge	CACO9	*Carex complanata*	Native	–	5–20
Indiangrass	SONU2	*Sorghastrum nutans*	Native	–	5–20
inland rush	JUIN2	*Juncus interior*	Native	–	5–20
broomsedge bluestem	ANVI2	*Andropogon virginicus*	Native	–	5–20
fall panicgrass	PADI	*Panicum dichotomiflorum*	Native	–	5–20
Muhlenberg's sedge	CAMU4	*Carex muehlenbergii*	Native	–	5–20
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	5–20
Forb/Herb					
prostrate ticktrefoil	DERO3	*Desmodium rotundifolium*	Native	–	1–10
Nuttall's ticktrefoil	DENU5	*Desmodium nuttallii*	Native	–	1–10
Dillenius' ticktrefoil	DEGL4	*Desmodium glabellum*	Native	–	1–10
sidebeak pencilflower	STBI2	*Stylosanthes biflora*	Native	–	1–10
wild bergamot	MOFI	*Monarda fistulosa*	Native	–	1–10
smooth violet prairie aster	SYTU2	*Symphyotrichum turbinellum*	Native	–	1–10
narrowleaf mountainmint	PYTE	*Pycnanthemum tenuifolium*	Native	–	1–10
woman's tobacco	ANPL	*Antennaria plantaginifolia*	Native	–	1–10
sidebeak pencilflower	STBI2	*Stylosanthes biflora*	Native	–	1–10
Virginia tephrosia	TEVI	*Tephrosia virginiana*	Native	–	1–10
stiff tickseed	COPA10	*Coreopsis palmata*	Native	–	1–10
largeflower yellow false foxglove	AUGR	*Aureolaria grandiflora*	Native	–	1–10
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	1–10
queendevil	HIGR3	*Hieracium gronovii*	Native	–	1–10
smooth small-leaf ticktrefoil	DEMA2	*Desmodium marilandicum*	Native	–	1–10
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	–	1–10
common cinquefoil	POSI2	*Potentilla simplex*	Native	–	1–10
white wild indigo	BAAL	*Baptisia alba*	Native	–	1–10

white wild indigo	BAAL	*Baptisia alba*	Native	–	1–10
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	1–10
late purple aster	SYPAP2	*Symphyotrichum patens var. patens*	Native	–	1–10
smooth violet prairie aster	SYTU2	*Symphyotrichum turbinellum*	Native	–	1–10
Parlin's pussytoes	ANPA9	*Antennaria parlinii*	Native	–	1–10
hairy bedstraw	GAPI2	*Galium pilosum*	Native	–	1–10
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	1–10
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	5–10
American hazelnut	COAM3	*Corylus americana*	Native	–	5–10
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	5–10
black huckleberry	GABA	*Gaylussacia baccata*	Native	–	5–10
St. Andrew's cross	HYHYM	*Hypericum hypericoides ssp. multicaule*	Native	–	5–10
leadplant	AMCA6	*Amorpha canescens*	Native	–	5–10
Blue Ridge blueberry	VAPA4	*Vaccinium pallidum*	Native	–	5–10
deerberry	VAST	*Vaccinium stamineum*	Native	–	5–10

Animal community

Wildlife Species (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 sites are Northern Bobwhite, Painted Bunting, Prairie Warbler, Field Sparrow, Blue-winged Warbler, Yellow-breasted Chat, Brown Thrasher, and Bachman’s Sparrow. All of these species also occur in glades associated with woodlands. Birds associated with mid- to late successional sites (80+ years) 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 these Woodlands 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 collected site index values average 45 for post oak, 53 for shortleaf pine, and 56 for black oak. Generally, the deeper the restricting layer, the higher the site index values. Timber management opportunities are fair to moderate. These sites have a root-restricting fragipan or an abrupt textural change, which impedes rooting. Reduced rooting depth restricts tree growth and increases windthrow hazards. These groups respond well to even-aged management. 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 group selection cuttings of ½ to 1 acre 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. 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.

Inventory data references

Potential Reference Sites: Fragipan Upland Woodland

Plot HATOSP09 – Union soil
Located in HaHa Tonka State Park, Camden County
Latitude: 37.964156
Longitude: -92.75265

Plot CARIFS_KS01 – Tonti soil
Located in Cane Ridge USFS, Wayne County
Latitude: 36.945593
Longitude: -90.660084

Plot CARIFS_KS02 – Tonti soil
Located in Cane Ridge USFS, Butler County
Latitude: 36.920454
Longitude: -90.616852

Plot ROCRCA_KS01 – Tonti soil
Located in Rocky Creek CA, Shannon County
Latitude: 37.042166
Longitude: -91.348111

Plot ROCRCA_KS02 – Lebanon soil
Located in Rocky Creek CA, Shannon County
Latitude: 37.03305
Longitude: -91.266981

Plot LORICA_KS01 – Union soil
Located in Long Ridge CA, Franklin County
Latitude: 38.278442
Longitude: -91.170207

Plot PODIFS04 – Tonti soil
Located in Potosi District USFS, Crawford County
Latitude: 37.995345
Longitude: -91.25390

Plot STFRSP_KS12 – Hildebrecht soil
Located in St. Francois State Park, St. Francois County
Latitude: 37.979491
Longitude: -90.515932

Plot WESTFS02 – Lebanon soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.86469
Longitude: -91.977573

Plot WESTFS06 – Lebanon soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.864866
Longitude: -91.973271

Plot WESTFS08 – Lebanon soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.851411
Longitude: -91.987669

Plot WHNUCA_KS03 – Hogcreek soil
Located in White (George O) Nursery CA, Texas County
Latitude: 37.547303
Longitude: -91.897852

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Contributors

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Approval

Nels Barrett, 9/24/2020

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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	05/12/2025
Approved by	Nels Barrett
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):**

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

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

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**
