Ecological site F116AY066MO
Fragipan Upland Flatwoods

Last updated: 9/24/2020
Accessed: 04/25/2024

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 an 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 a Quercus stellata / Cinna arundinacea Flatwoods Forest (CEGL002405).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily in the Central Plateau Subsection, in the western portion of 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 Flatwoods occur on areas of the Ozark Highlands that have not been deeply dissected by streams. Soils have root-restricting fragipans, and are affected by seasonal wetness. The reference plant community is a woodland with an overstory dominated by post oak and blackjack oak and a ground flora of wet-tolerant grasses, sedges, and forbs.

Associated sites

F116AY004MO	**Fragipan Upland Woodland** Fragipan Upland Woodlands are adjacent, on slightly higher, convex positions.
F116AY011MO	**Chert Upland Woodland** Chert Upland Woodlands and other upland ecological sites are downslope, on gently sloping shoulders and upper backslopes.

Similar sites

F116AY004MO	**Fragipan Upland Woodland** Fragipan Upland Woodlands are adjacent, on slightly higher, more convex positions.

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus marilandica*
Shrub	(1) *Rhus aromatica*
Herbaceous	(1) *Carex* (2) *Schizachyrium scoparium*

Physiographic features

This site is on level to broadly convex upland summits that include broad shallow depressions in some 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 Sturdevant et al, 2001) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “2” on the figure, shown here as a broad depressional area within an area of Fragipan Upland Woodland.

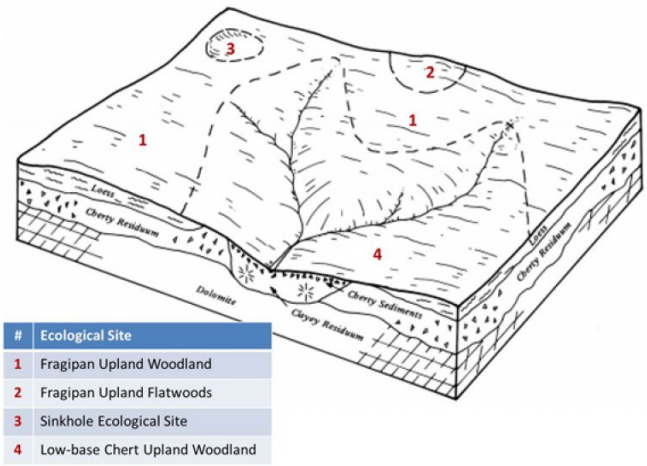


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Interfluve (3) Depression
Flooding frequency	None
Ponding frequency	None
Slope	0–8%
Water table depth	6–12 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)	143-155 days
Freeze-free period (characteristic range)	168-184 days
Precipitation total (characteristic range)	45-47 in
Frost-free period (actual range)	142-160 days
Freeze-free period (actual range)	166-189 days
Precipitation total (actual range)	45-47 in
Frost-free period (average)	149 days
Freeze-free period (average)	176 days
Precipitation total (average)	46 in

Climate stations used

- (1) BUFFALO 2N [USC00231087], Buffalo, MO
- (2) VIENNA 2 WNW [USC00238620], Vienna, MO
- (3) WEST PLAINS [USC00238880], West Plains, MO

Influencing water features

This ecological site is not influenced by wetland or riparian water features. However, a seasonal zone of saturation occurs, 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 on sites. 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).

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 Celt, Mariosa, Needleye, and Plato.

The accompanying picture of the Plato 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. Redoximorphic features in the subsoil above the fragipan are an indication of seasonal wetness. Scale is in centimeters. Photo credit, NRCS.

Figure 9. Plato series

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Poorly drained to somewhat poorly 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 Flatwoods were dominated by drought and fire-tolerant post and blackjack oaks 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 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 legume, aster, sunflower 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 often been cleared and converted to pasture or has been logged with 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 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.

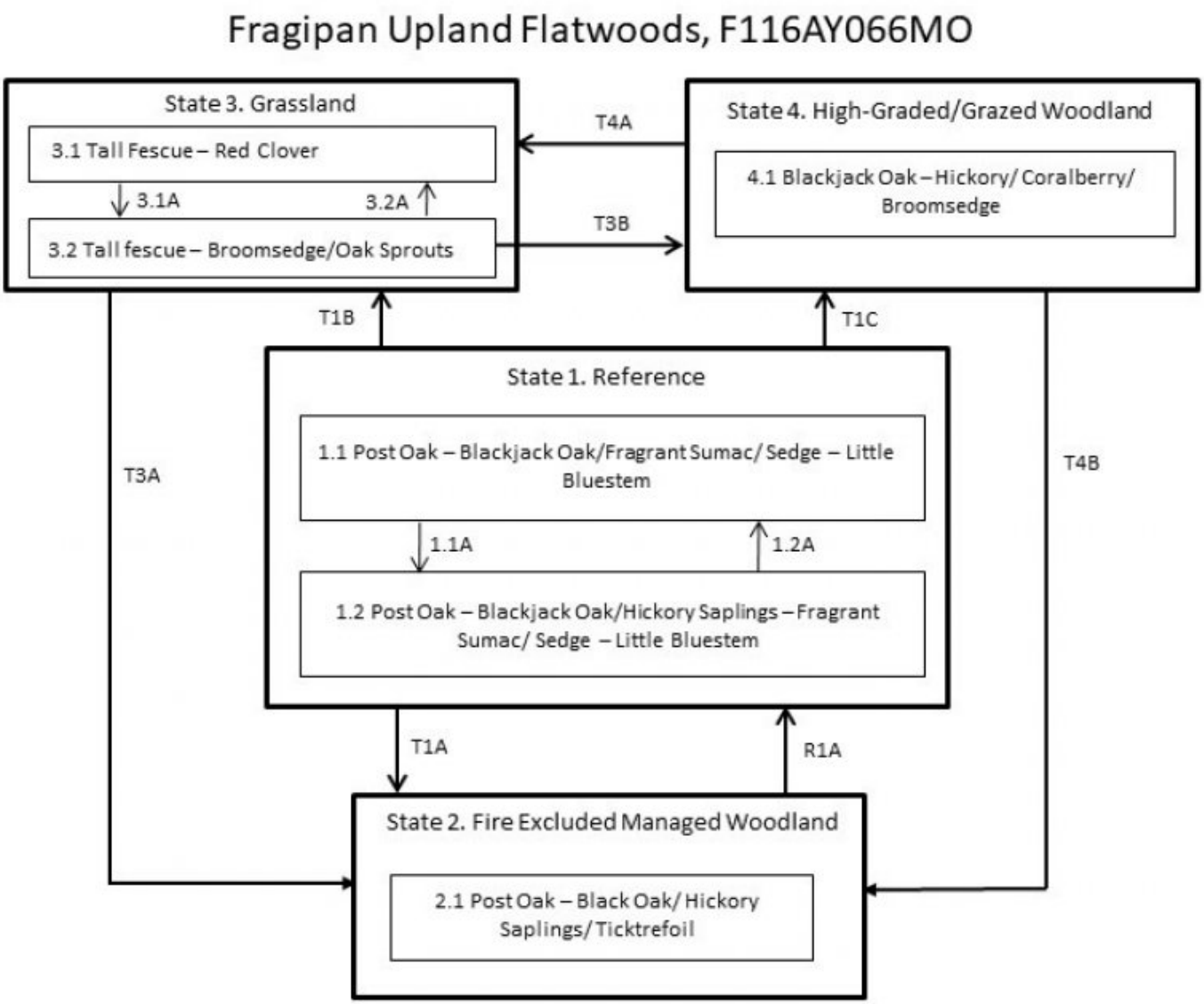
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing invasive species that are tolerant of grazing, such as coralberry, gooseberry, Virginia creeper and, in severely overgrazed situations, mosses and lichens.

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. 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.

A state-and-transition model 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	Activity/Event/Process
T1A	Harvesting; forest management; fire suppression
T1B, T4A	Clearing; pasture planting; grassland management
T1C	High-grade harvesting; uncontrolled grazing
T3A, T4B	Tree planting; long-term succession; no grazing; forest stand improvement
T3B	Long-term abandonment; uncontrolled grazing; unrestricted logging

Code	Activity/Event/Process
1.1A	No disturbance (10+ years)
1.2A	Disturbance (fire, wind, ice) 3-5 years
3.1A	Over grazing; no fertilization
3.2A	Brush management; grassland seeding; grassland management

Code	Activity/Event/Process
R1A	Extended rotations; prescribed fire; forest stand improvement

Figure 10. State and transition diagram for this ecological site

State 1

Reference

The reference state was dominated by post oak and blackjack oak. Periodic disturbances from fire, wind or ice maintained the dominance of oaks by opening the canopy and allowing more light for oak reproduction. Two community phases are recognized in this state, with shifts between phases based on disturbance frequency. Good examples of reference states still exist today. Some sites have been converted to grassland (State 3). Others have been subject to repeated, high-graded timber harvest coupled with uncontrolled domestic livestock grazing (State 4). Fire suppression has also resulted in increased canopy density, which has affected the abundance and diversity of ground flora.

Community 1.1
Post Oak – Blackjack Oak/Fragrant Sumac/ Sedge – Little Bluestem

Figure 11. Reference state at Western Star Flatwoods Natural Area, Phelps County, Missouri; photo credit MDC.

Figure 12. Reference state at St. Francois State Park, St. Francois County, Missouri; photo credit MDC.

Two community phases are recognized in this state, with shifts between phases based on disturbance frequency.

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 – Blackjack Oak/Hickory Saplings – Fragrant Sumac/ Sedge – Little Bluestem

Two community phases are recognized in this state, with shifts between phases based on disturbance frequency.

Pathway P1.1A
Community 1.1 to 1.2

No disturbance (10+ years)

Pathway P1.2A
Community 1.2 to 1.1

Disturbance (fire, wind, ice) 3-5 years

State 2
Fire Excluded Managed Woodland

These woodlands can resemble the reference state but are denser. The biggest differences are tree age, most being only 50 to 90 years old, and canopy closure. Composition is also likely altered from the reference state depending on tree selection during harvest. These former woodlands are now rather dense, with an under developed understory and ground flora. Thinning and selective harvesting can increase overall tree vigor and improve understory diversity. Continual good forest management will maintain this state.

Community 2.1
Post Oak – Black Oak/ Hickory Saplings/ Ticktrefoil

State 3
Grassland

Conversion of woodlands to planted, non-native pasture species such as tall fescue has been common in this MLRA. Soil wetness, AND low organic matter make non-native pastures challenging to maintain in a healthy, productive state on this ecological site. If grazing is uncontrolled and active pasture management is discontinued, the site will transition to phase 3.2.

Community 3.1
Tall Fescue - Red Clover

Soil wetness, low organic matter, and soil acidity make non-native pastures challenging to maintain in a healthy, productive state on this ecological site.

Community 3.2
Tall fescue - Broomsedge/Oak Sprouts

Soil wetness, low organic matter, and soil acidity make non-native pastures challenging to maintain in a healthy, productive state on this ecological site.

Pathway P3.1A
Community 3.1 to 3.2

Over grazing; no fertilization

Pathway P3.2A
Community 3.2 to 3.1

Brush management; grassland seeding; grassland management

State 4
High-Graded/Grazed Woodland

Woodland sites subjected to repeated, high-graded timber harvests and uncontrolled domestic grazing transition to this state. This state exhibits an over-abundance of blackjack oak, hickory and other less desirable tree species, and

weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Exclusion of livestock from sites in this state coupled with good forest management techniques will cause a transition to State 2 (Fire Excluded Managed Woodland).

Community 4.1
Blackjack Oak – Hickory/ Coralberry/ Broomsedge

Transition T1A
State 1 to 2

Harvesting; forest management; fire suppression

Transition T1B
State 1 to 3

Clearing; pasture planting; grassland management

Transition T1C
State 1 to 4

High-grade harvesting; uncontrolled grazing

Restoration pathway R1A
State 2 to 1

Extended rotations; prescribed fire; forest stand improvement

Transition T3A
State 3 to 2

Tree planting; long-term succession; no grazing; forest stand improvement

Transition T3B
State 3 to 4

Long-term abandonment; uncontrolled grazing; unrestricted logging

Restoration pathway T4B
State 4 to 2

Tree planting; long-term succession; no grazing; forest stand improvement

Transition T4A
State 4 to 3

Clearing; pasture planting; grassland management

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	–	30–60	–	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	20–40	–	–
black oak	QUVE	*Quercus velutina*	Native	–	10–30	–	–
black hickory	CATE9	*Carya texana*	Native	–	10–30	–	–
sassafras	SAAL5	*Sassafras albidum*	Native	–	0–20	–	–
white oak	QUAL	*Quercus alba*	Native	–	0–10	–	–

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	–	–
big bluestem	ANGE	*Andropogon gerardii*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
hirsute sedge	CACO9	*Carex complanata*	Native	–	–
eastern star sedge	CARA8	*Carex radiata*	Native	–	–
fuzzy wuzzy sedge	CAHI6	*Carex hirsutella*	Native	–	–
blue sedge	CAGL6	*Carex glaucodea*	Native	–	–
inland rush	JUIN2	*Juncus interior*	Native	–	–
broomsedge bluestem	ANVI2	*Andropogon virginicus*	Native	–	–
fall panicgrass	PADI	*Panicum dichotomiflorum*	Native	–	–
Indiangrass	SONU2	*Sorghastrum nutans*	Native	–	–
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	–
Indian woodoats	CHLA5	*Chasmanthium latifolium*	Native	–	–
common spikerush	ELPA3	*Eleocharis palustris*	Native	–	–
eastern star sedge	CARA8	*Carex radiata*	Native	–	–
Muhlenberg's sedge	CAMU4	*Carex muehlenbergii*	Native	–	–
Forb/Herb					
wild bergamot	MOFI	*Monarda fistulosa*	Native	–	–
narrowleaf mountainmint	PYTE	*Pycnanthemum tenuifolium*	Native	–	–
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	–	–
wild quinine	PAIN3	*Parthenium integrifolium*	Native	–	–
gray goldenrod	SONE	*Solidago nemoralis*	Native	–	–
common cinquefoil	POSI2	*Potentilla simplex*	Native	–	–
white wand beardtongue	PETU	*Penstemon tubaeflorus*	Native	–	–
whorled milkweed	ASVE	*Asclepias verticillata*	Native	–	–
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	–	–
sidebeak pencilflower	STBI2	*Stylosanthes biflora*	Native	–	–
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	–	–
common cinquefoil	POSI2	*Potentilla simplex*	Native	–	–
white wild indigo	BAAL	*Baptisia alba*	Native	–	–
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	–

clinical goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	–
Virginia tephrosia	TEVI	*Tephrosia virginiana*	Native	–	–
stiff tickseed	COPA10	*Coreopsis palmata*	Native	–	–
largeflower yellow false foxglove	AUGR	*Aureolaria grandiflora*	Native	–	–
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	–
queendevil	HIGR3	*Hieracium gronovii*	Native	–	–
smooth small-leaf ticktrefoil	DEMA2	*Desmodium marilandicum*	Native	–	–
late purple aster	SYPAP2	*Symphyotrichum patens var. patens*	Native	–	–
smooth violet prairie aster	SYTU2	*Symphyotrichum turbinellum*	Native	–	–
Parlin's pussytoes	ANPA9	*Antennaria parlinii*	Native	–	–
hairy bedstraw	GAPI2	*Galium pilosum*	Native	–	–
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	–
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
American hazelnut	COAM3	*Corylus americana*	Native	–	–
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	–
black huckleberry	GABA	*Gaylussacia baccata*	Native	–	–
St. Andrew's cross	HYHYM	*Hypericum hypericoides ssp. multicaule*	Native	–	–
leadplant	AMCA6	*Amorpha canescens*	Native	–	–

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 Upland Flatwoods 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 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 collected site index values average 53 for oak . Timber management opportunities are poor to fair. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. These sites respond well to prescribed fire as a management tool.

Limitations: Restricted rooting depth; seasonal wetness; long term ponding. Unsurfaced roads and traffic areas tend to be slippery and form ruts easily. Graveling roads facilitates year-round use. Equipment use when wet or ponded may compact soil and damage tree roots. Reduced rooting depth and seasonal high water tables restricts tree growth and increases windthrow hazards. Planting is difficult during wet spring periods. Seedling mortality may be high due to excess seasonal wetness and shallow effective rooting depths. The use of equipment can become

restricted in spring and other excessively wet periods.

Inventory data references

Potential Reference Sites: Fragipan Upland Flatwoods

Plot EDSPFS01 – Celt soil
Located in Mark Twain National Forest, near Edgar Springs, Phelps County
Latitude: 37.73272
Longitude: -91.850274

Plot HWYTFS01 – Celt soil
Located in Mark Twain National Forest, near Hwy T, Phelps County
Latitude: 37.806093
Longitude: -91.911748

Plot WESTFS_KS01 – Plato soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.86461
Longitude: -91.974416

Plot WESTFS01 – Celt soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.864565
Longitude: -91.976114

Plot WESTFS03 – Celt soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.864603
Longitude: -91.974381

Plot WESTFS07 – Celt soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.864268
Longitude: -91.974381

Plot WESTFS09 – Celt soil
Located in Western Star Flatwoods Natural Area, Phelps County
Latitude: 37.849733
Longitude: -91.986269

Plot WHNUCA_KS01 – Celt soil
Located in White (George O) Nursery CA, Texas County
Latitude: 37.549648
Longitude: -91.896165

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Contributors

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Approval

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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	04/25/2024
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):**

   _____

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:**

    _____

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be**

mistaken for compaction on this site):

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

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

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

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

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

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17. **Perennial plant reproductive capability:**
