USDA Natural Resources Conservation Service

Ecological site R116BY023MO
Sandstone/Shale Upland Prairie

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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 a Dry-Mesic Sandstone/Shale Prairie.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to Schizachyrium scoparium - Sorghastrum nutans - Andropogon ternarius - Coreopsis grandiflora Sandstone - Shale Herbaceous Vegetation (CEGL002212).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily within the following Land Type Associations:

Lockwood Smooth Prairie Plain
Stockton Prairie/Savanna Dissected Plain
Clear Creek Prairie/Savanna Dissected Plain
Upper Pomme de Terre Oak Savanna/Woodland Dissected Plain
Bolivar Prairie/Savanna 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”.

Sandstone/Shale Upland Prairies occur on gently rolling to moderately steep areas where mixed sandstone and shale deposits are near the surface, particularly around the lower James River in Jasper County, Missouri, to the west and along tributaries of the Sac River to the north. Soils are deep to stratified sandstone and shale bedrock. The reference plant community is prairie dominated by little bluestem, big bluestem, Indiangrass, prairie dropseed, and a wide variety of prairie wildflowers.

Associated sites

R116BY022MO	**Loamy Upland Prairie** Loamy Upland Prairies are upslope, on summits and shoulders.
F116BY017MO	**Gravelly/Loamy Upland Drainageway Woodland** Gravelly/Loamy Upland Drainageway Woodlands are downslope in lower drainages

Similar sites

R116BY021MO	**Chert Upland Prairie** Chert Upland Prairies are similar in composition and structure but are generally drier due to higher amounts of gravel in the soil profile.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon gerardii*

Physiographic features

This site is on summit crests, shoulders, and upper backslopes, 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 Peer, 2004) 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 on shoulders and upper backslopes. Loamy Upland Prairie sites, labeled “1”, are upslope on summits that have more loess and residuum over the underlying sandstone and shale.

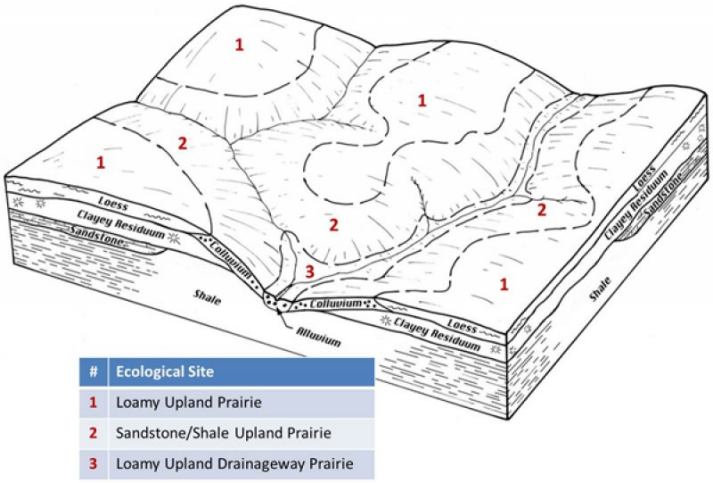


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Ridge (3) Hill
Flooding frequency	None
Ponding frequency	None
Slope	1–15%
Water table depth	19–39 in
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 few 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 comes in a fairly normal manner, moisture is stored in the top layers of the soil 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, a phenomenon that may result in a strikingly different ecology. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these unvegetated surfaces may create distinctive environmental niches such as glades and cliffs. 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 is measurably different from the climate of a more open grassland or savanna areas.

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)	164-168 days
Freeze-free period (characteristic range)	193-195 days
Precipitation total (characteristic range)	46-47 in
Frost-free period (actual range)	162-170 days
Freeze-free period (actual range)	192-196 days
Precipitation total (actual range)	46-48 in
Frost-free period (average)	166 days
Freeze-free period (average)	194 days
Precipitation total (average)	47 in

Climate stations used

- (1) STOCKTON DAM [USC00238082], Stockton, MO
- (2) JOPLIN REGIONAL AIRPORT [USW00013987], Webb City, MO
- (3) LOCKWOOD [USC00235027], Lockwood, MO

Influencing water features

This ecological site is not influenced by wetland or riparian water features. However, seeps may occur in headslope positions, particularly in the spring and following heavy rainfall events. These seeps are source areas for first-order ephemeral streams, typically within Upland Drainageway ecological sites downslope. Where present, these headslope seeps are in the SLOPE wetlands class of the Hydrogeomorphic (HGM) classification system (Brinson, 1993).

Soil features

These soils are underlain with sandstone or shale bedrock at depths below 40 inches, to greater than 60 inches. The soils were formed under prairie vegetation, and have dark, organic-rich surface horizons. Parent material is slope alluvium over residuum derived from sandstone and/or shale. Some soils have a surface layer of loess. They have silt loam, gravelly silt loam or very gravelly silt loam surface layers, and loamy or clayey subsoils that are gravelly to very gravelly in some soils. These soils are not affected by seasonal wetness. Soil series associated with this site include Barden, Goodson, and Sylvania.

The accompanying picture of the Goodson series shows a dark, organic-rich gravelly silt loam surface horizon over a brown, clayey subsoil. The light olive gray silty clay loam subsoil below 70 cm in this picture is derived from soft shale bedrock, which is below one meter. Scale is in centimeters. Picture from Kichler and Henderson (2000).

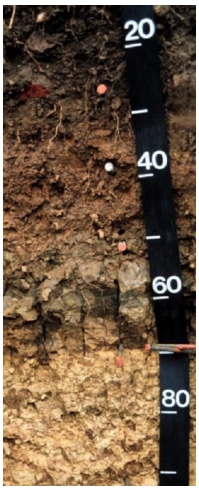


Figure 9. Goodson series

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and shale (2) Loess (3) Slope alluvium
Surface texture	(1) Silt loam (2) Gravelly silt loam (3) Very gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained
Permeability class	Very slow
Soil depth	20–72 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	3–70%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

Information contained in this section was developed using historical data, professional experience, field reviews, and scientific studies. The information presented is representative of very complex vegetation communities. Key indicator plants, animals and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to

cover every situation or the full range of conditions, species, and responses for the site.

The reference Sandstone/Shale Upland Prairie site is dominated by little bluestem, big bluestem, Indiangrass and switchgrass along with many secondary grasses such as tall dropseed, and assorted panicums. Numerous forbs also prevailed on this site. Common forbs included rosinweed, sunflowers, and lespedeza along with low growing shrubs such as leadplant and New Jersey tea. Occasional, widely scattered open-grown oaks and hickories also are present interspersed throughout this site.

With little to interrupt fire, this ecological site likely burned every 1 to 3 years. Fire removed dead plant litter and provided room for a lush growth of prairie vegetation. Fire also kept woody species at bay. Grazing by native large herbivores such as bison, elk and white-tailed deer also impacted these sites. Their activities altered composition and structure of the vegetation. Fuel loads would have been altered by heavy grazing and regular fire behavior, providing for a diversity of structure and composition. The partially wooded draws would have burned less intensely and less frequently. During fire free intervals woody species would have increased in abundance and spread out onto the prairie to add to existing scattered savanna trees.

Today, Sandstone/Shale Upland Prairies are rare and scattered in the region, as the former prairies and open savannas have been converted to pasture or cropland. The known remnants are degraded by fire suppression and uncontrolled grazing by domestic livestock. Continuous heavy grazing by livestock during the growing season will impact the vegetation composition. Continuous heavy grazing decreases vigor of the more palatable plants and generally encourages a gradual increase in secondary plants such as tall dropseed, purpletop tridens, and sideoats grama.

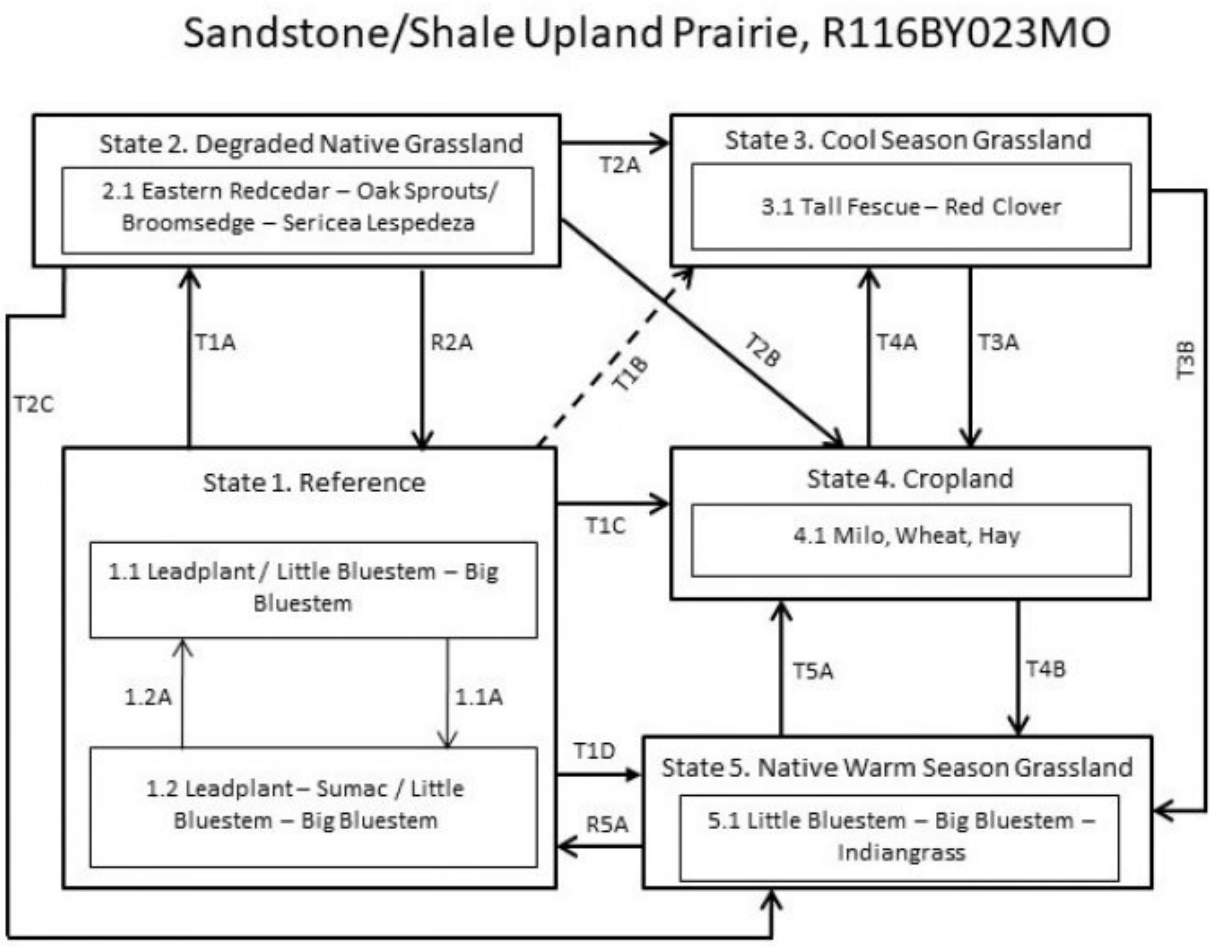
Many of the forbs are very palatable and readily grazed by livestock. These palatable forbs decrease with even moderate continuous grazing, but composition can be maintained using prescribed grazing. Forbs that increase include heathaster, tall goldenrod, Missouri goldenrod, western ragweed and Louisiana sagewort. Woody plants such as coralberry, blackberry and sumac also increase with continuous overgrazing and the the absence of fire on site.

The absence of both grazing and fire will encourage a gradual increase of mulch and litter. Heavy accumulations of mulch and litter will negatively affect vegetation growth. Herbage production will be reduced. Bunchgrasses, especially little bluestem, are usually reduced. Heavy mulch accumulation also accommodates the encroachment of woody plant species such as coralberry, blackberry, roughleaf dogwood, sumac, elm, persimmon, hawthorn and hackberry.

However, when properly managed, including the reintroduction of fire, existing remnants of Sandstone/Shale Upland Prairies show great resiliency and the stand composition can be improved and maintained indefinitely.

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

State and transition model



Code	Event/Activity/Process
T1A	Fire suppression > 10 years; woody invasion; domestic grazing
T1B	Tillage; vegetative seeding; grassland management
T1C, T3A, T5A	Tillage; conservation cropping system
T1D	Prescribed grazing; prescribed fire
T2A	Woody removal; tillage; vegetative seeding; grassland management
T2B	Woody removal; tillage; conservation cropping system
T2C	Woody removal; grassland management; prescribed fire
T4A	Vegetative seeding ; grassland management
T3B, T4B	Vegetative seeding; prescribed fire; grassland management
1.1A	Fire-free interval 5-10 years
1.2A	Fire interval 1-3 years
R2A	Woody removal; prescribed fire 1-3 years; limited grazing
R5A	Vegetative seeding; prescribed fire 1-3 years; limited grazing

Figure 10. State and transition diagram for this ecological site

State 1

Reference

This state is native prairie dominated by prairie dropseed, big bluestem, little bluestem, and forbs, along with numerous shrubs and occasional, widely scattered, stunted trees such as post oak and bur oak. Two phases can occur that will transition back and forth depending on fire frequencies. Longer fire free intervals will allow woody species to increase such as post oak and eastern redcedar. When fire intervals shorten these woody species will decrease. This undisturbed state is uncommon but some excellent examples still exist. Most sites, however, have been converted to cool season grasslands, cropland, or degraded by domestic grazing.

Community 1.1
Lead Plant/ Little Bluestem - Big Bluestem

Community 1.2
Leadplant – Sumac/ Little Bluestem - Big Bluestem

Pathway P1.1A
Community 1.1 to 1.2

Fire-free interval 5-10 years

Pathway P1.2A
Community 1.2 to 1.1

Fire interval 1-3 years

State 2
Degraded Native Grassland

Reference states that have experienced fire suppression for 10 or more years and heavy domestic grazing will transition to this State. With fire suppression, woody species such as post oak and eastern redcedar will begin to increase transitioning this state from a prairie to a woody invaded state. Native ground cover will also decrease and invasive species such as tall fescue, broomsedge and sericea lespedeza may begin to dominate. Transition to cool season grasslands (State 3) or cropland (State 4) is very common. Transition back to a reference state may be difficult if fire suppression and other disturbances have been long term. It may be easier to move to a re-established native warm season grassland and then over time back to a reference state.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates

Community 2.1
Eastern Redcedar - Oak Sprouts/ Broomsedge - Sericea Lespedeza

State 3
Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue and red clover has been common in this area. Occasionally, these pastures will have scattered post oak and eastern redcedar. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the reference state may require a very long series of management options.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition

- Terrestrial habitat for wildlife and invertebrates

Community 3.1
Tall Fescue – Red Clover

State 4
Cropland

This is a common state that currently exists in the region with corn, milo, wheat, and hay land production occurring. Some conversion to cool season grassland occurs for a limited period of time before transitioning back to cropland. Limited acres are sometimes converted to native warm season grassland.

Community 4.1
Milo, Wheat, Hay

State 5
Native Warm Season Grassland

Conversion from Cool Season Grassland (State 3) or the Cropland (State 4) to this state is increasing due to renewed interest in warm season grasses as a supplement to cool season grazing systems or as a native restoration activity. This state, once established, can be transformed back to a reference state. Substantial restoration time and management inputs will be needed.

Dominant resource concerns

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

Community 5.1
Little Bluestem – Big Bluestem – Indiangrass

Transition T1A
State 1 to 2

Fire suppression > 10 years; woody invasion; domestic grazing

Transition T1B
State 1 to 3

Tillage; vegetative seeding; grassland management

Transition T1C
State 1 to 4

Tillage; conservation cropping system

Transition T1D
State 1 to 5

Prescribed grazing; prescribed fire

Restoration pathway R2A
State 2 to 1

Woody removal; prescribed fire 1-3 years; limited grazing

Transition T2A
State 2 to 3

Woody removal; tillage; vegetative seeding; grassland management

Transition T2B
State 2 to 4

Woody removal; tillage; conservation cropping system

Transition T2C
State 2 to 5

Woody removal; grassland management; prescribed fire

Transition T3A
State 3 to 4

Tillage; conservation cropping system

Transition T3B
State 3 to 5

Vegetative seeding; prescribed fire; grassland management

Transition T4A
State 4 to 3

Vegetative seeding ; grassland management

Transition T4B
State 4 to 5

Vegetative seeding; prescribed fire; grassland management

Restoration pathway R5A
State 5 to 1

Vegetative seeding; prescribed fire 1-3 years; limited grazing

Transition T5A
State 5 to 4

Tillage; conservation cropping system

Additional community tables

Table 5. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
big bluestem	ANGE	*Andropogon gerardii*	Native	–	5–95
prairie dropseed	SPHE	*Sporobolus heterolepis*	Native	–	25–50
switchgrass	PAVI2	*Panicum virgatum*	Native	–	0.1–50
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	5–25
Indiangrass	SONU2	*Sorghastrum nutans*	Native	–	5–20

whip nutrush	SCTR	*Scleria triglomerata*	Native	–	0.1–1
marsh bristlegrass	SEPA10	*Setaria parviflora*	Native	–	0.1–1
Heller's rosette grass	DIOL	*Dichanthelium oligosanthes*	Native	–	0.1–1
prairie Junegrass	KOMA	*Koeleria macrantha*	Native	–	0.1–1
porcupinegrass	HESP11	*Hesperostipa spartea*	Native	–	0.1–1
Forb/Herb					
white heath aster	SYER	*Symphyotrichum ericoides*	Native	–	5–10
golden zizia	ZIAU	*Zizia aurea*	Native	–	2–5
ashy sunflower	HEMO2	*Helianthus mollis*	Native	–	0.1–5
sessileleaf ticktrefoil	DESE	*Desmodium sessilifolium*	Native	–	0.1–5
flowering spurge	EUCO10	*Euphorbia corollata*	Native	–	2–5
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	–	2–5
winecup	CADI2	*Callirhoe digitata*	Native	–	0.1–2
common sneezeweed	HEAU	*Helenium autumnale*	Native	–	1–2
Missouri goldenrod	SOMI2	*Solidago missouriensis*	Native	–	1–2
gray goldenrod	SONE	*Solidago nemoralis*	Native	–	0.1–1
western rough goldenrod	SORA	*Solidago radula*	Native	–	0.1–1
wild bergamot	MOFI	*Monarda fistulosa*	Native	–	0.1–1
Sampson's snakeroot	ORPE	*Orbexilum pedunculatum*	Native	–	0.1–1
Canadian lousewort	PECA	*Pedicularis canadensis*	Native	–	0.1–1
downy phlox	PHPI	*Phlox pilosa*	Native	–	0.1–1
common cinquefoil	POSI2	*Potentilla simplex*	Native	–	0.1–1
narrowleaf mountainmint	PYTE	*Pycnanthemum tenuifolium*	Native	–	0.1–1
Virginia strawberry	FRVI	*Fragaria virginiana*	Native	–	0.1–1
agueweed	GEQU2	*Gentianella quinquefolia*	Native	–	0.1–1
skyblue aster	SYOO	*Symphyotrichum oolentangiense*	Native	–	0.1–1
Arkansas ironweed	VEAR3	*Vernonia arkansana*	Native	–	0.1–1
prairie blazing star	LIPY	*Liatris pycnostachya*	Native	–	0.1–1
roundhead lespedeza	LECA8	*Lespedeza capitata*	Native	–	0.1–1
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	0.1–1
Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	Native	–	0.1–1
stiff ticktrefoil	DEOB5	*Desmodium obtusum*	Native	–	0.1–1
blackeyed Susan	RUHI2	*Rudbeckia hirta*	Native	–	0.1–1
fringeleaf wild petunia	RUHU	*Ruellia humilis*	Native	–	0.1–1
azure blue sage	SAAZ	*Salvia azurea*	Native	–	0.1–1
milkweed	ASCLE	*Asclepias*	Native	–	0.1–1
tall tickseed	COTR4	*Coreopsis tripteris*	Native	–	0.1–1
Texas goldentop	EUGY	*Euthamia gymnospermoides*	Native	–	0.1–1
button eryngo	ERYU	*Eryngium yuccifolium*	Native	–	0.1–1
pale purple coneflower	ECPA	*Echinacea pallida*	Native	–	0.1–1
white wild indigo	BAAL	*Baptisia alba*	Native	–	0.1–1
Indianhemp	APCA	*Apocynum cannabinum*	Native	–	0.1–1
Shrub/Subshrub					
prairie willow	SAHU2	*Salix humilis*	Native		0.1–10

prairie willow	SAHU2	*Salix humilis*	Native	–	0.1–10
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	2–5
leadplant	AMCA6	*Amorpha canescens*	Native	–	0.1–2
Carolina rose	ROCA4	*Rosa carolina*	Native	–	0.1–1

Animal community

Wildlife
Game species that utilize this ecological site include:
Northern Bobwhite will utilize this ecological site for food (seeds, insects) and cover needs (escape, nesting and roosting cover).

Cottontail rabbits will utilize this ecological site for food (seeds, soft mast) and cover needs.

Turkey will utilize this ecological site for food (seeds, green browse, soft mast, insects) and nesting and brood-rearing cover. Turkey poults feed heavily on insects provided by this site type.

White-tailed Deer will utilize this ecological site for browse (plant leaves in the growing season, seeds and soft mast in the fall/winter). This site type also can provide escape cover.

Bird species associated with this ecological site reference state condition:
Breeding birds as related to vegetation structure (related to time since fire, grazing, haying, and mowing):

Vegetation Height Short (0.5 meter, low litter levels, bare ground visible):
Grasshopper Sparrow, Horned Lark, Upland Sandpiper, Greater Prairie Chicken, Northern Bobwhite

Vegetation Height Moderate (0.5 – 1 meter, moderate litter levels, some bare ground visible): Eastern Meadowlark, Dickcissel, Field Sparrow, Upland Sandpiper, Greater Prairie Chicken, Northern Bobwhite, Blue Grosbeak, Scissor-Tailed Flycatcher, Eastern Kingbird, Lark Sparrow

Tall Vegetation Height (> 1 meter, moderate-high litter levels, little bare ground visible):
Henslow’s Sparrow, Dickcissel, Greater Prairie Chicken, Field Sparrow, Northern Bobwhite, Sedge Wren, Northern Harrier

Brushy – Mix of grasses, forbs, native shrubs (e.g., Rhus copallina, Prunus americana), native vines (Rubus spp., Rosa carolina) and small trees (e.g., Cornus racemosa):
Bell’s Vireo, Yellow-Breasted Chat, Loggerhead Shrike, Brown Thrasher, Common Yellowthroat

Winter Resident: Short-Eared Owl, Northern Harrier, Le Conte’s Sparrow, Savannah Sparrow

Amphibian and reptile species associated with this ecological site reference state condition: Ornate Box Turtle (Terrapene ornata ornata), Western Slender Glass Lizard (Ophisaurus attenuatus attenuatus), Prairie Ring-necked Snake (Diadophis punctatus arnyi), Prairie Kingsnake (Lampropeltis calligaster calligaster), Great Plains Skink (Eumeces obsoletus), Southern Prairie Skink (E. septentrionalis obtusirostris), and Bullsnake (Pituophis catenifer sayi).

Prairies with ephemeral vernal fishless wetlands: Western Chorus Frog (Pseudacris triseriata triseriata), Southern Leopard Frog (Rana sphenocephala), and Eastern Tiger Salamander (Ambystoma tigrinum).

Small mammals associated with this ecological site reference state condition:
Least Shrew (Cryptotis parva), Prairie Vole (Microtus ochrogaster), Plains Pocket Gopher (Geomys bursarius), Meadow Jumping Mouse (Zapus hudsonius), and Badger (Taxidea taxus).

Many native insect species are likely associated with this ecological site, especially native bees, ants, beetles, butterflies and moths, and crickets, grasshoppers and katydids. However information on these groups is often lacking enough resolution to assign them to individual ecological sites.

Insect species known to be associated with this ecological site's reference state condition: Regal Fritillary butterfly (Speyeria idalia) whose larvae feed primarily on native prairie violets (Viola pedata, V. pedatifida, and V. sagittata); Mottled Dusky Wing butterfly (Erynnis martialis), Ottoe Skipper butterfly (Hesperia ottoe), Arogos Skipper butterfly (Atrytone arogos iowa), Golden Byssus butterfly (Problema byssus kumskaka), Delaware Skipper butterfly (Atryone logan logan), and Crossline Skipper butterfly (Polites origenes). The larvae of the moth Eucosma bipunctella bore into compass plant (Silphium laciniatum) roots and feed and the larvae of the moth Eucosma giganteana bore into a number of Silphium species roots and feed. Native bees, important pollinators, that may be associated with this ecological site's reference condition include: Colletes brevicornis, Andrena beameri, A. helianthiformis, Protandrena rudbeckiae, Halictus parallelus, Lasioglossum albipennis, L. coreopsis, L. disparilis, L. nymphaereum, Ashmeadiella bucconis, Megachile addenda, Anthidium psoraleae, Eucera hamata, Melissodes coloradensis, M. coreopsis, and M. vernoniae. The Short-winged Katydid (Amblycorypha parvipennis), Prairie Mole Cricket (Gryllotalpa major), Green Grasshopper (Hesperotettix speciosus) and Two-voiced Conehead katydid (Neoconcephalus bivocatus) are possible orthopteran associates of this ecological site. A number of leaf beetle species (Anisostena funesta, Chaetocnema fuscata and Crytocephalus striatulus) may utilize this ecological site.

(This section prepared by Mike Leahy, Natural Areas Coordinator, Missouri Department of Conservation, 2013. References for this section: Fitzgerald and Pashley 2000b; Heitzman and Heitzman 1996; Jacobs 2001; Johnson 2000; Pitts and McGuire 2000; Schwartz and others 2001)

Other information

Forestry
Management: This ecological site is not recommended for traditional timber management activity. Historically this site was dominated by a ground cover of native prairie grasses and forbs. Some scattered open grown trees may have also been present. Altered sites may be suitable for non-traditional forestry uses such as windbreaks, environmental plantings, alley cropping (a method of planting, in which rows of trees or shrubs are interspersed with rows of crops) or woody bio-fuels.

Inventory data references

Potential Reference Sites: Sandstone/Shale Upland Prairie

Plot LAPEPF02 – Goodson soil
Located in La Petite Gemme MPF, Polk County, MO
Latitude: 37.563394
Longitude: -93.409836

Plot PEPRPF01 – Sylvania soil
Located in Penn-Sylvania Prairie MPF, Dade County, MO
Latitude: 37.49782
Longitude: -93.988587

Plot NIPRCA02 – Barden soil
Located in Niawathe Prairie CA, Dade County, MO
Latitude: 37.515493
Longitude: -93.968086

Plot TWMICA01 – Goodson soil
Located in Twenty-Five Mile Prairie CA, Polk County, MO
Latitude: 37.780368
Longitude: -93.532861

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Contributors

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Approval

Nels Barrett, 10/07/2020

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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	10/06/2020
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:**
