

Ecological site R116BY020MO

Claypan Summit 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.

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 Hardpan Prairie. National Vegetation Classification System Vegetation Association (NatureServe, 2010): The reference state for this ecological site is most similar to *Schizachyrium scoparium* - *Bouteloua curtipendula* - *Agrostis hyemalis* - *Eleocharis* spp. Hardpan Herbaceous Vegetation (CEGL002249). Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002): This ecological site occurs primarily within the following Land Type Associations: Spring River Prairie/Savanna Dissected Plain Springfield Karst Prairie Plain Buffalo 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”. Claypan Summit Prairies occur on the broad nearly level surface of the Springfield Plain, primarily in the west on interfluvies above Spring River and Shoal Creek. Soils have root-restricting fragipans and seasonal perched water tables. The reference plant community is prairie dominated by Indiangrass, big bluestem, little bluestem and sideoats grama, with a wide variety of prairie wildflowers and wet-tolerant sedges.

Associated sites

R116BY021MO	Chert Upland Prairie Chert Upland Prairies are downslope, on shoulders and upper backslopes.
R116BY022MO	Loamy Upland Prairie Loamy Upland Prairies are on convex summits and shoulders.

Similar sites

R116BY021MO	Chert Upland Prairie Chert Upland Prairies are downslope, on shoulders and upper backslopes from Claypan Prairies but have similar species composition and in some cases have a fragipan. These sites are usually drier and less productive.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Amorpha canescens</i> (2) <i>Rosa carolina</i>
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Andropogon gerardii</i>

Physiographic features

This site is on broad upland summit interfluves and divides, with slopes of 0 to 2 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Aldrich, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “1” on the figure, on broad summits. Chert Upland Prairie sites, labeled “2”, are typically downslope.

Figure 1. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Divide
Flooding frequency	None
Ponding frequency	None to occasional
Slope	0 %
Water table depth	50 – 80 cm
Aspect	Aspect is not a significant factor

Climatic features

The Springfield Plain has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade reasonably humid air, snowfall and rainfall result. In summer, moist, warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce abundant amounts of rain, either by fronts or by convectional processes. In some summers, high pressure stagnates over the region, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and

precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

The Springfield Plain experiences 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)	150-160 days
Freeze-free period (characteristic range)	180-190 days
Precipitation total (characteristic range)	1,170 mm
Frost-free period (actual range)	150-160 days
Freeze-free period (actual range)	180-190 days
Precipitation total (actual range)	1,170 mm
Frost-free period (average)	160 days
Freeze-free period (average)	190 days
Precipitation total (average)	1,170 mm

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

Influencing water features

This ecological site is influenced by a seasonal high water table, perched on the clayey subsoil and underlying fragipan. Some depressional areas pond for short periods of time, mostly in the spring. These shallow depressional areas were more common prior to the conversion of nearly all areas of this ecological site from prairie to cropland. Leveling and surface drainage have reduced or eliminated the shallow depressions. These areas were Emergent Palustrine wetlands (Cowardin et al., 1979).

This ecological site contains wetlands which fit into the MINERAL FLAT class in the Hydrogeomorphic (HGM) system (Brinson, 1993). The water source is direct precipitation, because there are no upslope contributing sites. Vertical water percolation in the soil is impeded by the clayey subsoil (the “claypan”), resulting in significant lateral discharge to adjacent downslope ecological sites.

Soil features

These soils have a root-restricting fragipan at about 24 inches, below the claypan subsoil. The soils were formed under prairie vegetation, and have dark, organic-rich surface horizons. They have silt loam surface horizons, and silty clay subsoils above the fragipan. Parent material is loess in the upper part, underlain with residuum. A seasonal high water table is perched above the fragipan during the spring months in most years. Soil series associated with this site include Gerald.

The accompanying picture of the Gerald series shows a dark silt loam surface horizon over a light-colored leached layer called an albic horizon. Below this is a brown silty clay subsoil, underlain by a fragipan in the lower part of the picture. Both the fragipan and the clayey subsoil impede water movement and root penetration.

Figure 8. Gerald series

Table 4. Representative soil features

Parent material	(1) Residuum – cherty limestone (2) Loess (3) Colluvium
Surface texture	(1) Silt loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained
Permeability class	Very slow
Soil depth	180 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-101.6cm)	15.24 – 17.78 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	4.5 – 7.3
Subsurface fragment volume <=3" (Depth not specified)	0 – 20 %
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.

Claypan Summit Prairies were dominated by tallgrass native prairie grasses and forbs, but also had a substantial component of wet tolerant sedges. This expanse of grass occurred on upland summit interfluvies and divides and was interrupted by shallow drainages whose wetness lessened the influence frequent, intense fires. Here the prairie transitioned into shrubby thickets and savannas with scattered trees. Leadplant and New Jersey tea were typical low growing shrubs that occurred over the site. Unlike most shrubs, these plants are both quite tolerant to fire. Islands of other shrubs such as dogwood, redroot, coralberry and Carolina rose were also found on the site.

With little to interrupt fire, this ecological site 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. During fire free intervals woody species would have increased in abundance and spread out onto the prairie. Grazing by native large herbivores, such as bison, elk, and white-tailed deer, also impacted these sites. Their activities would have altered composition and structure of the vegetation. Fuel loads would have been altered by heavy grazing and fire behavior affected, providing for a diversity of structure and composition. The partially wooded draws would have burned less intensely and frequently.

Today, Claypan Summit Prairies are nearly extirpated from the region as the former prairies have been converted to intensive agriculture. Few known remnants exist and are degraded by fire suppression and grazing by domestic livestock.

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 may change as knowledge increases.

State and transition model

Figure 9. State and transition diagram for this ecological site

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
big bluestem	ANGE	Andropogon gerardii	Native	–	5-20
little bluestem	SCSC	Schizachyrium scoparium	Native	–	5-20
Indiangrass	SONU2	Sorghastrum nutans	Native	–	5-20
eastern gamagrass	TRDA3	Tripsacum dactyloides	Native	–	5-10
porcupinegrass	HESP11	Hesperostipa spartea	Native	–	5-10
Bush's sedge	CABU5	Carex bushii	Native	–	5-10
winter bentgrass	AGHY	Agrostis hyemalis	Native	–	5-10
Mead's sedge	CAME2	Carex meadii	Native	–	5-10
whip nutrush	SCTR	Scleria triglomerata	Native	–	5-10
tapered rosette grass	DIAC2	Dichanthelium acuminatum	Native	–	5-10
spikerush	ELEOC	Eleocharis	Native	–	5-10
inland rush	JUIN2	Juncus interior	Native	–	5-10
switchgrass	PAVI2	Panicum virgatum	Native	–	5-10
globe beaksedge	RHRE8	Rhynchospora recognita	Native	–	5-10
Forb/Herb					
prairie milkweed	ASSU3	Asclepias sullivantii	Native	–	1-10
button eryngo	ERYU	Eryngium yuccifolium	Native	–	1-10
ashy sunflower	HEMO2	Helianthus mollis	Native	–	1-10
prairie blazing star	LIPY	Liatris pycnostachya	Native	–	1-10
wild quinine	PAIN3	Parthenium integrifolium	Native	–	1-10
Missouri goldenrod	SOMI2	Solidago missouriensis	Native	–	1-10
white wild indigo	BAAL	Baptisia alba	Native	–	1-10
longbract wild indigo	BABR2	Baptisia bracteata	Native	–	1-10
field pussytoes	ANNE	Antennaria neglecta	Native	–	1-10
groovestem Indian plantain	ARPL4	Arnoglossum plantagineum	Native	–	1-10
Illinois bundleflower	DEIL	Desmanthus illinoensis	Native	–	1-10
arrowleaf violet	VISA2	Viola sagittata	Native	–	1-10
purple milkwort	POSA3	Polygala sanguinea	Native	–	1-10
whorled milkwort	POVE	Polygala verticillata	Native	–	1-10
Texas goldentop	EUGY	Euthamia gymnospermoides	Native	–	1-10
winecup	CADI2	Callirhoe digitata	Native	–	1-10
narrowleaf mountainmint	PYTE	Pycnanthemum tenuifolium	Native	–	1-10
blackeyed Susan	RUHI2	Rudbeckia hirta	Native	–	1-10

fringeleaf wild petunia	RUHU	<i>Ruellia humilis</i>	Native	–	1-10
scarlet Indian paintbrush	CACO17	<i>Castilleja coccinea</i>	Native	–	1-10
common sneezeweed	HEAU	<i>Helenium autumnale</i>	Native	–	1-10
largeflower tickseed	COGR5	<i>Coreopsis grandiflora</i>	Native	–	1-10
Shrub/Subshrub					
leadplant	AMCA6	<i>Amorpha canescens</i>	Native	–	5-10
New Jersey tea	CEAM	<i>Ceanothus americanus</i>	Native	–	5-10
Carolina rose	ROCA4	<i>Rosa carolina</i>	Native	–	5-10

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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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's reference state condition: Breeding birds as related to vegetation structure (related to time since fire, grazing, haying, and mowing): Vegetation Height Short (1.5 feet, low litter levels, bare ground visible): Grasshopper Sparrow, Horned Lark, Upland Sandpiper, Greater Prairie Chicken, Northern Bobwhite Vegetation Height Moderate (1.5 – 3 feet, 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 Vegetation Height Tall (> 3 feet, 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 Amphibian and reptile species associated with this ecological site's reference state condition: prairies with crawfish burrows may have Northern Crawfish Frog (*Rana areolata circulosa*); 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*), and bullsnake (*Pituophis catenifer sayi*). Prairies with ephemeral vernal fishless wetlands: western chorus frog (*Pseudacris triseriata triseriata*), southern leopard frog (*Rana sphenoccephala*), and eastern tiger salamander (*Ambystoma tigrinum*). Small mammals associated with this ecological site's reference state condition: least shrew (*Cryptotis parva*), plains pocket gopher (*Geomys bursarius*), prairie vole (*Microtus ochrogaster*), 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 (*Atrytone 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. nymphaeum*, *Ashmeadiella buconis*, *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. Other invertebrate associates include the grassland crayfish (*Procambarus gracilis*). (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: Claypan Summit Prairie Plot HIPRCA01 – Gerald soil Located in Shelton L. Cook Meadow (The Nature Conservancy), Barton County, Missouri Latitude: 37.418300 Longitude: -94.128900 Plot KIPRCA02 – Gerald soil Located in Kickapoo Prairie CA, Lawrence County, MO Latitude: 37.225696 Longitude: -93.963407

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Contributors

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Approval

Nels Barrett, 10/07/2020

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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	10/05/2020
Approved by	
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):

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

Dominant:

Sub-dominant:

Other:

Additional:

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

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

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

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