

Ecological site R107XB014MO Wet Loess High Terrace Savanna

Last updated: 5/21/2020
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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): 107X—Iowa and Missouri Deep Loess Hills

The Iowa and Missouri Deep Loess Hills encompass the Missouri River floodplain and associated loess-covered uplands, from about Sioux City Iowa in the north to central Missouri. Elevation is about 1,565 feet on the highest ridges, to about 600 feet along the Missouri River near Glasgow in central Missouri. Local relief varies from 10-20 feet in the major river floodplains, to 50-100 feet in the dissected uplands, with loess bluffs of 200 to 300 feet along the Missouri River. The loess thins with distance from the Missouri river, and local relief decreases. The loess caps pre-Illinoian till, which crops out on lower hillslopes near the edges of the MLRA. The underlying bedrock is mainly Pennsylvanian and Cretaceous-aged shale, mudstone and sandstone.

Classification relationships

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

The reference state for this ecological site is most similar to a Wet-Mesic Bottomland Prairie.

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

The reference state for this ecological site is most similar to *Andropogon gerardii* - *Panicum virgatum* - *Helianthus grosseserratus* Herbaceous Vegetation (CEGL002024).

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

This ecological site occurs primarily in the Marshall Prairie Plain Land Type Association of the Loess Hills Subsection.

Ecological site concept

Wet Loess High Terrace Savannas are not extensive, and occur primarily in the southern part of the MLRA on a high, loess-covered terrace of the Missouri River near Malta Bend, Missouri. Soils are very deep, with seasonal high water tables. The reference plant community is savanna with scattered elm, bur oak, pin oak, shellbark hickory and willow, and a ground flora dominated by wet-tolerant grasses, sedges and forbs.

Table 1. Dominant plant species

Tree	(1) <i>Quercus macrocarpa</i>
Shrub	(1) <i>Salix humilis</i>
Herbaceous	(1) <i>Spartina pectinata</i> (2) <i>Andropogon gerardii</i>

Physiographic features

This site is on high, loess-covered stream terraces with slopes of 0 to 9 percent. The site receives runoff from adjacent upland sites.

The following figure (adapted from Baker, 1993) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “2”. Dashed lines within the Wet Loess High Terrace Savanna indicate different soils within this site. This site is closely associated with Deep Loess Upland Prairie and Claypan Summit Prairie sites, as shown in the diagram. Stream Terrace sites and Floodplain sites, formed in younger alluvium, are downslope.

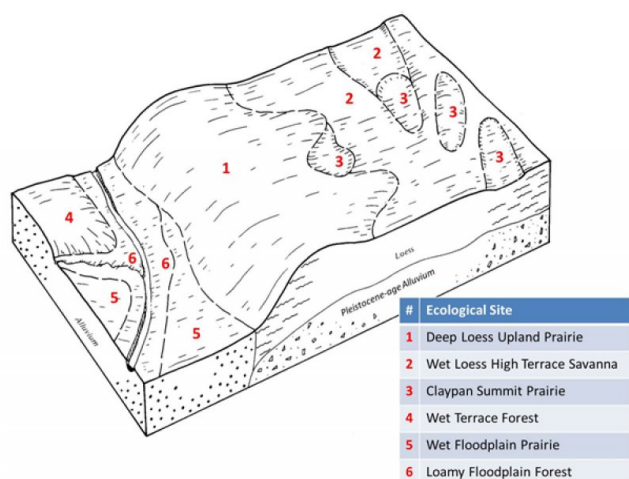


Figure 1. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace
Flooding frequency	None
Ponding frequency	None
Slope	0–2%
Water table depth	6–24 in
Aspect	Aspect is not a significant factor

Climatic features

The Iowa and Missouri Deep Loess Hills MLRA 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.

This MLRA 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 from north to south. Both mean annual temperature and precipitation exhibit gradients along this line.

Mean January minimum temperature follows the north-to-south gradient. However, mean July maximum temperature shows hardly any geographic variation in the region. Mean July maximum temperatures have a range of only three or four degrees across the region. Mean annual precipitation varies along the same gradient as temperature. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages five times greater than January precipitation.

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 influences ecological communities by limiting water supplies, especially at times of high temperatures and high evaporation rates. Drought indirectly affects ecological communities by increasing plant and animal susceptibility to the probability and severity of fire. Frequent fires encourage the development of grass/forb dominated communities and understories.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. 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. Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier, supporting more grass dominated communities than adjacent north- and-east-facing slopes that are cooler and moister that support more woody dominated communities. Finally, the cooler microclimate within a canopied forest is measurably different from the climate of a more open and warmer grassland or savanna area.

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)	135-163 days
Freeze-free period (characteristic range)	165-191 days
Precipitation total (characteristic range)	35-42 in
Frost-free period (actual range)	132-169 days
Freeze-free period (actual range)	158-194 days
Precipitation total (actual range)	30-43 in
Frost-free period (average)	150 days
Freeze-free period (average)	180 days
Precipitation total (average)	38 in

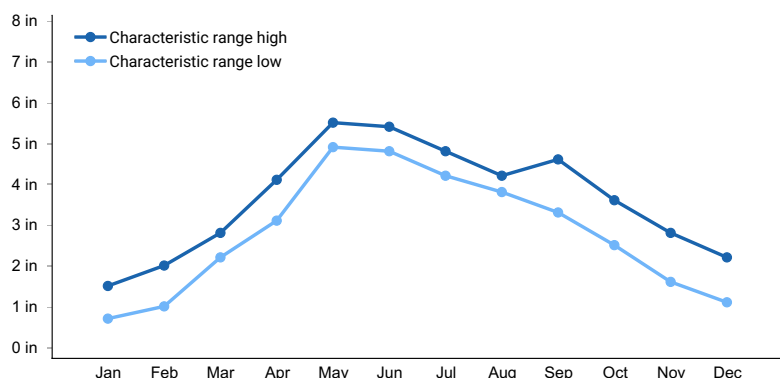


Figure 2. Monthly precipitation range

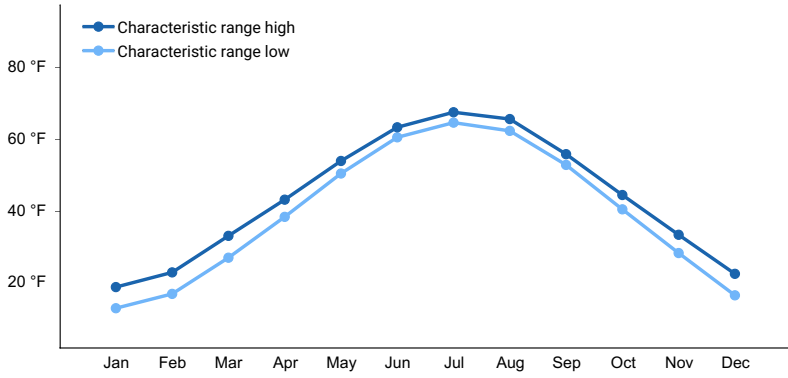


Figure 3. Monthly minimum temperature range

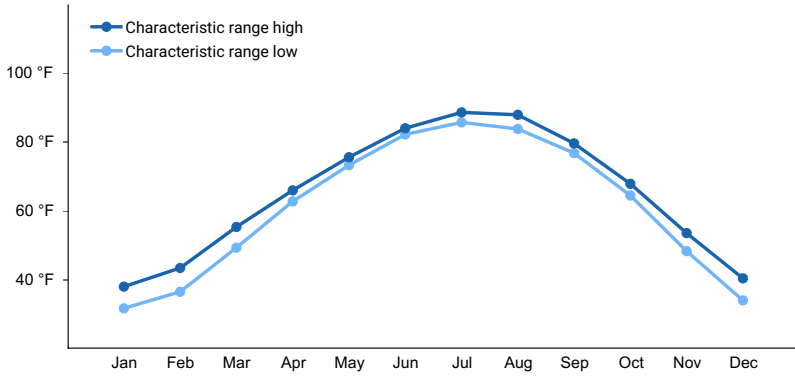


Figure 4. Monthly maximum temperature range

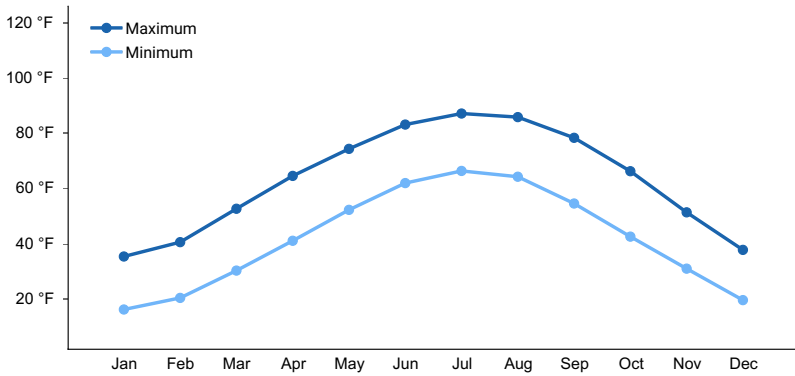


Figure 5. Monthly average minimum and maximum temperature

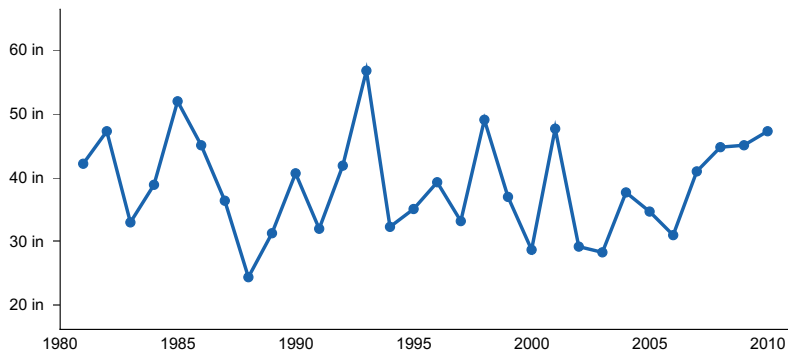


Figure 6. Annual precipitation pattern

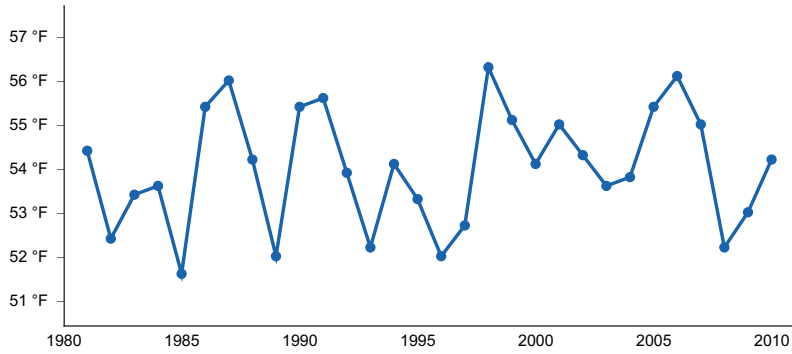


Figure 7. Annual average temperature pattern

Climate stations used

- (1) CARROLLTON [USC00231340], Carrollton, MO
- (2) MARSHALL [USW00013991], Marshall, MO
- (3) SWEET SPRINGS [USC00238223], Sweet Springs, MO
- (4) KANSAS CITY INTL AP [USW00003947], Kansas City, MO
- (5) TARKIO [USW00014945], Tarkio, MO
- (6) OAKLAND [USC00136151], Oakland, IA
- (7) SIOUX CITY GATEWAY AP [USW00014943], Sioux City, IA

Influencing water features

Wet Loess High Terrace Savannas are classified as a RIVERINE wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008)

Wetland description

Cowardin wetland types include: Palustrine Emergent Temporarily Flooded and Seasonally Flooded

Soil features

These soils have no rooting restriction. The soils were formed under prairie vegetation, and have dark, organic-rich surface horizons. Parent material is loess, with alluvium at depth. They have silt loam surface horizons and loamy or clayey subsoils. They are affected by a seasonal high water table during the spring months. Soil series associated with this site include Joy, Leslie, and Winterset.

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Very slow to moderately slow
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	8-9 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)	5.2-7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

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.

Wet Loess High Terrace Savannas occur on large flat terraces. They are frequently associated with Loess Terrace Prairies. This landscape position receives water from upslope, and seasonal wetness causes it to be periodically saturated. Accordingly, the site limits the presence of trees, and is dominated by moisture tolerant grasses, sedges and forbs. Slightly higher areas within or at the edge of the prairie matrix support scattered trees such as elm, bur oak, pin oak, shellbark hickory and willow.

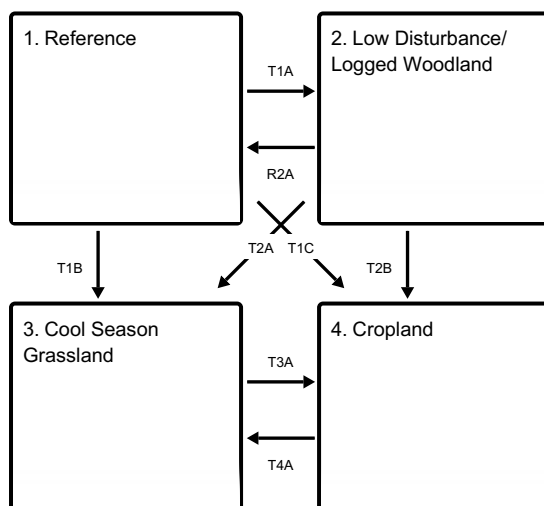
In addition to seasonal wetness, fire played a key role in limiting woody species, likely occurring at least once every 3 years. Fire during dry periods removed the dense mat of leaf litter creating opportunities for forbs less aggressive than the grasses and sedges.

Wet Loess High Terrace Savannas were also subjected to grazing by native large herbivores. Grazing by large native herbivores, such as bison, elk, and deer, would have effectively kept understory conditions open, creating conditions more favorable to ground flora species and minimizing woody trees and shrubs.

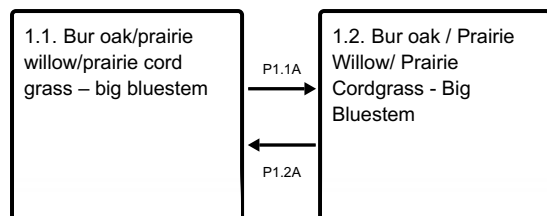
Today most of these ecological sites have been drained and turned into agricultural use. Few quality remnants exist. Left unfarmed, these wet terraces can be developed into prairie and savannas and are prime candidates for restoration of this type of system.

State and transition model

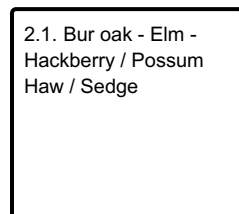
Ecosystem states



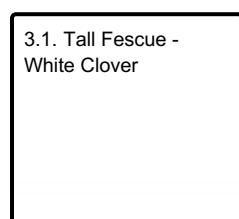
State 1 submodel, plant communities



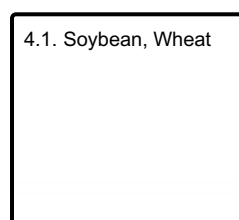
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1 Reference

Community 1.1 Bur oak/prairie willow/prairie cord grass – big bluestem

This savanna community is dominated by bur oak and native grasses that are tolerant of seasonal wetness.

Community 1.2 Bur oak / Prairie Willow/ Prairie Cordgrass - Big Bluestem

This site is a oak savanna with a diverse range of native species. Woody species such as prairie willow are developing prominence due to lack of disturbance.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- prairie willow (*Salix humilis*), shrub
- big bluestem (*Andropogon gerardii*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Pathway P1.1A Community 1.1 to 1.2

Lack of disturbance events 10 plus years,

Pathway P1.2A

Community 1.2 to 1.1

Disturbance event 2-5 years.

State 2

Low Disturbance/ Logged Woodland

Composition is altered from the reference state depending on tree selection during harvest. This state will slowly increase in more shade tolerant species and bur oak will become less dominant. Without periodic canopy disturbance, stem density and fire intolerant species, like hackberry, will increase in abundance. Some periodic grazing may be occurring.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- elm (*Ulmus*), tree
- common hackberry (*Celtis occidentalis*), tree

Community 2.1

Bur oak - Elm - Hackberry / Possum Haw / Sedge

This community will exhibit more shade tolerant species with bur oak becoming less dominant.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- common hackberry (*Celtis occidentalis*), tree
- elm (*Ulmus*), tree
- possumhaw (*Ilex decidua*), shrub
- sedge (*Carex*), grass

State 3

Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue, orchard grass, and white clover has been common. Occasionally, these pastures will have scattered oaks. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the reference state may be impossible, requiring a very long-term series of management options and transitions.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- orchardgrass (*Dactylis glomerata*), grass
- white clover (*Trifolium repens*), other herbaceous

Community 3.1

Tall Fescue - White Clover

This site is dominated by cool season grasses. Species depend on seeding and landowner objectives.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- white clover (*Trifolium repens*), other herbaceous

State 4

Cropland

This is a state that exists currently with intensive cropping of soybeans and wheat. Some conversion to cool season hay land occurs, but when commodity prices are high, these states transition back to cropland.

Community 4.1 Soybean, Wheat

A variety of crops may be planted on these sites depending on the landowners objectives.

Transition T1A State 1 to 2

Lack of disturbance events greater than 20 years ; repeated timber harvests.

Transition T1B State 1 to 3

Woody removal; tillage; vegetative seeding; grassland management.

Transition T1C State 1 to 4

Woody removal; tillage; conservation cropping system.

Restoration pathway R2A State 2 to 1

Forest stand improvement.

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 T3A State 3 to 4

Tillage; conservation cropping system.

Restoration pathway T4A State 4 to 3

Vegetative seeding; grassland management.

Additional community tables

Animal community

Wildlife*

Prairie Phase:

Game species that utilize this ecological site include:

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.

Migratory Waterbirds: Sora, Common Snipe and Virginia Rail

Furbearers: Muskrat, Beaver, and Mink.

Bird species associated with this ecological site's reference state condition:

Breeding birds: Sedge Wren, Red-Winged Blackbird, American Bittern, Marsh Wren, and Common Yellowthroat.

Migratory birds: Sora, Virginia Rail, Sedge Wren, American Bittern, Yellow Rail and Common Snipe.

Amphibian and reptile species associated with this ecological site's reference state condition: Western Chorus Frog (*Pseudacris triseriata triseriata*), Plains Leopard Frog (*Rana blairi*), Graham's Crayfish Snake (*Regina grahamii*), Midland Brown Snake (*Storeria dekayi wrightourm*), and prairies with crawfish burrows may have Northern Crawfish Frog (*Rana areolata circulosa*); Western Fox Snake (*Elaphe vulpina vulpina*), and Western Massasauga rattlesnake (*Sistrurus catenatus tergeminus*).

Small mammals associated with this ecological site's reference state condition: Muskrat (*Ondatra zibethicus*), Southern Bog Lemming (*Synaptomys cooperi*), and Mink (*Mustela vison*).

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: Swamp Milkweed Leaf Beetle (*Labidomera clivicollis*), Cordgrass Planthopper (*Prokelisia crocea*), Dion Skipper butterfly (*Euphyes dion*), Duke's Skipper butterfly (*Euphyes dukesi*), native bees (*Lasioglossum hartii*, *Hesperapis carinata*, *Svastra atripes* and *Cemolobus ipomoeae*), Bullate Meadow katydid (*Orchelimum bullatum*) and Sedge Grasshopper (*Stethophyma celatum*).

Other invertebrates: Grassland Crayfish (*Procambarus gracilis*)

Savanna Phase:

Both snags and live cavity or den trees provide important food and cover for vertebrate wildlife. Snags are also very important to invertebrate species. Wood Duck and Red-headed Woodpecker utilize snags and den trees for foraging, nesting or shelter. "Wolf" trees are a particularly valuable type of live cavity tree. These large diameter, often open-grown, old-ages, hollow trees provide both cavities for wildlife and usually hard or soft mast food sources. Large diameter snags and den trees are particularly important wildlife habitat features to retain.

Extremely little is known about this phase of this ecological site. It is assumed that many of the animal species described under the prairie phase of this ecological site are found in the savanna phase. Additional species that might be expected in the savanna phase: Red-headed Woodpecker, Wood Duck, Yellow Warbler, Fox Squirrel, and Indiana Bat.

*This section prepared by Mike Leahy, Natural Areas Coordinator, Missouri Department of Conservation, 2013

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. 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.

Other references

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Approval

Chris Tecklenburg, 5/21/2020

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)	Doug Wallace, Ecologist ACES program.
Contact for lead author	
Date	05/18/2020
Approved by	Chris Tecklenburg
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:**

17. **Perennial plant reproductive capability:**
