

Ecological site R115XB038MO

Wet Terrace Prairie

Accessed: 05/05/2024

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): 115X—Central Mississippi Valley Wooded Slopes

The Central Mississippi Valley Wooded Slopes, Western Part (area outlined in red on the map) consists mainly of the deeply dissected, loess-covered hills bordering the Missouri and Mississippi Rivers as well as the floodplains and terraces of these rivers. It wraps around the northeast corner of the Ozark Uplift, and constitutes the southern border of the Pre-Illinoian-aged till plain. Elevation ranges from about 320 feet along the Mississippi River near Cape Girardeau in the south to about 1,020 feet on the highest ridges near Hillsboro, MO in the east. Local relief varies from 10 to 20 feet in the major river floodplains, to 50 to 100 feet in the dissected uplands, with bluffs of 200 to 350 feet along the Mississippi and Missouri Rivers. Underlying bedrock is mainly Ordovician-aged dolomite and sandstone, with Mississippian-aged limestone north of the Missouri River.

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.

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

This ecological site occurs primarily in Land Type Associations of the following Subsections:

Inner Ozark Border

Outer Ozark Border

Missouri River Alluvial 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”.

Wet Terrace Prairies (green areas on the map) are on Mississippi and Missouri river alluvium near the confluence of the two rivers. Sites are associated with Loamy Terrace Prairie ecological sites, as well as both Loamy and Clayey Floodplain Forest sites. Soils are very deep and loamy or clayey, with seasonal high water tables. Some areas are subject to rare flooding. The reference plant community is prairie dominated by a dense cover of wetland species,

including prairie cord grass, sedges, and wet-tolerant forbs.

Associated sites

F115XB041MO	Clayey Floodplain Forest Clayey Floodplain Forests are found adjacent to these sites but nearer the main channel and are wooded.
R115XB037MO	Loamy Terrace Prairie Loamy Terrace Prairies are commonly adjacent to these sites and are on higher positions.

Similar sites

R115XB038MO	Wet Terrace Prairie There are no similar ecological sites in this MLRA.
-------------	---

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Salix humilis</i>
Herbaceous	(1) <i>Spartina pectinata</i> (2) <i>Andropogon gerardii</i>

Physiographic features

This site is on stream terraces of the Missouri and Mississippi Rivers. Slopes are 0 to 2 percent. The site receives some runoff from adjacent stream terrace sites. This site is subject to rare flooding.

The accompanying figure (adapted from Tummons, 1982) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites near the confluence of the Missouri and Mississippi Rivers. This site is within the area labeled as “2” on the figure, and is typically on high stream terrace positions of the Missouri and Mississippi rivers. These sites are commonly adjacent to Loamy Terrace Prairie sites (labeled “1”), and are on higher positions adjacent to Floodplain Forest sites as shown in the figure.

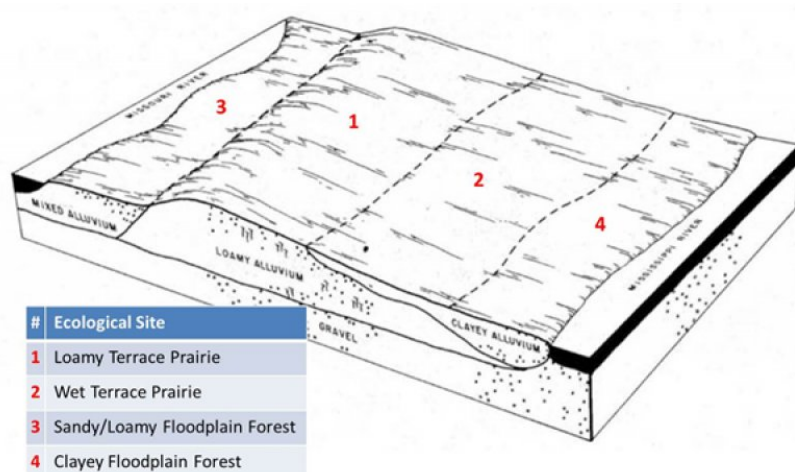


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare
Ponding frequency	None
Slope	0–2%

Water table depth	20–51 cm
Aspect	Aspect is not a significant factor

Climatic features

The Central Mississippi Valley Wooded Slopes, Western Part 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 Central Mississippi Valley Wooded Slopes, Western Part 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 diagonally crossing the MLRA from northwest to southeast. Both mean annual temperature and precipitation exhibit gradients along this line.

The average annual precipitation in most of this area is 38 to 48 inches. The average annual temperature is 53 to 57 degrees F. Mean January minimum temperature follows the northwest-to-southeast gradient. However, mean July maximum temperature shows hardly any geographic variation in the MLRA. Mean July maximum temperatures have a range of only two or three degrees across the area.

Mean annual precipitation varies along the same gradient as temperature. 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. Snowfall is common in winter.

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. 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>; accessed June 2012

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 (average)	175 days
Freeze-free period (average)	197 days
Precipitation total (average)	1,118 mm

Climate stations used

- (1) ALTON MELVIN PRICE L&D [USC00110137], West Alton, IL
- (2) KASKASKIA RVR NAV LOCK [USC00114629], Ellis Grove, IL
- (3) BOONVILLE [USC00230817], Boonville, MO

Influencing water features

This ecological site is influenced by a seasonal high water table from high groundwater levels, as well as slow hydraulic conductivity, which impedes throughflow from precipitation and flood events. The water table is typically near the surface in late fall through spring, receding in the summer.

This ecological site is on footslopes, and on high stream terraces of perennial streams. They are not adjacent to the current stream channel. A few areas on stream terraces are subject to rare flooding, typically of short duration and low intensity. Constructed levees, often accompanied by stream channelization, have altered the flooding dynamics in many places and may be a sign of an alternative state.

Sites that flood are in the RIVERINE wetlands class of the Hydrogeomorphic (HGM) classification system (Brinson, 1993), whereas footslopes and high stream terrace areas are best considered as MINERAL FLAT wetlands. These areas are Emergent Palustrine wetlands (Cowardin et al., 1979).

Soil features

These soils have no rooting restriction. They were formed under prairie vegetation. Parent material is alluvium. They have silt loam or silty clay 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 Blase, Nevin, Newhaven, Ridgeville, Shaffton, Speed, and Tanglenook.

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Very slow to moderately slow
Soil depth	183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–6%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–8.2
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 Terrace Prairie ecological sites exist because of their association with wet, poorly drained conditions. These conditions along with periodic fire had a strong influence on excluding trees. Wet Terrace Prairies are dominated by a dense cover of native wet tolerant grasses and forbs. On slightly higher areas within or at the edge of the prairie matrix scattered elm, bur oak, pin oak, shellbark hickory and willow occurred amid the grass-dominated landscape.

These sites are on relatively stable former floodplain positions that rarely flooded, probably once every 25 or so years. In addition to site wetness, periodic fire also played a role in keeping woody species at bay. Fire during dry periods removed the dense mat of leaf litter creating opportunities for plants less aggressive than the grasses and sedges.

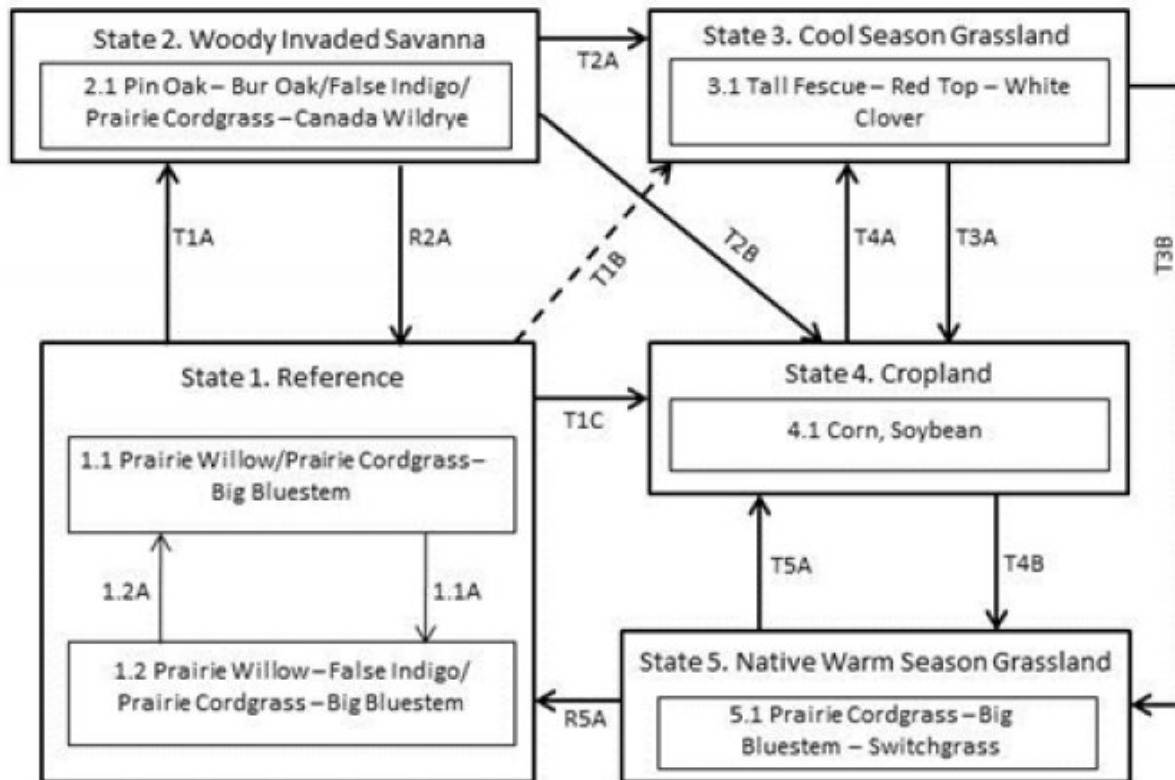
Wet Terrace Prairies were also subjected to grazing by native large herbivores, such as bison, elk and deer. Grazing by native herbivores would have effectively kept understory conditions open, creating conditions more favorable to ground flora species and minimizing woody trees and shrubs.

Today almost all of these ecological sites have been drained and farmed. However, during wet years, they do act as ephemeral farmed wetlands in the agricultural landscape. While their flood regime usually has been altered, their position and soil properties still make them good candidates for wet prairie and savanna development management. Quality remnants are very rare.

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

Wet Terrace Prairie, R115BY038MO



Code	Event/Activity/Process
T1A	Fire suppression > 20 years; woody invasion
T1B	Tillage; vegetative seeding; grassland management
T1C, T3A, T5A	Tillage; conservation cropping system
T2A	Woody removal; tillage; vegetative seeding; grassland management
T2B	Woody removal; tillage; conservation cropping system
T4A	Vegetative seeding; grassland management
T3B, T4B	Vegetative seeding; prescribed fire; grassland management
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 1-3 years
R2A	Woody removal; prescribed fire 1-3 years
R5A	Vegetative seeding; prescribed fire 1-3 years

Figure 7. State and transition diagram for this ecological s

State 1

Reference

This State is native tall grass prairie dominated by prairie cordgrass, big bluestem and a wide variety of prairie forbs. This State occurs on level to gently sloping soils. In some cases, bur oak, swamp white oak, post oak, elm, American hazelnut, prairie willow and wild plum occurred in small groves or as scattered individuals across the prairie landscape. This State is very rare. Nearly all former reference states have been converted to cool season grassland and intensive agriculture cropland.

Community 1.1

Prairie Willow - False Indigo/Prairie Cordgrass-Big Bluestem

This phase is a wet prairie dominated by big bluestem, prairie cord grass, Eastern gamagrass and a wide variety of prairie wildflowers and sedges. Occasional bur oak, swamp white oak, pin oak, elm, American hazelnut, prairie willow and wild plum occurred as scattered individuals across the open landscape.

Forest overstory. The Forest Overstory Species list is based on commonly occurring species listed in Nelson (2010).

Forest understory. The Forest Understory list is based on commonly occurring species listed in Nelson (2010).

Community 1.2

Prairie Willow - False Indigo/Prairie Cordgrass-Big Bluestem

This phase is similar to community phase 1.1 but woody shrubs are increasing due to longer periods of fire suppression. Some displacement of grasses and forbs may be occurring due to shading and competition from the increased woody canopy cover.

Forest overstory. The Forest Overstory Species list is based on commonly occurring species listed in Nelson (2010).

Forest understory. The Forest Understory list is based on commonly occurring species listed in Nelson (2010).

State 2

Woody Invaded Savanna

Conversion of other states to non-native cool season species such as tall fescue, red top and white clover has been common in this area. Occasionally, these pastures will have scattered bur oaks and/or swamp white oak. Long term uncontrolled grazing and a lack of grassland management can cause significant soil erosion and compaction and increases in less productive species such as Kentucky bluegrass and weedy forbs such as ironweed. A return to the reference state may be impossible, requiring a very long term series of management options.

Community 2.1

Pin Oak – Bur Oak/False Indigo/ Prairie Cordgrass – Canada Wildrye

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

State 3

Cool Season Grassland

This is the dominant State that exists currently with intensive cropping of corn and soybeans occurring. Some conversion to cool season hayland occurs for a limited period of time before transitioning back to cropland. Limited acres are sometimes converted to native warm season grassland through federal set-aside programs.

Community 3.1

Tall Fescue – Red Top – White Clover

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

State 4 Cropland

Conversion from the 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 is the most easily transformable state back to a Reference State. Substantial restoration time and management inputs will still be needed.

Community 4.1 Corn, Soybean

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

State 5 Native Warm Season Grassland

Conversion from the 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 is the most easily transformable state back to a Reference State. Substantial restoration time and management inputs will still be needed.

Community 5.1 Prairie Cordgrass – Big Bluestem – Switchgrass

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

Additional community tables

Table 5. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
shellbark hickory	CALA21	<i>Carya laciniosa</i>	Native	–	0–5	–	–
bur oak	QUMA2	<i>Quercus macrocarpa</i>	Native	–	0–5	–	–
pin oak	QUPA2	<i>Quercus palustris</i>	Native	–	0–5	–	–
slippery elm	ULRU	<i>Ulmus rubra</i>	Native	–	–	–	–

Table 6. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
big bluestem	ANGE	<i>Andropogon gerardii</i>	Native	–	20–40
prairie cordgrass	SPPE	<i>Spartina pectinata</i>	Native	–	20–40
switchgrass	PAVI2	<i>Panicum virgatum</i>	Native	–	20–30
bluejoint	CACA4	<i>Calamagrostis canadensis</i>	Native	–	10–20
hop sedge	CALU4	<i>Carex lupulina</i>	Native	–	10–20
fox sedge	CAVU2	<i>Carex vulpinoidea</i>	Native	–	10–20
fescue sedge	CAFE3	<i>Carex festucacea</i>	Native	–	10–20
Canada wildrye	ELCA4	<i>Elymus canadensis</i>	Native	–	10–20
Forb/Herb					
Shreve's iris	IRVIS	<i>Iris virginica var. shrevei</i>	Native	–	5–20
smooth white oldfield aster	SYRA5	<i>Symphotrichum racemosum</i>	Native	–	5–20
sawtooth sunflower	HEGR4	<i>Helianthus grosseserratus</i>	Native	–	5–20
swamp milkweed	ASIN	<i>Asclepias incarnata</i>	Native	–	5–20
winged lythrum	LYAL4	<i>Lythrum alatum</i>	Native	–	5–20
white doll's daisy	BOAS	<i>Boltonia asteroides</i>	Native	–	5–20
sweet coneflower	RUSU	<i>Rudbeckia subtomentosa</i>	Native	–	5–20
bearded beggarticks	BIAR	<i>Bidens aristosa</i>	Native	–	5–20
seedbox	LUAL2	<i>Ludwigia alternifolia</i>	Native	–	5–20
water knotweed	POAM8	<i>Polygonum amphibium</i>	Native	–	5–20
harvestlice	AGPA6	<i>Agrimonia parviflora</i>	Native	–	5–20
hemlock waterparsnip	SISU2	<i>Sium suave</i>	Native	–	5–20
prairie ironweed	VEFA2	<i>Vernonia fasciculata</i>	Native	–	5–20
Virginia bunchflower	VEVI5	<i>Veratrum virginicum</i>	Native	–	5–20
Culver's root	VEVI4	<i>Veronicastrum virginicum</i>	Native	–	5–20
Shrub/Subshrub					
false indigo bush	AMFR	<i>Amorpha fruticosa</i>	Native	–	5–20
prairie willow	SAHU2	<i>Salix humilis</i>	Native	–	5–20

Table 7. Community 1.4 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
shellbark hickory	CALA21	<i>Carya laciniosa</i>	Native	–	0–5	–	–
bur oak	QUMA2	<i>Quercus macrocarpa</i>	Native	–	0–5	–	–
pin oak	QUPA2	<i>Quercus palustris</i>	Native	–	0–5	–	–
slippery elm	ULRU	<i>Ulmus rubra</i>	Native	–	–	–	–

Table 8. Community 1.4 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
big bluestem	ANGE	<i>Andropogon gerardii</i>	Native	–	20–40
prairie cordgrass	SPPE	<i>Spartina pectinata</i>	Native	–	20–40
switchgrass	PAVI2	<i>Panicum virgatum</i>	Native	–	20–30
bluejoint	CACA4	<i>Calamagrostis canadensis</i>	Native	–	10–20
hop sedge	CALU4	<i>Carex lupulina</i>	Native	–	10–20
fox sedge	CAVU2	<i>Carex vulpinoidea</i>	Native	–	10–20
fescue sedge	CAFE3	<i>Carex festucacea</i>	Native	–	10–20
Canada wildrye	ELCA4	<i>Elymus canadensis</i>	Native	–	10–20
Forb/Herb					
Shreve's iris	IRVIS	<i>Iris virginica var. shrevei</i>	Native	–	5–20
smooth white oldfield aster	SYRA5	<i>Symphotrichum racemosum</i>	Native	–	5–20
sawtooth sunflower	HEGR4	<i>Helianthus grosseserratus</i>	Native	–	5–20
swamp milkweed	ASIN	<i>Asclepias incarnata</i>	Native	–	5–20
winged lythrum	LYAL4	<i>Lythrum alatum</i>	Native	–	5–20
white doll's daisy	BOAS	<i>Boltonia asteroides</i>	Native	–	5–20
sweet coneflower	RUSU	<i>Rudbeckia subtomentosa</i>	Native	–	5–20
bearded beggarticks	BIAR	<i>Bidens aristosa</i>	Native	–	5–20
seedbox	LUAL2	<i>Ludwigia alternifolia</i>	Native	–	5–20
water knotweed	POAM8	<i>Polygonum amphibium</i>	Native	–	5–20
harvestlice	AGPA6	<i>Agrimonia parviflora</i>	Native	–	5–20
hemlock waterparsnip	SISU2	<i>Sium suave</i>	Native	–	5–20
prairie ironweed	VEFA2	<i>Vernonia fasciculata</i>	Native	–	5–20
Virginia bunchflower	VEVI5	<i>Veratrum virginicum</i>	Native	–	5–20
Culver's root	VEVI4	<i>Veronicastrum virginicum</i>	Native	–	5–20
Shrub/Subshrub					
false indigo bush	AMFR	<i>Amorpha fruticosa</i>	Native	–	5–20
prairie willow	SAHU2	<i>Salix humilis</i>	Native	–	5–20

Animal community

Wildlife*

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 include:

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

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

Amphibian and reptile species associated with this ecological site's reference state condition include: Western

Chorus Frog (*Pseudacris triseriata triseriata*), Southern Leopard Frog (*Rana sphenoccephala*), Graham's Crayfish Snake (*Regina grahamii*), and Midland Brown Snake (*Storeria dekayi wrightourm*).

Small mammals associated with this ecological site's reference state condition include: 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 include: 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*)

*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.

Inventory data references

No known reference sites.

Other references

Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands. Technical Report WRP-DE-4, U.S. Army Corps of Engineers, Engineer Waterways Experiment Station, Vicksburg, MS.

Cowardin, L.M., V. Carter, F.C. Golet, & E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Dept. of Interior, Fish & Wildlife Service, Office of Biological Services, Washington DC.

Fitzgerald, J.A. and D.N. Pashley. 2000a. Partners in Flight bird conservation plan for the Ozark/Ouachitas. American Bird Conservancy.

Fitzgerald, J.A. and D.N. Pashley. 2000b. Partners in Flight bird conservation plan for the Dissected Till Plains. American Bird Conservancy.

Heitzman, J.R. and J.E. Heitzman. 1996. Butterflies and moths of Missouri. 2nd ed. Missouri Department of Conservation, Jefferson City.

Jacobs, B. 2001. Birds in Missouri. Missouri Department of Conservation, Jefferson City.

Johnson, T.R. 2000. The amphibians and reptiles of Missouri. 2nd ed. Missouri Department of Conservation, Jefferson City.

Nelson, Paul W. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Nigh, Timothy A., & Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, Missouri.

Pitts, D.E. and W.D. McGuire. 2000. Wildlife management for Missouri landowners. 3rd ed. Missouri Department of Conservation, Jefferson City.

Schwartz, C.W., E.R. Schwartz and J.J. Conley. 2001. The wild mammals of Missouri. University of Missouri Press, Columbia and Missouri Department of Conservation, Jefferson City.

Tummons, Richard L. 1982. Soil Survey of St. Charles County, Missouri. U.S. Dept. of Agric. Soil Conservation Service.

University of Missouri Climate Center - <http://climate.missouri.edu/climate.php>; accessed June 2012

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/>

Contributors

Fred Young
Doug Wallace

Acknowledgments

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	
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:**

17. **Perennial plant reproductive capability:**
