Ecological site R115XB052MO
Shallow Sandstone Backslope Glade/Woodland

Accessed: 04/25/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 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-Illinoisan-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 Sandstone Glade.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to Schizachrium scoparium-Aristida dichotoma-Croton willdenowii/Lichens Wooded Herbaceous Vegetation (CEGL002242).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily in the Inner Ozark Border Subsection, in the following Land Type Associations:
Hermann Oak Woodland/Forest Rugged Hills
Osage-Gasconade River Oak Woodland/Forest Hills

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”.

Shallow Sandstone Backslope Glade/Woodlands are within the green areas on the map. These sites are inextensive in uplands not adjacent to the Missouri or Mississippi River floodplains. Soils are very shallow to sandstone bedrock. The reference plant community ranges from open areas of grasses and forbs interspersed with bare bedrock, to areas with shrubs and widely scattered blackjack oak.

Associated sites

F115XB017MO	**Sandstone Protected Backslope Forest** Sandstone Protected Backslope Forests are closely associated with this site on northerly and easterly aspects.
F115XB051MO	**Sandstone Exposed Backslope Woodland** Sandstone Exposed Backslope Woodlands are closely associated with this site on southerly and westerly aspects.

Similar sites

R115XB009MO	**Shallow Limestone/Dolomite Upland Glade/Woodland** Shallow Limestone/Dolomite Upland Glade/Woodlands are similar in structure but associated with limestone/dolomite bedrock.

Table 1. Dominant plant species

Tree	(1) *Quercus marilandica*
Shrub	(1) *Rhus copallina*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Crotonopsis elliptica*

Physiographic features

This site is on upland backslopes with slopes of 15 to 50 percent. The site receives runoff from upslope summit and shoulder sites, and generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Brown & Childress, 1985) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in uplands that are underlain by sandstone. The site is within the area labeled “4”, on steep lower backslopes. Sandstone Backslope Woodland sites (labeled “3” on the figure) and closely associated with this site, and Sandstone Upland Woodland sites are often upslope (labeled “2”). These Shallow Sandstone glade ecological sites may also occur as narrow bands or ledges within the other sandstone sites, or at the interface with limestone ecological sites. The Fragipan Upland Woodland sites shown in this figure (labeled “1”) can be found on summit positions along the Ozark border in the southern part of MLRA 115B. In other areas, these positions are occupied by Loamy Upland Woodland ecological sites.

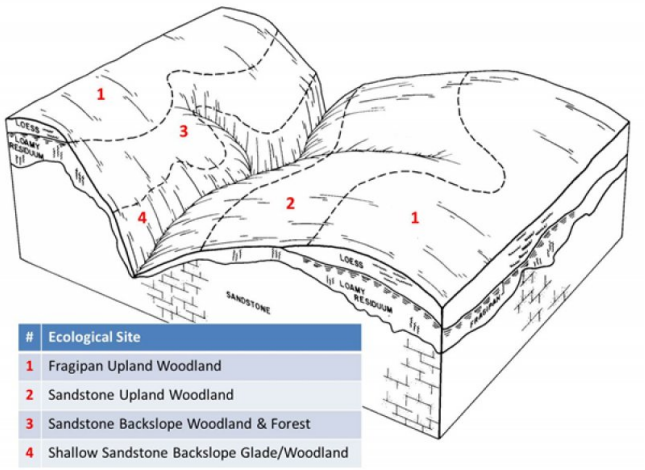


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None

Ponding frequency	None
Slope	15–50%
Water table depth	60 in
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)	158 days
Freeze-free period (average)	187 days

Precipitation total (average)	45 in

Climate stations used

- (1) ROSEBUD [USC00237300], Gerald, MO
- (2) ELSBERRY 1 S [USC00232591], Elsberry, MO

Influencing water features

High temperatures, intense solar radiation, and dry conditions prevail throughout much of the growing season, although soils may be saturated in spring, winter and late fall. Frost upheaval frequently disrupts these shallow soils during the dominant season. While evapotranspiration remains the most constant water feature, evapotranspiration rates typically peak in the summer and become dominant. The surface runoff pulse is greatly influenced by extreme events.

Soil features

These soils are underlain by sandstone bedrock at less than 20 inches. The soils were formed under a mixture of grasses, forbs, and woodlands. Organic matter content is generally low. Parent material is sandstone residuum. They have fine sandy loam or loam surface layers, with loamy subsoils. Low to moderate amounts of sandstone fragments are in some soils. They are not affected by seasonal wetness. Soil series associated with this site include Ramsey.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone
Surface texture	(1) Fine sandy loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Somewhat excessively drained
Permeability class	Very slow
Soil depth	4–20 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–6%
Available water capacity (0-40in)	2–3 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)	4.5–6
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0–3%

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.

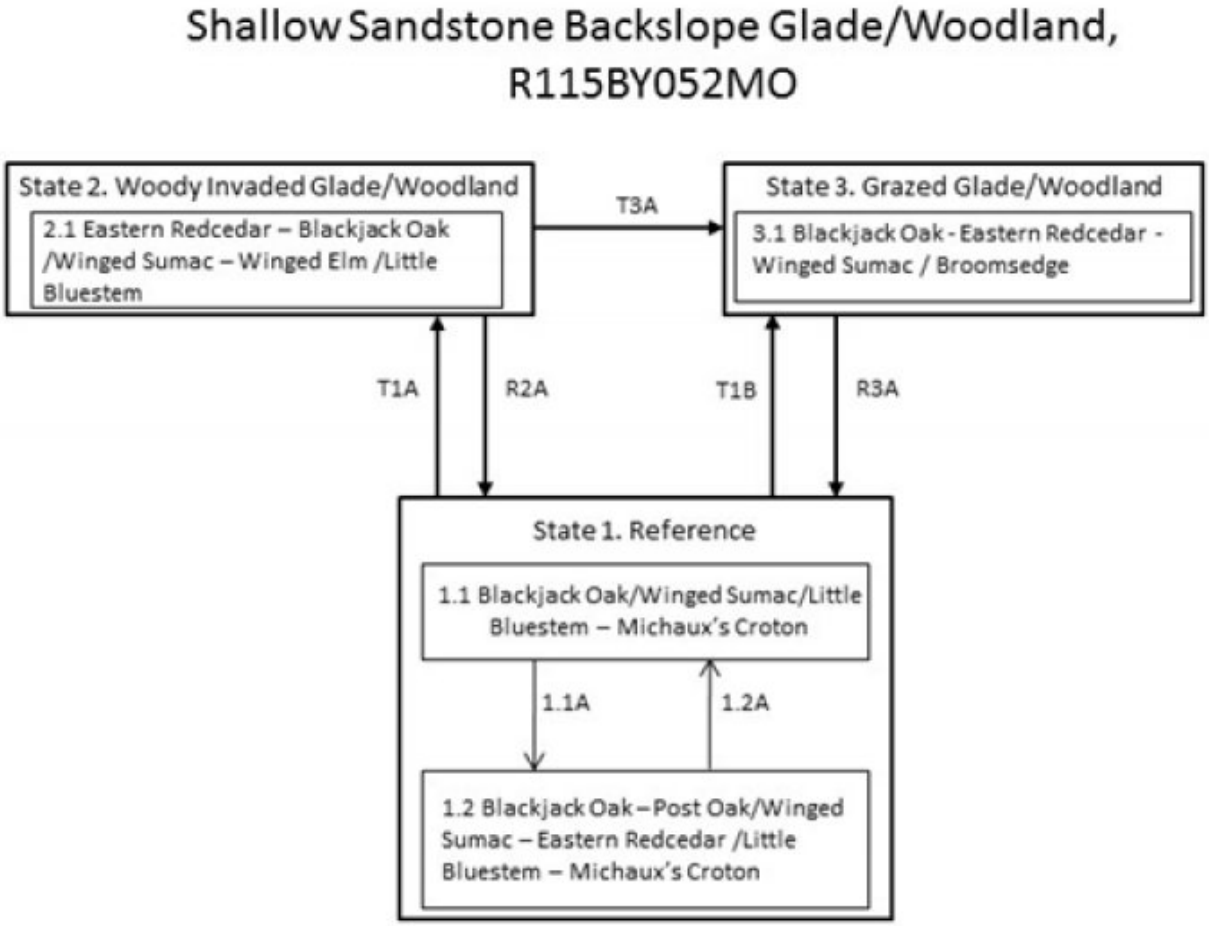
Shallow Sandstone Backslope Glade/Woodlands harbor a wide diversity of lichens, plants and animals. The dominant grasses include little bluestem, broomsedge and Indian grass. The glade/woodland complexes range from wide open grassy areas with very shallow soils and bare bedrock, to areas with widely scattered blackjack oaks on slightly deeper soil areas. While most have suffered from grazing and fire suppression, good examples can still be found.

The shallow acidic soils of the Shallow Sandstone Backslope Glade/Woodlands limit the growth of trees and support the native grasses and forbs that dominate these systems. Trees found on and near glades are often stunted and express poor development because of shallow droughty soils and poor growing conditions. Like the adjacent prairies, fire also played an important role in the maintenance of these systems. These systems typically burned at least once every three years. These periodic fires removed the litter and stimulated the growth and flowering of the grasses and forbs. They also further limited the growth and dominance of trees. Fire tolerant oaks occupied islands and edges of deeper soils, creating a complex mosaic of open glade and low-density woodland.

During fire-free intervals, woody species increased, especially on protected slopes. Once established, blackjack oak eastern redcedar and sumac can quickly fill in a glade/woodland system, especially if grazing has diminished the vigor of the diverse flora. Many glades have been heavily grazed and suffer substantial woody invasion. Removal of the undesirable woody plants and the application of prescribed fire have proven to be effective management tools.

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
T1A	Fire suppression (>20 years)
T1B	Uncontrolled grazing; fire suppression
T3A	Uncontrolled grazing
R2A	Cedar removal; prescribed fire
R3A	Grazing exclusion; prescribed fire; woody removal
1.1A	Fire-free interval (10-20 years)
1.2A	Fire interval (3-10 years)

Figure 7. State and transition diagram for this ecological s

State 1

Reference

Glade/Woodland reference sites harbor a wide diversity of plants and animals. Desert-adapted animals, like scorpions and tarantulas, also occupy healthy glades. The glade/woodland complexes range from wide open grassy areas with shallow soils and bare bedrock, to areas with widely scattered blackjack oak on locations with soil depths at the deeper extreme of the range for this soil component. On protected slopes, open woodlands are more common. Here the deeper soil depth range for this soil component and protected aspects allow more woody components to dominate.

Community 1.1
Blackjack Oak/Winged Sumac/Little Bluestem-Michaux's Croton

This phase has widely scattered stunted, old growth blackjack oak and winged sumac with little bluestem, side oats grama, and dropseeds dominating the open ground layer. Numerous forbs and lichens are also present and locally abundant.

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

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

Community 1.2
Blackjack Oak – Post Oak/Winged Sumac – Eastern Redcedar /Little Bluestem – Michaux’s Croton

This phase is similar to community phase 1.1 but post oak, eastern red cedar and numerous 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 densities of shrubs and oaks.

State 2
Woody Invaded Glade/Woodland

This state is dominated by eastern redcedar with large increases of oak density due to extended periods of fire suppression. This state can form relatively even-age stands, dating to when fire suppression became the dominant management characteristic on the site. Canopy closures can approach 100 percent with little or no ground flora. Transition back to the Reference state may require a number of prescribed fire events and thinning out of excess woody species. This state also can transition to a grazed state (State 3) with the introduction of domestic livestock.

Community 2.1
Eastern Redcedar – Blackjack Oak /Winged Sumac – Winged Elm /Little Bluestem

This phase is dominated by eastern redcedar and numerous shrub species. They can form relatively even-age stands, dating to when fire suppression began. This phase can occur relatively quickly (10 to 20 years). Canopy closures can approach 50 to 80 percent with little or no ground flora under the overstory canopy. Without active management, such as prescribed fire and woody removal, these sites will continue increasing in canopy coverage except on the shallowest soil and open bedrock areas where droughty conditions often keep woody invasion in check.

State 3
Grazed Glade/Woodland

The Grazed Glade/Woodland State has reduced cover, diversity and vigor of native glade/woodland flora. Woody species encroachment, particularly by eastern redcedar, has also increased in this State. Potential physical site damage by uncontrolled livestock grazing may further degrade this State.

Community 3.1

Blackjack Oak - Eastern Redcedar - Winged Sumac / Broomsedge

Due to long periods of domestic livestock grazing grass the forb diversity and ground cover are severely reduced increasing the potential for soil erosion and increased water runoff. This phase may also have increased densities of eastern redcedar, oak, and shrubs. Other weedy species such as non-native grasses and forbs also increase.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
post oak	QUST	*Quercus stellata*	Native	–	–	–	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
black hickory	CATE9	*Carya texana*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Indiangrass	SONU2	*Sorghastrum nutans*	Native	–	–
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
Great Plains flatsedge	CYLU2	*Cyperus lupulinus*	Native	–	–
lopsided rush	JUSE	*Juncus secundus*	Native	–	–
broomsedge bluestem	ANVI2	*Andropogon virginicus*	Native	–	–
tapered rosette grass	DIAC2	*Dichanthelium acuminatum*	Native	–	–
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	–
big bluestem	ANGE	*Andropogon gerardii*	Native	–	–
Forb/Herb					
mealy fumewort	COCR2	*Corydalis crystallina*	Native	–	–
Michaux's croton	CRMIE	*Croton michauxii var. ellipticus*	Native	–	–
Virginia tephrosia	TEVI	*Tephrosia virginiana*	Native	–	–
scaly blazing star	LISQ	*Liatris squarrosa*	Native	–	–
roundstem false foxglove	AGGA	*Agalinis gattingeri*	Native	–	–
fringeleaf wild petunia	RUHU	*Ruellia humilis*	Native	–	–
hairy pinweed	LEMU3	*Lechea mucronata*	Native	–	–
orangegrass	HYGE	*Hypericum gentianoides*	Native	–	–
threadleaf evening primrose	OELI	*Oenothera linifolia*	Native	–	–
prairie tea	CRMO6	*Croton monanthogynus*	Native	–	–
yellow stonecrop	SENU	*Sedum nuttallianum*	Native	–	–
dwarf plantain	PLPU	*Plantago pusilla*	Native	–	–
poorjoe	DITE2	*Diodia teres*	Native	–	–
Virginia dwarfdandelion	KRVI	*Krigia virginica*	Native	–	–
southern bluet	HOMI4	*Houstonia micrantha*	Native	–	–

southern blast	[illegible]	*Houstonia micrantha*	Native		
Fern/fern ally					
upland brittle bladderfern	CYTE7	*Cystopteris tenuis*	Native	–	–
marginal woodfern	DRMA4	*Dryopteris marginalis*	Native	–	–
hairy lipfern	CHLA2	*Cheilanthes lanosa*	Native	–	–
Shrub/Subshrub					
winged sumac	RHCO	*Rhus copallinum*	Native	–	–
farkleberry	VAAR	*Vaccinium arboreum*	Native	–	–
shrubby St. Johnswort	HYPR	*Hypericum prolificum*	Native	–	–
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	–	–
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
winged elm	ULAL	*Ulmus alata*	Native	–	–
Nonvascular					
greygreen reindeer lichen	CLRA60	*Cladina rangiferina*	Native	–	–
cup lichen	CLMA17	*Cladonia mateocyatha*	Native	–	–
Schleicher's cracked lichen	ACSC5	*Acarospora schleicheri*	Native	–	–
northern selaginella	SERU	*Selaginella rupestris*	Native	–	–

Animal community

Wildlife*

Wildlife habitat: oaks provide hard mast; numerous native legumes provide high-quality wildlife food; native warm-season grasses provide extensive cover and nesting habitat; and a diversity of forbs provides a diversity and abundance of insects.

Post-burn areas can provide temporary bare-ground – herbaceous cover habitat important for turkey poults and quail chicks.

Game species that utilize this ecological site include:
Turkey will utilize this ecological site for food (seeds, green browse, soft mast, and 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: Field Sparrow, Yellow-breasted Chat, White-eyed vireo, Brown Thrasher, Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager and Eastern Wood-Pewee.

Amphibian and reptile species that may be associated with this ecological site's reference state: Five-lined Skink (Eumeces fasciatus), Six-lined Racerunner (Cnemidophorus sexlineatus), Flat-headed Snake (Tantilla gracilis), Eastern Coachwhip (Masticophis flagellum flagellum), Red Milk Snake (Lampropeltis triangulum syspila), Ground Snake (Snora semiannulata) and Prairie Ring-necked Snake (Diadophis punctatus arnyi).

Small mammals likely associated with this ecological site's reference state condition: Eastern Woodrat (Neotoma floridana) and Peromyscus species.

Invertebrates – Many native insect species are likely associated with this ecological site's reference state condition, especially native bees, ants, beetles, butterflies and moths, and crickets, grasshoppers and katydids.

Insect species likely associated with this ecological site's reference state condition: Lichen Grasshopper (Trimerotropis saxatilis), a prickly pear borer moth (Melitara prodenialis), native ants (Pheidole tysoni, Formica

schaufussi), and native bees (Colletes aestivalis, Andrena helianthiformis, Protandrena rudbeckiae, Lasioglossum coreopsis, Anthidium psoraleae and Dianthidium subrufulum).

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

Other information

Forestry

Management: Estimated site index values are generally less than 40 for eastern redcedar and oak. Productivity is very low. Very limited timber management opportunities exist. These sites are valuable for wildlife purposes and watershed protection. Severely reduced rooting depth restricts tree growth and increases windthrow hazards. These sites respond well to prescribed fire as a management tool.

Limitations: Surface stones and surface rock; very shallow soil depth. Surface stones and rocks are problems for efficient and safe equipment operation. Severe seedling mortality due to high soil surface temperatures and low available water holding capacity is possible. Machine planting and mechanical site preparation is not recommended. Hard bedrock at shallow depths may interfere with equipment operation. Rock outcrops may cause breakage of timber when harvesting. Surface stones and rocks will make equipment use extremely difficult. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35 percent, traction problems increase and equipment use is not recommended.

Inventory data references

Shallow Sandstone Backslope Glade/Woodland – Potential Reference – R115BY052MO

Plot DOROSP05 - Ramsey soil
Located in Don Robinson State Park, Jefferson County, MO
Latitude: 38.394671
Longitude: -90.697353

Plot GRCASP_KS04 - Ramsey soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.904586
Longitude: -91.57255

Plot GRCASP_KS05 – Ramsey soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.904072
Longitude: -91.573229

Plot GRCASP_KS06 – Ramsey soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.903679
Longitude: -91.572741

Plot GRCASP01 – Ramsey soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.903614
Longitude: -91.572346

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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

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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	
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:

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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:**