

## *Ecological Site Description*

### **Shallow Limestone Upland Glade/Woodland**

**R116BY024MO**

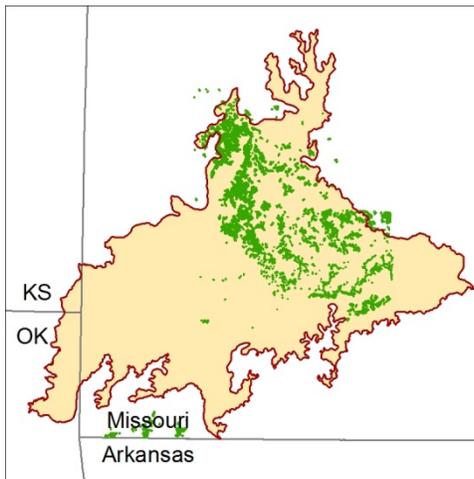
- (*Quercus muehlenbergii/Bumelia lanuginosa - Rhus aromatica/Schizachyrium scoparium - Bouteloua curtipendula*)
- (chinkapin oak/gum bumelia – aromatic sumac/little bluestem – sideoats grama)

An Ecological Site Description (ESD) is a reference document of ecological knowledge regarding a particular land area (ecological site). An ESD describes ecological potential and ecosystem dynamics of land areas and their potential management. Ecological sites are linked to soil survey map unit components, which allows for mapping of ecological sites. *(NOTE: This is a “provisional” ESD, and is subject to change. It contains basic ecological information sufficient for conservation planning and land management in Missouri. After additional information is developed and reviewed, a “Correlated” ESD will be published and will be available via the Web Soil Survey <http://websoilsurvey.nrcs.usda.gov> .)*

**Major Land Resource Area:** 116B – Springfield Plain

### **Introduction**

The Springfield Plain (area outlined in red on the map) 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.

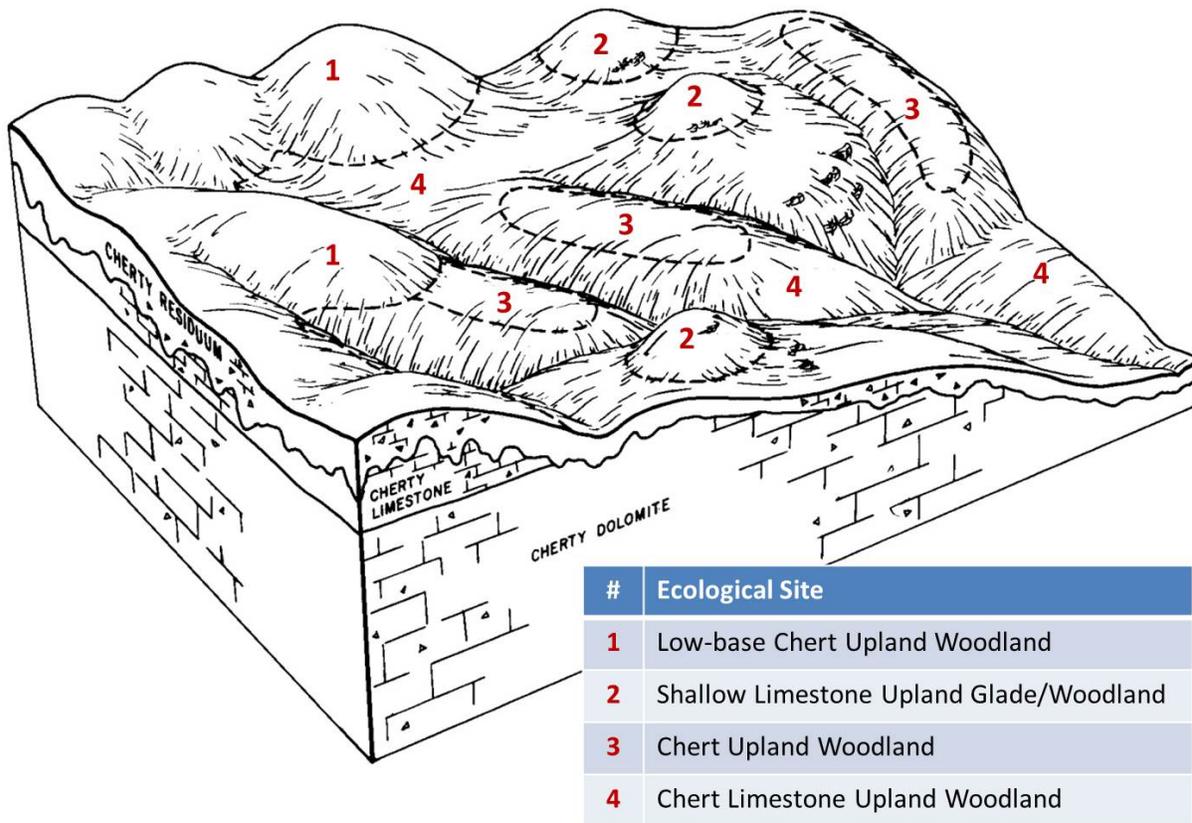
Shallow Limestone Upland Glade/Woodlands (green areas on map) occur in dissected areas where the underlying limestone is exposed, primarily in the Sac River watershed and tributaries in Dade and Cedar counties. Small areas also occur to the south in the Elk River watershed, primarily over

dolomite. Soils are very shallow to limestone bedrock.

### **Physiographic Features**

This site is on upland crests, shoulders and backslopes with slopes of 3 to 50 percent. The site generates runoff to adjacent, downslope ecological sites, and in places receives runoff from upslope summit and shoulder sites. This site does not flood.

The following figure (adapted from Dodd, 1985) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “2” on the figure, shown here on knobs. Shallow Limestone Upland Glade/Woodland sites are typically associated with Chert Limestone Upland Woodland sites, labeled “4”.



**Soil Features**

These soils are underlain with limestone bedrock at less than 20 inches. The soils were formed under prairie vegetation, and have dark, organic-rich surface horizons. Parent material is limestone residuum. These soils are loamy and are skeletal, with high amounts of limestone gravel, channers and flagstones. They are not affected by seasonal wetness. Soil series associated with this site include Gasconade and Moko.

**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.*

Glade plants in general possess many adaptations enabling them to survive in a harsh environment often subject to widely fluctuating extremes of temperature and moisture. The following conditions are general characteristic of most limestone glades (Nelson and Ladd 1983; Nelson et al. 2013):

- Calcareous bedrock at or near the surface as a result of major erosional activity;

- Moderate to steep slopes in deeply dissected drainages or hilly to mountainous terrain with a southern or western exposure with intense solar radiation;
- Extremely thin soil cover interspersed with abundant rock fragments and rock outcrops;
- Exceptionally dry conditions throughout much of the growing season, although soils may be seasonally saturated in spring, winter, and fall;
- Peripheral areas and sometimes large expanses of the glades themselves characterized by a mosaic of stunted, often gnarled trees and shrubs.

The shallow soils of this ecological site limit the growth and abundance of trees and support the native grasses and forbs that dominate these systems. Fire played an important role in the maintenance of these systems, as well. It is likely that these sites burned at least once every five 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, especially eastern redcedar.

Fire tolerant chinkapin oak and post oak 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, but not to densities on over-grazed glades.

In the absence of fire, woody species, especially eastern redcedar, quickly occupy the site. This is especially true after grazing has reduced grass cover and exposed more surface to the dispersal of cedar seeds by birds. Once established, cedars can quickly fill in a glade/woodland system, especially if grazing has diminished the vigor of the diverse flora.

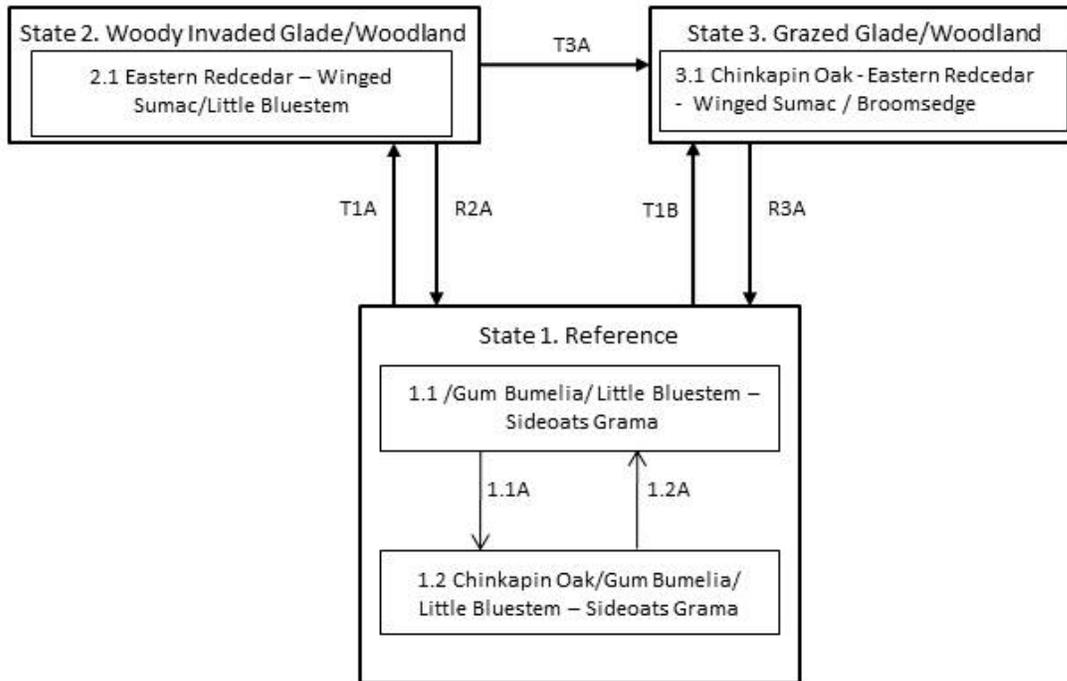
Many glades have been heavily grazed and suffer substantial redcedar invasion. Removal of the redcedar by chainsaw and the application of prescribed fire have proven to be an effective way to manage these systems.

Glade/Woodland Complexes harbor a wide diversity of plants and animals. Grasses such as little bluestem, Indian grass, and sideoats grama, are also found on prairies. But other species, such as Missouri coneflower, calamint, and the federally listed Missouri bladder-pod (*Lesquerella filiformis*), are only found on limestone/dolomite glades. Desert-adapted animals, like scorpions and tarantulas, also occupy healthy glades.

A State and Transition Diagram is depicted in Figure 1. 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.

**Figure 1: State and transition diagram**

Shallow Limestone Upland Glade/Woodland, R116BY024MO



| 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)                        |

**Ecological States**

**State 1: Reference State**

Glade/Woodland reference sites harbor a wide diversity of plants and animals. Many, like little bluestem, Indian grass, and sideoats grama, are also found on prairies. But others, such as Missouri coneflower and calamint are only found on limestone/dolomite glades. 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 chinkapin and post oaks 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. While many have suffered from grazing and fire suppression, good examples can still be found.

**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% 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.

**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.

**Reference State Plant Community**

Canopy Trees

| Common Name      | Botanical Name               | Cover % (low-high) | Canopy Height (ft) |
|------------------|------------------------------|--------------------|--------------------|
| CHINQUAPIN OAK   | <i>Quercus muehlenbergii</i> | 0-10               | 30                 |
| DWARF HACKBERRY  | <i>Celtis tenuifolia</i>     | 0-10               | 10                 |
| POST OAK         | <i>Quercus stellata</i>      | 0-10               | 30                 |
| EASTERN REDCEDAR | <i>Juniperus virginiana</i>  | 0-10               | 20                 |

Shrubs

| Common Name    | Botanical Name            | Cover % (low-high) | Canopy Height (ft) |
|----------------|---------------------------|--------------------|--------------------|
| CHITTIM WOOD   | <i>Bumelia lanuginosa</i> | 5-20               | 8                  |
| FRAGRANT SUMAC | <i>Rhus aromatica</i>     | 5-20               | 3                  |

Forbs

| Common Name           | Botanical Name                          | Cover % (low-high) |
|-----------------------|---|--------------------|
| ORANGE PUCCOON        | <i>Lithospermum canescens</i>           | 2-5                |
| WILD ONION            | <i>Allium canadense</i>                 | 2-5                |
| NARROWLEAF MILKWEED   | <i>Asclepias stenophylla</i>            | 2-5                |
| BLUE WILD INDIGO      | <i>Baptisia australis var. minor</i>    | 2-5                |
| LIMESTONE CALAMINT    | <i>Clinopodium arkansanum</i>           | 2-5                |
| NARROW LEAF BLUETS    | <i>Houstonia nigricans</i>              | 2-5                |
| WILD PETUNIA          | <i>Ruellia humilis</i>                  | 2-5                |
| CROTONOPSIS           | <i>Croton michauxii var. ellipticus</i> | 2-5                |
| ONESEED CROTON        | <i>Croton monanthogynus</i>             | 2-5                |
| CAROLINA LARKSPUR     | <i>Delphinium carolinianum</i>          | 2-5                |
| PALE CONEFLOWER       | <i>Echinacea pallida</i>                | 2-5                |
| STONE CROP            | <i>Sedum pulchellum</i>                 | 2-5                |
| PURPLE PRAIRIE CLOVER | <i>Dalea purpurea</i>                   | 2-5                |
| PRAIRIE DOCK          | <i>Silphium terebinthinaceum</i>        | 2-5                |
| MISSOURI CONE FLOWER  | <i>Rudbeckia missouriensis</i>          | 2-5                |
| CALAMINT              | <i>Calamintha arkansana</i>             | 2-5                |
| PRICKLEY PEAR         | <i>Opuntia humifusa</i>                 | 2-5                |

Lichens

| Common Name      | Botanical Name             | Cover % (low-high) |
|------------------|----------------------------|--------------------|
| FISHSCALE LICHEN | <i>Psora decipiens</i>     | 2-5                |
| SARCOGYNE LICHEN | <i>Sarcogyne regularis</i> | 2-5                |
| WART LICHEN      | <i>Verrucaria marmorea</i> | 2-5                |

Grasses and sedges

| Common Name            | Botanical Name                 | Cover % (low-high) |
|------------------------|--------------------------------|--------------------|
| LITTLE BLUESTEM        | <i>Schizachyrium scoparium</i> | 10-20              |
| MEAD’S SEDGE           | <i>Carex meadii</i>            | 2-5                |
| SIDEOATS GRAMA         | <i>Bouteloua curtipendula</i>  | 10-20              |
| POVERTY GRASS          | <i>Sporobolus neglectus</i>    | 5-20               |
| FLATSTEMMED SPIKESEDGE | <i>Eleocharis compressa</i>    | 2-5                |

Site Interpretations

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:  
Northern Bobwhite will utilize this ecological site for food (seeds, insects), cover needs (escape, nesting and roosting cover) and brood-rearing habitat.

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, 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.

- Breeding bird species associated with this ecological site’s reference state condition: Field Sparrow, Yellow-breasted Chat, Blue-winged Warbler, Brown Thrasher, Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Prairie Warbler, and Eastern Towhee.
- Amphibian and reptile species that may be associated with this ecological site’s reference state: collared lizard (*Crotaphytus collaris collaris*), 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 sypila*), eastern narrow-mouthed toad (*Gastrophyne carolinensis*), coal skink

(*Eumeces anthracinus pluvialis*), 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: dusted skipper butterfly (*Atrytonopsis hianna*), cobweb skipper butterfly (*Hesperia metea*), pepper and salt skipper butterfly (*Amblyscirtes hegon*), Delaware skipper butterfly (*Atryone logan logan*), crossline skipper butterfly (*Polites origenes*), native ants (*Crematogaster lineolata*, *Monomorium minimum*, *Forelius pruinus* *Paratrechnia terricola*), and native bees (*Colletes aestivalis*, *Andrena helianthiformis*, *Protandrena rudbeckiae*, *Lasioglossum coreopsis*, *Anthidium psoraleae* and *Dianthidium subrufulum*).

Other invertebrates: black widow spider (*Latrodectus mactans*) and striped bark scorpion (*Centruroides vittatus*)

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

### Forestry

- Management: Site index values are less than 30 for eastern redcedar and generally less than 40 for oak. Productivity is very low. No 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.

### Glossary

*Backslope* – a hillslope profile position that forms the steepest and generally linear, middle portion of the slope.

*Backswamp* – marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces

*Calcareous* – the presence of calcium carbonate in the soil parent material within the rooting zone; relatively alkaline

*Claypan* – a dense, compact, slowly permeable layer in the subsoil having much higher clay content than the overlying material

*Chert* – hard, extremely dense or compact crystalline sedimentary rock, consisting dominantly of interlocking crystals of quartz

*Cliff* – a significant vertical, or near vertical, rock exposure

*Dolomite* – a type of sedimentary rock that is a carbonate mineral composed of calcium magnesium carbonate

*Drainageway* – the upper most reach of a stream channel system characterized by little meandering

*Dry* – a site where soil moisture is limiting during the growing season; low available water capacity

*Dune* – a low mound, ridge, bank or hill of loose, wind-blown sand

*Exposed* – steep, south and west-facing slopes, which are warmer and drier than other slope aspects

*Flatwoods* – a type of woodland that occurs on soils with a root restricting subsoil layer within 20 to 30 inches, resulting in very slow runoff and ponding that remains saturated for most of the winter and early spring months but dries out and becomes very dry in the summer months; plants that grow there must be adapted to both conditions

*Floodplain* – the nearly level plain that borders a stream and is subject to inundation under flood-stage conditions

*Footslope* – a hillslope position at the base of a slope where hillslope sediment (colluvium) accumulates

*Forest* – a vegetative community dominated by trees forming a closed canopy and interspersed with shade-tolerant understory species

*Fragipan* – a dense, brittle subsoil horizon that is extremely hard and compact when dry

*Glade* – open, rocky, barren vegetative community dominated by drought-adapted forbs and grasses, typically with scattered, stunted woody plants

*Igneous* – bedrock formed by cooling and solidification of magma. Granite and rhyolite are typical igneous bedrocks in Missouri

*Limestone* – a type of sedimentary rock composed largely of calcium carbonate

*Loess* – material transported and deposited by wind and consisting predominantly of silt-size particles

*Loamy* – soil material containing a relatively equal mixture of sand and silt and a somewhat smaller proportion of clay

*Marsh* – a type of wetland that is dominated by herbaceous rather than woody plant species

*Moist* – a site that is moderately well to well drained and has high available water capacity, resulting in a well-balanced supply of moisture (neither too dry nor too wet).

*Mudstone* – blocky or massive, fine-grained sedimentary rock in which the proportions of clay and silt are approximately equal

*Natric* – a soil horizon that displays a blocky, columnar, or prismatic structure and has a subhorizon with an exchangeable-sodium saturation of over 15%

*Outwash* – stratified sediments of sand and gravel removed or “washed out” from a glacier by melt-water streams

*Prairie* – a vegetative community dominated by perennial grasses and forbs with scattered shrubs and very few trees

*Protected* – steep, north- and east-facing slopes, which are cooler and moister than other slope aspects

*Residuum* - unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place

*Riser* – a component of terraces and flood-plain steps consisting of the steep side slope; the escarpment

*Riverfront* – a vegetative community in the floodplain immediately adjacent and generally parallel to a river or stream channel

*River hills* – a geographic area characterized by thick, dissected loess deposits, formed immediately adjacent to the edges of the Missouri and Mississippi River floodplains

*Sandy* – a coarse-sized soil containing a large mixture of sand and gravels and a somewhat smaller proportion of silts and clays with excessive drainage

*Sandstone* – a sedimentary rock containing dominantly sand-size particles

*Savanna* – grasslands interspersed with open-grown scattered trees, groupings of trees, and shrubs

*Shale* – a sedimentary rock formed from clay, silty clay, or silty clay loam deposits and having the tendency to split into thin layers

*Shallow* – a site with bedrock within 20 inches of the surface

*Shoulder* – the slope profile position that forms the convex surface near the top of a hill slope; it comprises the transition zone from summit to backslope

*Sinkhole* – a closed, circular or elliptical depression, commonly funnel-shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock or by collapse of underlying caves within bedrock

*Summit* – the top or highest area of a hillslope

*Swale* –shallow, closed depressions irregularly spaced across a floodplain or terrace with an irregularly undulating surface.

*Swamp* – an area of low, saturated ground, intermittently or permanently covered with water, and predominantly vegetated by shrubs and trees.

*Talus* – rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope.

*Terrace* – a step-like surface, bordering a valley floor that represents the former position of a flood plain

*Till* – dominantly unsorted and unstratified soil material deposited directly by a glacier

*Upland* – a general term for the higher ground of a region, in contrast with a low-lying, adjacent land such as a valley or floodplain

*Wet* – a somewhat poorly, poorly or very poorly drained site that has an oversupply of moisture during the growing season

*Woodland* – a highly variable vegetative community with a canopy of trees ranging from 30 to 100 percent closure with a sparse midstory and a dense ground flora of grasses, sedges and forbs

## References

Dodd, Jerry A. 1985. Soil Survey of Christian County, Missouri. U.S. Dept. of Agric. Soil Conservation Service.

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

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

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

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

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

Nelson P.W. and D. Ladd. 1983. Preliminary report on the identification, distribution, and classification of Missouri glades. Pp. 59-76 in C.L. Kucera (ed.). Proceedings of the seventh North American Prairie Conference. Southwest Missouri State University, Springfield, Missouri.

Nelson, P. W., J. A. Fitzgerald, K. Larson, R. McCoy, A. Schotz, J. Taft, T. Witsell, B. Yahn. 2013. Central Hardwoods Joint Venture Glade Conservation Assessment for the Interior Highlands and

Interior Low Plateaus of the Central Hardwoods Region. Central Hardwoods Joint Venture. <http://www.chjv.org/projects.html>.

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. 3<sup>rd</sup> ed. Missouri Department of Conservation. Jefferson City, Missouri.

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, Missouri.