

## *Ecological Site Description*

### **Calcareous Limestone Exposed Backslope Woodland**

**F115BY050MO**

- (*Quercus muehlenbergii* - *Fraxinus quadrangulata* /*Rhamnus caroliniana* /*Schizachyrium scoparium*)
- (chinkapin oak – blue ash/Carolina buckthorn/little bluestem)

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:** 115B – Central Mississippi Valley Wooded Slopes, Western Part

#### **Introduction**

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

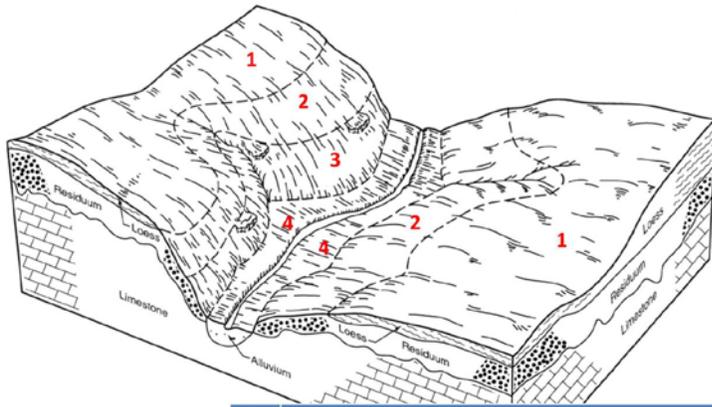


of the Ozark Uplift, and constitutes the southern border of the Pre-Illinoian-aged till plain. Elevation ranges from about 320 feet along the Mississippi River near Cape Girardeau in the south to about 1,020 feet on the highest ridges near Hillsboro, Missouri in the east. Local relief varies from 10 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.

Calcareous Limestone Exposed Backslope Woodlands are within the green areas on the map. They occupy the southerly and westerly aspects of steep, dissected slopes, and are mapped in complex with the Calcareous Limestone Protected Backslope Forest ecological site. These sites are in the eastern part of the MLRA, north of the Missouri River. They are closely associated with Limestone/Dolomite Glade ecological sites, often occurring directly downslope. Other close ecological site associates include Chert Limestone/Dolomite woodland and forest sites, and loess woodland sites, which are upslope. Soils are high in bases, and are moderately deep over limestone bedrock, with gravelly surfaces.

**Physiographic Features**

This site is on backslopes with slopes of 15 to 70 percent. It is on exposed aspects (south, southwest, and west), which receive significantly more solar radiation than the protected aspects. Sites are often downslope from limestone/dolomite glades. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.



#	Ecological Site
1	Deep Loess Upland Woodland
2	Chert Limestone/Dolomite Backslope Woodland & Forest
3	Calcareous Limestone Backslope Woodland & Forest
4	Gravelly Upland Drainageway Forest

The adjacent figure (adapted from Young et al., 2003) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the uplands. The site is within the area labeled “3”, and is often closely associated with Chert Limestone/Dolomite sites (labeled “2” in the figure), as well as Shallow Limestone/Dolomite Glade sites.

**Soil Features**

These soils are underlain with limestone bedrock at 20 to 40 inches. The soils were formed under a mixture of prairie and woodland

vegetation, and have dark, organic-rich surface horizons that are enriched in places by upslope prairie glades. Parent material is slope alluvium over residuum weathered from limestone, overlying limestone bedrock. They have very gravelly silt loam surface layers, with clayey subsoils that have moderate to high amounts of chert and limestone gravel and cobbles. These soils are base-rich, but do not contain free carbonates. These soils are not affected by seasonal wetness. Soil series associated with this site include Clinkenbeard.

**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.*

The somewhat shallow soils and south to west aspects of Calcareous Limestone Exposed Backslope Woodlands limited the growth of trees and supported an abundance of native grasses and forbs in the understory. Rather short (35 to 50 feet) chinquapin oak dominated an open overstory, with occasional white ash, blue ash and Shumard oak. Shrubs were scattered within a dense matrix of native grasses and forbs. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground

flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth.

Fire played an important role in the maintenance of these systems. It is likely that these ecological sites, along with adjacent glades and woodlands burned at least once every 5 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. They would have also further limited the growth and dominance of trees, especially Eastern redcedar. During fire free intervals, woody species would have increased and the herbaceous understory diminished. But the return of fire would have re-opened the woodlands and stimulated the ground flora. In the long term absence of fire, woody species, especially eastern red cedar have encroached into these ecological sites. Most of these ecological sites today are denser, and shadier with a greatly diminished ground flora. Removal of the younger understory by chainsaw and the application of prescribed fire have proven to be effective restoration methods.

Calcareous Limestone Exposed Backslope Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores, such as bison, elk, and deer. Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. Grazing by native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and sun-loving ground flora species.

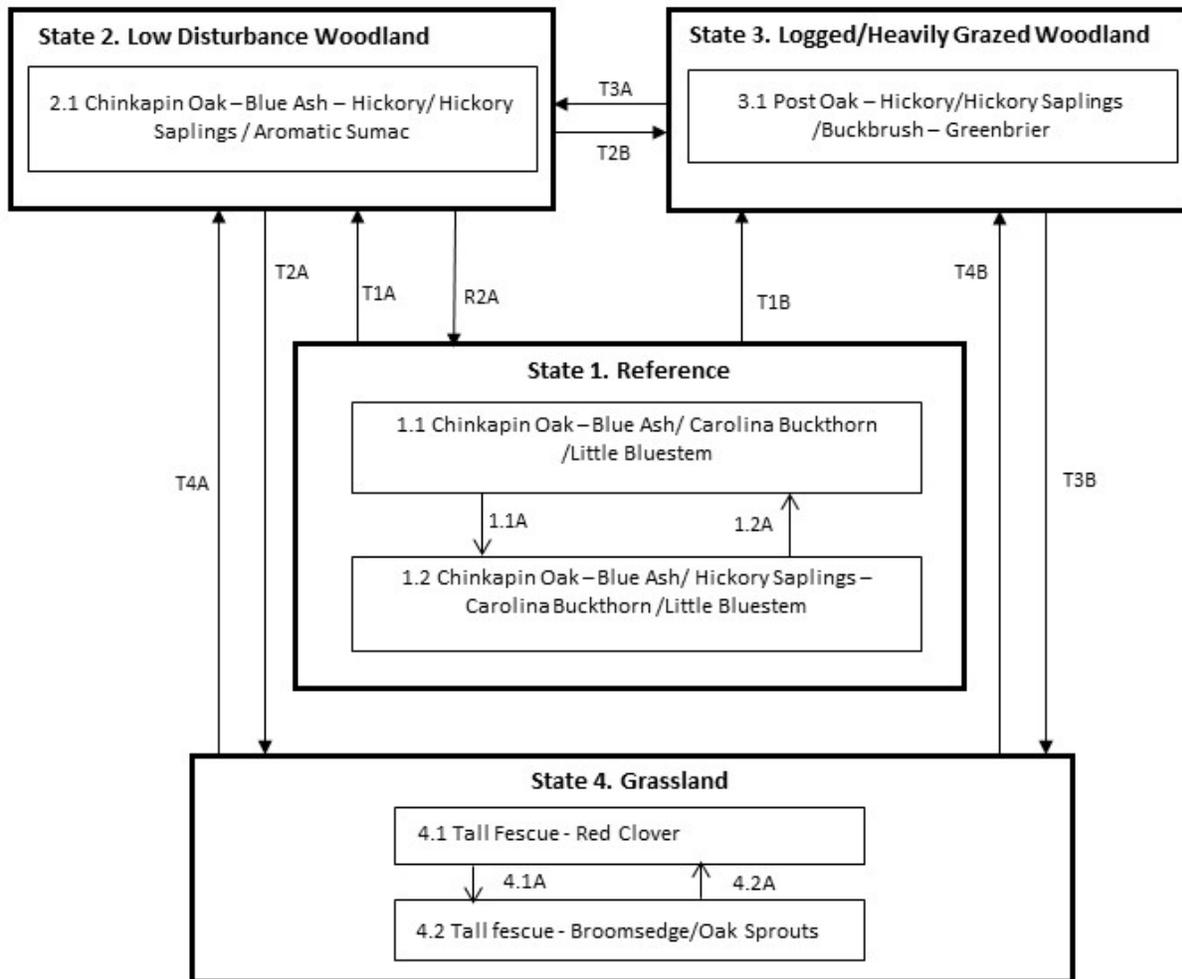
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper. It also promotes the invasion of eastern red cedar. Grazed sites have a more open understory. In addition, soil compaction and soil erosion related to grazing can be a problem and lower site productivity.

These ecological sites are not productive. Without some thinning of the stands and application of prescribed fire, the ground flora diversity can be shaded out and diversity of the stand may suffer.

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**

**Calcareous Limestone Exposed Backslope Woodland, F115BY050MO**



Code	Event/Activity
T1A	Fire-free interval (20+ years)
T1B	Fire suppression; heavy grazing by livestock; logging
T3A	Livestock removal; forest stand improvement
T2B	Heavy grazing by livestock; logging
T2A, T3B	Clearing; grassland seeding; grassland management
T4A	Tree planting; long term succession (50+ years); no grazing
T4B	Long term succession (50+ years); light periodic grazing
R2A	Understory removal; prescribed fire; forest stand improvement
1.1A	Disturbance-free interval >20 years
1.2A	Disturbance 10-20 year cycle; fire intervals (3-5 years)
4.1A	Over grazing; no fertilization
4.2A	Brush management; grassland seeding; grassland management

**Ecological States**

**State 1: Reference**

The reference state was dominated by chinkapin oak and ash. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the dominance of white and chinkapin oak by opening up the canopy and allowing more light for oak reproduction. Long disturbance-free periods allowed an increase in more shade tolerant species such as northern red oak and sugar maple. Two community phases are recognized in this state, with shifts between phases based on disturbance frequency. This reference state is uncommon today. Some sites have been converted to grassland (State 4). Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing (State 3). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many reference sites have been managed for timber harvests.

**State 2: Low Disturbance Woodland**

Lower disturbance levels has allowed these woodlands to become dense with saplings such as ash and hickory. The dense, shaded conditions and lack of disturbance has caused the ground flora to decrease in cover and diversity. However, many of the original herbaceous species persist as small plantlets or in the seed bank. Consequently, thinning of the woody species and the re-introduction of periodic disturbances has shown these communities to be exceptionally resilient, and a return, after a period of many years, to the reference condition is possible.

**State 3: Logged/Heavily Grazed Woodland**

Many of these sites have been subjected to heavy grazing by domestic livestock and periodic logging. These areas are more open with a diminished ground flora. In addition, grazed areas exhibit a lower diversity of native ground flora species and an increase of invasive natives such as buck brush and greenbrier. Restricting livestock access and eliminating logging will be necessary for successful restoration.

**State 4: Grassland**

Conversion of other states to non-native cool season species such as tall fescue and red 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. If oak sprouting is left unchecked and grazing is eliminated or reduced then over time this state will transition to a low disturbance woodland or to a logged/heavily grazed woodland.

**Reference State Plant Community**

Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	<i>Quercus alba</i>	5-10	40
BLACK OAK	<i>Quercus velutina</i>	5-10	50
CHINKAPIN OAK	<i>Quercus muehlenbergii</i>	20-40	50
POST OAK	<i>Quercus stellata</i>	10-20	50
SHAGBARK HICKORY	<i>Carya ovata</i>	10-20	50
SHUMARD OAK	<i>Quercus shumardii</i>	10-20	50
BLUE ASH	<i>Fraxinus quadrangulata</i>	10-20	40
WHITE ASH	<i>Fraxinus americana</i>	5-10	40

## Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height(ft)
AROMATIC SUMAC	<i>Rhus aromatica</i>	10-20	4
AMERICAN HAZELNUT	<i>Corylus americana</i>	10-20	5
DWARF HACKBERRY	<i>Celtis tenuifolia</i>	10-20	5
RED BUD	<i>Cercis canadensis</i>	10-20	12
CAROLINA BUCKTHORN	<i>Rhamnus caroliniana</i>	10-20	6

## Forbs

Common Name	Botanical Name	Cover % (low-high)
YELLOW PINPERNEL	<i>Taenidia integerrima</i>	5-20
ORANGE PUCCOON	<i>Lithospermum canescens</i>	5-20
BENT MILK VETCH	<i>Astragalus distortus</i>	5-20
BUTTERFLYWEED	<i>Asclepias tuberosa</i>	5-20
ELM-LEAVED GOLDENROD	<i>Solidago ulmifolia</i>	5-20
POINTED LEAF TICK-TREFOIL	<i>Desmodium glutinosum</i>	5-20
EASTERN BEEBALM	<i>Monarda bradburiana</i>	5-20
PURPLE CONEFLOWER	<i>Echinacea purpurea</i>	5-20
HAIRY SUNFLOWER	<i>Helianthus hirsutus</i>	5-20
BLAZING STAR	<i>Liatris aspera</i>	5-20

## Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
SLENDER WOODLAND SEDGE	<i>Carex digitalis</i>	10-20
OVAL-LEAF SEDGE	<i>Carex cephalophora</i>	10-20
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	10-30
WOODLAND BROME	<i>Bromus pubescens</i>	10-20
BOTTLEBRUSH GRASS	<i>Elymus hystrix</i>	10-20
VIRGINIA WILDRYE	<i>Elymus virginicus</i>	10-30

## Site Interpretations

## Wildlife

- Oaks provide hard mast for wildlife; scattered shrubs provide soft mast; frequent bedrock outcrops provide reptile habitat and a patchier ground flora.
- Sedges and native grasses provide green browse; native grasses on dry sites provide 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.
- Bird species associated with Limestone/Dolomite Woodlands include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, and Red-eyed Vireo.
- Reptiles and amphibians associated with mature Limestone/Dolomite Woodlands include: ornate box turtle, northern fence lizard, five-lined skink, coal skink, broad-headed skink, six-lined racerunner, western slender glass lizard, prairie ring-necked snake, flat-headed snake, rough earth snake, red milk snake, western pygmy rattlesnake, and timber rattlesnake.

### Forestry

- **Management:** Estimated site index values range from 45 to 50 for oak. Timber management opportunities are fair. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool is an effective management tool for this site. Favor post oak, black oak, chinkapin oak, and Shumard oak.
- **Limitations:** Coarse fragments throughout the soil profile; bedrock is within 40 inches. Surface stones and rocks are problems for efficient and safe equipment operation and will make equipment use somewhat difficult. Disturbing the surface excessively in harvesting operations and building roads increases soil losses, which leaves a greater amount of coarse fragments on the surface. Hand planting or direct seeding may be necessary. Seedling mortality due to low available water capacity may be high. Mulching or providing shade can improve seedling survival. Mechanical tree planting will be limited. 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

MDC, 2006. Missouri Forest and Woodland Community Profiles. Missouri Department of Conservation, Jefferson City, Missouri.

Natural Resources Conservation Service. 2002. Woodland Suitability Groups. Missouri FOTG, Section II, Soil Interpretations and Reports. 30 pgs.

Natural Resources Conservation Service. Site Index Reports. Accessed May 2014.  
[https://esi.sc.egov.usda.gov/ESI\\_Forestland/pgFSWelcome.aspx](https://esi.sc.egov.usda.gov/ESI_Forestland/pgFSWelcome.aspx)

NatureServe, 2010. Vegetation Associations of Missouri (revised). NatureServe, St. Paul, Minnesota.

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.

Young, Fred J., Caryl A. Radatz, & Curtis A. Marshall. 2003. Soil Survey of Boone County, Missouri. U.S. Dept. of Agric. Natural Resources Conservation Service.