

## *Ecological Site Description*

### **Igneous Protected Backslope Forest**

**F116CY004MO**

- (*Quercus alba* - *Quercus rubra*/*Cornus florida*/*Podophyllum peltatum* - *Desmodium nudiflorum*)
- (white oak – northern red oak/flowering dogwood/May apple – naked ticktrefoil)

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:** 116C – St. Francois Knobs and Basins

### **Introduction**

The St Francois Knobs and Basins (area outlined in red on the map) is the structural center of the Ozark Dome. Elevation ranges from about 450 feet along the rivers in the southern part of the area, to 1,772 feet on the summit of Taum Sauk Mountain, the highest point in Missouri. Prominent features of this MLRA are the Precambrian igneous knobs and hills that rise conspicuously to various elevations, interspersed with smooth-floored basins and valleys overlying dolomite and sandstone. Ecological Sites defined for this MLRA are associated with the igneous parent materials, either in knob or basin positions. Areas influenced primarily by dolomite and/or sandstone are included in ecological sites within MLRA 116A (Ozark Highlands).



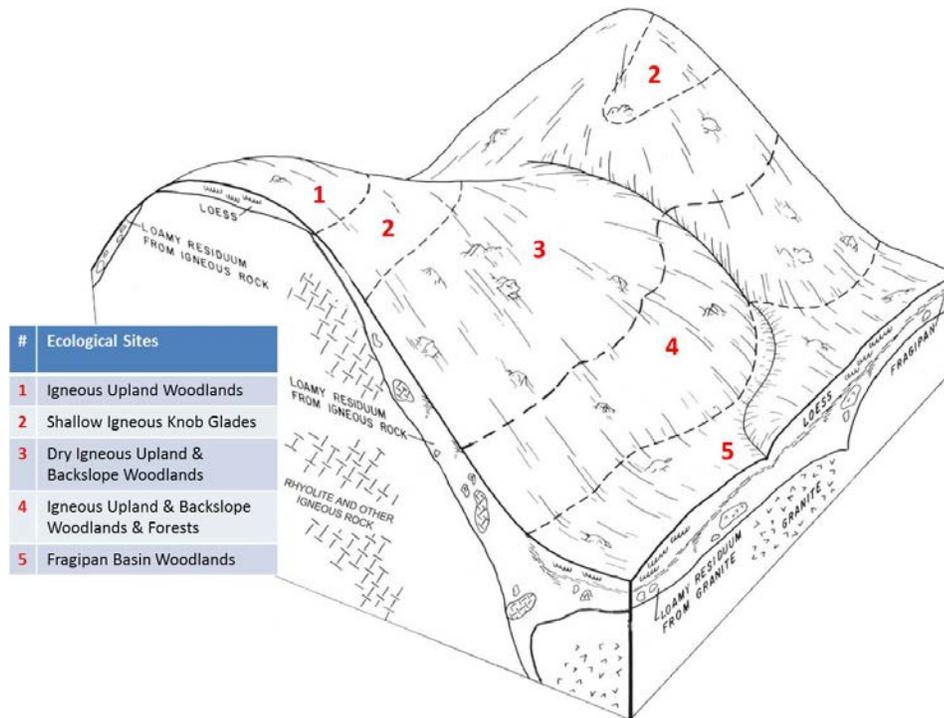
Igneous Protected Backslope Forests are within the green areas on the map. They occupy the northerly and easterly aspects of steep, dissected slopes, and are mapped in complex with the

Igneous Exposed Backslope Woodland ecological site. These sites occur throughout the area, and on outlying igneous knobs in adjacent counties. Soils are deep, with abundant volcanic rock fragments, and are low in bases. These sites are often downslope from Dry Igneous Upland Woodland ecological sites, which have root-restricting bedrock in the upper part of the soil profile, as do the upslope Shallow Igneous Knob Glade sites. Vegetation of the reference state is forest with a well-developed canopy dominated by white oak and red oak, a structurally diverse understory and an abundant forest ground flora.

### **Physiographic Features**

This site is on upland backslopes with slopes of 15 to 45 percent. It is on protected aspects (north, northeast, and east), which receive significantly less solar radiation than the exposed aspects. The

site receives runoff from upslope summit and shoulder sites, and generates runoff to adjacent, downslope ecological sites. This site does not flood.



The adjacent figure (adapted from Simmons et al., 2006) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the igneous uplands. The site is within the area labeled “4”, on the lower, steeper backslope positions.

**Soil Features**

These soils have acidic subsoils that are low in bases. Some soils have a fragipan rooting barrier at about 24

inches. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium over residuum weathered from acid igneous rock such as granite and diorite. They have gravelly to very gravelly and cobbly silt loam surface horizons, and subsoils with moderate to high amounts of volcanic gravel and cobbles. They are not affected by seasonal wetness. Soil series associated with this site include Frenchmill, Killarney, and Mudlick.

**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.*

Among the igneous knobs, Igneous Protected Backslope Forests occur in the most protected landscape positions on lower, steep slopes. Igneous Protected Backslope Forest have a well-developed forest canopy (70 to 90 feet tall and 90 to 100 percent canopy cover) dominated by white oak and red oak, a structurally diverse understory and an abundant forest ground flora. While the upland knobs and woodlands had an estimated fire frequency of 3 to 5 years, these igneous forests burned less frequently (estimated 10 to 25 years) and with lower intensity.

Historically, grazing by large native herbivores, such as bison, elk, and deer, kept understory conditions more open. In addition, these forests were subject to occasional disturbances from wind and ice, which periodically opened the canopy up by knocking over trees or breaking substantial branches of canopy trees. Such canopy disturbances allowed more light to reach the ground and favor reproduction of the dominant oak species.

Today, these communities have undergone repeated timber harvest and some domestic grazing. Most existing occurrences have a younger (50 to 80 years) canopy layer whose composition may have been altered by timber harvesting practices. An increase in hickories over historic conditions is common. The absence of periodic fire would have allowed more shade-tolerant tree species, such as red maple or hickories to increase in abundance.

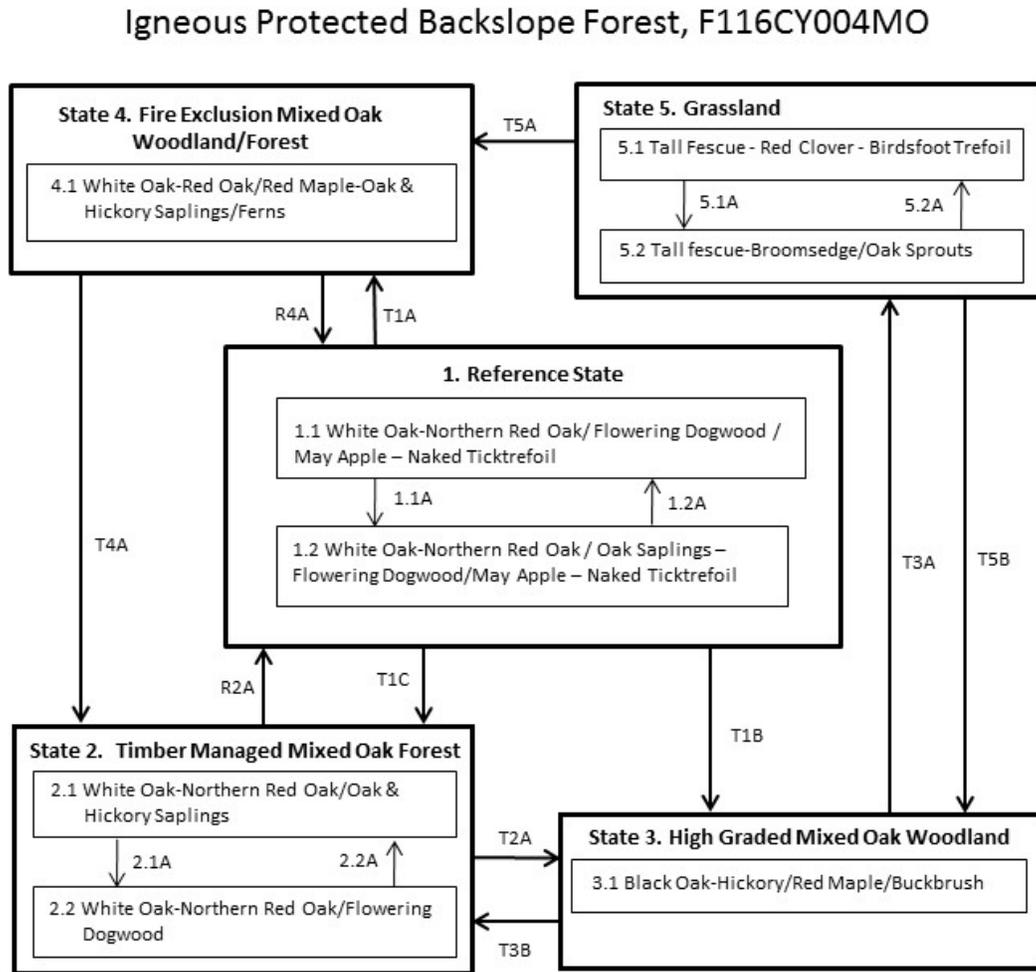
Uncontrolled domestic grazing has also diminished the diversity and cover of woodland ground flora species, and has often introduced weedy species such as gooseberry, buckbrush, poison ivy and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and erosion related to grazing can lower site productivity.

Igneous Protected Backslope Forests are relatively productive timber sites. Timber harvest in this region typically is done using single-tree selection, and often results in removal of the most productive trees, or high-grading of the stand. This can result in poorer quality timber and a shift in species composition away from more valuable oak species. Carefully planned single tree selection or the creation of group openings can help regenerate more desirable oak species and increase vigor on the residual trees. Clear-cutting results in dense, even-aged stands of primarily oak. This may be most beneficial for existing stands whose composition has been highly altered by past management practices. However, without some thinning of the dense stands, the ground flora diversity can be shaded out and productivity of the stand may suffer.

Prescribed fire can play a beneficial but limited role in the management of this ecological site. The higher productivity of these sites makes it more challenging than on other forest sites in the region. Control of woody species will be more difficult. Protected aspect forests did evolve with some fire, but their composition often reflects more closed, forested conditions, with fewer woodland ground flora species that can respond to fire. While having protected sites in a burn unit is acceptable, targeting them solely for woodland restoration is not advisable.

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**



Code	Event/Process
T1A	Fire suppression
T1B, T2A, T5B	Logging – high grading; some grazing
T3A	Clearing; grassland seeding; grassland management
T1C, T4A, 2.2A	Managed forest harvesting; fire suppression
1.1A	Fire-free interval 25+ years
1.2A	Fire interval 10-25 years
2.1A	20-30 years of limited logging disturbance
5.1A	Over grazing; no fertilization
5.2A	Brush management; grassland seeding; grassland management
R2A, R4A	Selective thinning and prescribed fire interval 10-25 years
T3B	Logging cessation; selective thinning
T5A	Cessation of grazing & haying; native tree, forb and grass planting

## **Ecological States**

### **State 1 - Reference**

The historical reference state for this ecological site was old growth oak forest. This state was dominated by white oak, northern red oak, with occasional black oak, and shortleaf pine. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind and ice maintained the reference structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species. Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency. Reference sites are rare today.

Most of these sites have been subject to repeated, high-graded timber harvest (State 3). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora (State 4). Relatively few igneous forests have been managed effectively for timber harvest (State 2), resulting in either even-age or uneven-age forests.

### **State 2 - Timber Managed Mixed Oak Forest**

Periodic timber management, along with the absence of fire, will maintain this state. Continued exclusion of prescribed without a regular 15 to 20 year harvest re-entry into these stands, will slowly create an increase in more shade tolerant species. White oak will become less dominant and mid-story species such as flowering dogwood and hickory will become more dominant and cause a transition to community phase 2.2.

### **State 3 - High Graded Mixed Oak Woodland**

This state is subjected to repeated, high-graded timber harvests resulting in a significant reduction in white oak densities. Fire cessation has also occurred. This state exhibits an over-abundance of black oak and hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The canopy is somewhat open. Some intermittent uncontrolled domestic livestock grazing may also occur further degrading the site. Proper forest management techniques can cause a transition to State 4.

### **State 4 - Fire Excluded Mixed Oak Forest**

This state is dominated by white and northern red oaks. They can form relatively even-age stands, dating to when fire suppression became the dominant management characteristic on the site. This stage can occur relatively quickly (20 to 25 years). Canopy closures can approach 80 to 90 percent with decreasing ground flora. Without active management or long term presence of fire, woody species will continue to encroach into these woodlands. Once established, these woody species can quickly fill the forest system. Most occurrences of this state today are dense and shady with a greatly diminished ground flora. Some logging typically occurs. They are excellent wildlife sites. Removal of the younger understory, opening the upper canopy, and the application of periodic prescribed fire (10 to 25 years) has proven to be effective management tools in restoring the stage back to the reference state.

### **State 5 - Grassland**

Conversion of forested sites to planted, non-native grassland species such as tall fescue is a stage that is primarily associated with upper slope positions of this ecological site. If active grassland

management is discontinued, the site will eventually transition to Phase 5.2 with an increase in broomsedge and oak sprouts. Return to the reference state from this state may be impossible requiring a very long term series of management options and stages. Many species may need to be eventually planted or reseeded to restore the system.

Studies on Ozark woodlands indicate that conversion to grassland may result in soil loss from the clearing process and from erosion before the grassland is well established. Long-term grassland management results in higher soil pH levels and higher levels of calcium and magnesium from pasture liming. These effects may extend a foot or more into the soil profile. The effects of liming are more evident in phase 5.1 (Tall fescue – red clover).

## Reference State Plant Community

### Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	<i>Quercus alba</i>	20-40	80
BLACK OAK	<i>Quercus velutina</i>	10-20	90
NORTHERN RED OAK	<i>Quercus rubra</i>	20-40	90
MOCKERNUT HICKORY	<i>Carya tomentosa</i>	10-20	80
BLACK GUM	<i>Nyssa sylvatica</i>	10-20	70
SHORTLEAF PINE	<i>Pinus echinata</i>	0-5	80
PIGNUT HICKORY	<i>Carya glabra</i>	5-20	60

### Understory Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
RED MAPLE	<i>Acer rubrum</i>	10-20	40
FLOWERING DOGWOOD	<i>Cornus florida</i>	10-20	30
DOWNY SERVICEBERRY	<i>Amelanchier arborea</i>	10-20	20

### Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WITCH HAZEL	<i>Hamamelis virginiana</i>	5-20	6
AROMATIC SUMAC	<i>Rhus aromatica</i>	10-30	5
LOW BUSH BLUEBERRY	<i>Vaccinium angustifolium</i>	5-20	3

### Forbs

Common Name	Botanical Name	Cover % (low-high)
NAKED FLOWER TICKTREFOIL	<i>Desmodium nudiflorum</i>	5-10
BLACK BUGBANE	<i>Actaea racemosa</i>	5-10
VIRGINIA SNAKEROOT	<i>Aristolochia serpentaria</i>	5-10
LARGE BELLWORT	<i>Uvularia grandiflora</i>	5-10
WAKE ROBIN	<i>Trillium sessile</i>	5-10
SPRING BEAUTY	<i>Claytonia virginica</i>	5-10
WHITE TROUT LILY	<i>Erythronium albidum</i>	5-10
SHINNING BEDSTRAW	<i>Galium concinnum</i>	5-10
MAY APPLE	<i>Podophyllum peltatum</i>	5-10

Ferns

Common Name	Botanical Name	Cover % (low-high)
RATTLESNAKE FERN	<i>Botrychium virginianum</i>	0-5
CHRISTMAS FERN	<i>Polystichum acrostichoides</i>	0-5

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
RIBBED SEDGE	<i>Carex virescens</i>	5-10

**Site Interpretations**

*Wildlife*

- Wild turkey, white-tailed deer, and eastern gray squirrel depend on hard and soft mast food sources and are typical upland game species of this type.
- Bird species associated with late-successional ecological sites include Worm-eating warbler, Whip-poor-will, Great Crested Flycatcher, Ovenbird, Pileated Woodpecker, Wood Thrush, Red-eyed Vireo, Northern Parula, Louisiana Waterthrush (near streams), and Broad-winged Hawk.
- Reptile and amphibian species include: ringed salamander, spotted salamander, marbled salamander, central newt, long-tailed salamander, dark-sided salamander, southern red-backed salamander, three-toed box turtle, western worm snake, western earth snake, and American toad.

*Forestry*

- Management: Field measured site index values range from 53 for northern red oak and 55 for white oak. Timber management opportunities are generally good. Create group openings of at least 2 acres. 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 could have a negative impact on timber quality, and should be used with caution on a particular site if timber management is the primary objective. Favor white oak, northern red oak, and black oak.
- Limitations: Large amounts of coarse fragments throughout profile; bedrock or a restrictive root layer may be within 60 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 created by cooling and crystallization of magma forming igneous rock. 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

Missouri Department of Conservation. 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.

Simmons, M., J. D. Childress, K. Godsey, & R. Taylor. 2006. Soil Survey of Reynolds County, Missouri. U.S. Dept. of Agric. Natural Resources Conservation Service.