

Ecological Site Description

Loamy Sinkhole Woodland

F116AY043MO

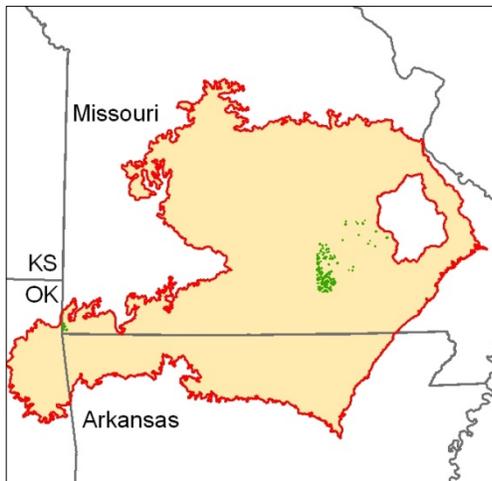
- (*Quercus velutina* - *Quercus alba*/Vaccinium/*Elymus virginicus* - *Carex pensylvanica*)
- (black oak – white oak/blueberry/ Virginia wild rye – Pennsylvania sedge)

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: 116A – Ozark Highland

Introduction

The Ozark Highland (area outlined in red on the map) constitutes the Salem Plateau of the Ozark



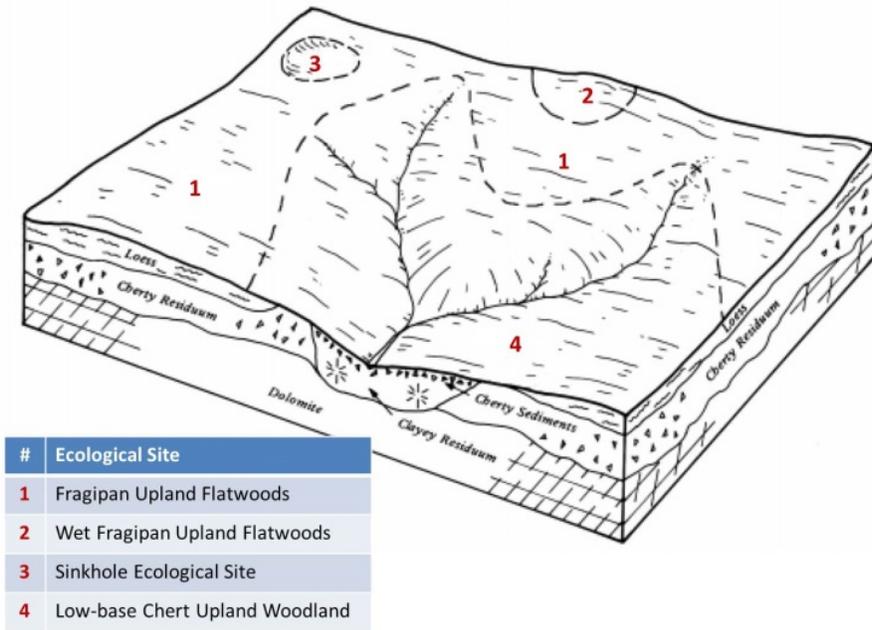
Uplift. Elevation ranges from about 300 feet on the southeast edge of the Ozark escarpment, to about 1,600 feet in the west, adjacent to the Burlington Escarpment of the Springfield Plateau. The underlying bedrock is mainly horizontally bedded Ordovician-aged dolomites and sandstones that dip gently away from the uplift apex in southeast Missouri. Cambrian dolomites are exposed on deeply dissected hillslopes. In some places, Pennsylvanian and Mississippian sediments overlie the plateau. Relief varies from the gently rolling central plateau areas to deeply dissected hillslopes associated with drainageways such as the Current and Eleven Point Rivers.

Loamy Sinkhole Woodlands (green areas on the map) occur in small, scattered delineations, primarily in the central Ozark Highland counties of Shannon and Reynolds in Missouri. Soils are very deep, and are loamy throughout.

Physiographic Features

This site is on sinkholes with slopes of 0 to 8 percent. The site receives runoff from the adjacent uplands, and is subject to rare ponding in the winter months.

The following figure (adapted from Sturdevant et al, 2001) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “3” on the figure. Loamy Sinkhole Woodland sites are associated with a variety of other upland ecological sites formed over dolomite bedrock.



Soil Features

These soils have no rooting restriction. The soils were formed under a mixture of herbaceous and woodland vegetation. Organic matter content is variable. Parent material is colluvium. They have silt loam surface horizons, and loamy subsoils. They are not affected by seasonal wetness. Soil series associated with this site include Cornwall, Horneybuck, and Pembroke.

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.

Loamy Sinkhole Woodlands are variable, but are typically a well-developed woodland dominated by an overstory of black oak and white oak. The canopy is moderately tall (65 to 80 feet) and somewhat open (65 to 85 percent closure). Increased light from the open canopy causes a diversity of woodland ground flora species to flourish. In deeper sinks, more moisture loving species are added and productivity may increase. 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 burned at least once every 5 to 10 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

Loamy Sinkhole Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores. 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.

Today, these ecological sites have been cleared and converted to pasture or have undergone repeated timber harvest and domestic grazing. Most existing forested ecological sites have a younger (50 to 80 years) canopy layer whose species composition and quality has been altered by timber harvesting practices.

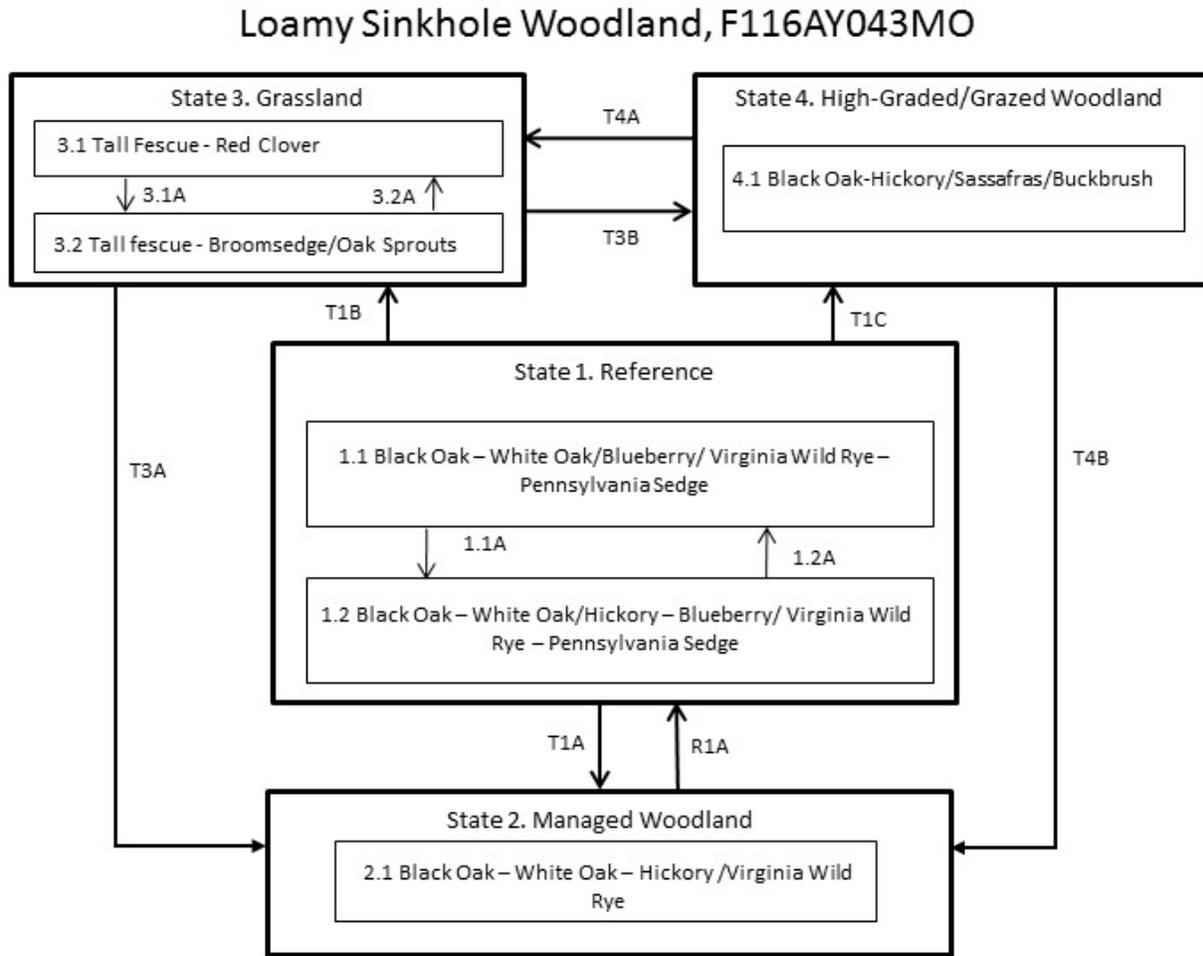
In the long term absence of fire, woody species, especially hickory and sugar maple, encroach into these woodlands. Once established, these woody plants can quickly fill the existing understory increasing shade levels with a greatly diminished ground flora. Removal of the younger understory and the application of prescribed fire have proven to be effective restoration means.

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. Grazed sites also have a more open understory. In addition, soil compaction and soil erosion from grazing can be a problem and lower site productivity.

These ecological sites are moderately productive. Oak regeneration can be problematic. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects. Single tree selection timber harvests are common in this region and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the creation of group openings can help regenerate and maintain more desirable oak species and increase vigor on the residual trees. Clearcutting also occurs and results in dense, even-aged stands dominated by 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 and the application of prescribed fire, the ground flora diversity may 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



Code	Event/Process
T1A	Forest management; harvesting; fire suppression
T1B, T4A	Clearing; forage planting; grassland management
T1C	Poorly planned harvest; uncontrolled grazing; fire suppression
T3A	Tree planting; long-term succession; no grazing; forest stand improvement
T3B	Abandonment (>40 years); grazing; logging
T4B	Forest stand improvement; no grazing

Code	Event/Process
1.1A	No disturbance (10+ yrs)
1.2A	Disturbance (fire, wind, ice) < 10 yrs
3.1A	Over grazing; no fertilization
3.2A	Brush management; grassland seeding; grassland management

Code	Event/Process
R1A	Prescribed fire; extended rotations; forest stand improvement

Ecological States

State 1: Reference

The historical reference state for this ecological site was dominated by black oak, post oak and white oak. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the woodland 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 states are rare today. Many sites have been converted to grassland. Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing. Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many sites have been managed effectively for timber harvest, resulting in managed woodlands.

State 2: Managed Woodland.

These woodlands tend to be rather dense, with a low diversity understory and ground flora. Composition is also likely altered from the reference state depending on tree selection during harvest. Thinning can increase overall tree vigor and improve understory diversity. However, in the absence of fire, the diversity and cover of the ground flora is still diminished. Continual proper timber management, depending on the practices used, will maintain this state. Without periodic disturbance, stem density and fire intolerant species, like hickory, increase in abundance.

State 3: Grassland

Conversion of woodlands to planted, non-native cool season grassland species such as tall fescue is common for this region. Surface fragments, low organic matter contents and soil acidity make grasslands harder to maintain in a healthy, productive state on this ecological site.

Two community phases are recognized in the grassland state, with shifts between phases based on types of management. Poor management will result in a shift to *Community 3.2* that shows an increase in oak sprouting and increases in broomsedge densities.

State 4: High-Graded/Grazed Woodland

States that were subjected to repeated, high-grading timber harvests and uncontrolled domestic grazing transitioned to a High-Graded Grazed Woodland state. This state exhibits an over-abundance of hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The existing vegetation offers little nutritional value for cattle, and excessive cattle stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Two common transitions from this state are woody clearing and conversion to State 3, grassland or removing livestock, limited harvesting, and allowing long term succession to occur to some other woodland state.

Reference State Plant Species

Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	<i>Quercus alba</i>	30-40	70
MOCKERNUT HICKORY	<i>Carya tomentosa</i>	10-20	60
SHAGBARK HICKORY	<i>Carya ovata</i>	10-20	60
BLACK OAK	<i>Quercus velutina</i>	30-40	80
POST OAK	<i>Quercus stellata</i>	5-10	50

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
FRAGRANT SUMAC	<i>Rhus aromatica</i>	10-20	5
LOWBUSH BLUEBERRY	<i>Vaccinium angustifolium</i>	10-20	3
FARKELBERRY	<i>Vaccinium arboreum</i>	10-20	6

Forbs

Common Name	Botanical Name	Cover % (low-high)
PRAIRIE BUSH CLOVER	<i>Lespedeza violacea</i>	5-10
BRISTLY SUNFLOWER	<i>Helianthus hirsutus</i>	5-20
SMOOTH BLUE ASTER	<i>Symphyotrichum laeve</i>	10-20
ELM-LEAVED GOLDENROD	<i>Solidago ulmifolia</i>	5-30
NAKED FLOWER TICK TREFOIL	<i>Desmodium nudiflorum</i>	10-20
WILD QUININE	<i>Parthenium integrifolium</i>	10-15
WHORLED MILKWEED	<i>Asclepias quadrifolia</i>	5-10
PURPLE CONE FLOWER	<i>Echinacea purpurea</i>	10-15
SLENDER LESPEDEZA	<i>Lespedeza virginica</i>	10-15
CANADIAN BLACKSNAKEROOT	<i>Sanicula canadensis</i>	5-20

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
WOODLAND BROME	<i>Bromus pubescens</i>	5-20
BOTTLEBRUSH GRASS	<i>Elymus hystrix</i>	5-20
PENNSYLVANIA SEDGE	<i>Carex pensylvanica.</i>	10-20
PANIC GRASS	<i>Panicum latifolium</i>	5-20
EASTERN STAR SEDGE	<i>Carex radiata</i>	5-20
ROCK MUHLY	<i>Muhlenbergia sobolifera</i>	5-20
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	5-20
BIG BLUESTEM	<i>Andropogon gerardii</i>	5-10
VIRGINIA WILD RYE	<i>Elymus virginicus</i>	10-30
PARASOL SEDGE	<i>Carex umbellata</i>	5-20

Site Interpretations

Wildlife

- Hard mast from the oaks, soft mast from shrubs, high nutrition seeds and forage is abundant in this ecological site. These food values and the two-tiered structure are attractive to abundant 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 this ecological site include Red-headed Woodpecker, Eastern Wood-Pewee, Broad-winged Hawk, Great-Crested Flycatcher, Summer Tanager, Red-eyed Vireo, and Yellow-billed Cuckoo.
- Amphibians and reptiles associated with ecological site include tiger salamander, small-mouthed salamander, ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, flat-headed snake, and rough earth snake.

Forestry

- **Management:** Estimated site index values range from 55 to 65 for oak. Timber management opportunities are 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 and black oak.
- **Limitations:** No major equipment restrictions or limitations exist. 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

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