

Ecological Site Description

Sandstone Upland Woodland

F115BY016MO

- (*Quercus alba* - *Quercus velutina*/*Vaccinium pallidum* - *Rhus aromatica*/*Schizachyrium scoparium* - *Desmodium*)
- (white oak – black oak/lowbush blueberry – aromatic sumac/little bluestem – tick trefoil)

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, MO in the east. Local relief varies from 10 to 20 feet in the major river floodplains, to 50 to 100 feet in the dissected uplands, with bluffs of 200 to 350 feet along the Mississippi and Missouri Rivers. Underlying bedrock is mainly Ordovician-aged dolomite and sandstone, with Mississippian-aged limestone north of the Missouri River.

Sandstone Upland Woodlands (green areas on the map) are in a few scattered upland locations in the Mississippi River watershed, not adjacent to the Mississippi River floodplain. Soils are typically moderately deep over sandstone bedrock, with an abundance of sandstone fragments in the subsoil.

Physiographic Features

This site is on upland summits, shoulders and backslopes with slopes of 3 to 15 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Skaer, 2004) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in uplands that are underlain by sandstone. The site is within the area labeled “3”, on hillslope shoulders and upper

backslopes. Loamy Upland Woodland sites underlain by sandstone are often upslope (labeled “2” on the figure), and Sandstone Backslope sites are typically downslope (labeled “4”). Shallow Sandstone Glade sites are usually closely associated with this site (labeled “1”), often as a narrow band or ledge.



Soil Features

These soils are underlain with sandstone bedrock at 20 to 40 inches deep. They have subsoils that are not low in bases. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium and residuum weathered from sandstone, overlying sandstone bedrock. They have sandy loam or loam surface layers. Subsoils are loamy and skeletal, with high amounts of sandstone fragments. These soils are not affected by seasonal wetness. Soil series associated with this site include Pevely.

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.

Sandstone Upland Woodlands are dominated by white oak with lesser amounts of black oak and post oak. The canopy is moderately tall (65 to 80 feet) but less dense (65 to 85 percent closure) than protected slopes and the understory is poorly developed with less structural diversity. Periodic disturbances from fire, wind and 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, especially hickories. 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 this system. It is likely that this ecological site 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.

Sandstone Upland 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 large native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction.

Today, these ecological sites have been cleared and converted to pasture or have undergone repeated timber harvest and domestic grazing. Most existing wooded 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, 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.

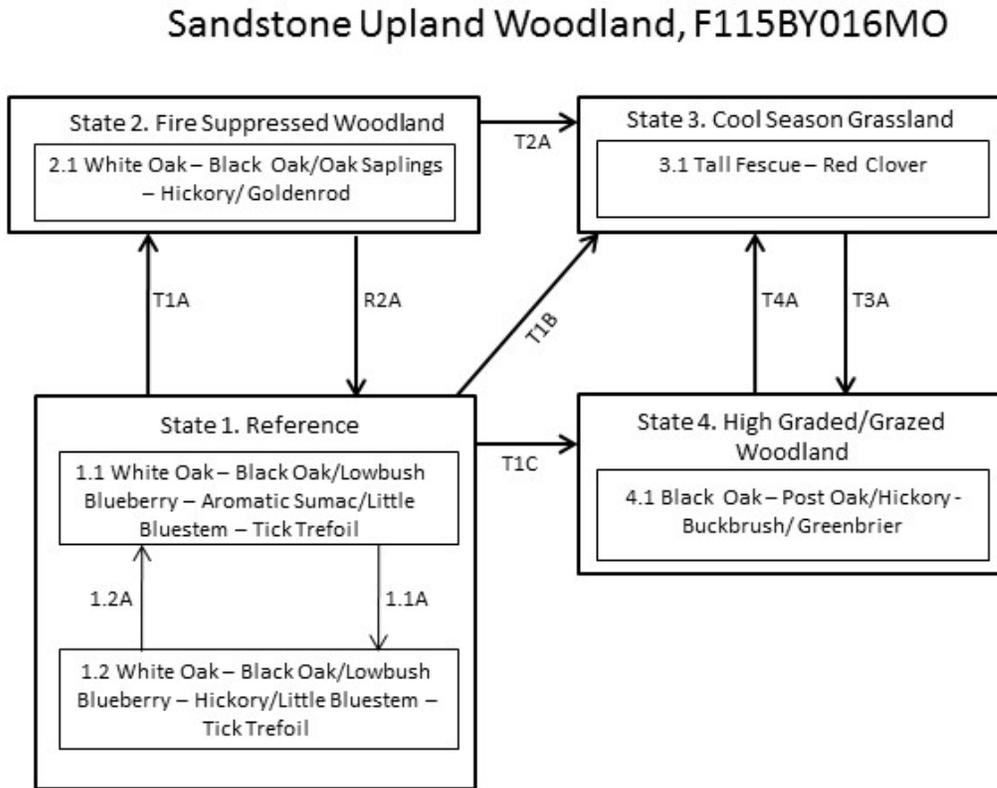
Uncontrolled domestic grazing has also impacted this community, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and soil erosion related to grazing can be a problem along with lower site productivity.

Site productivity is fair to moderate for timber production. Oak regeneration is typically problematic. Ironwood, red elm, and hickories can be dominant competitors in the understory. Maintenance of the oak component will require disturbances such as prescribed burning and careful harvesting that will encourage more sun adapted species and reduce shading effects.

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 can be shaded out and diversity of the stand may suffer.

A State and Transition Diagram follows. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases

Figure 1: State and transition diagram



Code	Event/Activity/Process
T1A	Fire suppression >30 years; woody invasion
T1B	Clearing; tillage; vegetative seeding; grassland management
T1C	Fire suppression; logging; grazing
T2A	Woody removal; tillage; vegetative seeding; grassland management
T4A	Clearing; vegetative seeding ; grassland and grazing management
T3A	Abandonment >30 years; uncontrolled grazing
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 5-10 years
R2A	Woody removal; prescribed fire 5-10 years; forest stand improvement

Ecological States

State 1: Reference

This state is native oak woodland dominated by white oak and black oak, with a variety of prairie forbs and grasses in the understory. 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 non-native pasture (State 3). Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing (State 4). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora (State 2).

State 2: Fire Suppressed Woodland

Degraded reference states that have experienced fire suppression and woody invasion for 20 or more years will transition to this state. With fire suppression, woody species such as black oak, post oak and hickory will begin to increase. Native herbaceous ground cover will also decrease.

State 3: Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue and red clover has been common in this area. Occasionally, these pastures will have scattered oaks. Long term uncontrolled grazing and a lack of grassland management can cause significant soil erosion and compaction and increases in less productive species such as Kentucky bluegrass and weedy forbs such as ironweed. A return to the reference state may be impossible, requiring a very long term series of management options.

State 4: High-Graded/Grazed Woodland

Wooded sites subjected to repeated, high-graded timber harvests and uncontrolled domestic grazing transition to this 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 vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff.

Reference State Plant Community

Canopy Trees

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

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
AROMATIC SUMAC	<i>Rhus aromatica</i>	10-30	4
LOWBUSH BLUEBERRY	<i>Vaccinium pallidum</i>	10-30	2

Forbs

Common Name	Botanical Name	Cover % (low-high)
BIRD'S FOOT VIOLET	<i>Viola pedata</i>	5-20
VIRGINIA SPIDERWORT	<i>Tradescantia virginiana</i>	5-20
MANY RAY ASTER	<i>Symphyotrichum anomalum</i>	5-20
NAKED FLOWER TICK TREFOIL	<i>Desmodium nudiflorum</i>	10-20
POINTED LEAF TICK TREFOIL	<i>Desmodium glutinosum</i>	10-20
PROSTRATE TICK TREFOIL	<i>Desmodium rotundifolium</i>	10-20
ELM-LEAVED GOLDENROD	<i>Solidago ulmifolia</i>	5-20
EASTERN BEEBALM	<i>Monarda bradburiana</i>	5-20
PURPLE CONEFLOWER	<i>Echinacea purpurea</i>	5-20
BRISTLY SUNFLOWER	<i>Helianthus hirsutus</i>	5-20
ST. ANDREW'S CROSS	<i>Hypericum hypericoides</i>	5-20
PARLIN'S PUSSYTOES	<i>Antennaria parlinii</i>	5-20
AMERICAN HOGPEANUT	<i>Amphicarpaea bracteata</i>	5-20

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
WHITETINGE SEDGE	<i>Carex albicans</i>	10-30
MUHLENBERG'S SEDGE	<i>Carex muehlenbergii</i>	10-30
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	30-50
WOODLAND BROME	<i>Bromus pubescens</i>	10-30
VARIABLE PANIC GRASS	<i>Panicum commutatum</i>	10-20
POVERTY GRASS	<i>Danthonia spicata</i>	10-20
VIRGINIA WILDRYE	<i>Elymus virginicus</i>	10-20
BOSCI'S PANICUM	<i>Panicum boscii</i>	10-20

Site Interpretations

Wildlife

- Oaks provide abundant hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food;
- Sedges and native cool-season grasses provide green browse; native warm-season grasses provide cover and nesting habitat; and a diversity of forbs provides a diversity and abundance of insects.
- Birds species associated with late successional to mature ecological sites are Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, Red-eyed Vireo, Rose-breasted Grosbeak, Yellow-billed Cuckoo, and Broad-winged Hawk.
- Reptile and amphibian species associated with open woodlands include ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, six-lined racerunner, flat-headed snake, rough earth snake, and timber rattlesnake.

Forestry

- **Management:** Estimated site index values for oak range from 50 to 55. Timber management opportunities are fair. Sandy and gravelly textures and lower available water affects tree growth and increases windthrow hazards. Harvest methods that leave some mature trees to provide shade and soil protection may be desirable. Restrict cuttings to group selection cuttings of 2 to 5 acres or single tree selections. These sites respond well to prescribed fire as a management tool. Where possible, favor black oak, southern red oak, white oak and post oak.
- **Limitations:** Lower available water capacity and lower fertility. Coarse fragments in lower profile; bedrock is within 40 inches. 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 percent

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

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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