USDA Natural Resources Conservation Service

Ecological site F116BY004MO
Low-Base Chert Upland Woodland

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

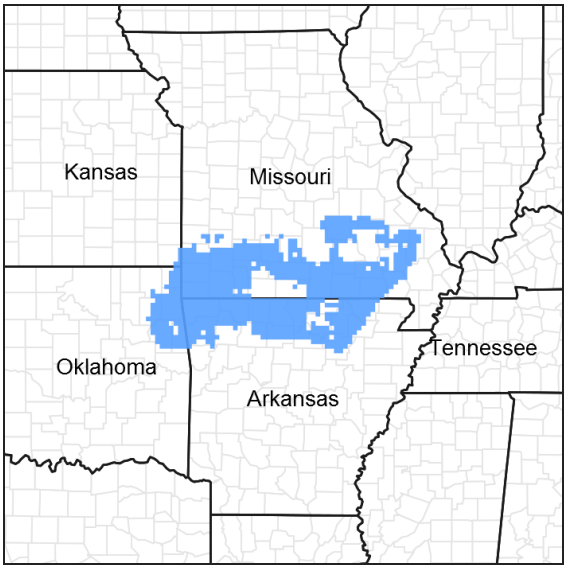


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 116B–Springfield Plain

The Springfield Plain 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.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Dry Chert Woodland.

Missouri Department of Conservation Forest and Woodland Communities (Missouri Department of Conservation, 2006):
The reference state for this ecological site is most similar to a Mixed Oak Woodland.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus stellata - Quercus marilandica - Quercus

velutina - Carya texana / Schizachyrium scoparium Woodland (CEGL002149).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily within the following Land Type Associations:
Spring River Prairie/Savanna Dissected Plain
Shoal Creek Oak Savanna/Woodland Low Hills
James River Oak Savanna/Woodland Low Hills
Sparta Oak Savanna Plain
Finley River Oak Savanna/Woodland Low Hills
Seymour Highland Oak Savanna/Woodland Dissected Karst Plain

Ecological site concept

NOTE: This is a “provisional” Ecological Site Description (ESD) that is under development. It contains basic ecological information that can be used for conservation planning, application and land management. As additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Low-base Chert Upland Woodlands occur mostly in the southern portion of the Springfield Plain on rolling hillslopes below the Plain surface, especially in the headwaters of Spring River and Shoal Creek, around the headwaters of the James River in the easternmost lobe of the Springfield Plain, and on the slopes of the lower James River watershed above Table Rock Lake. Soils are typically very deep, acidic, and low in bases such as calcium, with an abundance of chert fragments. The reference plant community is woodland with an overstory dominated by black oak and white oak, and a ground flora of native grasses and forbs.

Associated sites

F116BY001MO	**Fragipan Upland Woodland** Fragipan Upland Woodlands are often upslope on summits, particularly in watersheds with lower relief and broader interfluves.
F116BY010MO	**Low-Base Chert Protected Backslope Woodland** Low-base Chert Protected Backslope Woodlands are often downslope, on steep northern and eastern aspects.
F116BY017MO	**Gravelly/Loamy Upland Drainageway Woodland** Gravelly/Loamy Upland Drainageway Woodlands are downslope.
F116BY033MO	**Low-Base Chert Exposed Backslope Woodland** Low-base Chert Exposed Backslope Woodlands are often downslope, on steep southern and western aspects.

Similar sites

F116BY033MO	**Low-Base Chert Exposed Backslope Woodland** Low-base Chert Exposed Backslope Woodlands are similar in species composition but are found on steeper slopes.
F116BY005MO	**Low-Base Loamy Upland Woodland** Low-base Loamy Upland Woodland are found on gentler upland summit crests with slopes of 1 to 3 percent. Species composition may be similar but these sites are generally less productive.

Table 1. Dominant plant species

Tree	(1) *Quercus velutina* (2) *Quercus alba*
Shrub	(1) *Vaccinium*
Herbaceous	(1) *Carex* (2) *Schizachyrium scoparium*

Physiographic features

This site is on upland summit crests, 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 Aldrich, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “2”, on upland shoulders and upper backslopes. Fragipan Upland Woodland sites are often directly upslope, and are included within the area labeled “1”.

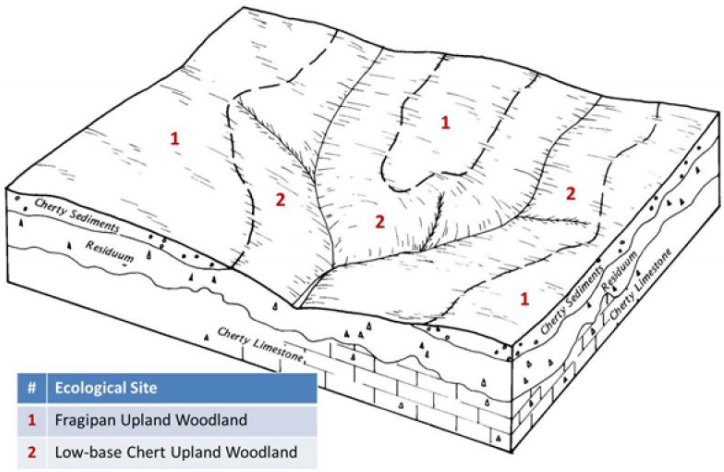


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Ridge (3) Hill
Flooding frequency	None
Ponding frequency	None
Slope	3–15%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

The Springfield Plain has a continental type of climate marked by strong seasonality. In winter, dry-cold air masses, unchallenged by any topographic barriers, periodically swing south from the northern plains and Canada. If they invade reasonably humid air, snowfall and rainfall result. In summer, moist, warm air masses, equally unchallenged by topographic barriers, swing north from the Gulf of Mexico and can produce abundant amounts of rain, either by fronts or by convectional processes. In some summers, high pressure stagnates over the region, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses.

The Springfield Plain experiences few regional differences in climates. The average annual precipitation in this area is 41 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 55 to 58 degrees F. The lower temperatures occur at the higher elevations. Mean July maximum temperatures have a range of only one or two degrees across the area.
Mean annual precipitation varies along a west to east gradient. Seasonal climatic variations are more complex. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages three to four times greater than January precipitation. Most of the rainfall occurs as high-intensity, convective thunderstorms in summer.

During years when precipitation comes in a fairly normal manner, moisture is stored in the top layers of the soil during the winter and early spring, when evaporation and transpiration are low. During the summer months the loss

of water by evaporation and transpiration is high, and if rainfall fails to occur at frequent intervals, drought will result. Drought directly affects plant and animal life by limiting water supplies, especially at times of high temperatures and high evaporation rates.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. In regions of appreciable relief, for example, air drainage at nighttime may produce temperatures several degrees lower in valley bottoms than on side slopes. At critical times during the year, this phenomenon may produce later spring or earlier fall freezes in valley bottoms. Deep sinkholes often have a microclimate significantly cooler, moister, and shadier than surrounding surfaces, a phenomenon that may result in a strikingly different ecology. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these un-vegetated surfaces may create distinctive environmental niches such as glades and cliffs. Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier than adjacent north- and-east-facing slopes. Finally, the climate within a canopied forest is measurably different from the climate of a more open grassland or savanna areas.

Source: University of Missouri Climate Center - http://climate.missouri.edu/climate.php; Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, United States Department of Agriculture Handbook 296 - http://soils.usda.gov/survey/geography/mlra/

Table 3. Representative climatic features

Frost-free period (characteristic range)	143-167 days
Freeze-free period (characteristic range)	181-192 days
Precipitation total (characteristic range)	1,143-1,219 mm
Frost-free period (actual range)	141-170 days
Freeze-free period (actual range)	181-193 days
Precipitation total (actual range)	1,143-1,219 mm
Frost-free period (average)	155 days
Freeze-free period (average)	187 days
Precipitation total (average)	1,168 mm

Climate stations used

- (1) MONETT 4SW [USC00235704], Monett, MO
- (2) NEOSHO [USC00235976], Neosho, MO
- (3) BILLINGS 1SW [USC00230657], Billings, MO
- (4) SELIGMAN [USC00237645], Seligman, MO

Influencing water features

Water features associated with this upland ecological site are influenced by karst landscapes throughout the area (see following graphic). Rainfall enters the groundwater system through the soil or by flowing into sinkholes and streams. Springs form where land drops low enough to meet underground water tables. Dissolution of carbonate rocks along fractures and faults has produced cave systems, sinkholes (closed and open), springs, and natural tunnels in the region. These sinkholes and losing streams can rapidly transfer water from upland recharge areas to spring outlets. The most common mechanism for groundwater recharge occurs by the relatively slow downward movement of water through soil and carbonate bedrock over a large area known as diffuse recharge, which maintains a high storage volume providing a consistent supply of water to springs. In addition to diffuse recharge, aquifers in karst terrain receive the relatively rapid transfer of water through sinkholes or losing streams connected by subsurface conduits. Surface water entering the aquifer in this fashion has very little contact with soil or rock and consequently the chemical nature of the water changes little in route. Discharge variability does not seem to be controlled by drainage area, but rather the conduit capacity of losing stream sections that can transport the entire volume of base-flow during dry periods in the year. High variability in base flow shows the impact of karst in the form of losing and gaining stream sections (Owen and Pavlowsky 2010).

The following graphic depicts the distribution of these karst-related features in the state of Missouri. Relative cave density per USGS 7.5" quadrangle is depicted by shades of red, deeper red signifying a larger number of caves in the quadrangle. Stretches of losing streams are shown in yellow. Known springs are shown as blue dots.

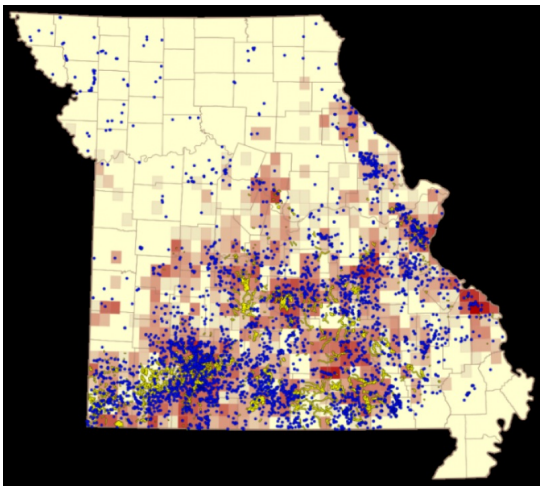


Figure 9. Image from Wikimedia Commons developed from the Missouri Department of Natural Resources, Division of Geology and Land Survey.

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 primarily from limestone. Surface horizon textures are very gravelly or very cobbly silt loam. Subsoils are skeletal, with high amounts of coarse fragments. These soils are not affected by seasonal wetness. Soil series associated with this site include Clarksville, Crackerneck, Jollymill, Nixa, Noark, Scholten, and Wilderness.

The accompanying picture of a roadcut in the Clarksville series shows a thin, light-colored surface horizon underlain by reddish loam with a high chert fragment content. Although rooting depth is high, as is shown in this picture, plants must be adapted to these low-base soils, which are high in soluble aluminum. Picture courtesy of John Preston.

Figure 10. Clarksville series

Table 4. Representative soil features

Parent material	(1) Residuum–cherty limestone

Surface texture	(1) Very gravelly silt loam (2) Gravelly silt loam (3) Extremely gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately slow
Soil depth	38–183 cm
Surface fragment cover <=3"	20–70%
Surface fragment cover >3"	0–25%
Available water capacity (0-101.6cm)	5.08–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	30–65%
Subsurface fragment volume >3" (Depth not specified)	0–40%

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 reference plant community is well developed woodland dominated by an overstory of black oak and white oak. The canopy of Low-Base Chert Upland Woodland is moderately tall (60 to 70 feet) but less dense (45 to 85 percent canopy) than protected slopes and Chert Upland Woodlands and with the understory poorly developed with low structural diversity. Increased light from the more open canopy causes a diversity of ground flora species to flourish. Extreme soil chertiness and low soil bases are unifying soil features of these ecological sites.

In addition, proximity to shallow soil glades and open woodlands provides additional opportunity for increased light and species diversity. 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.

This ecological site was also subjected to occasional disturbances from wind and ice, as well as grazing by large native herbivores, such as bison, elk and white-tailed 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 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, 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 coralberry, 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 only moderately productive, especially when compared to adjacent protected slopes and deeper loess covered units. Oak regeneration is typically problematic. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects.

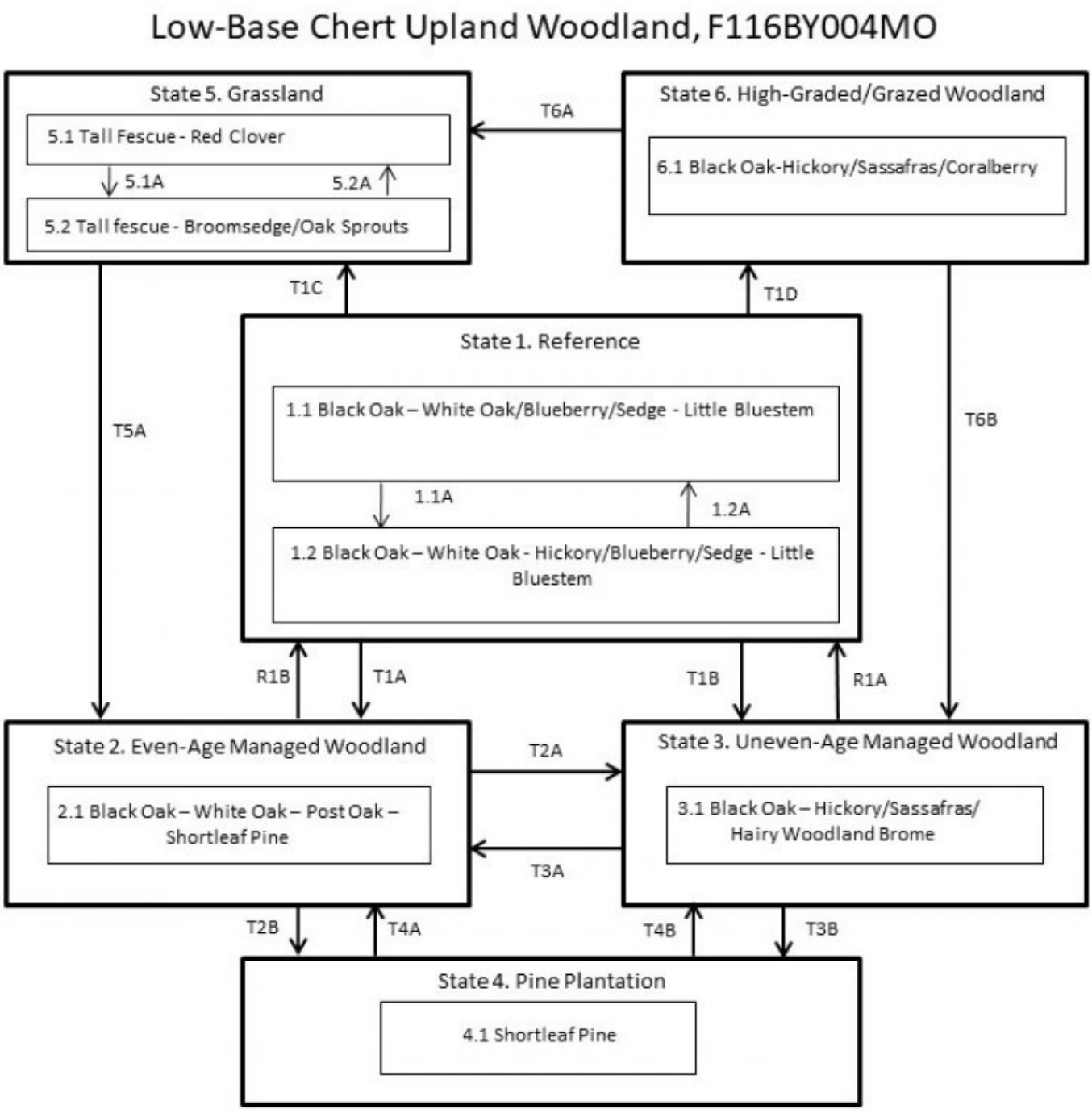
Single tree selection timber cutting is a common harvesting method and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the 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 prescribed burning the ground flora diversity can be shaded out and diversity of the stand may suffer. A number of sites in the 1950’s and 1960’s were cleared and planted to shortleaf pine. These sites typically lacked proper management and may now have significant oak densities in the understory.

Prescribed fire can play a beneficial role in the management of this ecological site. The higher productivity of these sites makes control of woody species somewhat more difficult. The inclusion of backslope sites in larger burn units can add to the habitat diversity of the landscape.

A state-and-transition model 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.

State and transition model



Code	Event/Process
T1A	Even-aged management
T1B	Fire suppression; uneven-age management
T2B, T3B	Prescribed fire; clearing; pine planting
T1C, T6A	Clearing; pasture planting; grassland management
T1D	Poorly planned harvest & uncontrolled grazing
T2A	Uneven-age management
T3A	Even-age management
T5A	Tree planting; long-term succession; no grazing
T6B	Even-age management; tree planting; no grazing
T4B	Uneven-age management; thinning; no fire
T4A	Even-age management; no fire; thinning

Code	Event/Process
1.1A	No disturbance (10+ yrs)
1.2A	Disturbance (fire, wind, ice) < 10 yrs
5.1A	Over grazing; no fertilization
5.2A	Brush management; grassland seeding; grassland management

Code	Event/Process
R1A	Prescribed fire & extended rotations
R1B	Uneven-age mgt, extended rotations

Figure 11. State and Transition Model for this ecological site.

State 1

Reference

The historical reference state for this Ecological Site was old growth oak woodland. The woodland was dominated by black oak, post oak and white oak. 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. Unaltered reference sites are rare today. Many sites have been converted to grassland (State 5). Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing (State 6). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many former reference sites have been managed effectively for timber harvest, resulting in either even-age (State 2) or uneven-age (State 3) woodlands.

Community 1.1
Black Oak - White Oak/Blueberry/Sedge - Little Bluestem

Forest overstory. White oak and black oak are typical overstory species. Other oak species and hickory are also usually present. Canopy cover can range from 50 percent to nearly 80 percent. The Overstory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Forest understory. Little bluestem dominates the dense ground layer. Numerous forbs and shrubs are also present and locally abundant. The Understory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Community 1.2
Black Oak - White Oak - Hickory/Blueberry/Sedge - Little Bluestem

Pathway 1.1A
Community 1.1 to 1.2

This pathway is a gradual transition that results from extended, disturbance-free periods of roughly 50 years or longer.

Pathway 1.2A
Community 1.2 to 1.1

This pathway results from ecological disturbances such as fire, ice storms, or violent wind storms. Historically, native grazers such as bison provided disturbance events as well.

State 2
Even-Age Managed Woodland

These woodlands tend to be rather dense, with a sparse understory and ground flora. Thinning can increase overall tree vigor and improve understory diversity. These woodlands tend to be rather dense, with a sparse understory and ground flora. 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 timber management, depending on the practices used, will either maintain this state, or convert the site to uneven-age (State 3) woodlands.

Dominant resource concerns

- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates

Community 2.1
Black Oak-White Oak-Post Oak-Shortleaf Pine

This woodland community has a simple, dense, single-tiered structure, with canopy height that varies with age, and

100% canopy closure. The understory and ground flora is depauperate. 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.

State 3
Uneven-Age Managed Woodland

Uneven-Age Managed Woodlands resemble their reference state. The biggest differences are tree age, most being only 50 to 90 years old and denser understories. Composition is also likely altered from the reference state depending on tree selection during harvest. Scarlet oak is often more abundant than historically. In addition, without a regular 15 to 20 year harvest re-entry into these stands, they will slowly increase in more shade tolerant species and white oak will become less dominant. Without periodic disturbance, stem density and fire intolerant species, like hickory, increase in abundance.

Dominant resource concerns

- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates

Community 3.1
Black Oak-Hickory/Sassafras/Woodland Brome

This woodland community has a multi-tiered structure, and 60-90% canopy closure.

State 4
Pine Plantation

Many areas were planted to plantations of shortleaf pine from the 1940’s to the early 1960’s. They are now mature plantations that are usually a mono-culture of a dense pine overstory with a brushy understory of oak and hickory and a dense carpet of shortleaf pine needles on the ground. They lack the diversity and structure. Restoration to phase 1.2 of the reference state is a long-term prospect, requiring extensive thinning, long-term prescribed fire, and perhaps planting of native ground flora species.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates

Community 4.1
Shortleaf Pine

State 5
Grassland

Conversion of woodlands to non-native cool season grassland species such as tall fescue has been common. Low available water, abundant surface fragments, low organic matter contents and soil acidity make non-native grasslands difficult to maintain in a healthy, productive state on this ecological site. Occasionally, these pastures will have scattered patches of tall, mature shortleaf pine. If grazing and pasture management is discontinued, oak sprouts will occur and the site will eventually transition to State 2. Forest stand improvement and tree planting practices can hasten this process.

Community 5.1
Tall Fescue - Red Clover

This is an herbaceous community that is typically dominated by tall fescue. Various other grass and forb species are typically present, in various amounts. Shrub and pioneer tree species such as eastern redcedar and black locust

typically invade sites that are not regularly managed.

Dominant resource concerns

- Terrestrial habitat for wildlife and invertebrates

Community 5.2
Tall Fescue - Broomsedge/Oak Sprouts

Dominant resource concerns

- Sheet and rill erosion
- Ephemeral gully erosion
- Nutrients transported to surface water
- Plant productivity and health
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

Pathway P5.1A
Community 5.1 to 5.2

Over grazing; no fertilization

Pathway P5.2A
Community 5.2 to 5.1

Brush management; grassland seeding; grassland management

State 6
High-Graded / Grazed Woodland

Timbered sites subjected to repeated, high-graded timber harvests and 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. Exclusion of cattle from sites in this state coupled with uneven-age management techniques will cause a transition to State 3 (Uneven-Age). This state will be transitioned to a grassland state through clearing and grassland planting or to a pine plantation through clearing, tree planting and fire control.

Community 6.1
Black Oak - Hickory/Sassafras/Coralberry

This woodland community has a multi-tiered structure, with irregular, variable canopy closure.

Transition T1A
State 1 to 2

This transition typically results from even-age forest management practices, such as clear-cut, seed tree or shelterwood harvest and fire suppression.

Transition T1B
State 1 to 3

This transition typically results from uneven-age forest management practices, such as clear-cut, seed tree or shelterwood harvest and fire suppression.

Transition T1C
State 1 to 5

This transition is the result of clearing the woodland community and planting pasture species. Soil erosion can be extensive in this process, along with loss of organic matter. Liming and fertilizing associated with pasture management typically raises the soil pH and increases the cation concentration (such as calcium and magnesium) of the upper soil horizons.

Transition T1D
State 1 to 6

This transition is the result of poorly planned timber harvest techniques such as high-grading, accompanied by unmanaged livestock grazing. Soil erosion and compaction often result from cattle grazing after the understory has been damaged.

Restoration pathway R1B
State 2 to 1

Restoration activities include uneven-age management; extended rotations; prescribed fire every 5-10 years

Transition T2A
State 2 to 3

This transition typically results from uneven-age forest management practices, such as single tree or group selection harvest.

Transition T2B
State 2 to 4

This transition is the result of the systematic application of prescribed fire. Mechanical thinning may also be used. Tree planting with shortleaf pine.

Restoration pathway R1A
State 3 to 1

This restoration pathway generally requires forest management practices with extended rotations that allow mature trees to exceed ages of about 100 years. Prescribed fire is part of the restoration process. Mechanical thinning may be necessary in dense woodlands.

Transition T3A
State 3 to 2

This transition typically results from even-age forest management practices, such as clear-cut, seed tree or shelterwood harvest.

Transition T3B
State 3 to 4

This transition is the result of the systematic application of prescribed fire. Mechanical thinning may also be used. Shortleaf pine tree planting.

Transition T4A
State 4 to 2

This transition typically results from even-age forest management practices, such as clear-cut, seed tree or shelterwood harvest and fire suppression.

Transition T4B
State 4 to 3

This transition typically results from even-age forest management practices, such as single tree or group selection harvest; thinning; fire cessation.

Transition T5A
State 5 to 2

This transition results from the cessation of livestock grazing and associated pasture management such as mowing and brush-hogging. Herbicide application, tree planting and forest stand improvement techniques can speed up this otherwise very lengthy transition.

Transition T6B
State 6 to 3

This transition typically results from uneven-age forest management practices, such as single tree or group selection harvest. Tree planting, mechanical thinning and other forest stand improvement techniques may be helpful to decrease the transition time.

Transition T6A
State 6 to 5

This transition is the result of clearing the woodland communities and planting pasture species. Soil erosion can be extensive in this process, along with loss of organic matter. Liming and fertilizing associated with pasture management typically raises the soil pH and increases the cation concentration (such as calcium and magnesium) of the upper soil horizons.

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
black oak	QUVE	*Quercus velutina*	Native	–	10–30	–	–
white oak	QUAL	*Quercus alba*	Native	–	10–30	–	–
post oak	QUST	*Quercus stellata*	Native	–	10–30	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	10–20	–	–
sassafras	SAAL5	*Sassafras albidum*	Native	–	10–20	–	–
shortleaf pine	PIEC2	*Pinus echinata*	Native	–	0–5	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	10–20
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	10–20
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	10–20
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	10–20
fuzzy wuzzy sedge	CAHI6	*Carex hirsutella*	Native	–	10–20
oval-leaf sedge	CACE	*Carex cephalophora*	Native	–	10–20
reflexed sedge	CARE9	*Carex retroflexa*	Native	–	10–20
Forb/Herb					
gray goldenrod	SONE	*Solidago nemoralis*	Native	–	5–20
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	–	5–20
narrowleaf mountainmint	PYTE	*Pycnanthemum tenuifolium*	Native	–	5–20
rue anemone	THTH2	*Thalictrum thalictroides*	Native	–	5–20
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	5–20
Virginia spiderwort	TRVI	*Tradescantia virginiana*	Native	–	5–20
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	5–20
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	5–20
smooth small-leaf ticktrefoil	DEMA2	*Desmodium marilandicum*	Native	–	5–20
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	5–20
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	5–20
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	5–20
fourleaf milkweed	ASQU	*Asclepias quadrifolia*	Native	–	5–20
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	–	5–20
Fern/fern ally					
rattlesnake fern	BOVI	*Botrychium virginianum*	Native	–	5–20
Shrub/Subshrub					
American bladdernut	STTR	*Staphylea trifolia*	Native	–	5–10
eastern redbud	CECA4	*Cercis canadensis*	Native	–	5–10
Blue Ridge blueberry	VAPA4	*Vaccinium pallidum*	Native	–	5–10
leadplant	AMCA6	*Amorpha canescens*	Native	–	5–10
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	5–10

Animal community

Wildlife (MDC 2006):
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.

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;

Post-burn areas can provide temporary bare-ground – herbaceous cover habitat important for turkey poults and quail chicks.

Bird species associated with early-successional woodlands are Northern Bobwhite, Prairie Warbler, Field Sparrow, Blue-winged Warbler, Yellow-breasted Chat, and Brown Thrasher.

Bird species associated with mid- to late successional woodlands 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 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.

Other information

Forestry (NRCS 2002; 2014):
Management: Field measured site index values average 59 for white oak and 64 for black 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 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, may not be fitting, or should be used with caution on a site if timber management is the primary objective.

Limitations: Large amounts of coarse fragments throughout profile; 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

Inventory data references

Potential Reference Sites: Low-Base Chert Upland Woodland

Plot COHOCA04 – Clarksville soil
Located in Compton Hollow CA, Webster County, MO
Latitude: 37.239579
Longitude: -92.996729

Plot STLACE_JK10 – Clarksville soil
Located in Stockton Lake COE/CA, Cedar County, MO
Latitude: 37.574096
Longitude: -93.66565

Plot TALBCA02 – Wilderness soil
Located in Talbot CA, Lawrence County, MO
Latitude: 37.18089
Longitude: -93.93289

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Contributors

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Approval

Nels Barrett, 10/06/2020

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Missouri Department of Conservation and Missouri Department of Natural Resources personnel provided significant and helpful field and technical support in the development of this ecological site.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	

Date	09/16/2020
Approved by	Nels Barrett
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
