USDA Natural Resources Conservation Service

Ecological site F116BY003MO 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-Mesic 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 alba - Quercus stellata - Quercus velutina /

Schizachyrium scoparium Woodland (CEGL002150).

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/Savannah Dissected Plain
Truman Lake Oak Woodland Hills
Stockton Prairie/Savannah Dissected Plain
Upper Sac River Oak Savannah/Woodland Low Hills
Little Sac River Oak Savanna/Woodland Low Hills
James River Oak Savannah/Woodland Low Hills
Finley River Oak Savanna/Woodland Low Hills
Sparta Oak Savanna 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”.

Chert Upland Woodlands are widely distributed on rolling hillslopes where streams have dissected the Springfield Plain, especially around Spring River and Center Creek in Jasper county, and Finley Creek, James River and the watershed of Stockton and Truman Lakes. They are often upslope from Chert Backslope woodland and forest ecological sites. Fragipan ecological sites are often on broader summits upslope from this site. Soils are typically very deep, with an abundance of chert fragments. The reference plant community is woodland with an overstory dominated by white oak and black oak and a ground flora of native grasses and forbs.

Associated sites

F116BY011MO	**Chert Limestone Protected Backslope Forest** Chert Limestone Protected Backslope Forests are often downslope where the depth to limestone bedrock is less than 40 inches, on steep northern and eastern aspects.
F116BY032MO	**Chert Exposed Backslope Woodland** Chert Exposed Backslope Woodlands are often downslope, on steep southern and western aspects.
F116BY034MO	**Chert Limestone Exposed Backslope Woodland** Chert Limestone Exposed Backslope Woodlands are often downslope where the depth to limestone bedrock is less than 40 inches, on steep southern and western aspects.
F116BY001MO	**Fragipan Upland Woodland** Fragipan Upland Flatwoods are often upslope, particularly in watersheds with lower relief and broader interfluves.
F116BY006MO	**Chert Limestone Upland Woodland** Chert Limestone Upland Woodlands are often downslope where the depth to limestone bedrock is less than 40 inches.
F116BY008MO	**Interbedded Sedimentary Upland Woodland** In areas where the Mississippian-aged Compton Formation occurs, Shale Upland Woodlands are adjacent or downslope.
F116BY009MO	**Chert Protected Backslope Forest** Chert Protected Backslope Forests are often downslope, on steep northern and eastern aspects.
R116BY024MO	**Shallow Limestone Upland Glade/Woodland** Shallow Limestone Upland Glade/Woodlands are often downslope, where the depth to limestone bedrock is less than 20 inches.

Similar sites

F116BY034MO	**Chert Limestone Exposed Backslope Woodland** Chert Limestone Exposed Backslope Woodlands have similar species composition but are underlain with limestone bedrock between 20 and 60 inches and are on steeper slopes.

F116BY006MO	**Chert Limestone Upland Woodland** Chert Limestone Upland Woodlands are also on summit and shoulder positions but are moderately deep.

Table 1. Dominant plant species

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

Physiographic features

This site is on upland summit crests, shoulders and backslopes with slopes of 1 to 15 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Aldrich, 2003) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “1”, on upland summit crests, shoulders and upper backslopes. This site may be associated with a variety of upland sites on the landscape. In the figure, the thickness of the residuum decreases on the backslopes, resulting in Chert Limestone Upland and Chert Limestone Backslope ecological sites, labeled “2”.

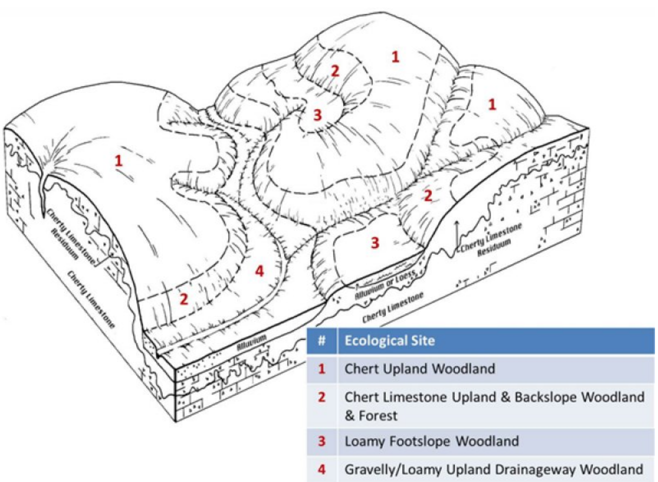


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Interfluve (3) Hill
Flooding frequency	None
Ponding frequency	None
Slope	1–15%
Water table depth	60 in
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 some 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 is normal, moisture is stored in the soil profile 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. Drought indirectly affects ecological communities by increasing plant and animal susceptibility to the probability and severity of fire. Frequent fires encourage the development of grass/forb dominated communities and understories.

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 that may result in a strikingly different vegetational composition and community structure. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these unvegetated surfaces create characteristic glade and cliff ecological sites. 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 ecological site is measurably different from the climate of the more open grassland or savanna ecological sites.

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)	161-163 days
Freeze-free period (characteristic range)	193-196 days
Precipitation total (characteristic range)	45 in
Frost-free period (actual range)	161-164 days
Freeze-free period (actual range)	192-197 days
Precipitation total (actual range)	45-46 in
Frost-free period (average)	162 days
Freeze-free period (average)	194 days
Precipitation total (average)	45 in

Climate stations used

- (1) CARTHAGE [USC00231356], Carthage, MO

- (2) BILLINGS 1SW [USC00230657], Billings, MO
- (3) STOCKTON DAM [USC00238082], Stockton, MO

Influencing water features

Water features associated with this upland ecological site are influenced by karst landscapes throughout the area (see following diagram). 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.

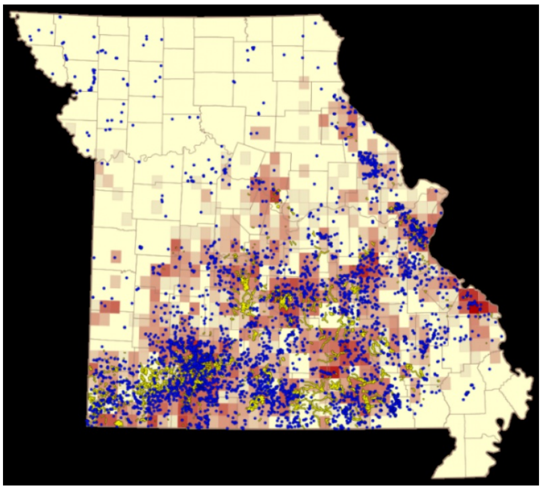


Figure 9. Image from Wikimedia Commons developed from the Missouri Department of Natural Resources, Division of Geology and Land Survey.

Soil features

These soils have no rooting restrictions, and subsoils are not low in bases. 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. They have gravelly or very gravelly silt loam surface horizons, and skeletal subsoils with high amounts of chert gravel and cobbles. These soils are not affected by seasonal wetness. Soil series associated with this site include Goss, Hailey, and Rueter.

The accompanying picture of the Goss series shows a thin, light-colored surface horizon underlain by very cobbly reddish clay. Scale is in inches. Picture from Henderson (2004).

Figure 10. Goss series

Table 4. Representative soil features

Parent material	(1) Residuum–cherty limestone
Surface texture	(1) Gravelly silt loam (2) Very gravelly silt loam
Family particle size	(1) Clayey
Drainage class	Well drained to excessively drained
Permeability class	Very slow to moderately slow
Soil depth	72 in
Surface fragment cover <=3"	25–45%
Surface fragment cover >3"	0–20%
Available water capacity (0-40in)	2–4 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–6.5
Subsurface fragment volume <=3" (Depth not specified)	35–70%
Subsurface fragment volume >3" (Depth not specified)	5–30%

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 white oak and black oak.

The canopy is moderately tall (60 to 75 feet) but less dense (45 to 85 percent canopy) than protected slopes and the understory is poorly developed with less structural diversity. Increased light causes a diversity of ground flora species to flourish. 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 Chert Upland Woodlands. 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 native large 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 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.

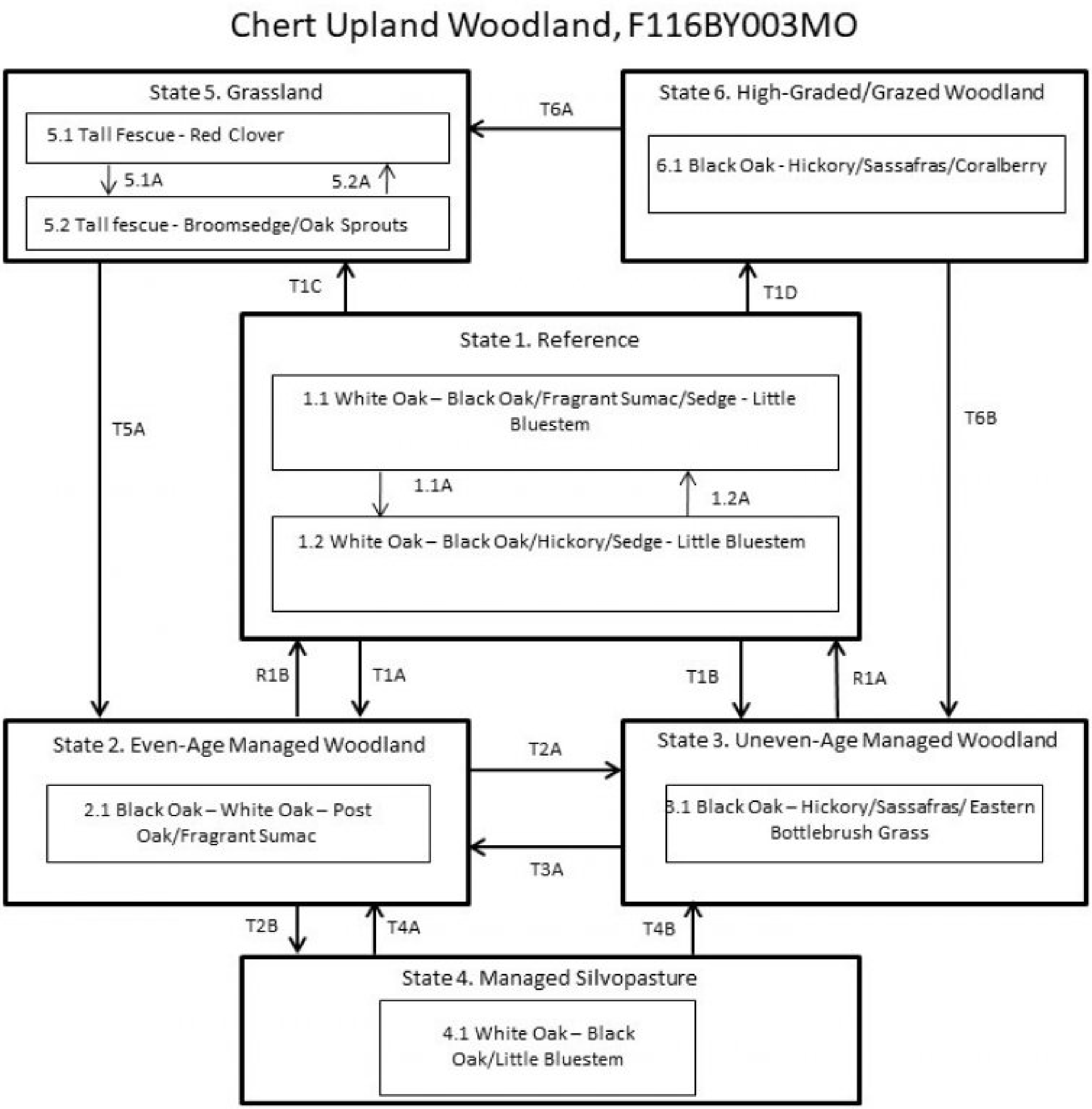
Domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as coralberry, gooseberry, and Virginia creeper. Grazed sites also have a more open understory. In addition, soil compaction and soil erosion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

Chert Upland Woodlands are moderately productive. Oak regeneration is typically problematic. Sugar maple, red elm, and hickory are often dominant competitors in the understory. 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 prescribed burning the ground flora diversity can be shaded out and diversity of the stand may suffer.

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	Prescribed fire; thinning; grazing management
T1C, T6A	Clearing & pasture planting
T1D	Poorly planned harvest & uncontrolled grazing
T2A	Uneven-age management
T3A	Even-age management
T5A	Tree planting; long-term succession; no grazing
T6B	Uneven-age management; tree planting
T4A	Uneven-age management; no grazing
T4B	Even-age management; no grazing

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 dominated by white oak and black 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. Reference states are rare today. Many sites have been converted to grassland (State 5). Others have been subject to repeated, high-graded timber harvest coupled with uncontrolled domestic livestock grazing (State 6). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Some former reference states have been managed effectively for timber harvests, resulting in either even-age (State 2) or uneven-age (State 3) woodlands.

Community 1.1
White Oak - Black Oak/Fragrant Sumac/Sedge - Little Bluestem

Forest overstory. 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. 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
White Oak - Black Oak/Hickory/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

This state can start with a sequence of early seral mixed oak woodlands, which mature over time. These woodlands tend to be rather dense, with a depauperate 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. Prescribed fire along with a more open canopy and prescribed grazing can transition this state to a Managed Silvopasture state (State 4).

Dominant resource concerns

- Plant structure and composition

Community 2.1
Black Oak-White Oak-Post Oak/Aromatic Sumac

This woodland community has a single-tiered structure, with canopy height that varies with age, and 80 to 100 percent 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 can resemble a reference state. The biggest difference is tree age, most sites being only 50 to 90 years old. Composition is also likely altered from the reference state depending on tree selection during harvest. 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. Uneven Age Managed Woodland is also denser because of fire suppression. Consequently, the woodland ground flora is more suppressed and structural diversity is not as well maintained. Without periodic disturbance, stem density and fire intolerant species, like sassafras and hickory, increase in abundance.

Dominant resource concerns

- Plant productivity and health
- Terrestrial habitat for wildlife and invertebrates

Community 3.1
Black Oak-Hickory/Sassafras/Bottlebrush grass

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

State 4
Managed Silvopasture

The Managed Silvopasture state results from managing woodland communities (States 2 or 3) with prescribed fire, canopy thinning, and controlled grazing. This state can resemble the reference state, but with younger maximum tree ages, more open canopies and lower ground flora diversity. Cessation of grazing and controlled harvesting will allow transition to various managed woodland states.

Community 4.1

White Oak-Black Oak/Little Bluestem

This woodland community has a single to two-tiered structure, and 70 to 90 percent canopy closure.

State 5
Grassland

Conversion of woodlands to planted, non-native cool season grassland species such as tall fescue is common for this region. Steep slopes, 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 5.2 that shows an increase in oak sprouting and increases in broomsedge densities. If grazing and active pasture management is discontinued, the site will eventually transition to State 2 from this phase.

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
- Plant productivity and health
- Plant pest pressure
- Terrestrial habitat for wildlife and invertebrates
- Feed and forage imbalance

State 6
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 5, Grassland or removing livestock, limited harvesting, and allowing long term succession to occur to some other woodland state.

Community 6.1
Black Oak-Hickory/Sassafras/Buckbrush

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 timber management practices, such as clear-cut, seed tree or shelterwood harvest.

Transition T1B
State 1 to 3

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

Restoration pathway R1A
State 1 to 4

This restoration pathway generally requires uneven-age timber management practices, such as single tree or group selection harvest, with extended rotations that allow mature trees to exceed ages of about 150 years. Prescribed fire is part of the restoration process.

Restoration pathway R1B
State 1 to 4

This restoration pathway generally requires uneven-age timber management practices, such as single tree or group selection harvest, with extended rotations that allow mature trees to exceed ages of about 150 years. Prescribed fire is part of the restoration process. Mechanical thinning may be necessary in dense woodlands.

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 cattle grazing. Soil erosion and compaction often result from cattle grazing after the understory has been damaged.

Transition T2A
State 2 to 3

This transition typically results from uneven-age timber 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.

Transition T3A
State 3 to 2

This transition typically results from even-age timber 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.

Transition T4A
State 4 to 2

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

Transition T4B
State 4 to 3

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

Transition T5A
State 5 to 2

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

Transition T6B
State 6 to 3

This transition typically results from uneven-age timber management practices, such as single tree or group selection harvest. Tree planting, mechanical thinning and other timber 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 (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white oak	QUAL	*Quercus alba*	Native	–	30–60	–	–
black oak	QUVE	*Quercus velutina*	Native	–	30–60	–	–
post oak	QUST	*Quercus stellata*	Native	–	10–30	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	10–20	–	–
sassafras	SAAL5	*Sassafras albidum*	Native	–	10–20	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	5–20
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	5–20
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	5–20
oval-leaf sedge	CACE	*Carex cephalophora*	Native	–	5–20
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	5–20
switchgrass	PAVI2	*Panicum virgatum*	Native	–	5–20
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	5–20
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	5–20
fuzzy wuzzy sedge	CAHI6	*Carex hirsutella*	Native	–	5–20
Muhlenberg's sedge	CAMU4	*Carex muehlenbergii*	Native	–	5–20
whitetinge sedge	CAAL25	*Carex albicans*	Native	–	5–20
Forb/Herb					
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	–	5–20
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	5–20
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	5–20
Virginia spiderwort	TRVI	*Tradescantia virginiana*	Native	–	5–20
smooth small-leaf ticktrefoil	DEMA2	*Desmodium marilandicum*	Native	–	5–20
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	5–20
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	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
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	5–20
Blue Ridge blueberry	VAPA4	*Vaccinium pallidum*	Native	–	5–20
leadplant	AMCA6	*Amorpha canescens*	Native	–	5–20
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	–	5–20
St. Andrew's cross	HYHY	*Hypericum hypericoides*	Native	–	5–20
Carolina rose	ROCA4	*Rosa carolina*	Native	–	5–20

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: Site index values range from 50 to 65 for 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 particular 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: Chert Upland Woodland

Plot STLACE03 – Goss soil
Located in Stockton Lake COE/CA, Cedar County, MO
Latitude: 37.624805
Longitude: -93.717199

Plot SARCA03 – Goss soil
Located in Sare CA, Greene County, MO
Latitude: 37.36847
Longitude: -93.321645

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Contributors

Doug Wallace
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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	09/14/2020
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:**
