USDA Natural Resources
Conservation Service

Ecological site F115XB008MO
Loamy Limestone/Dolomite Protected Backslope Forest

Accessed: 04/30/2024

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): 115X–Central Mississippi Valley Wooded Slopes

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-Illinoisan-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.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Mesic Limestone/Dolomite Forest.

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

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest (CEGL002058).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily in Land Type Associations of the following Subsections:
Inner Ozark Border
Outer Ozark Border
Mississippi River Hills

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. After additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Loamy Limestone/Dolomite Protected Backslope Forests are within the green areas on the map. They occupy the

northerly and easterly aspects of steep, dissected slopes, and are mapped in complex with the Loamy Limestone/Dolomite Exposed Backslope Woodland ecological site. These sites are in scattered locations throughout the MLRA, in uplands that are not adjacent to the Missouri or Mississippi River floodplains. They are often associated with both Chert and Calcareous Limestone/Dolomite Woodland and Forest ecological sites. Loess or Loamy ecological sites are often upslope. Soils are typically moderately deep over limestone/dolomite bedrock, with loamy surfaces and clayey subsoils. The reference plant community is forest dominated by northern red oak, white oak, white ash, bitternut hickory, sugar maple, American elm and black walnut, with a well-developed understory and a rich herbaceous ground flora.

Associated sites

F115XB003MO	**Deep Loess Protected Backslope Forest** Deep Loess Protected Backslope Forests sites are directly upslope on northerly and easterly aspects.
F115XB043MO	**Deep Loess Exposed Backslope Woodland** Deep Loess Exposed Backslope Woodlands sites are directly upslope on southerly and westerly aspects.
F115XB045MO	**Loamy Limestone/Dolomite Exposed Backslope Woodland** Loamy Limestone/Dolomite Exposed Backslope Woodland are mapped in complex with the Loamy Limestone/Dolomite Protected Backslope Forest.

Similar sites

F115XB045MO	**Loamy Limestone/Dolomite Exposed Backslope Woodland** Loamy Limestone/Dolomite Exposed Backslope Woodland are mapped in complex with the Loamy Limestone/Dolomite Protected Backslope Forest.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus rubra*
Shrub	(1) *Lindera benzoin*
Herbaceous	(1) *Polystichum acrostichoides*

Physiographic features

This site is on upland backslopes with slopes of 15 to 60 percent. It is on protected aspects (north, northeast, and east), which receive significantly less solar radiation than the exposed aspects. The site receives runoff from upslope summit and shoulder sites, and generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Young et al., 2003) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites in the uplands adjacent to the Missouri River. The site is within the area labeled “2”, on steep backslopes with northerly and easterly aspects. Deep Loess Backslope sites are directly upslope, and are included within the area labeled “1”.

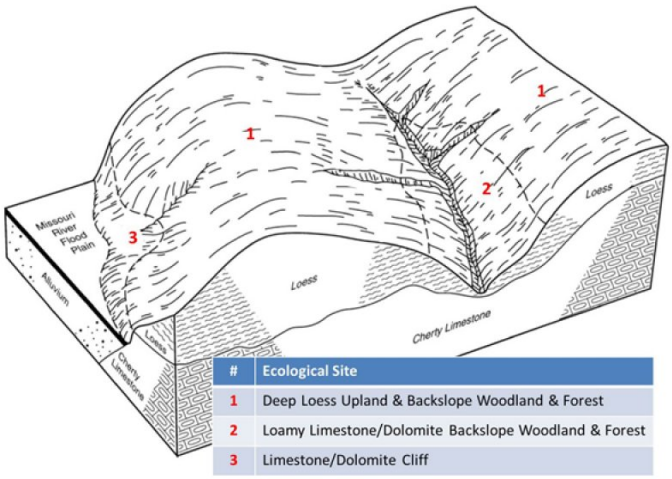


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Slope	15–60%
Water table depth	84–152 cm
Aspect	N, NE, E

Climatic features

The Central Mississippi Valley Wooded Slopes, Western Part 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 Central Mississippi Valley Wooded Slopes, Western Part experiences regional differences in climates, but these differences do not have obvious geographic boundaries. Regional climates grade inconspicuously into each other. The basic gradient for most climatic characteristics is along a line diagonally crossing the MLRA from northwest to southeast. Both mean annual temperature and precipitation exhibit gradients along this line.
The average annual precipitation in most of this area is 38 to 48 inches. The average annual temperature is 53 to 57 degrees F. Mean January minimum temperature follows the northwest-to-southeast gradient. However, mean July maximum temperature shows hardly any geographic variation in the MLRA. Mean July maximum temperatures have a range of only two or three degrees across the area.

Mean annual precipitation varies along the same gradient as temperature. 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. Snowfall is common in winter.

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. Higher daytime temperatures of bare rock surfaces and higher reflectivity of these unvegetated 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; accessed June 2012

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 (average)	178 days
Freeze-free period (average)	199 days
Precipitation total (average)	1,219 mm

Climate stations used

- (1) FESTUS [USC00232850], Crystal City, MO
- (2) JACKSON [USC00234226], Jackson, MO
- (3) COLUMBIA U OF M [USC00231801], Columbia, MO

Influencing water features

The water features of this upland ecological site include evapotranspiration, surface runoff, and drainage. Each water balance component fluctuates to varying extents from year-to-year. Evapotranspiration remains the most constant. Precipitation and drainage are highly variable between years. Seasonal variability differs for each water component. Precipitation generally occurs as single day events. Evapotranspiration is lowest in the winter and peaks in the summer. Water stored as ice and snow decreases drainage and surface runoff rates throughout the winter and increases these fluxes in the spring. The surface runoff pulse is greatly influenced by extreme events. Conversion to cropland or other high intensities land uses tends to increase runoff, but also decreases evapotranspiration. Depending on the situation, this might increase groundwater discharge, and decrease baseflow in receiving streams (Vano 2005).

Soil features

These soils are underlain with limestone and/or dolomite bedrock at 20 to 60 inches deep. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is a thin layer of loess, over slope alluvium, over residuum weathered from limestone and dolomite, overlying limestone or dolomite bedrock. They have silt loam surface layers, with loamy or clayey subsoils that have low to moderate amounts of chert gravel and cobbles. They are not affected by seasonal wetness. Soil series associated with this site include Bonnefemme, Caneyville, and Chilhowie.

The accompanying picture of the Bonnefemme series shows a silt loam surface horizon to about 9 inches over a yellowish brown silty clay loam subsoil. Soft dolomite bedrock is at 40 inches. Scale is in inches. Picture courtesy of Fred Young, NRCS.

Figure 7. Bonnefemme series

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	51–102 cm
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–15.24 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)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–40%
Subsurface fragment volume >3" (Depth not specified)	0–15%

Ecological dynamics

Information contained in this section was developed using historical data, professional experience, field reviews, and scientific studies. The information presented is representative of very complex vegetation communities. Key indicator plants, animals and ecological processes are described to help inform land management decisions. Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Loamy Limestone/Dolomite Protected Backslope Forests have a well-developed forest canopy and subcanopy

dominated by a mixture of oaks and other hardwoods adapted to the cooler, more mesic conditions. White oak and northern red oak are common, along with, sugar maple, bitternut hickory, white ash, elm and black walnut. This ecological site exhibits a structurally diverse understory and an abundant forest ground flora. While similar to deeper Chert Protected Backslope Forests, the shallower carbonate soils limit tree height, but create an environment where a wider variety of species occur in a more complex structural arrangement.

Loamy Limestone/Dolomite Protected Backslope Forests occur in rather protected landscape positions on steep slopes in the deeper valleys furthest from the prairie uplands. While the upland prairies and savannas had an estimated fire frequency of 1 to 3 years, this ecological site burned less frequently (estimated 10 to 25 years) and with lower intensity. The moderately deep soils and occasional fires make this community transitional between forest and woodland, with more open woodland conditions being created briefly after the periodic fires. Site conditions overall, however, favor shade and moisture loving forest species that quickly redevelop after fire.

Loamy Limestone/Dolomite Protected Backslope Forests would have also been subjected to occasional disturbances from wind and ice, as well as grazing by large native 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. Such canopy disturbances allowed more light to reach the ground and favored reproduction of the dominant oak species. Grazing by native large herbivores would have kept understory conditions more open, also creating conditions more favorable to oak reproduction.

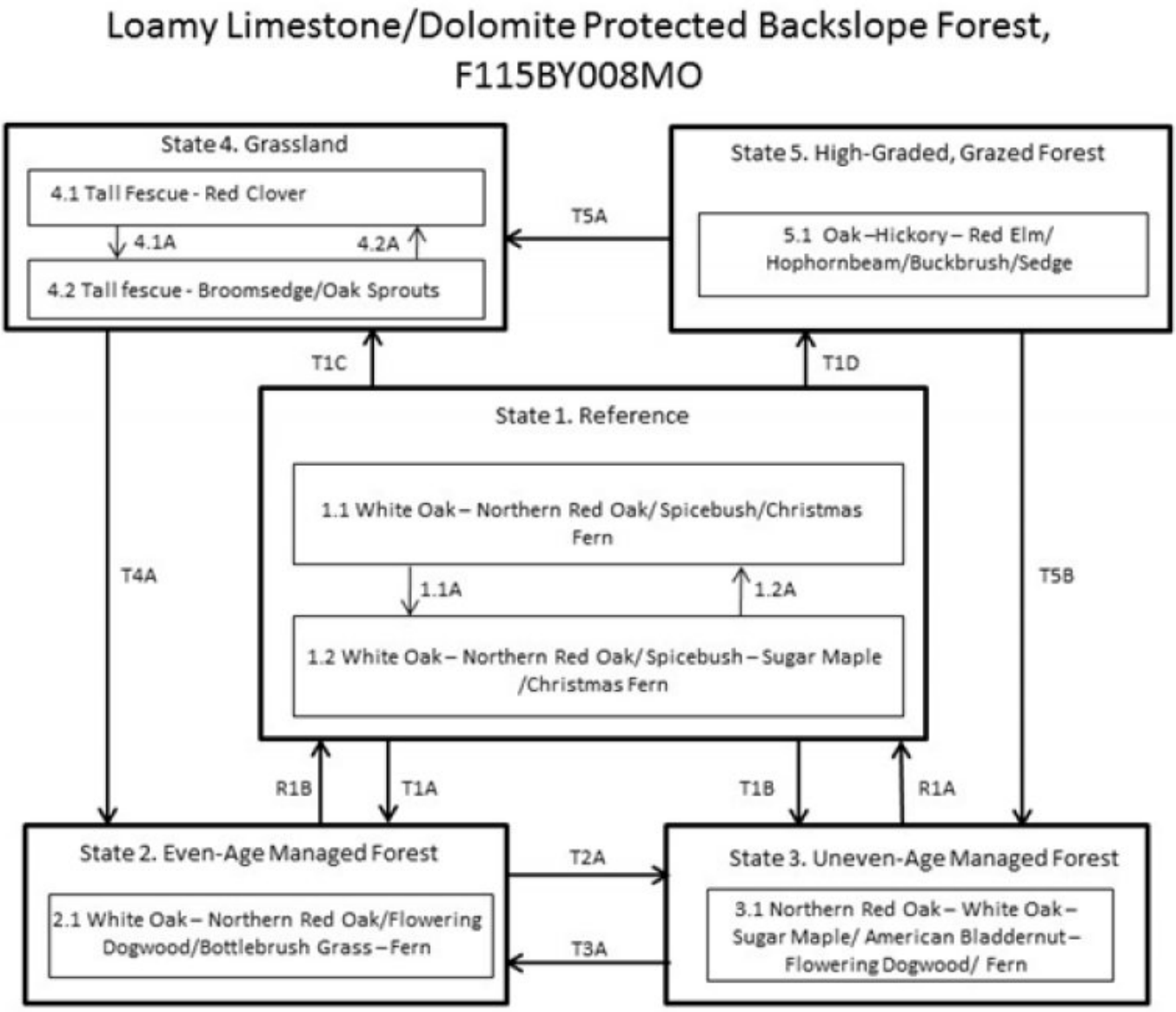
Today, these communities have been cleared and converted to pasture, or have undergone repeated timber harvest and domestic grazing. Most existing occurrences have a younger (50 to 80 years) canopy layer whose composition has been altered by timber harvesting practices. An increase in hickories over historic conditions is common. In addition, in the absence of fire, the canopy, sub-canopy and woody understory layers are better developed. The absence of periodic fire has allowed more shade-tolerant tree species, such as sugar maple, white ash, or hickories to increase in abundance.

Uncontrolled domestic grazing has diminished the diversity and cover of woodland ground flora species, and has introduced weedy species such as gooseberry, buckbrush, poison ivy and Virginia creeper created a more open understory and increased soil compaction.
Loamy Limestone/Dolomite Protected Backslope Forests are moderately productive timber sites. Carefully planned single tree selection or the creation of small group openings can help regenerate more desirable oak species and increase vigor on the residual trees. Clear-cutting does occur and results in dense, even-aged stands of primarily oak. This may be most beneficial for existing stands whose composition has been highly altered by past management practices. However, without some thinning of the dense stands, the ground flora diversity can be shaded out and productivity of the stand may suffer.

Oak regeneration is typically problematic. Sugar maple, red elm, ironwood, hickories, grapes, pawpaw and spicebush are often dominant competitors in the understory. Maintenance of the oak component will require disturbances that will impair the cool, moist, shaded conditions, so trade-offs will have to be made carefully. Prescribed fire can play a beneficial role in the management of this ecological site. The higher productivity of these sites makes it more challenging than on other forest sites in the region. Protected aspect forests did evolve with some fire, but their composition often reflects more closed, forested conditions, with fewer woodland ground flora species that can respond to fire. Consequently, while having protected aspects in a prescribed burn unit is acceptable, targeting them solely for woodland restoration is not advisable.

A State and Transition Diagram model 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	Harvesting; even-aged management
T1B	Harvesting; uneven-age management
T1C, T5A	Clearing; pasture planting
T1D	High-grade harvesting; uncontrolled grazing
T2A	Uneven-age management
T3A	Even-age management
T4A, T5A	Tree planting; long-term succession; no grazing
T5B	Uneven-age management; tree planting; no grazing

Code	Event/Process
1.1A	No disturbance (10+ yrs)
1.2A	Disturbance (fire, wind, ice) < 10 yrs
4.1A	Over grazing; no fertilization
4.2A	Brush management; grassland seeding; grassland management

Code	Event/Process
R1A	Extended rotations
R1B	Uneven-age mgt, extended rotations

Figure 8. State and transition diagram for this ecological s

State 1

Reference

The reference state was dominated by white oak associated with northern red oak and other mixed hardwoods. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the dominance of white oak by opening up the canopy and allowing more light for white oak reproduction. Long disturbance-free periods allowed an increase in more shade tolerant species such as northern red oak and sugar maple. Two community phases are recognized in this state, with shifts between phases based on disturbance frequency. The reference state can be found in scattered locations throughout the MLRA. Some sites have been converted to grassland (State 4). Others have been subject to repeated, high-graded timber harvests coupled with uncontrolled domestic livestock grazing (State 5). Fire suppression throughout the region has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many reference sites have been effectively managed for timber harvesting, resulting in either even-age (State 2) or uneven-age (State 3) managed forests depending upon the removal intensity and the species selection.

Community 1.1
White Oak – Northern Red Oak/ Spicebush/Christmas Fern

Figure 9. Reference site at Reifsnider Conservation Area, Warren County, Missouri

This phase is a forest dominated by an overstory of white oak, northern red oak, white ash and scattered sugar maple. The canopy and understory are well developed with great structural and species diversity. This phase experienced some periodic burning (estimated 10 to 25 years) but with low intensity.

Forest overstory. Forest Overstory Composition based on Nelson (2010) and field surveys.

Forest understory. Forest Understory Composition based on Nelson (2010) and field surveys.

Community 1.2
White Oak – Red Oak/ Spicebush – Sugar Maple /Christmas Fern

Long disturbance-free periods allowed an increase in more shade tolerant species such as northern red oak and

sugar maple with increased canopy density, which has affected the abundance and diversity of ground flora.

State 2
Even-Age Managed Forest

This forest tends to be rather dense with an even-aged overstory and an under developed understory and ground flora. Thinning can increase overall tree vigor and improve understory diversity. Continual managed timber harvesting, depending on the practices used and age classes removed, will either maintain this state, or convert the site to uneven-age (State 3) forests. This state can be restored to a reference state by modifying or eliminating timber harvests, extending rotations, incorporating selective thinning, and re-introducing limited prescribed fire.

Community 2.1
White Oak – Northern Red Oak/Flowering Dogwood/Bottlebrush Grass – Fern

This is an even-aged forest management phase. Logging activities are removing higher volumes of white oak causing a decrease in white oak in the canopy and an increase in northern red oak. Large group, shelterwood or clearcut harvests create a more uniform age class structure throughout the canopy layer while also opening up the understory and allowing more sunlight to reach the forest floor.

State 3
Uneven-Age Managed Forest

An uneven-age managed forest can resemble the reference state. The primary difference is tree age, most being only 50 to 90 years old. Composition is also likely altered from the reference state depending on tree selection during harvests and disturbance activities. Without a regular 15 to 20 year harvest re-entry into these stands, they will slowly increase in more shade tolerant species such as sugar maple and white oak will become less dominant. This state can be restored to a reference state by modifying timber harvests, extending rotations, incorporating selective thinning, and re-introducing limited prescribed fire.

Community 3.1
Northern Red Oak – White Oak – Sugar Maple/ American Bladdernut – Flowering Dogwood/ Fern

This is an uneven-aged forest management phase. Selective logging activities are removing higher volumes of white oak causing a decrease in white oak in the canopy and an increase in northern red oak and sugar maple. Densities numbers, especially more shade tolerant species, are increasing at the lower size-class levels.

State 4
Grassland

Conversion of forests to planted, non-native cool season grasses and legumes has been common. Without proper grassland management these ecological sites are challenging to maintain in a healthy, productive state. With over grazing and cessation of active pasture management, tall fescue, white clover and multi-flora rose will increase in density.

Community 4.1
Tall Fescue - Red Clover

This phase is well-managed grassland, composed of non-native cool season grasses and legumes. Grazing and haying is occurring. The effects of long-term liming on soil pH, and calcium and magnesium content, is most evident in this phase. Studies show that these soils have higher pH and higher base status in soil horizons as much as two feet below the surface, relative to poorly managed grassland and to woodland communities (where liming is not practiced).

Community 4.2
Tall fescue - Broomsedge/Oak Sprouts

This phase is the result of over use, poor grassland and grazing management and lack of adequate nutrient application. Oak sprouts, oak saplings, and invasive species are increasing as a result of poor management.

State 5
High-Graded/Grazed Forest

Reference or managed forested states subjected to repeated, high-grading timber harvests and uncontrolled cattle grazing transition to this degraded state. This state exhibits an over-abundance of hickory and other less economically desirable tree species and weedy understory species such as buckbrush, gooseberry, poison ivy and multi-flora rose. The vegetation offers little nutritional value for cattle, and excessive livestock stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Browsing by goats using good rotational management can open up the shrub layer, eliminate many of the weedy species and increase both native herbaceous vegetation and may induce regeneration of oak and hickory species. Cessation of active logging and exclusion of livestock from sites in this state will create an idle phase that experiences an increase in black cherry and Ohio buckeye in the understory layer. Transition back to either an even-age managed or uneven-age managed forest will required dynamic and sustained forest stand improvements, cessation of grazing, and selective thinning of overstory and understory canopies.

Community 5.1
Oak –Hickory – Red Elm/ Hophornbeam/Buckbrush/Sedge

Due to high-grade logging and uncontrolled grazing, this community phase exhibits an over-abundance of hickory and other less economically desirable tree species and weedy understory species such as buckbrush, gooseberry, poison ivy and multi-flora rose. The understory vegetation offers little nutritional value for cattle, and excessive livestock stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff.

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							
northern red oak	QURU	*Quercus rubra*	Native	–	10–95	–	–
sugar maple	ACSA3	*Acer saccharum*	Native	–	2–75	–	–
white oak	QUAL	*Quercus alba*	Native	–	2–50	–	–
American basswood	TIAM	*Tilia americana*	Native	–	5–25	–	–
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	1–25	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	0.1–10	–	–
bitternut hickory	CACO15	*Carya cordiformis*	Native	–	1–2	–	–
black walnut	JUNI	*Juglans nigra*	Native	–	1–2	–	–
white ash	FRAM2	*Fraxinus americana*	Native	–	–	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	2–5
eastern woodland sedge	CABL	*Carex blanda*	Native	–	1–2
pubescent sedge	CAHI5	*Carex hirtifolia*	Native	–	1–2

eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	1–2
slender looseflower sedge	CAGR8	*Carex gracilescens*	Native	–	–
oval-leaf sedge	CACE	*Carex cephalophora*	Native	–	–
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	–
hairy wildrye	ELVI	*Elymus villosus*	Native	–	–
Forb/Herb					
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	2–10
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	–	1–10
beaked agrimony	AGRO3	*Agrimonia rostellata*	Native	–	2–5
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	1–2
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	–	1–2
common blue wood aster	SYCO4	*Symphyotrichum cordifolium*	Native	–	1–2
lady's slipper	CYPRI	*Cypripedium*	Native	–	1–2
wild blue phlox	PHDI5	*Phlox divaricata*	Native	–	0.1–2
bloodroot	SACA13	*Sanguinaria canadensis*	Native	–	1–2
largeflower bellwort	UVGR	*Uvularia grandiflora*	Native	–	0.1–2
hepatica	HENO2	*Hepatica nobilis*	Native	–	–
eastern greenviolet	HYCO6	*Hybanthus concolor*	Native	–	–
Canadian woodnettle	LACA3	*Laportea canadensis*	Native	–	–
cutleaf toothwort	CACO26	*Cardamine concatenata*	Native	–	–
Virginia snakeroot	ARSE3	*Aristolochia serpentaria*	Native	–	–
Virginia springbeauty	CLVI3	*Claytonia virginica*	Native	–	–
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	–
toadshade	TRSE2	*Trillium sessile*	Native	–	–
harbinger of spring	ERBU	*Erigenia bulbosa*	Native	–	–
white fawnlily	ERAL9	*Erythronium albidum*	Native	–	–
green dragon	ARDR3	*Arisaema dracontium*	Native	–	–
Canadian wildginger	ASCA	*Asarum canadense*	Native	–	–
eastern waterleaf	HYVI	*Hydrophyllum virginianum*	Native	–	–
Fern/fern ally					
lowland bladderfern	CYPR4	*Cystopteris protrusa*	Native	–	1–5
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	–	2–5
northern maidenhair	ADPE	*Adiantum pedatum*	Native	–	1–2
Shrub/Subshrub					
hophornbeam	OSVI	*Ostrya virginiana*	Native	–	1–50
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	2–5
northern spicebush	LIBE3	*Lindera benzoin*	Native	–	–
American bladdernut	STTR	*Staphylea trifolia*	Native	–	–
Tree					
flowering dogwood	COFL2	*Cornus florida*	Native	–	1–25
common serviceberry	AMAR3	*Amelanchier arborea*	Native	–	1–5
eastern redbud	CECA4	*Cercis canadensis*	Native	–	1–5
pawpaw	ASTR	*Asimina triloba*	Native	–	–
hophornbeam	OSVI	*Ostrya virginiana*	Native	–	–

hophornbeam	OSVI	*Ostrya virginiana*	Native		
Vine/Liana					
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	–	–
summer grape	VIAE	*Vitis aestivalis*	Native	–	–

Table 7. Community 2.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
sugar maple	ACSA3	*Acer saccharum*	Native	–	–	–	–

Table 8. Community 2.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Shrub/Subshrub					
Carolina buckthorn	FRCA13	*Frangula caroliniana*	Native	–	–

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.

Birds associated with this ecological site include Worm-eating warbler, Whip-poor-will, Great Crested Flycatcher, Ovenbird, Pileated Woodpecker, Wood Thrush, Red-eyed Vireo, Northern Parula, Louisiana Waterthrush (near streams), and Broad-winged Hawk.

Reptile and amphibian species associated with mature forests include: ringed salamander, spotted salamander, marbled salamander, central newt, long-tailed salamander, dark-sided salamander, southern red-backed salamander, three-toed box turtle, western worm snake, western earth snake, and American toad

Other information

Forestry (NRCS 2002):

Management: Estimated site index values range from 50 to 60 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 small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality and should be used with caution on a particular site if timber management is the primary objective. Favor white oak, northern red oak, black oak, and chinkapin oak.

Limitations: Low to moderate amounts of coarse fragments in lower profile; bedrock is within 60 inches. Surface stones and rocks may be a problem 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. Hand planting or direct seeding may be necessary. 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

Loamy Limestone/Dolomite Protected Backslope Forest – Potential Reference – F115BY008MO

Plot RUBECA_JK05 - Chilhowie soil
Located in Rudolf Bennitt CA, Randolph County, MO
Latitude: 39.273466
Longitude: -92.478063

Plot DABOCA_JK18 – Chilhowie soil
Located in Daniel Boone CA, Warren County, MO
Latitude: 38.79025
Longitude: -91.381403

Plot HACRCA_KS01 – Bonnefemme soil – no veg cover
Located in Hart Creek CA, Boone County, MO
Latitude: 38.713062
Longitude: -92.324736

Plot REIFCA_JK18 – Chilhowie soil
Located in Reifsnider CA, Warren County, MO
Latitude: 38.78688
Longitude: -91.108378

Other references

MDC, 2006. Missouri Forest and Woodland Community Profiles. Missouri Department of Conservation, Jefferson City, Missouri.

Natural Resources Conservation Service. 2002. Woodland Suitability Groups. Missouri FOTG, Section II, Soil Interpretations and Reports. 30 pgs.

NatureServe, 2010. Vegetation Associations of Missouri (revised). NatureServe, St. Paul, Minnesota.

Nelson, Paul W. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Nigh, Timothy A., & Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, Missouri.

Vano, Julie A. 2005. Land Surface Hydrology in Northern Wisconsin: Influences of climatic variability and land cover. University of Wisconsin-Madison.

Young, Fred J., Caryl A. Radatz, & Curtis A. Marshall. 2003. Soil Survey of Boone County, Missouri. U.S. Dept. of Agric. Natural Resources Conservation Service.

University of Missouri Climate Center - http://climate.missouri.edu/climate.php; accessed June 2012

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/

Contributors

Fred Young
Doug Wallace

Acknowledgments

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	
Approved by	
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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**