

Ecological site F115XB006MO

Loamy Protected Backslope Forest

Accessed: 04/20/2024

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-Illinoian-aged till plain. Elevation ranges from about 320 feet along the Mississippi River near Cape Girardeau in the south to about 1,020 feet on the highest ridges near Hillsboro, MO in the east. Local relief varies from 10 to 20 feet in the major river floodplains, to 50 to 100 feet in the dissected uplands, with bluffs of 200 to 350 feet along the Mississippi and Missouri Rivers. Underlying bedrock is mainly Ordovician-aged dolomite and sandstone, with Mississippian-aged limestone north of the Missouri River.

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 Forest.

Missouri Department of Conservation Forest and Woodland Communities (MDC, 2006):

The reference state for this ecological site is most similar to a White Oak Forest.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):

The reference state for this ecological site is most similar to a *Quercus alba* / *Cornus florida* Unglaciaded Forest (CEGL002066).

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 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 Exposed Backslope Woodland ecological site. These ecological sites are in the uplands mainly in the Missouri River watershed, but are not adjacent to the Missouri River floodplain. Loess Upland and Loamy Upland ecological sites are typically upslope. Areas of Woodland/Glade ecological sites are commonly associated with these sites. Soils are very deep, and typically have coarse fragments with depth. The reference plant community is forest dominated by northern red oak, white oak, white ash and sugar maple, with a well-developed understory and a rich herbaceous ground flora.

Associated sites

F115XB005MO	Loamy Upland Woodland Loamy Upland sites are often upslope.
F115XB011MO	Chert Protected Backslope Forest Chert Protected Backslope Forests are downslope from this ecological site on northerly and easterly aspects.
F115XB048MO	Chert Exposed Backslope Woodland Chert Exposed Backslope Woodlands are downslope from this ecological site on southerly and westerly aspects.
R115XB009MO	Shallow Limestone/Dolomite Upland Glade/Woodland Shallow Limestone/Dolomite Glade sites are often associated with this site.

Similar sites

F115XB044MO	Loamy Exposed Backslope Woodland Loamy Exposed Backslope Woodlands are mapped in a complex with this ecological site but are on southerly and westerly aspects.
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Table 1. Dominant plant species

Tree	(1) <i>Quercus rubra</i> (2) <i>Quercus alba</i>
Shrub	(1) <i>Asimina triloba</i> (2) <i>Ulmus rubra</i>
Herbaceous	(1) <i>Laportea canadensis</i> (2) <i>Erigenia bulbosa</i>

Physiographic features

This site is on upland backslopes, with slopes of 15 to 50 percent. It is on protected aspects (north, northeast, and east), which receive significantly less solar radiation than the exposed aspects. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The accompanying figure (adapted from Baker, 1998) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the uplands. The site is within the area labeled “2”, on northerly and easterly exposures. Loamy Upland sites (labeled “1”) are often upslope, and Chert Backslope sites (labeled “3”) are often downslope. In other areas, Shallow Limestone/Dolomite Glade sites are associated with this site.

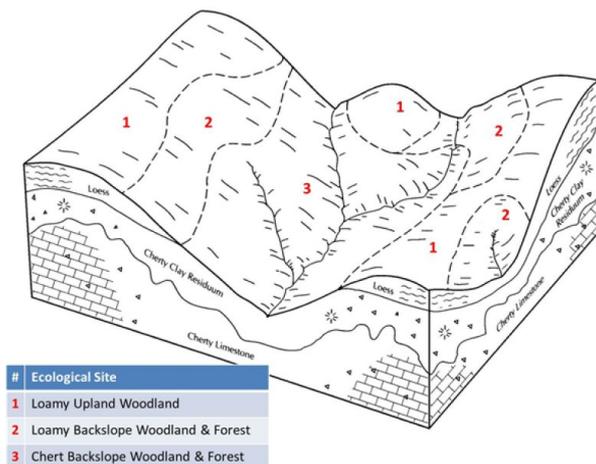


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Slope	15–50%
Water table depth	20–60 in
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 convective 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 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.

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 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 (average)	174 days
Freeze-free period (average)	196 days
Precipitation total (average)	47 in

Climate stations used

- (1) JACKSON [USC00234226], Jackson, MO
- (2) BOONVILLE [USC00230817], Boonville, MO
- (3) JEFFERSON CITY WTP [USC00234271], Jefferson City, MO
- (4) UNION [USC00238515], Union, 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 have no major rooting restriction. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is loess over slope alluvium and residuum weathered from either limestone and dolomite, or from sandstone. The soils have silt loam surface horizons. Subsoils are silty clay loam in the upper part, and are very gravelly and cobbly silty clay loam, clay loam to clay in the underlying slope alluvium and residuum. Soils with sandstone residuum have more sand in the subsoil. These soils are not affected by seasonal wetness. A few soils have a bedrock contact below 40 inches. Soil series associated with this site include Baxter, Bluelick, Bucklick, Crider, Holstein, Minnith, Rocheport, Useful, Weingarten, Wellston, Westmore, and Wrengart.

The accompanying picture of the Bluelick series shows loess over reddish brown clayey residuum, underlain by very cobbly clay. Roots can be seen in the picture throughout the soil profile. Picture from Baker (1998).



Figure 7. Bluelick series

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	40–72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–8 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)	4.5–7.3
Subsurface fragment volume <=3" (Depth not specified)	20–35%
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 a forest dominated by an overstory of red oak, white oak, white ash and occasional sugar maple. The canopy is tall (75 to 90 feet) and well developed (80 to 100 percent closure) and the understory well developed and with great structural diversity. In the most mesic landscape positions, shade tolerant

and moisture loving species, such as basswood, coffee tree, and bitternut hickory would have been in greater abundance.

While fire-prone prairies, savannas and open woodlands surround this region, Loamy Protected Backslope Forests historically occurred in the most protected landscape positions on lower, steep slopes in the deeper valleys furthest from the prairie uplands. While the upland prairies and savannas may have had a fire frequency of 1 to 3 years, Loamy Protected Backslope Forests would have burned less frequently (estimated 10 to 25 years) and with lower intensity. Periodic fires would have removed some of the shade tolerant understory, but it would have quickly recovered.

Loamy 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 and soil erosion.

Loamy Protected Backslope Forests are 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 but limited 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 burn unit is acceptable, targeting them solely for woodland restoration is not advisable.

A State and Transition Diagram model is depicted in Figure 1. Detailed descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

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State and transition model

Loamy Protected Backslope Forest, F115BY006MO

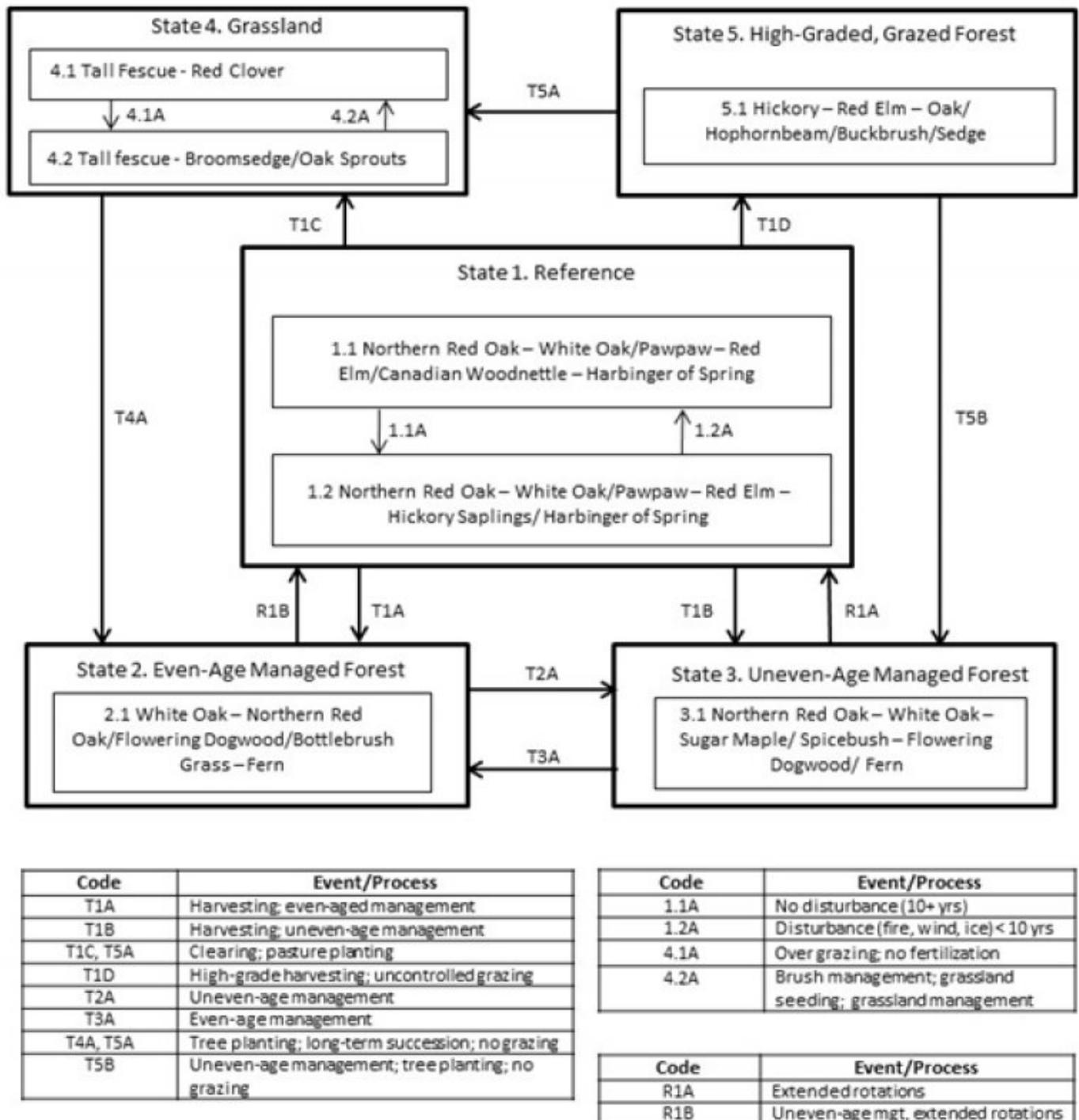


Figure 8. State and transition diagram for this ecological s

State 1

Reference

The reference state was dominated by northern red oak associated with white 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

Northern Red Oak – White Oak/Pawpaw – Red Elm/Canadian Woodnettle – Harbinger of Spring

This phase is a forest dominated by an overstory of red oak, white oak, white ash and occasional 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. The Overstory Species list is based on field surveys and commonly occurring species listed in Nelson (2010).

Forest understory. The Understory Species list is based on field surveys and commonly occurring species listed in Nelson (2010).

Community 1.2

Northern Red Oak – White Oak/Pawpaw – Red Elm - Hickory Saplings/Harbinger of Spring

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



Figure 9. A Loamy Protected Backslope Forest on private land in Boone County, Missouri

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/ Spicebush – 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

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

This phase is the result of repeated, high-grading timber harvests and uncontrolled cattle grazing.

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	<i>Quercus alba</i>	Native	–	30–50	–	–
northern red oak	QURU	<i>Quercus rubra</i>	Native	–	30–50	–	–
shagbark hickory	CAOV2	<i>Carya ovata</i>	Native	–	20–30	–	–
sugar maple	ACSA3	<i>Acer saccharum</i>	Native	–	5–20	–	–
slippery elm	ULRU	<i>Ulmus rubra</i>	Native	–	10–20	–	–
American basswood	TIAM	<i>Tilia americana</i>	Native	–	5–10	–	–
bitternut hickory	CACO15	<i>Carya cordiformis</i>	Native	–	5–10	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Forb/Herb					
Virginia springbeauty	CLVI3	<i>Claytonia virginica</i>	Native	–	20–40
mayapple	POPE	<i>Podophyllum peltatum</i>	Native	–	20–30
toadshade	TRSE2	<i>Trillium sessile</i>	Native	–	20–30
harbinger of spring	ERBU	<i>Erigenia bulbosa</i>	Native	–	20–30
wild blue phlox	PHDI5	<i>Phlox divaricata</i>	Native	–	10–20
white fawnlily	ERAL9	<i>Erythronium albidum</i>	Native	–	10–20
hepatica	HENO2	<i>Hepatica nobilis</i>	Native	–	10–20
goldenseal	HYCA	<i>Hydrastis canadensis</i>	Native	–	10–20
feathery false lily of the valley	MARA7	<i>Maianthemum racemosum</i>	Native	–	10–20
largeflower bellwort	UVGR	<i>Uvularia grandiflora</i>	Native	–	10–20
Canadian woodnettle	LACA3	<i>Laportea canadensis</i>	Native	–	10–20
Virginia snakeroot	ARSE3	<i>Aristolochia serpentaria</i>	Native	–	10–20
green dragon	ARDR3	<i>Arisaema dracontium</i>	Native	–	5–10
lesser yellow lady's slipper	CYPAP4	<i>Cypripedium parviflorum var. parviflorum</i>	Native	–	0–5
Fern/fern ally					
Christmas fern	POAC4	<i>Polystichum acrostichoides</i>	Native	–	5–20
northern maidenhair	ADPE	<i>Adiantum pedatum</i>	Native	–	5–20
Shrub/Subshrub					
American hazelnut	COAM3	<i>Corylus americana</i>	Native	–	10–30
fragrant sumac	RHAR4	<i>Rhus aromatica</i>	Native	–	5–20
northern spicebush	LIBE3	<i>Lindera benzoin</i>	Native	–	10–20
Tree					
hophornbeam	OSVI	<i>Ostrya virginiana</i>	Native	–	10–20
pawpaw	ASTR	<i>Asimina triloba</i>	Native	–	10–20
American bladdernut	STTR	<i>Staphylea trifolia</i>	Native	–	10–20
flowering dogwood	COFL2	<i>Cornus florida</i>	Native	–	10–20
Vine/Liana					
Virginia creeper	PAQU2	<i>Parthenocissus quinquefolia</i>	Native	–	10–20
summer grape	VIAE	<i>Vitis aestivalis</i>	Native	–	10–20

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.

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, 2014):

Management: Field calculated site index values range from 53 to 76 for oak. Timber management opportunities are good. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality, may not be fitting, or should be used with caution on a particular site if timber management is the primary objective. Favor white oak and northern red oak, and black oak.

Limitations: No major equipment restrictions or limitations exist. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35 percent, traction problems increase and equipment use is not recommended.

Inventory data references

Loamy Protected Backslope Forest – Potential Reference – F115BY006MO

Plot CLRAPR_KS05 - Bluelick soil

Located in Clatterbuck Ranch, Private, Boone County, MO

Plot DABOCA_JK12 – Wrengart soil

Located in Daniel Boone CA, Warren County, MO

Latitude: 38.783534

Longitude: -91.37662851

Plot DOROSP02 - Bucklick soil

Located in Don Robinson SP, Jefferson County, MO

Latitude: 38.39356

Longitude: -90.704197

Plot DOROSP15 – Holstein soil – no veg cover

Located in Don Robinson SP, Jefferson County, MO

No gps location taken

Plot GRCASP_KS03 - Holstein soil

Located in Graham Cave SP, Montgomery County, MO

Latitude: 38.904757

Longitude: -91.572512

Plot LILOCA_JK18 – Wrengart soil

Located in Little Lost Creek CA, Warren County, MO

Latitude: 38.76862

Longitude: -91.26983

Other references

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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:**
