USDA Natural Resources Conservation Service

Ecological site F115XB050MO
Calcareous Limestone Exposed Backslope Woodland

Accessed: 05/18/2024

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 Dry Limestone/Dolomite Woodland.

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

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium Woodland (CEGL002143).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs in the Outer Ozark Border Subsection, in the following Land Type Associations:
Harrisburg Oak Woodland/Forest Hills
Rock Bridge Woodland/Forest Low Karst Hills
Central Missouri Oak Woodland/Forest 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”.

Calcareous Limestone Exposed Backslope Woodlands are within the green areas on the map. They occupy the

southerly and westerly aspects of steep, dissected slopes, and are mapped in complex with the Calcareous Limestone Protected Backslope Forest ecological site. These sites are in the eastern part of the MLRA, north of the Missouri River. They are closely associated with Limestone/Dolomite Glade ecological sites, often occurring directly downslope. Other close ecological site associates include Chert Limestone/Dolomite woodland and forest sites, and loess woodland sites, which are upslope. Soils are high in bases, and are moderately deep over limestone bedrock, with gravelly surfaces. The reference plant community is woodland with an overstory dominated by chinkapin oak, with minor amounts of white ash, blue ash and Shumard oak, and a ground flora of native grasses and forbs with scattered shrubs.

Associated sites

F115XB014MO	**Chert Limestone/Dolomite Protected Backslope Forest** Chert Protected Limestone/Dolomite sites are often closely associated upslope with this ecological site.
F115XB036MO	**Calcareous Limestone Protected Backslope Forest** Calcareous Limestone Protected Backslope are mapped in complex with this site but are on north and east aspects.
F115XB046MO	**Chert Limestone/Dolomite Exposed Backslope Woodland** Chert Exposed Limestone/Dolomite sites are often closely associated upslope with this ecological site.
R115XB009MO	**Shallow Limestone/Dolomite Upland Glade/Woodland** Shallow Limestone/Dolomite Glade sites are often closely associated with this site.

Similar sites

F115XB036MO	**Calcareous Limestone Protected Backslope Forest** Calcareous Limestone Protected Backslope are mapped in complex with this site but are on north and east aspects.

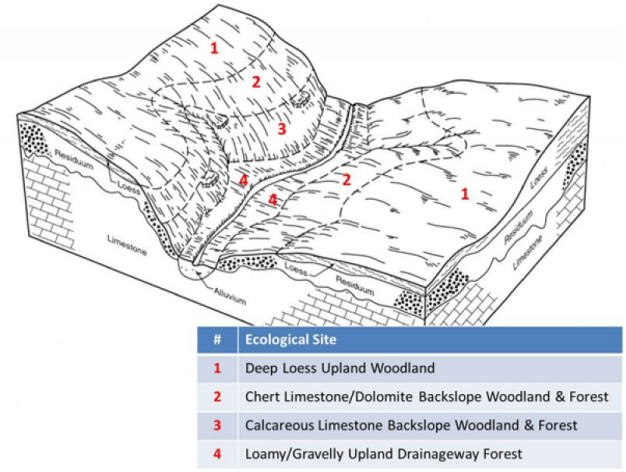
Table 1. Dominant plant species

Tree	(1) *Quercus muehlenbergii* (2) *Fraxinus quadrangulata*
Shrub	(1) *Rhamnus caroliniana*
Herbaceous	(1) *Schizachyrium scoparium*

Physiographic features

This site is on backslopes with slopes of 15 to 70 percent. It is on exposed aspects (south, southwest, and west), which receive significantly more solar radiation than the protected aspects. Sites are often downslope from limestone/dolomite glades. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The accompanying figure (adapted from Young et al., 2003) 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 “3”, and is often closely associated with Chert Limestone/Dolomite sites (labeled “2” in the figure), as well as Shallow Limestone/Dolomite Glade sites.



#	Ecological Site
1	Deep Loess Upland Woodland
2	Chert Limestone/Dolomite Backslope Woodland & Forest
3	Calcareous Limestone Backslope Woodland & Forest
4	Loamy/Gravelly Upland Drainageway Forest

Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Slope	15–70%
Water table depth	152 cm
Aspect	S, SW, W

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)	176 days
Freeze-free period (average)	199 days
Precipitation total (average)	1,168 mm

Climate stations used

- (1) COLUMBIA U OF M [USC00231801], Columbia, MO
- (2) FULTON [USC00233079], Fulton, MO
- (3) NEW FRANKLIN 1W [USC00236012], Franklin, 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 bedrock at 20 to 40 inches. The soils were formed under a mixture of prairie and woodland vegetation, and have dark, organic-rich surface horizons that are enriched in places by upslope prairie glades. Parent material is slope alluvium over residuum weathered from limestone, overlying limestone bedrock. They have very gravelly silt loam surface layers, with clayey subsoils that have moderate to high amounts of chert and limestone gravel and cobbles. These soils are base-rich, but do not contain free carbonates. These soils are not affected by seasonal wetness. Soil series associated with this site include Clinkenbeard.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–dolomite (2) Residuum–dolomite
Surface texture	(1) Very gravelly silt loam
Family particle size	(1) Clayey

Drainage class	Well drained
Permeability class	Not specified
Soil depth	51–102 cm
Surface fragment cover <=3"	35–50%
Surface fragment cover >3"	5–30%
Available water capacity (0-101.6cm)	5.08–7.62 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)	25–40%
Subsurface fragment volume >3" (Depth not specified)	5–20%

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 somewhat shallow soils and south to west aspects of Calcareous Limestone Exposed Backslope Woodlands limited the growth of trees and supported an abundance of native grasses and forbs in the understory. Rather short (35 to 50 feet) chinquapin oak dominated an open overstory, with occasional white ash, blue ash and Shumard oak. Shrubs were scattered within a dense matrix of native grasses and forbs. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth.

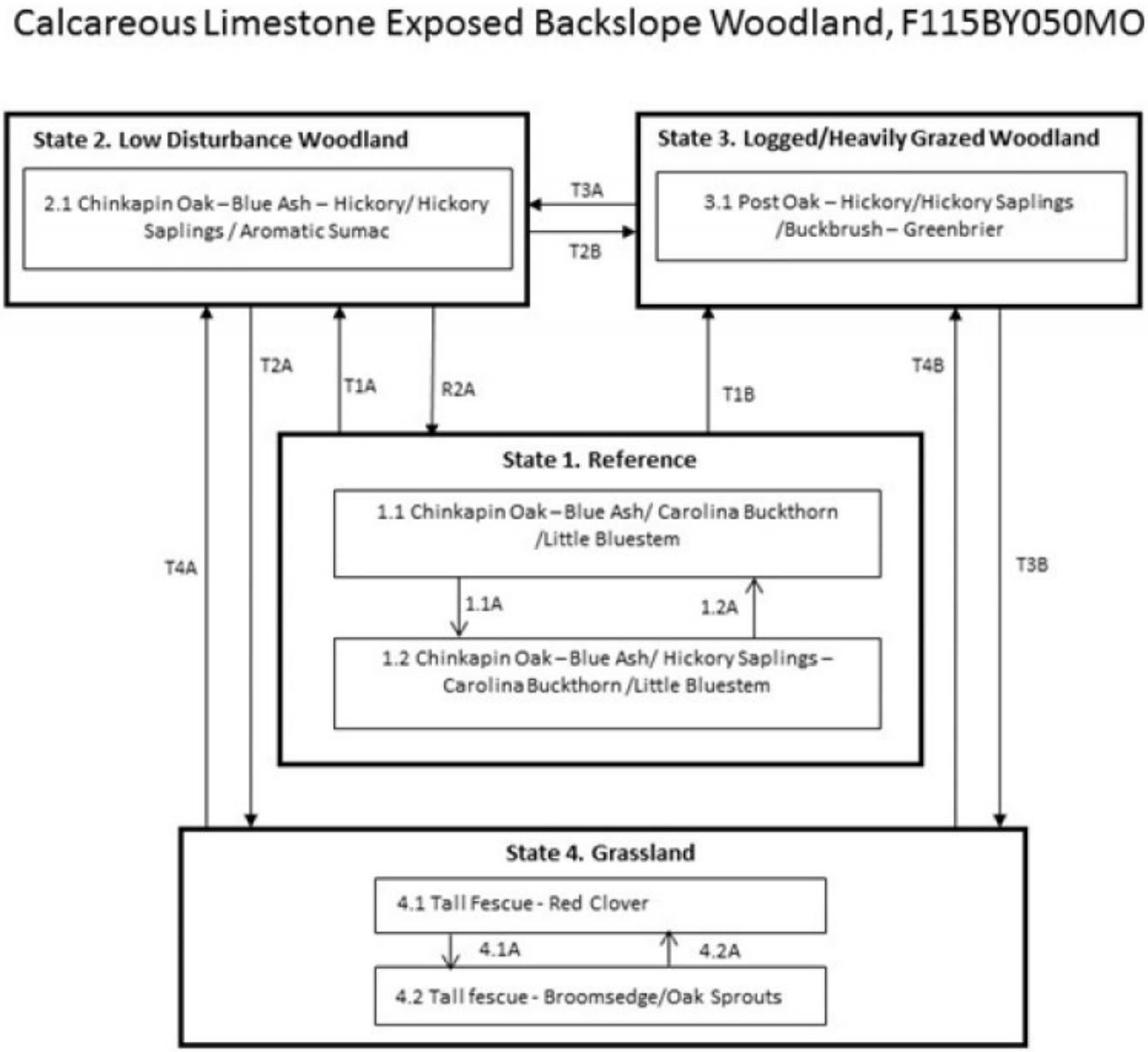
Fire played an important role in the maintenance of these systems. It is likely that these ecological sites, along with adjacent glades and woodlands burned at least once every 5 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. They would have also further limited the growth and dominance of trees, especially Eastern redcedar. During fire free intervals, woody species would have increased and the herbaceous understory diminished. But the return of fire would have re-opened the woodlands and stimulated the ground flora. In the long term absence of fire, woody species, especially eastern red cedar have encroached into these ecological sites. Most of these ecological sites today are denser, and shadier with a greatly diminished ground flora. Removal of the younger understory by chainsaw and the application of prescribed fire have proven to be effective restoration methods.

Calcareous Limestone Exposed Backslope Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores, such as bison, elk, and deer. Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. Grazing by native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and sun-loving ground flora species.

Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper. It also promotes the invasion of eastern red cedar. Grazed sites have a more open understory. In addition, soil compaction and soil erosion related to grazing can be a problem and lower site productivity.
These ecological sites are not productive. Without some thinning of the stands and application of prescribed fire, the ground flora diversity can be shaded out and diversity of the stand may suffer.

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

State and transition model



Code	Event/Activity
T1A	Fire-free interval (20+ years)
T1B	Fire suppression; heavy grazing by livestock; logging
T3A	Livestock removal; forest stand improvement
T2B	Heavy grazing by livestock; logging
T2A, T3B	Clearing; grassland seeding; grassland management
T4A	Tree planting; long term succession (50+ years); no grazing
T4B	Long term succession (50+ years); light periodic grazing
R2A	Understory removal; prescribed fire; forest stand improvement
1.1A	Disturbance-free interval >20 years
1.2A	Disturbance 10-20 year cycle; fire intervals (3-5 years)
4.1A	Over grazing; no fertilization
4.2A	Brush management; grassland seeding; grassland management

Figure 7. State and transition diagram for this ecological s

State 1

Reference

The reference state was dominated by chinkapin oak and ash. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the dominance of white and chinkapin oak by opening up the canopy and allowing more light for 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. This reference state is uncommon today. Some sites have been converted to grassland (State 4). Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing (State 3). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many reference sites have been managed for timber harvests.

Community 1.1
Chinkapin Oak – Blue Ash/ Aromatic Sumac /Little Bluestem – Hairy Sunflower

Figure 8. Ecological site located on private property in Boone County, Missouri

This phase is an old growth woodland with a chinkapin oak dominated a semi-open overstory with occasional blue ash and northern red oak. This woodland phase has a two-tiered structure with an open understory with scattered shrubs and a dense, diverse native herbaceous ground flora.

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
Chinkapin Oak – Blue Ash/ Hickory Saplings – Carolina Buckthorn /Little Bluestem

This phase is similar to community phase 1.1 but oak and hickory understory densities are increasing due to longer

periods of fire suppression. Displacement of some grasses and forbs may be occurring due to shading and competition from the increased densities of oak and hickory saplings in the understory.

State 2
Low Disturbance Woodland

Lower disturbance levels has allowed these woodlands to become dense with saplings such as ash and hickory. The dense, shaded conditions and lack of disturbance has caused the ground flora to decrease in cover and diversity. However, many of the original herbaceous species persist as small plantlets or in the seed bank. Consequently, thinning of the woody species and the re-introduction of periodic disturbances has shown these communities to be exceptionally resilient, and a return, after a period of many years, to the reference condition is possible.

Community 2.1
Chinkapin Oak – Blue Ash – Hickory/ Hickory Saplings / Aromatic Sumac

This is the only phase associated with this state at this time. See the corresponding state narrative for details.

State 3
Logged/Heavily Grazed Woodland

Many of these sites have been subjected to heavy grazing by domestic livestock and periodic logging. These areas are more open with a diminished ground flora. In addition, grazed areas exhibit a lower diversity of native ground flora species and an increase of invasive natives such as buck brush and greenbrier. Restricting livestock access and eliminating logging will be necessary for successful restoration.

Community 3.1
Post Oak – Hickory/Hickory Saplings /Buckbrush – Greenbrier

This is the only phase associated with this state at this time. See the corresponding state narrative for details.

State 4
Grassland

Conversion of other states to non-native cool season species such as tall fescue and red clover has been common. Occasionally, these pastures will have scattered oaks. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the reference state may be impossible, requiring a very long term series of management options. If oak sprouting is left unchecked and grazing is eliminated or reduced then over time this state will transition to a low disturbance woodland or to a logged/heavily grazed woodland.

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.

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							
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	–	–	–
blue ash	FRQU	*Fraxinus quadrangulata*	Native	–	–	–	–
white ash	FRAM2	*Fraxinus americana*	Native	–	–	–	–
post oak	QUST	*Quercus stellata*	Native	–	–	–	–
white oak	QUAL	*Quercus alba*	Native	–	–	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	–	–
Shumard's oak	QUSH	*Quercus shumardii*	Native	–	–	–	–
black oak	QUVE	*Quercus velutina*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	–
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	–
slender woodland sedge	CADI5	*Carex digitalis*	Native	–	–
oval-leaf sedge	CACE	*Carex cephalophora*	Native	–	–
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
Forb/Herb					
wild quinine	PAAU7	*Parthenium auriculatum*	Native	–	–
widowsfrill	SIST	*Silene stellata*	Native	–	–
golden zizia	ZIAU	*Zizia aurea*	Native	–	–
butterfly milkweed	ASTU	*Asclepias tuberosa*	Native	–	–
slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	Native	–	–
tall blazing star	LIAS	*Liatris aspera*	Native	–	–
hoary puccoon	LICA12	*Lithospermum canescens*	Native	–	–
Ozark milkvetch	ASDI4	*Astragalus distortus*	Native	–	–
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	–
yellow pimpernel	TAIN	*Taenidia integerrima*	Native	–	–
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	–
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	–
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	–
Shrub/Subshrub					
American hazelnut	COAM3	*Corylus americana*	Native	–	–
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	–	–
Carolina buckthorn	FRCA13	*Frangula caroliniana*	Native	–	–
Tree					
eastern redbud	CECA4	*Cercis canadensis*	Native	–	–

Animal community

Wildlife (MDC 2006):

Oaks provide hard mast for wildlife; scattered shrubs provide soft mast; frequent bedrock outcrops provide reptile habitat and a patchier ground flora.

Sedges and native grasses provide green browse; native grasses on dry sites provide cover and nesting habitat and a diversity of forbs provides a diversity and abundance of insects.

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

Bird species associated with Limestone/Dolomite Woodlands include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, and Red-eyed Vireo.

Reptiles and amphibians associated with mature Limestone/Dolomite Woodlands include: ornate box turtle, northern fence lizard, five-lined skink, coal skink, broad-headed skink, six-lined racerunner, western slender glass lizard, prairie ring-necked snake, flat-headed snake, rough earth snake, red milk snake, western pygmy rattlesnake, and timber rattlesnake.

Other information

Forestry (NRCS 2002, 2014):

Management: Estimated site index values range from 45 to 50 for oak. Timber management opportunities are fair. 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 is an effective management tool for this site. Favor post oak, black oak, chinkapin oak, and Shumard oak.

Limitations: Coarse fragments throughout the soil profile; bedrock is within 40 inches. 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

Calcareous Limestone Exposed Backslope Woodland – Potential Reference? – F115BY050MO

Plot CLRAPR_KS02 – Clinkenbeard soil – no veg cover
Located in Clatterbuck Ranch, Private, Boone County, MO

Plot DANVCA_JK20 – Clinkenbeard soil
Located in Danville CA, Montgomery County, MO
Latitude: 38.867348
Longitude: -91.532146

Other references

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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:**

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

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

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

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

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

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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:**
