USDA Natural Resources Conservation Service

Ecological site R115XB018MO
Limestone/Dolomite Protected Cliff

Accessed: 05/03/2024

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 Moist Limestone/Dolomite Cliff.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs primarily in Land Type Associations of the following Subsections:
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”.

Limestone/Dolomite Protected Cliffs are within the green areas on the map. They occupy northerly and easterly aspects, and are mapped in complex with the Limestone/Dolomite Exposed Cliff ecological site. These sites are north of the Missouri River, often on cliffs adjacent to floodplains. They are typically associated with Limestone/Dolomite Glade/Woodland ecological sites. Soils are very shallow to limestone or dolomite. The reference plant community consists of scattered small trees, shrubs, grasses, forbs, and ferns, occupying cracks

and ledges in the cliff face.

Associated sites

F115XB003MO	**Deep Loess Protected Backslope Forest** Deep Loess Protected Backslope Forests are typically upslope from this ecological site
R115XB009MO	**Shallow Limestone/Dolomite Upland Glade/Woodland** Shallow Limestone/Dolomite Glade/Woodlands are typically associated with this ecological site.

Similar sites

R115XB019MO	**Limestone/Dolomite Exposed Cliff** Limestone/Dolomite Exposed Cliffs are similar but on south and west aspects.

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Fraxinus quadrangulata*
Shrub	(1) *Hydrangea arborescens* (2) *Staphylea trifolia*
Herbaceous	(1) *Aquilegia canadensis* (2) *Asplenium rhizophyllum*

Physiographic features

This site is on cliffs. 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, and in places receives runoff from upslope summit and shoulder 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 “3”, on cliffs with northerly and easterly aspects. They are typically associated with Shallow Limestone/Dolomite Glade/Woodland ecological sites, included within the area labeled “3”. Deep Loess sites often directly upslope, and are included within the area labeled “1”.

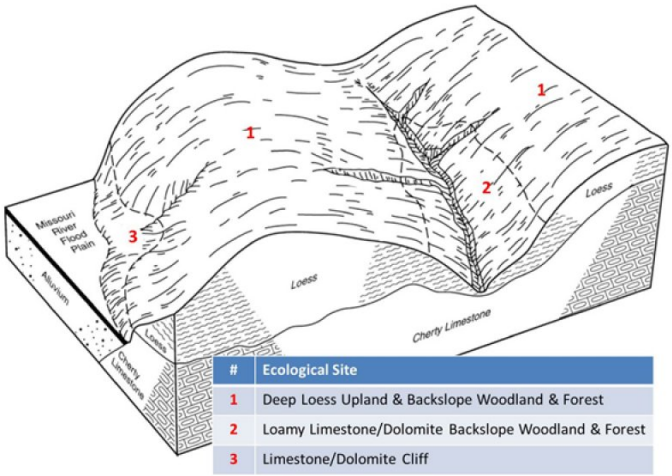


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Cliff
Flooding frequency	None
Slope	9–70%

Water table depth	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)	1,143 mm

Climate stations used

- (1) ELSBERRY 1 S [USC00232591], Elsberry, MO
- (2) COLUMBIA U OF M [USC00231801], Columbia, MO
- (3) COLUMBIA RGNL AP [USW00003945], Columbia, MO

Influencing water features

The site generates runoff to adjacent, downslope ecological sites, and in places receives runoff from upslope summit and shoulder sites. This site does not flood.

Soil features

These soils are underlain with limestone and/or dolomite bedrock at less than 20 inches and have a slope range to 70 percent. The soils have dark, organic-rich surface horizons. Parent material is limestone and dolomite residuum. These soils are loamy or clayey, and are skeletal, with high amounts of limestone/dolomite gravel, channers and flagstones. They are not affected by seasonal wetness. Soil series associated with this site include Gasconade.

Table 4. Representative soil features

Parent material	(1) Residuum–dolomite
Surface texture	(1) Gravelly silty clay loam (2) Very gravelly clay loam (3) Extremely gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow
Soil depth	10–51 cm
Surface fragment cover <=3"	15–55%
Surface fragment cover >3"	5–60%
Available water capacity (0-101.6cm)	2.54–5.08 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)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	5–40%
Subsurface fragment volume >3" (Depth not specified)	5–60%

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 community is characterized by vertical rock cliffs and by stress tolerant trees and shrubs, ferns, lichens and mosses. These sites have large expanses of bare rock, with a variety of plants occupying cracks and minor ledges across the cliff face. Protected cliffs are normally more vegetated than exposed. Some harbor rare plants that are relicts of the colder climate of the Pleistocene.

Limestone/Dolomite Protected Cliffs can be above talus slopes or terraces, and are often below loess or chert forests and woodlands. When present, trees are stunted and the herbaceous vegetation is generally sparse. Cliff faces with visible seep zones and cool shaded habitats often support ferns, liverworts, mosses, algae, and fungi.

Soils are generally absent but do occur on cliff edges, ledges, and rock terraces and support higher densities of forbs and ferns. Microhabitats associated with cliffs are often ephemerally wet, becoming dry in summer. Shading on north and east facing aspects coupled with adjacent taller trees at the cliff bases keep the cliff face cooler.

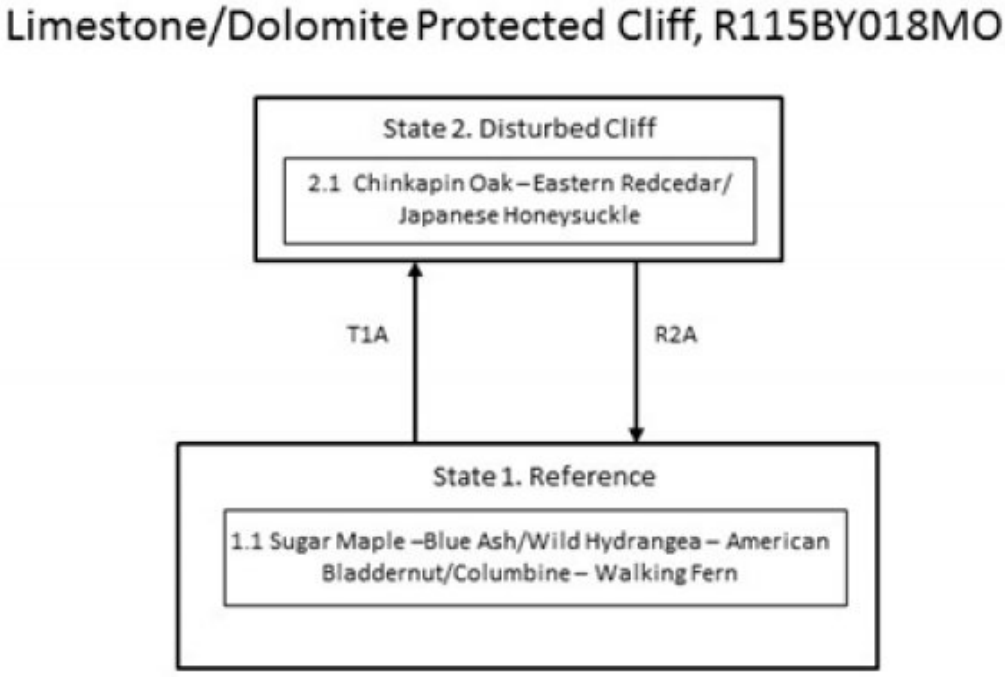
Protected cliffs are normally more vegetated than exposed cliffs. Vegetation structure is influenced by drought stress (cliff edge), wind, and storm damage and damage by falling rocks.

A state-and-transition 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 may change as knowledge increases.

Ecological Site Correlation Issues and Questions:

OSD information for this ecological site indicates that Gasconade map units are limestone derived but Clinkenbeard map units can be either limestone or dolomite derived. The Gasconade-Rock outcrop map unit (60103) associated with this ecological site may need to be more accurately named Limestone Protected/Exposed Cliff rather than its existing naming, with map unit 60009 remaining Limestone/Dolomite Protected Cliff or Limestone/Dolomite Exposed Cliff. Further field review is needed.

State and transition model



Code	Event/Activity/Process
T1A	Exotic plant invasion; woody encroachment; Human disturbances: rock climbing, rappelling
R2A	Woody removal; site protection and monitoring

Figure 7. State and transition diagram for this ecological s

State 1

Reference

The reference plant community is characterized by rock shelves, vertical rock cliffs and by stress tolerant trees, shrubs, ferns, lichens and mosses. These sites have large expanses of bare rock, with a variety of plants occupying cracks and minor ledges across the cliff face. When present, trees are stunted and the herbaceous vegetation is generally sparse.

Community 1.1
Sugar Maple –Blue Ash/Wild Hydrangea – American Bladdernut/Columbine – Walking Fern

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

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).

State 2
Disturbed Cliff

This state has experienced significant exotic plant invasion, such as Japanese honeysuckle. Repeated trampling by human rock climbing and rappelling activities destroy the structure and composition of the reference plant communities. In addition, woody encroachment through these disturbances is also occurring.

Community 2.1
Chinkapin Oak – Eastern Redcedar/ Japanese Honeysuckle

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

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	–	–	–	–
sugar maple	ACSA3	*Acer saccharum*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
sideoats grama	BOCU	*Bouteloua curtipendula*	Native	–	–
bristleleaf sedge	CAEB2	*Carex eburnea*	Native	–	–
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
Forb/Herb					
waxyleaf meadow-rue	THRE	*Thalictrum revolutum*	Native	–	–
zigzag goldenrod	SOFL2	*Solidago flexicaulis*	Native	–	–
orange coneflower	RUFUU	*Rudbeckia fulgida var. umbrosa*	Native	–	–
red columbine	AQCA	*Aquilegia canadensis*	Native	–	–
wrinkleleaf goldenrod	SORU2	*Solidago rugosa*	Native	–	–
Fern/fern ally					
walking fern	ASRH2	*Asplenium rhizophyllum*	Native	–	–
bulblet bladderfern	CYBU3	*Cystopteris bulbifera*	Native	–	–
ebony spleenwort	ASPL	*Asplenium platyneuron*	Native	–	–
purple cliffbrake	PEAT2	*Pellaea atropurpurea*	Native	–	–
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
wild hydrangea	HYAR	*Hydrangea arborescens*	Native	–	–
American bladdernut	STTR	*Staphylea trifolia*	Native	–	–
Nonvascular					
rim lichen	LEMU60	*Lecanora muralis*	Native	–	–
false Russell's fishscale lichen	PSPS3	*Psora pseudorussellii*	Native	–	–

Table 7. Community 2.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
Indiangrass	SONU2	*Sorghastrum nutans*	Native	–	–
sideoats grama	BOCU	*Bouteloua curtipendula*	Native	–	–
Forb/Herb					
Missouri orange coneflower	RUMI	*Rudbeckia missouriensis*	Native	–	–

Animal community

Wildlife *

Only a few animals are highly associated with cliff natural communities due to their unique structural conditions.

Bird species associated with this ecological site’s reference state condition: Turkey Vulture, Eastern Phoebe, American Kestrel, Northern Rough-winged Swallow, Cliff Swallow, and Barn Swallow.

North-facing cliffs that are wet and moist may have numerous lungless salamander (Family Plethodontidae) species and pickerel frogs (Rana palustris).

Small mammals likely associated with this ecological site’s reference state condition: Eastern Woodrat (Neotoma floridana) and Peromyscus species.

As with most natural communities, many invertebrate groups are represented on cliff natural communities including snails, spiders, insects, centipedes, millipedes and protistan microbe communities. Funnel-web and aerial web spiders are two groups well represented on cliff natural communities. Colonies of microcaddisflies and midgeflies are some of the invertebrate groups that occur on seep-type habitats created by the movement of thin sheets of water over the rock surface. Terrestrial snails are often abundant in the talus slopes that develop at the base of protected limestone/dolomite cliffs.

*This section prepared by Mike Leahy, Natural Areas Coordinator, Missouri Department of Conservation, 2013

Other information

Forestry

Management: This ecological site is not recommended for traditional timber management activity

Inventory data references

No known reference sites.

Other references

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

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

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Contributors

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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:**