USDA Natural Resources Conservation Service

Ecological site F116AY037MO
Gravelly/Loamy Upland Drainageway Forest

Last updated: 9/24/2020
Accessed: 04/25/2024

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): 116A–Ozark Highland

The Ozark Highland constitutes the Salem Plateau of the Ozark Uplift. Elevation ranges from about 300 feet on the southeast edge of the Ozark escarpment, to about 1,600 feet in the west, adjacent to the Burlington Escarpment of the Springfield Plateau. The underlying bedrock is mainly horizontally bedded Ordovician-aged dolomites and sandstones that dip gently away from the uplift apex in southeast Missouri. Cambrian dolomites are exposed on deeply dissected hillslopes. In some places, Pennsylvanian and Mississipian sediments overlie the plateau. Relief varies, from the gently rolling central plateau areas to deeply dissected hillslopes associated with drainageways such as the Buffalo, Current, Eleven Point and White Rivers.

Classification relationships

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

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

The reference state for this ecological site is most similar to a Acer (barbatum, saccharum) - Juglans nigra - Fraxinus americana / Hybanthus concolor Forest (CEGL007811).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site is widespread across the Ozark Highlands Section.

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”.

Gravelly/Loamy Upland Drainageway Forests are widely distributed throughout the Ozark Highland, in narrow upland drainageways. Soils range from loamy to very gravelly, and are subject to flooding. The reference plant community is forest with an overstory dominated by a wide variety of trees including white oak, black oak, northern red oak, elm and hickory, an understory dominated by flowering dogwood and American hornbeam and an herbaceous ground flora dominated by wildrye and sedge.

Associated sites

F116AY013MO	**Low-Base Chert Protected Backslope Woodland** Low-base Chert Protected Backslope Woodlands and other chert upland ecological sites are upslope, on steep lower backslopes with northern to eastern exposures.
F116AY049MO	**Low-Base Chert Exposed Backslope Woodland** Low-base Chert Exposed Backslope Woodlands and other chert upland ecological sites are upslope, on steep lower backslopes with southern to western exposures.

Similar sites

F116AY036MO	**Wet Upland Drainageway Forest** Wet Upland Drainageway Forests are on similar landscape positions but are more hydric.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Cornus florida* (2) *Carpinus caroliniana*
Herbaceous	(1) *Elymus virginicus* (2) *Carex*

Physiographic features

This site is in narrow drainageways in the uplands, with slopes of 1 to 5 percent. The site receives runoff from adjacent upland sites. Most areas are subject to frequent, brief flooding.

The following figure (adapted from Wolf, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “4” on the figure. Gravelly/Loamy Upland Drainageway sites are often associated with uplands that have abundant chert fragments, such as the Low-base Chert sites shown here.

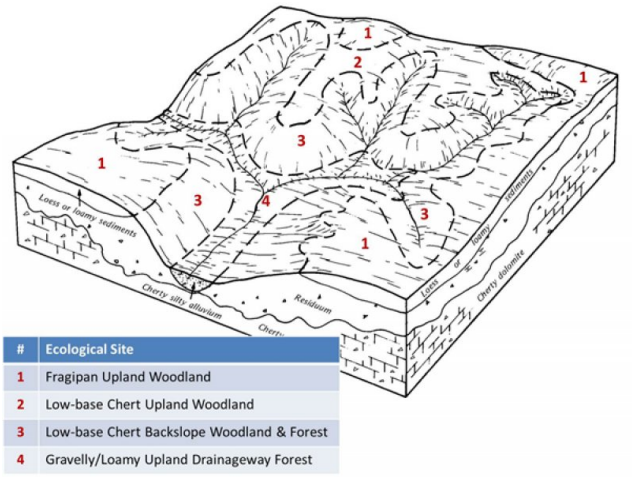


Figure 2. Landscape relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Drainageway
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Slope	0–3%
Aspect	Aspect is not a significant factor

Climatic features

The Ozark Highland 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 Ozark Highland 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 crossing the MLRA from northwest to southeast.
The average annual precipitation in almost all of this area is 38 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 53 to 60 degrees F. The lower temperatures occur at the higher elevations in the western part of the MLRA. Mean January minimum temperature follows a stronger north-to-south 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 a northwest to southeast gradient. Seasonal climatic variations are more complex. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages three to four times greater than January precipitation. Most of the rainfall occurs as high-intensity, convective thunderstorms in summer.

During years when precipitation 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. Deep sinkholes often have a microclimate significantly cooler, moister, and shadier than surrounding surfaces, a phenomenon that may result in a strikingly different ecology. 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; Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin, United States Department of Agriculture Handbook 296 - http://soils.usda.gov/survey/geography/mlra/

Table 3. Representative climatic features

Frost-free period (characteristic range)	149-162 days
Freeze-free period (characteristic range)	177-187 days
Precipitation total (characteristic range)	1,143-1,245 mm
Frost-free period (actual range)	147-176 days
Freeze-free period (actual range)	177-203 days
Precipitation total (actual range)	1,143-1,270 mm
Frost-free period (average)	157 days
Freeze-free period (average)	185 days
Precipitation total (average)	1,194 mm

Climate stations used

- (1) VERSAILLES 2W [USC00238603], Versailles, MO
- (2) MARBLE HILL [USC00235253], Marble Hill, MO
- (3) ALTON 6 SE [USC00230127], Alton, MO
- (4) ROLLA UNI OF MISSOURI [USC00237263], Rolla, MO
- (5) GALENA [USC00233094], Galena, MO

Influencing water features

This ecological site contains first-order streams, which originate from headslope positions at the upper reaches of the units, and are fed from smaller headslopes in the adjacent uplands. The lower reaches of units often contain second-order streams. These streams are ephemeral in most years, with flow in the late fall, winter, and spring months, generally disappearing in the summer, or reduced to isolated pools in the lower reaches. Stream levels typically respond quickly to storm events, especially in watersheds where surface runoff is dominant. Short-duration flooding is common in many areas. Streambeds that are typically incised into the surrounding floodplain by as much as 10 feet may be a sign of an alternative state.

These upland drainageways with high permeability sands and gravels, have significant volume of flow in the lateral and longitudinal directions that is quite large, and can exceed the volume of stream flow in the active channel. These reaches have a high watershed recharge potential. This potential is maximized when the channel is no deeper than its reference geometry. Deeper channels remove water by drainage lateral effect at a high rate, sending water downstream that otherwise would have been stored in the soil matrix for slow recharge to maintain baseflow during dry periods.

Soil features

These soils have no rooting restrictions, although many areas have low plant-available water capacity, due to an abundance of coarse fragments. They were formed under primarily woodland vegetation. Parent material is alluvium. They have loam or silt loam surface horizons that are often gravelly, and loamy subsoils with abundant gravel and cobbles in many places. These soils are not affected by seasonal wetness. Soil series associated with this site include Atkins, Bearthicket, Bloomsdale, Britwater, Cedargap, Dameron, Dapue, Elsah, Gladden, Haymond, Hontas, Horsecreek, Huzzah, Jamesfin, Kaintuck, Midco, Perche, Pinerun, Possumtrot, Racket, Raftville, Razort, Relfe, Sandbur, Secesh, Sharon, Stultz, Sturkie, Tilk, Wakefield, and Wideman.

The accompanying picture of the Cedargap series shows the abundant gravel and cobble content that characterizes these skeletal soils. Scale is in feet. Picture courtesy of John Preston, NRCS.

Figure 9. Cedargap series

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	183 cm
Surface fragment cover <=3"	0–40%
Surface fragment cover >3"	0–20%
Available water capacity (0-101.6cm)	5.08–20.32 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)	4.5–7.2
Subsurface fragment volume <=3" (Depth not specified)	0–70%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

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

Gravelly/Loamy Upland Drainageway Forests occur throughout the Ozark Highland as a very common linear feature along many low order streams. Because many of the streams are relatively high gradient, they have a rather flashy flood regime, and movement and deposition of coarse alluvial materials is common. They are well drained and drier, thus supporting more drought resistant white oak and black oak along with a variety of other hardwood trees.

The reference community is a well-developed forest with a rather tall, developed canopy (60 to 80 feet tall and 80 to 100 percent canopy closure), a complex understory and a dense herbaceous ground flora. Gaps in all three layers are common due to flash flooding. White oak and black oak dominate along with a variety of mixed hardwood tree species, including northern red oak, elm, shortleaf pine and hickory. Flowering dogwood and American hornbeam form a well-developed understory with a dense herbaceous layer dominated by wildrye and sedge.

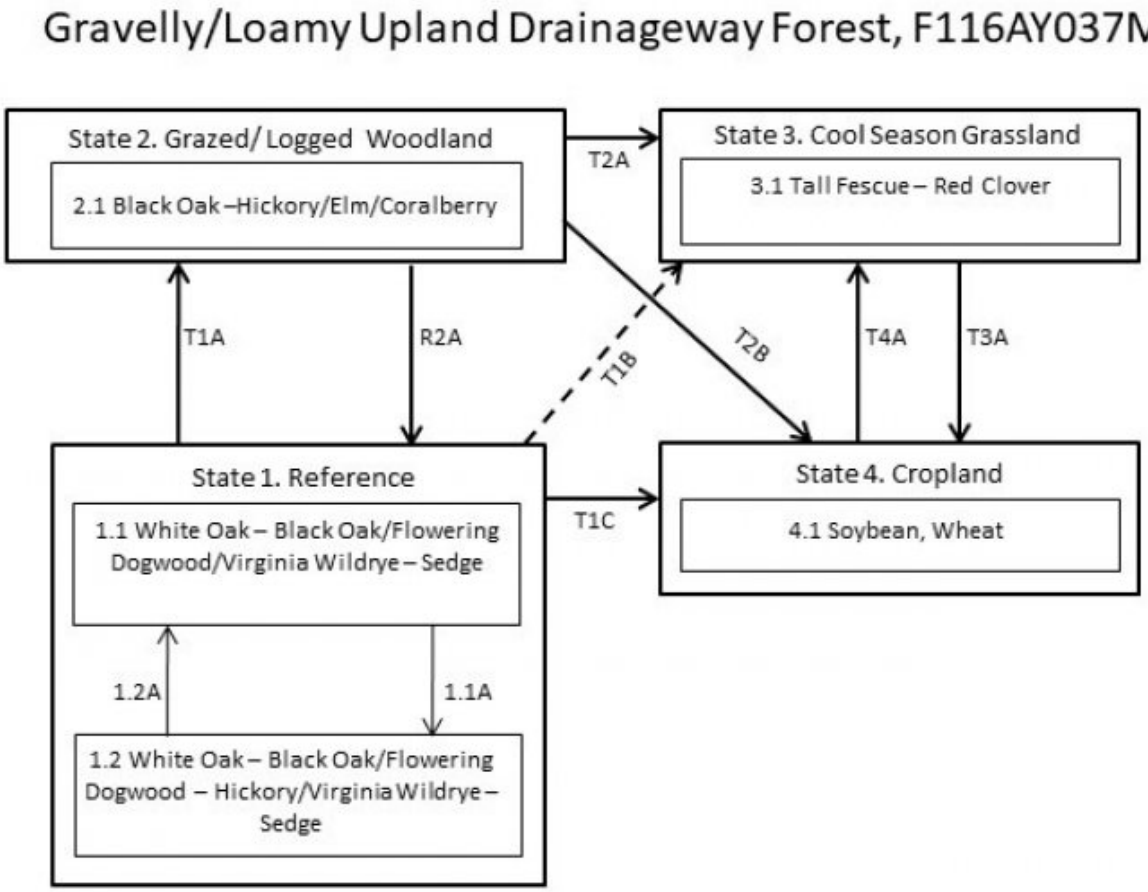
Because of the narrow floodplain setting, frequent flooding and rather droughty soils, many upland drainageway forests remain. They often occur as a rather narrow band of timber traversing the headwater streams, often in a matrix of upland forest.

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

Some carefully planned timber harvest might be tolerated by this system, but high grading of the timber can also degrade the system. Re-establishment of these drainageway forests is important for stream quality and health, as well as for migratory birds. Replanting of these systems has proven to be quite successful, but species selection needs to pay attention to local soil and moisture conditions.

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/Process
T1A	Grazing; repeated timber harvests
T3A	Conservation tillage; conservation cropping system
T1B,T2A	Woody removal; tillage; vegetative seeding; grassland management
T1C, T2B	Woody removal; conservation tillage; conservation cropping system
T4A	Vegetative seeding ; grassland management; fertilizing
1.1A	Lack of disturbance events 10+ years
1.2A	Disturbance events 2-5 years
R2A	Forest stand improvement

Figure 10. State and transition diagram for this ecological site

State 1

Reference

The historical reference state for this ecological site was old growth oak forest. The forest was dominated by a wide variety of deciduous hardwood tree species including white oak and black oak. Periodic disturbances from flooding, fire, wind or ice as well as grazing by native large herbivores maintained the forest structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species. Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency. Reference states are very rare today. Fire suppression and altered drainage have resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Most reference states are currently altered because of timber harvesting, clearing and conversion to grassland or cropland.

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- flowering dogwood (*Cornus florida*), shrub
- Virginia wildrye (*Elymus virginicus*), grass
- sedge (*Carex*), grass

Community 1.1
White Oak – Black Oak/Flowering Dogwood/Virginia Wildrye – Sedge

Figure 11. Gravelly/Loamy Upland Drainageway Forest at Cave Fork Creek, Mark Twain National Forest. Carter Co., Missouri; photo credit MDC.

Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency.

Forest overstory. Forest Overstory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Forest understory. Forest Understory Species list is based on field reconnaissance as well as commonly occurring species listed in Nelson 2010; names and symbols are from USDA PLANTS database.

Community 1.2
White Oak – Black Oak/Flowering Dogwood – Hickory Saplings/Virginia Wildrye – Sedge

Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency.

Pathway P1.1A
Community 1.1 to 1.2

Lack of disturbance events 10 plus years

Pathway P1.2A
Community 1.2 to 1.1

Disturbance events 2-5 years.

State 2
Grazed/ Logged Forest

Composition is altered from the reference state due to tree selection during harvest. This state will slowly increase in more shade tolerant species and white oak will become less dominant. Without periodic canopy disturbance, stem density and fire intolerant species, like elm, will increase in abundance. Some periodic grazing may be occurring.

Dominant plant species

- black oak (*Quercus velutina*), tree
- shagbark hickory (*Carya ovata*), tree
- elm (*Ulmus*), tree
- coralberry (*Symphoricarpos orbiculatus*), shrub

Community 2.1
Black Oak –Hickory/Elm Saplings/Coralberry

State 3
Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue, orchard grass, 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 and transitions.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- red clover (*Trifolium pratense*), other herbaceous

Community 3.1
Tall Fescue – White Clover

State 4
Cropland

This is a state that exists currently with intensive cropping of soybeans and wheat. Some conversion to non-native cool season hay land occurs, but when commodity prices are high, these states transition back to cropland.

Dominant plant species

- wheat (*Triticum*), grass
- soybean (*Glycine max*), other herbaceous

Community 4.1
Soybean, Wheat

Transition T1A
State 1 to 2

Grazing; repeated timber harvests

Transition T1B
State 1 to 3

Woody removal; tillage; vegetative seeding; grassland management.

Transition T1C
State 1 to 4

Woody removal; tillage; conservation cropping system.

Restoration pathway R2A
State 2 to 1

Forest stand improvement; Access control; no grazing

Transition T2A
State 2 to 3

Woody removal; tillage; vegetative seeding; grassland management.

Transition T2B
State 2 to 4

Woody removal; tillage; conservation cropping system.

Transition T3A
State 3 to 4

Tillage; conservation cropping system.

Transition T4A
State 4 to 3

Vegetative seeding; grassland 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							
shortleaf pine	PIEC2	*Pinus echinata*	Native	–	–	–	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	–	–	–
Shumard's oak	QUSH	*Quercus shumardii*	Native	–	–	–	–
black oak	QUVE	*Quercus velutina*	Native	–	–	–	–
mockernut hickory	CATO6	*Carya tomentosa*	Native	–	–	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
American sycamore	PLOC	*Platanus occidentalis*	Native	–	–	–	–
common hackberry	CEOC	*Celtis occidentalis*	Native	–	–	–	–
bitternut hickory	CACO15	*Carya cordiformis*	Native	–	–	–	–
black walnut	JUNI	*Juglans nigra*	Native	–	–	–	–
white oak	QUAL	*Quercus alba*	Native	–	–	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	–	–	–
American elm	ULAM	*Ulmus americana*	Native	–	–	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
parasol sedge	CAUM4	*Carex umbellata*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	–
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	–
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	–
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	–
Indian woodoats	CHLA5	*Chasmanthium latifolium*	Native	–	–
nodding fescue	FESU3	*Festuca subverticillata*	Native	–	–
eastern woodland sedge	CABL	*Carex blanda*	Native	–	–
reflexed sedge	CARE9	*Carex retroflexa*	Native	–	–
black edge sedge	CANI3	*Carex nigromarginata*	Native	–	–
northern panicgrass	DIBO	*Dichanthelium boreale*	Native	–	–
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	–
Forb/Herb					
Canadian wildginger	ASCA	*Asarum canadense*	Native	–	–
American bellflower	CAAM18	*Campanulastrum americanum*	Native	–	–
carpenter's square	SCMA2	*Scrophularia marilandica*	Native	–	–
Carolina elephantsfoot	ELCA3	*Elephantopus carolinianus*	Native	–	–
striped cream violet	VIST3	*Viola striata*	Native	–	–
green dragon	ARDR3	*Arisaema dracontium*	Native	–	–

white crownbeard	VEVI3	*Verbesina virginica*	Native	–	–
eastern greenviolet	HYCO6	*Hybanthus concolor*	Native	–	–
bluejacket	TROH	*Tradescantia ohiensis*	Native	–	–
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	–
Canadian clearweed	PIPU2	*Pilea pumila*	Native	–	–
wild blue phlox	PHDI5	*Phlox divaricata*	Native	–	–
cutleaf coneflower	RULA3	*Rudbeckia laciniata*	Native	–	–
bristly buttercup	RAHI	*Ranunculus hispidus*	Native	–	–
stalked wild petunia	RUPE4	*Ruellia pedunculata*	Native	–	–
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	–
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	–
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	–
Carolina elephantsfoot	ELCA3	*Elephantopus carolinianus*	Native	–	–
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	–
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	–
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	–	–
fourleaf yam	DIQU	*Dioscorea quaternata*	Native	–	–
Shrub/Subshrub					
American hazelnut	COAM3	*Corylus americana*	Native	–	–
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
Carolina buckthorn	FRCA13	*Frangula caroliniana*	Native	–	–
Tree					
flowering dogwood	COFL2	*Cornus florida*	Native	–	–
American hornbeam	CACA18	*Carpinus 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.

Oaks provide hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food;

Sedges and native cool-season grasses provide green browse; patchy native warm-season grasses 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 mature communities include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Eastern Wood-Pewee, Broad-winged Hawk, Great-Crested Flycatcher, Summer Tanager, and Red-eyed Vireo.

Reptile and amphibian species associated with this ecological site include tiger salamander, small-mouthed salamander, ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, flat-headed snake, and rough earth snake.

Other information

Forestry (NRCS 2002; 2014):

Management: Estimated site index values range from 50 to 70. 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. Maintain adequate riparian buffer areas.

Limitations: Wetness from flooding – short duration; coarse fragments in profile; excessive drainage. The use of equipment may be restricted in spring and other excessively wet periods. Disturbing the surface excessively in harvesting operations and building roads increases soil losses, which may leave a greater amount of coarse fragments on the surface. Tree planting is difficult during spring flooding periods. Mechanical tree planting may be limited due to coarse fragments on surface.

Inventory data references

Potential Reference Sites: Gravelly/Loamy Upland Drainageway Forest

Plot CAFOFS01 – Tilk soil
Located in Cave Fork Creek, MTNF, USFS, Carter County, MO
Latitude: 36.871945
Longitude: -91.024307

Plot CASPFS06 – Relfe soil
Located in Carman Springs NA, MTNF, USFS, Howell County, MO
Latitude: 36.932935
Longitude: -92.076176

Plot GIRACA02 – Cedargap soil
Located in Gist Ranch CA, Texas County, MO
Latitude: 37.173681
Longitude: -91.794434

Plot NOFOFS01 – Bloomsdale soil
Located in North Fork Fourche Creek, MTNF, USFS, Carter County, MO
Latitude: 36.641001
Longitude: -91.018583

Plot STJOSP_KS07 – Midco soil
Located in St. Joe State Park, St. Francois County, MO
Latitude: 37.794617
Longitude: -90.473367

Plot WESTFS10 – Cedargap soil
Located in Western Star Flatwoods NA, MTNF, USFS, Phelps County, MO
Latitude: 37.852068
Longitude: -91.973971

Plot RORISP06 – Cedargap soil
Located in Roaring River State Park, Barry County, MO
Latitude: 36.592857
Longitude: -93.844788

Other references

Anderson, R.C. 1990. The historic role of fire in North American grasslands. Pp. 8-18 in S.L. Collins and L.L. Wallace (eds.). Fire in North American tallgrass prairies. University of Oklahoma Press, Norman.

Batek, M.J., A.J. Rebertus, W.A. Schroeder, T.L. Haithcoat, E. Compas, and R.P. Guyette. 1999. Reconstruction of early nineteenth-century vegetation and fire regimes in the Missouri Ozarks. Journal of Biogeography 26:397-412.

Harlan, J.D., T.A. Nigh and W.A. Schroeder. 2001. The Missouri original General Land Office survey notes project. University of Missouri, Columbia.

Ladd, D. 1991. Reexamination of the role of fire in Missouri oak woodlands. Pp. 67-80 in G.V. Brown, James K.; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 257 p.

Missouri Department of Conservation. 2010. 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.

Natural Resources Conservation Service. Site Index Reports. Accessed May 2014. https://esi.sc.egov.usda.gov/ESI_Forestland/pgFSWelcome.aspx

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. 550p.

Nigh, Timothy A., and Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, Missouri. 212p.

Schoolcraft, H.R. 1821. Journal of a tour into the interior of Missouri and Arkansas from Potosi, or Mine a Burton, in Missouri territory, in a southwest direction, toward the Rocky Mountains: performed in the years 1818 and 1819. Richard Phillips and Company, London.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 682 pgs.

Wolf, David W. 1989. Soil Survey of Pulaski County, Missouri. U.S. Dept. of Agric. Soil Conservation Service.

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Approval

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Acknowledgments

Missouri Department of Conservation and Missouri Department of Natural Resources personnel provided significant and helpful field and technical support during this project.

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	04/25/2024
Approved by	Nels Barrett
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

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

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

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

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

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

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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:**