USDA Natural Resources Conservation Service

Ecological site F115XB028MO
Loamy/Gravelly Upland Drainageway Forest

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 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 Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest (CEGL002058).

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

Ecological site concept

NOTE: This is a “provisional” Ecological Site Description (ESD) that is under development. It contains basic ecological information that can be used for conservation planning, application and land management. After additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Loamy/Gravelly Upland Drainageway Forests are scattered in small delineations throughout the upland portions of

the MLRA and in adjacent areas. They are associated with Loamy Floodplain Riverfront Forest sites downstream, and with adjacent upland ecological sites. Soils are loamy, with abundant gravel in some places, and are subject to flooding. The reference plant community is forest with an overstory dominated by a wide variety of trees including northern red oak, sugar maple, and American elm, an understory dominated by spicebush and hornbeam, and an herbaceous ground flora dominated by sedges.

Associated sites

F115XB004MO	**Loess Upland Woodland** Deep loess upland ecological sites, such as Loess Upland Woodlands, are typically found upslope.
F115XB017MO	**Sandstone Protected Backslope Forest** Steep backslope ecological sites, such as Sandstone Protected Backslope Forests, are usually found immediately upslope.

Similar sites

F115XB026MO	**Wet Upland Drainageway Forest** Wet Upland Drainageway Forests are also associated with upland stream systems but have species more associated with wetter sites.

Table 1. Dominant plant species

Tree	(1) *Quercus rubra* (2) *Acer saccharum*
Shrub	(1) *Carpinus caroliniana*
Herbaceous	(1) *Viola missouriensis* (2) *Carex*

Physiographic features

This site is in narrow drainageways in the uplands, with slopes of 1 to 4 percent. The site receives runoff from adjacent upland sites. Most areas are subject to frequent, brief flooding.

The following figure (adapted from Skaer, 2004) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the adjacent uplands. The site is within the area labeled “5”, in narrow drainageways directly adjacent to steep uplands. Sandstone stratigraphy is shown here, but Loamy/Gravelly Upland Drainageways are also associated with deep loess and limestone uplands.

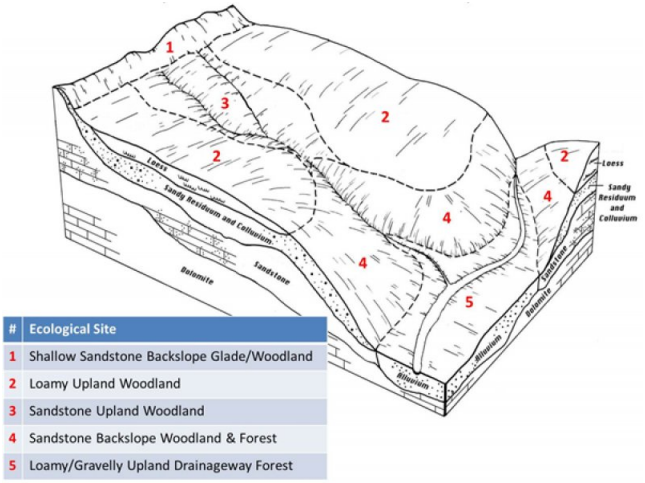


Figure 2. Landscape relationships for this ecological site.

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	1–4%
Aspect	Aspect is not a significant factor

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)	170 days

Freeze-free period (average)	196 days
Precipitation total (average)	1,194 mm

Climate stations used

- (1) COLUMBIA U OF M [USC00231801], Columbia, MO
- (2) JACKSON [USC00234226], Jackson, MO
- (3) ELSBERRY 1 S [USC00232591], Elsberry, MO
- (4) WELDON SPRING NWS [USC00238805], Saint Charles, MO

Influencing water features

This ecological site contains first- and second-order streams, which originate from headslope positions at the upper reaches of the units, and are fed from smaller headslopes in the adjacent uplands. 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 reaches have a high watershed recharge potential. This potential is maximized when the channel is no deeper than it’s 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. In addition, 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.

Soil features

These soils have no rooting restriction. They were formed under a mixture of prairie and woodland vegetation. Parent material is alluvium. They have loam or silt loam surface horizons, and loamy subsoils that are gravelly in some soils. In places the soils are very gravelly and cobbly throughout. These soils are not affected by seasonal wetness. Soil series associated with this site include Carr, Cedargap, Dameron, Haymond, Horsecreek, Jemerson, Landes, Perche, Sensabaugh, and Wilbur.

The accompanying picture of the Dameron series shows dark, loamy alluvium, underlain by stratified very gravelly sediments. Picture from Baker (1998).

Figure 7. Dameron series

Table 4. Representative soil features

Surface texture	(1) Gravelly silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately slow
Soil depth	183 cm
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	10.16–20.32 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)	5.2–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–55%
Subsurface fragment volume >3" (Depth not specified)	0–20%

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 reference plant community is a well-developed forest with a rather tall, well developed canopy (75 to 90 feet and 80 to 100 percent canopy closure), a complex understory and a dense herbaceous ground flora. These drainageways tend to be relatively high gradient with frequent annual (often multiple times in a year), flashy floods with quick rises and falls after significant rainfall events. Gaps in all three layers are common due to flash flooding.

A variety of mixed hardwood tree species, including northern red oak, sugar maple, and American elm occur over moisture loving saplings and shrubs (spicebush, hornbeam) and herbaceous ground flora, especially sedges.

Typically, many upland drainageway forests still remain. They often occur as a rather narrow band of timber traversing the headwater streams, often in a matrix of upland forest. Occasionally, on wider drainageways, this ecological site is cleared and converted to cropland or pasture, with a narrow strip of woodland retained along the stream edge. In such cases, severe flooding may cause stream bank erosion and complete loss of this site.

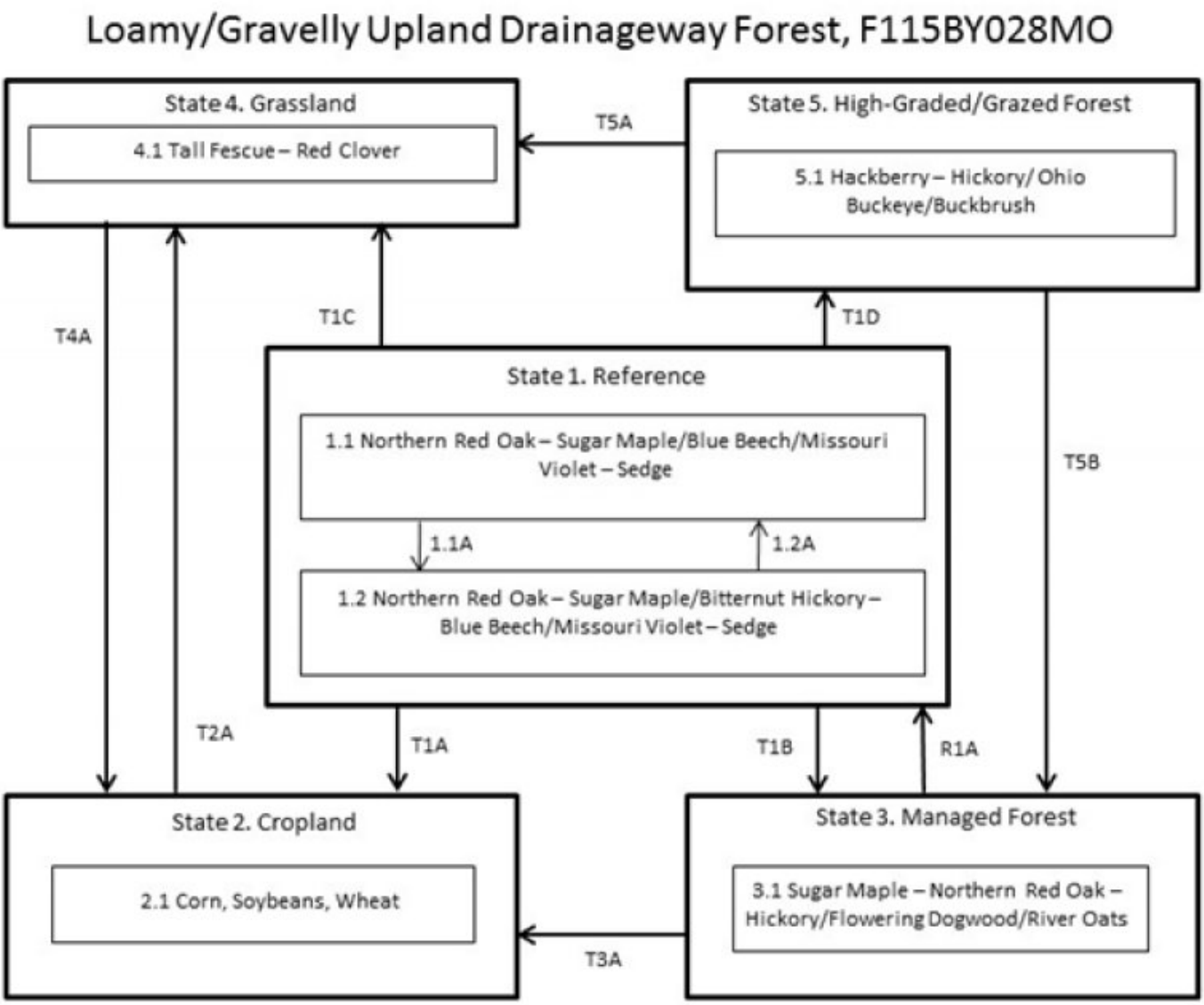
Uncontrolled grazing by domestic livestock in the remaining strips of forest can also kill trees and remove the ground cover, resulting in de-stabilization and potential loss of this system as well. These sites are productive. Some carefully planned timber harvest can be tolerated in this system, but high grading of the timber will degrade the system.

Re-establishment of these productive 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, and 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	Activity/Event/Process
T1A	Clearing; conservation cropping system
T1B	Harvesting; forest management
T1C, T5A	Clearing; grassland planting
T1D	High-grade harvesting; uncontrolled grazing
T2A	Grassland planting
T3A	Clearing; conservation cropping system
T4A	Tillage; conservation cropping system
T5A	Tree planting; long-term succession; no grazing
T5B	Forest management; tree planting; no grazing

Code	Activity/Event/Process
1.1A	No disturbance (10+ years)
1.2A	Disturbance (fire, wind, ice) 3-5 years

Code	Activity/Event/Process
R1A	Extended rotations; forest stand improvement

Figure 8. State and transition diagram for this ecological s

State 1

Reference

The reference state was dominated by northern red oak and sugar maple including a wide variety of other deciduous hardwood tree species. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or occurred along with infrequent flooding. Long disturbance-free periods allowed an increase in more shade tolerant species such as bitternut hickory and sugar maple. Two community phases are recognized in this state, with shifts between phases based on disturbance frequency. The reference state is rare today. Some sites have been converted to cropland (State 2) or grassland (State 4). Others have been subject to repeated, high-graded timber harvest coupled with uncontrolled domestic livestock grazing (State 5). Many reference sites have been managed for timber harvest, resulting in either managed (State 3) forests.

Community 1.1
Northern Red Oak – Sugar Maple/Blue Beech/Missouri Violet – Sedge

Figure 9. Graham Cave State Park, Montgomery County, Missouri; photo credit MDC

This phase is an old growth forest dominated by an overstory of northern red oak and sugar maple. The canopy and understory are well developed with great structural and species diversity. This phase experiences flooding but of short duration.

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

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

Community 1.2
Northern Red Oak – Sugar Maple/Bitternut Hickory – Blue Beech/Missouri Violet – Sedge

Long disturbance-free periods allows an increase in more shade tolerant species such as bitternut hickory, and sugar maple with increased canopy density, which affects the abundance and diversity of ground flora.

State 2
Cropland

Occasionally, on wider drainageways, this ecological site is cleared and converted to cropland with a narrow strip of woodland retained along the stream edge. Major crops include corn, soybeans and wheat.

Community 2.1
Corn, Soybeans, Wheat

This is a common phase that exists currently with intensive cropping of corn, soybeans, and wheat occurring. Some conversion to cool season grassland occurs for a limited period of time before transitioning back to cropland.

State 3

Managed Forest

Managed forests can resemble the reference state but are denser. The biggest differences are tree age, most being only 50 to 90 years old, and canopy closure. Composition is also likely altered from the reference state depending on tree selection during harvest. In addition, without a regular 15 to 20 year harvest re-entry into these stands, they will slowly increase in more shade tolerant species such as bitternut hickory and sugar maple and northern red oak will become less dominant.

Community 3.1
Sugar Maple – Northern Red Oak – Hickory/Flowering Dogwood/River Oats

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

State 4
Grassland

Conversion of forests to planted, non-native cool season grassland species such as tall fescue and red clover has been common in this region. High grain commodity prices will encourage transition to State 2 (Cropland).

Community 4.1
Tall Fescue – Red Clover

This phase is a 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).

State 5
High-Graded/Grazed Woodland

Forested sites subjected to repeated, high-graded timber harvests and uncontrolled domestic grazing transition to this state. This state exhibits an over-abundance of hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Exclusion of livestock from sites in this state coupled with forest management techniques will cause a transition to State 3.

Community 5.1
Hackberry – Hickory/ Ohio Buckeye/Buckbrush

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							
white ash	FRAM2	*Fraxinus americana*	Native	–	–	–	–
sugar maple	ACSA3	*Acer saccharum*	Native	–	–	–	–
bitternut hickory	CACO15	*Carya cordiformis*	Native	–	–	–	–
white oak	QUAL	*Quercus alba*	Native	–	–	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	–	–	–
American elm	ULAM	*Ulmus americana*	Native	–	–	–	–
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	–	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	–	–	–
bur oak	QUMA2	*Quercus macrocarpa*	Native	–	–	–	–
silver maple	ACSA2	*Acer saccharinum*	Native	–	–	–	–
shellbark hickory	CALA21	*Carya laciniosa*	Native	–	–	–	–
common hackberry	CEOC	*Celtis occidentalis*	Native	–	–	–	–
black walnut	JUNI	*Juglans nigra*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
American sycamore	PLOC	*Platanus occidentalis*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
nodding fescue	FESU3	*Festuca subverticillata*	Native	–	–
richwoods sedge	CAOL2	*Carex oligocarpa*	Native	–	–
Indian woodoats	CHLA5	*Chasmanthium latifolium*	Native	–	–
eastern woodland sedge	CABL	*Carex blanda*	Native	–	–
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	–
parasol sedge	CAUM4	*Carex umbellata*	Native	–	–
Forb/Herb					
Canadian woodnettle	LACA3	*Laportea canadensis*	Native	–	–
biannual lettuce	LALU	*Lactuca ludoviciana*	Native	–	–
early meadow-rue	THDI	*Thalictrum dioicum*	Native	–	–
stalked wild petunia	RUPE4	*Ruellia pedunculata*	Native	–	–
bloodroot	SACA13	*Sanguinaria canadensis*	Native	–	–
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	–
common blue wood aster	SYCO4	*Symphyotrichum cordifolium*	Native	–	–
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	–
cutleaf coneflower	RULA3	*Rudbeckia laciniata*	Native	–	–
beaked agrimony	AGRO3	*Agrimonia rostellata*	Native	–	–
yellow passionflower	PALU2	*Passiflora lutea*	Native	–	–

violet lespedeza	LEVI6	*Lespedeza violacea*	Native	–	–
largebract ticktrefoil	DECU	*Desmodium cuspidatum*	Native	–	–
cutleaf toothwort	CACO26	*Cardamine concatenata*	Native	–	–
white avens	GECA7	*Geum canadense*	Native	–	–
feathery false lily of the valley	MARA7	*Maianthemum racemosum*	Native	–	–
lateflowering thoroughwort	EUSE2	*Eupatorium serotinum*	Native	–	–
licorice bedstraw	GACI2	*Galium circaezans*	Native	–	–
common yellow oxalis	OXST	*Oxalis stricta*	Native	–	–
Canadian wildginger	ASCA	*Asarum canadense*	Native	–	–
eastern waterleaf	HYVI	*Hydrophyllum virginianum*	Native	–	–
wingstem	VEAL	*Verbesina alternifolia*	Native	–	–
Fern/fern ally					
Christmas fern	POAC4	*Polystichum acrostichoides*	Native	–	–
lowland bladderfern	CYPR4	*Cystopteris protrusa*	Native	–	–
Shrub/Subshrub					
Carolina buckthorn	FRCA13	*Frangula caroliniana*	Native	–	–
coralberry	SYOR	*Symphoricarpos orbiculatus*	Native	–	–
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	–
pawpaw	ASTR	*Asimina triloba*	Native	–	–
eastern leatherwood	DIPA9	*Dirca palustris*	Native	–	–
Tree					
hophornbeam	OSVI	*Ostrya virginiana*	Native	–	–
Ohio buckeye	AEGL	*Aesculus glabra*	Native	–	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	–
flowering dogwood	COFL2	*Cornus florida*	Native	–	–
American hornbeam	CACA18	*Carpinus caroliniana*	Native	–	–
Vine/Liana					
cat greenbrier	SMGL	*Smilax glauca*	Native	–	–

Animal community

Wildlife (MDC 2006):

Wild turkey, white-tailed deer, and eastern gray squirrel depend on hard and soft mast food sources and are typical upland game species of this type.

Birds associated with mid-successional stages include Whip-poor-will and Wood Thrush while birds associated with late-successional stages 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 measured site index values average 66 for black oak and chinkapin oak and 58 for northern red 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. Where possible, favor white oak, black walnut, northern red oak, and bitternut hickory. Maintain adequate riparian buffer areas.

Limitations: No major limitations or restrictions. Occasional periods of seasonal wetness; Use of equipment may be restricted in spring and other excessively wet periods. Equipment use when wet may compact soil and damage tree roots. Tree planting may be difficult during spring flooding periods.

Inventory data references

Loamy/Gravelly Upland Drainageway Forest – Potential Reference – F115BY028MO - Loamy

Plot BAWIUM02 - Dameron soil
Located in Baskett Wilderness Area, Boone County, MO
Latitude: 38.736083
Longitude: -92.206152

Plot DOROSP03 – Perche soil
Located in Don Robinson State Park, Jefferson County, MO
Latitude: 38.398376
Longitude: -90.70243

Plot DOROSP09 - Perche soil
Located in Don Robinson State Park, Jefferson County, MO
Latitude: 38.398186
Longitude: -90.702516

Plot EAHOCA02 – Dameron soil
Located in Earthquake Hollow CA, Callaway County, MO
Latitude: 38.695691
Longitude: -92.052277

Plot REIFCA_JK03 – Dameron soil
Located in Reifsnider CA, Warren County, MO
Latitude: 38.76963
Longitude: -91.0986

Plot REIFCA_JK16 - Dameron soil
Located in Reifsnider CA, Warren County, MO
Latitude: 38.7678
Longitude: -91.10032

Loamy/Gravelly Upland Drainageway Forest – Potential Reference – F115BY028MO – Gravelly

Plot BAWIUM03 - Cedargap soil
Located in Baskett Wilderness Area, Boone County, MO
Latitude: 38.745015
Longitude: -92.208249

Plot DABOCA_JK19 – Cedargap soil
Located in Daniel Boone CA, Warren County, MO
Latitude: 38.792166
Longitude: -91.38311

Plot DABOCA06 – Cedargap soil
Located in Daniel Boone CA, Warren County, MO
Latitude: 38.772365
Longitude: -91.37764

Plot DANVCA_JK14 – Cedargap soil
Located in Danville CA, Montgomery County, MO
Latitude: 38.875214
Longitude: -91.53925836

Plot DANVCA05 – Cedargap soil
Located in Danville CA, Montgomery County, MO
Latitude: 38.885563
Longitude: -91.544783

Plot GRCASP12 – Cedargap soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.905589
Longitude: -91.572497

Plot GRCASP15 – Cedargap soil
Located in Graham Cave State Park, Montgomery County, MO
Latitude: 38.903139
Longitude: -91.571094

Plot THCRCA02 – Cedargap soil
Located in Three Creeks CA, Boone County, MO
Latitude: 38.833502
Longitude: -92.287568

Other references

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Skaer, David M. 2004. Soil Survey of Jefferson County, Missouri. U.S. Dept. of Agric. Natural Resources Conservation Service.

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Contributors

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Acknowledgments

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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:**
