USDA Natural Resources Conservation Service

Ecological site F116BY017MO
Gravelly/Loamy Upland Drainageway Woodland

Last updated: 10/07/2020
Accessed: 05/09/2024

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.

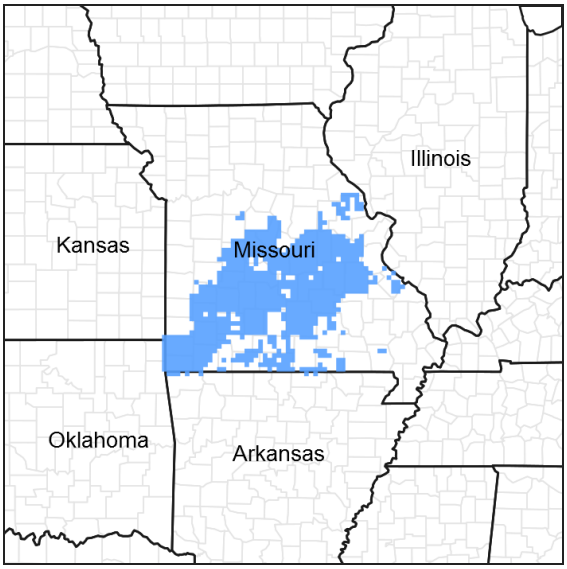


Figure 1. Mapped extent

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): 116B–Springfield Plain

The Springfield Plain is in the western part of the Ozark Uplift. It is primarily a smooth plateau with some dissection along streams. Elevation is about 1,000 feet in the north to over 1,700 feet in the east along the Burlington Escarpment adjacent to the Ozark Highlands. The underlying bedrock is mainly Mississippian-aged limestone, with areas of shale on lower slopes and structural benches, and intermittent Pennsylvanian-aged sandstone deposits on the plateau surface.

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 Woodland.

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

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to a Quercus alba - Quercus stellata - Quercus velutina /

Schizachyrium scoparium Woodland (CEGL002150).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs throughout the Springfield Plain Subsection.

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 Woodlands occur throughout the Springfield Plain, in narrow upland drainageways. Soils range from loamy to very gravelly, and are subject to flooding. The reference plant community is woodland with an overstory dominated by a variety of trees, including white oak, black oak, elm and hickory, an understory dominated by common serviceberry and eastern redbud, and a dense herbaceous layer dominated by wildrye and sedge.

Associated sites

F116BY010MO	**Low-Base Chert Protected Backslope Woodland** Low-base Chert Protected Backslope Woodlands and other upland ecological sites are upslope.
F116BY033MO	**Low-Base Chert Exposed Backslope Woodland** Low-base Chert Exposed Backslope Woodlands and other upland ecological sites are upslope.

Similar sites

F116BY029MO	**Sandy/Gravelly Floodplain Forest** Sandy/Gravelly Floodplain Forests are found in higher order streams with more developed floodplains.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Amelanchier arborea* (2) *Cercis canadensis*
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 adjacent figure (adapted from Aldrich, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “3”, and is typically in narrow drainageways of uplands dominated by Chert or Low-base Chert ecological sites.

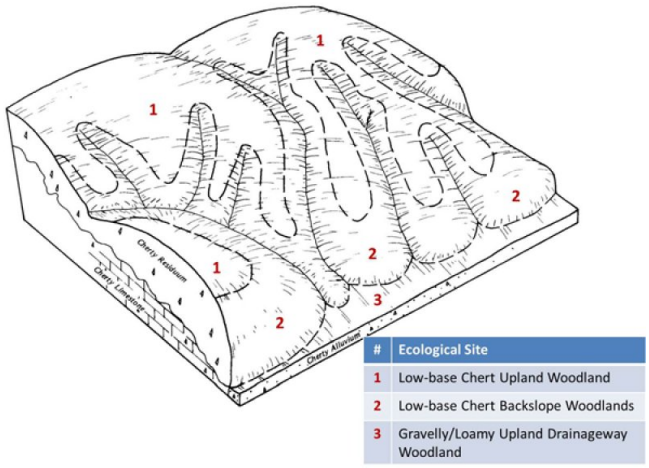


Figure 2. Landscape relationships for this ecological site.

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	1–5%
Aspect	Aspect is not a significant factor

Climatic features

The Springfield Plain 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 Springfield Plain experiences few regional differences in climates. The average annual precipitation in this area is 41 to 45 inches. Snow falls nearly every winter, but the snow cover lasts for only a few days. The average annual temperature is about 55 to 58 degrees F. The lower temperatures occur at the higher elevations. Mean July maximum temperatures have a range of only one or two degrees across the area.
Mean annual precipitation varies along a west to east 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)	144-165 days
Freeze-free period (characteristic range)	185-191 days
Precipitation total (characteristic range)	1,168-1,219 mm
Frost-free period (actual range)	142-169 days
Freeze-free period (actual range)	182-192 days
Precipitation total (actual range)	1,168-1,219 mm
Frost-free period (average)	155 days
Freeze-free period (average)	188 days
Precipitation total (average)	1,194 mm

Climate stations used

- (1) CASSVILLE RANGER STN [USC00231383], Cassville, MO
- (2) NEOSHO [USC00235976], Neosho, MO
- (3) LOCKWOOD [USC00235027], Lockwood, MO
- (4) SPRINGFIELD [USW00013995], Springfield, 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 are typically incised into the surrounding floodplain by as much as 10 feet.

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 a mixture of prairie and woodland vegetation. Parent material is alluvium. They have silt loam surface horizons that are often gravelly, and loamy subsoils with abundant gravel and cobbles in many places. They are not affected by seasonal wetness. Soil series associated with this site include Cedargap, Pinerun, and Secesh.

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) Very gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately slow to moderately rapid
Soil depth	183 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–5%
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)	5.2–7.3
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 Woodlands occur throughout the Springfield Plain 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 trees.

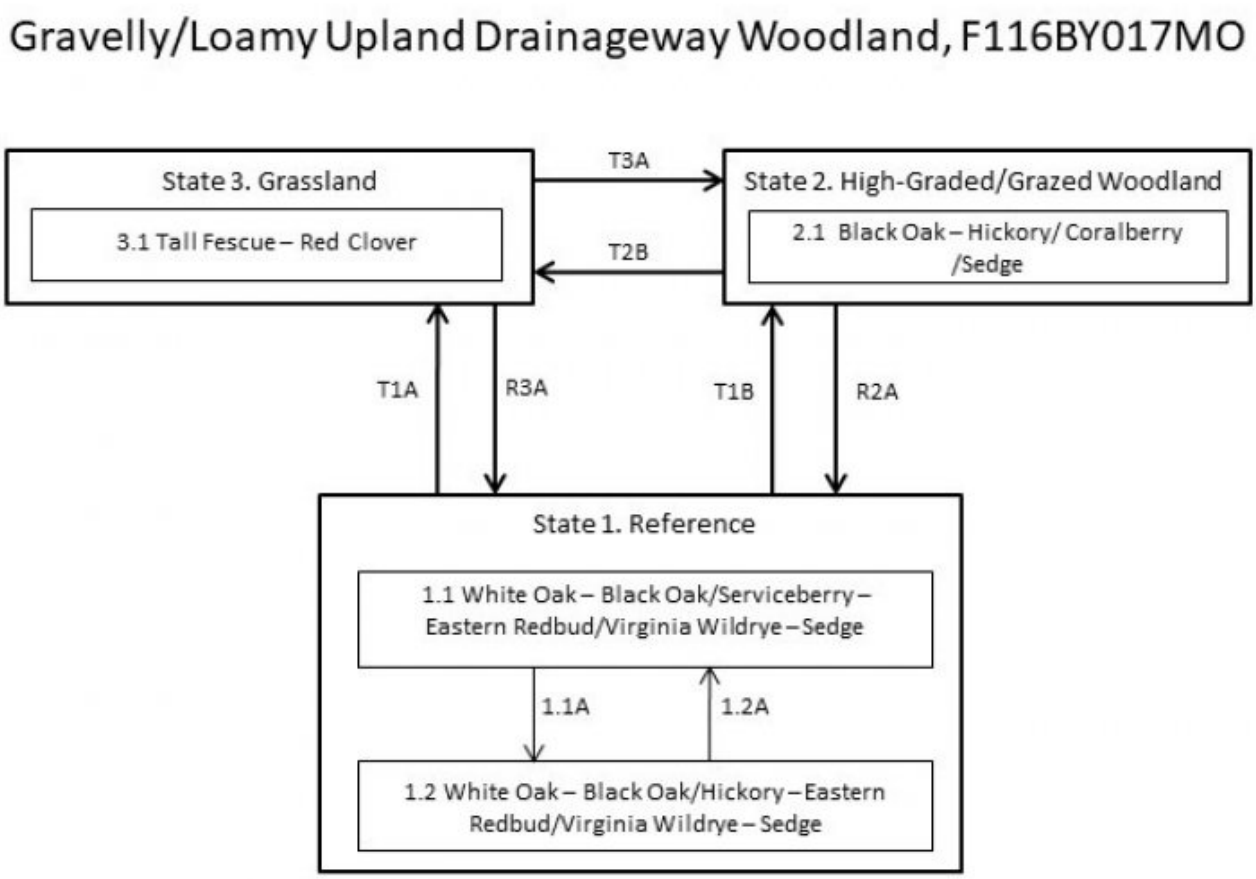
The reference community is a well-developed woodland with a rather tall, developed canopy (60 to 80 feet and 80 to 100 percent canopy closure), a complex understory and a dense herbaceous ground flora. Gaps in all three layers are common due to flash flooding. White oak and black oak dominate along with a variety of tree species, including eastern redcedar, elm, shortleaf pine and hickory. Common serviceberry and eastern redbud are part of 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 woodlands remain. They often occur as a rather narrow band of timber traversing the headwater streams, often in a matrix of upland woodlands and forests.

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 woodlands 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
T1A, T2B	Clearing; pasture planting; prescribed grazing; hayland management
T1B	Poorly planned harvest (high grading); uncontrolled grazing
T3A	Intermittent uncontrolled grazing; woody invasion (+20-40 years)
R2A	Grazing exclusion; access control; tree planting; forest stand improvement
R3A	Tree planting; long term succession (+50-70 years)
1.1A	Flooding disturbance
1.2A	No flooding disturbance

Figure 10. State and transition diagram for this ecological site

State 1

Reference

The reference community is a well-developed woodland with a rather tall, developed canopy (60 to 80 feet and 80 to 90 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 elm and hickory.

Community 1.1
White Oak – Black Oak/Common Serviceberry – Eastern Redbud/Virginia Wildrye – Sedge

Forest overstory. The 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. The 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/Hickory Saplings – Eastern Redbud/Virginia Wildrye – Sedge

Pathway P1.1A
Community 1.1 to 1.2

Flooding disturbance

Pathway P1.2A
Community 1.2 to 1.1

No flooding disturbance

State 2
High-Graded/Grazed Woodland

Gravelly Upland Drainageway Woodlands subjected to repeated, high-graded timber harvests and domestic grazing transition to this state. This state exhibits an over-abundance of less desirable tree species, and weedy understory species such as coralberry. The vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition, destabilizes stream banks and results in soil compaction and accelerated erosion and runoff during flood events. Restoration of this state can be facilitated by exclusion of cattle coupled with tree planting.

Dominant resource concerns

- Ephemeral gully erosion
- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation
- Terrestrial habitat for wildlife and invertebrates

Community 2.1
Black Oak – Hickory/ Coralberry /Sedge

State 3
Grassland

Conversion of Gravelly Upland Drainageway Woodlands to non-native pasture species such as tall fescue has been common in the Springfield Plain. Frequent flooding and low available water capacity make non-native pastures difficult to maintain in a healthy, productive state on this ecological site. Restoration of this state is time consuming and costly but can be achieved over time by discontinuing grazing and active pasture management and tree

planting.

Dominant resource concerns

- Plant structure and composition
- Terrestrial habitat for wildlife and invertebrates

Community 3.1
Tall Fescue – Red Clover

Transition T1B
State 1 to 2

Poorly planned harvest (high grading); uncontrolled grazing

Transition T1A
State 1 to 3

Clearing; grassland planting; prescribed grazing; grassland management

Restoration pathway R2A
State 2 to 1

Grazing exclusion; access control; tree planting; forest stand improvement

Transition T2B
State 2 to 3

Clearing; grassland planting; prescribed grazing; grassland management

Restoration pathway R3A
State 3 to 1

Tree planting; long term succession (60-70 years); forest stand improvement

Restoration pathway T3A
State 3 to 2

Intermittent uncontrolled grazing; woody invasion (30-50 years)

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 oak	QUAL	*Quercus alba*	Native	–	20–40	–	–
black oak	QUVE	*Quercus velutina*	Native	–	20–40	–	–
slippery elm	ULRU	*Ulmus rubra*	Native	–	5–20	–	–
mockernut hickory	CATO6	*Carya tomentosa*	Native	–	5–10	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	5–10	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	5–10	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	5–10	–	–
shortleaf pine	PIEC2	*Pinus echinata*	Native	–	5–10	–	–
post oak	QUST	*Quercus stellata*	Native	–	5–10	–	–

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	–	5–20
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	5–20
parasol sedge	CAUM4	*Carex umbellata*	Native	–	5–20
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	5–20
eastern bottlebrush grass	ELHY	*Elymus hystrix*	Native	–	5–20
nodding fescue	FESU3	*Festuca subverticillata*	Native	–	5–20
Forb/Herb					
pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	–	5–20
white snakeroot	AGAL5	*Ageratina altissima*	Native	–	5–20
clustered blacksnakeroot	SAOD	*Sanicula odorata*	Native	–	5–20
Canadian clearweed	PIPU2	*Pilea pumila*	Native	–	5–20
largeflower yellow false foxglove	AUGR	*Aureolaria grandiflora*	Native	–	5–20
American lopseed	PHLE5	*Phryma leptostachya*	Native	–	5–20
Canadian wildginger	ASCA	*Asarum canadense*	Native	–	5–20
American bellflower	CAAM18	*Campanulastrum americanum*	Native	–	5–20
carpenter's square	SCMA2	*Scrophularia marilandica*	Native	–	5–20
Carolina elephantsfoot	ELCA3	*Elephantopus carolinianus*	Native	–	5–20
Fern/fern ally					
rattlesnake fern	BOVI	*Botrychium virginianum*	Native	–	5–20
Shrub/Subshrub					
American hazelnut	COAM3	*Corylus americana*	Native	–	10–20
Tree					
common serviceberry	AMAR3	*Amelanchier arborea*	Native	–	10–20
eastern redbud	CECA4	*Cercis canadensis*	Native	–	10–20

Animal community

Wildlife (MDC 2006)

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

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: Field measured site index values average 58 for northern red oak. 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 Woodland

No quality reference sites are known to exist.

Other references

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Contributors

Fred Young
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Approval

Nels Barrett, 10/07/2020

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	09/25/2020
Approved by	Nels Barrett
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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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:**
