Ecological site F109XY003MO
Loess Upland Woodland

Accessed: 04/24/2024

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.

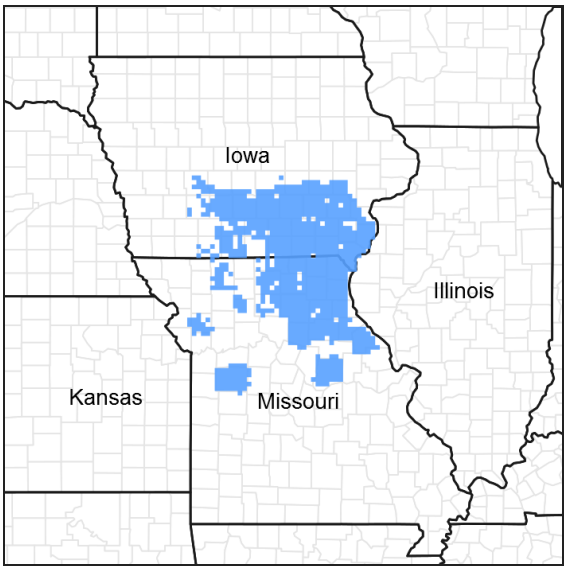


Figure 1. Mapped extent

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): 109X–Iowa and Missouri Heavy Till Plain

The Iowa and Missouri Heavy Till Plain (area outlined in red on the map) is an area of rolling hills interspersed with interfluve divides and alluvial valleys. Elevation ranges from about 660 feet along the lower reaches of rivers, to about 980 feet on stable interfluve summits in southern Iowa. Relief is about 80 to 160 feet between major streams and adjacent interfluve summits. Most of the till plain drains south to the Missouri River via the Grand and Chariton River systems, but the northeastern portion drains southeast to the Mississippi River. Loess caps the pre-Illinoisan aged till on interfluves, whereas the till is exposed on side slopes. Mississippian aged limestone and Pennsylvanian aged sandstone and shale crop out on lower slopes in some areas.

Classification relationships

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Dry-Mesic Loess/Glacial Till 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 Mixed Oak Loess/Glacial Till Woodland.

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

The reference state for this ecological site is most similar to a Quercus alba - (Carya ovata) / Carex pensylvanica Glaciated Woodland (CEGL002134).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002):
This ecological site occurs in many Land Type Associations, primarily within the following Subsections:
Chariton River Hills
Claypan Till Plains
Mississippi River Hills
Wyaconda River Dissected Till Plains

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. As additional information is collected, analyzed and reviewed, this ESD will be refined and published as “Approved”.

Loess Upland Woodlands are within the green areas on the map. Sites are more prevalent in the eastern part of the MLRA and adjacent areas, where woodlands and forests were historically present on hillslopes. This is the principal ecological site of woodland hillslope summits in the MLRA. Till woodland or forest ecological sites are typically downslope. Soils are very deep, with no rooting restrictions. The reference plant community is woodland with an overstory dominated by white oak and black oak, and a ground flora of native grasses and forbs.

Associated sites

F109XY007MO	**Till Upland Woodland** Till Upland Woodlands are downslope, on shoulders and backslopes.
F109XY009MO	**Till Protected Backslope Forest** Till Protected Backslope Woodlands are downslope, on steep backslopes with northern to eastern aspects.
F109XY022MO	**Till Exposed Backslope Woodland** Till Exposed Backslope Woodlands are downslope, on steep backslopes with southern to western aspects.

Similar sites

F109XY007MO	**Till Upland Woodland** Till Upland Woodlands have a similar overstory composition but seasonal wetness can create differences in the ground layer composition.

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Rhus aromatica*
Herbaceous	(1) *Elymus virginicus* (2) *Carex pensylvanica*

Physiographic features

This site is on upland summit crests and shoulders, with slopes of 3 to 9 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Seaholm, 1981) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the uplands. The site is within the area labeled “1”, generally upslope from ecological sites formed in till.

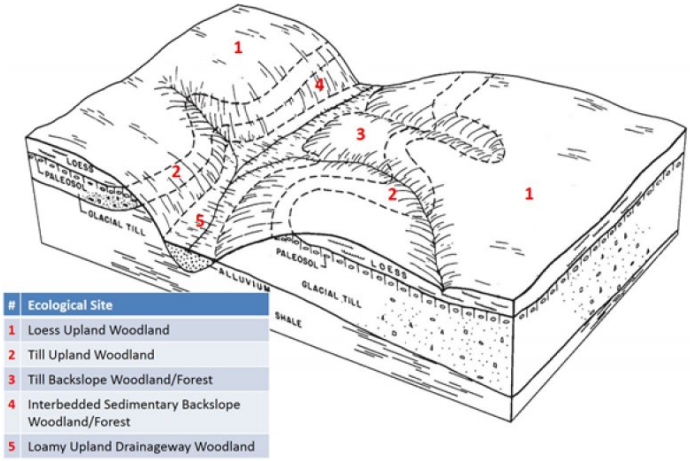


Figure 2. Landscape relationships for this ecological site

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Hill
Flooding frequency	None
Ponding frequency	None
Slope	3–14%
Water table depth	12–48 in
Aspect	Aspect is not a significant factor

Climatic features

The Iowa and Missouri Heavy Till Plain MLRA 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.

This MLRA experiences small regional differences in climates that grade inconspicuously into each other. The basic gradient for most climatic characteristics is along a line from north to south. Both mean annual temperature and precipitation exhibit fairly minor gradients along this line.

Mean January minimum temperature follows the north-to-south gradient. However, mean July maximum temperature shows hardly any geographic variation in the region. Mean July maximum temperatures have a range of only two to three degrees across the region.

Mean annual precipitation varies along the same gradient as temperature – lower annual precipitation in the north, higher in the south. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages four to five times greater than January precipitation.

During years when precipitation is normal, moisture is stored in the soil profile 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 influences ecological communities by limiting water supplies, especially at times of high temperatures and high evaporation rates. Drought indirectly affects ecological communities by increasing plant and animal susceptibility to the probability and severity of fire. Frequent fires encourage the development of grass/forb dominated communities and understories.

Superimposed upon the basic MLRA climatic patterns are local topographic influences that create topoclimatic, or microclimatic variations. 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. Slope orientation is an important topographic influence on climate. Summits and south-and-west-facing slopes are regularly warmer and drier, supporting more grass dominated communities than adjacent north- and-east-facing slopes that are cooler and moister that support more woody dominated communities. Finally, the climate within a canopied forest ecological site is measurably different from the climate of the more open grassland or savanna ecological sites.

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 (average)	170 days
Freeze-free period (average)	191 days
Precipitation total (average)	42 in

Climate stations used

- (1) BLOOMFIELD 1 WNW [USC00130753], Bloomfield, IA
- (2) DONNELLSON [USC00132299], Donnellson, IA
- (3) LONG BRANCH RSVR [USC00235050], Macon, MO
- (4) MEMPHIS [USC00235492], Memphis, MO

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

These soils have no major rooting restriction. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is loess. Some soils have residuum in the lower part. The soils have silt loam surface horizons. Subsoils are silty clay loam to silty clay. These soils are slightly affected by seasonal wetness. Soil series associated with this site include Clinton, Fayette, Gorin, Keomah, Rathbun, and Weller.

The accompanying picture of the Weller series shows a thin, light-colored surface horizon overlying the brown silty clay loam subsoil. Roots can be seen throughout the soil profile.

Figure 7. Weller series

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Clayey
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Very slow to slow
Soil depth	72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.5–6
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

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.

This ecological site is a well-developed woodland dominated by an overstory of white oak, along with occasional black oak. The canopy is moderately tall (65 to 80 feet) with a 55 to 75 percent canopy closure. This community is more structurally diverse than the adjacent protected slopes. Increased light from a more open canopy causes a diversity of woodland ground flora species to flourish. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth.

Because of their proximity to prairies, fire played a significant role in the maintenance of these ecological sites which likely burned at least once every 3 to 10 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

Loess Upland Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores. Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. Grazing by native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and woodland ground flora species.

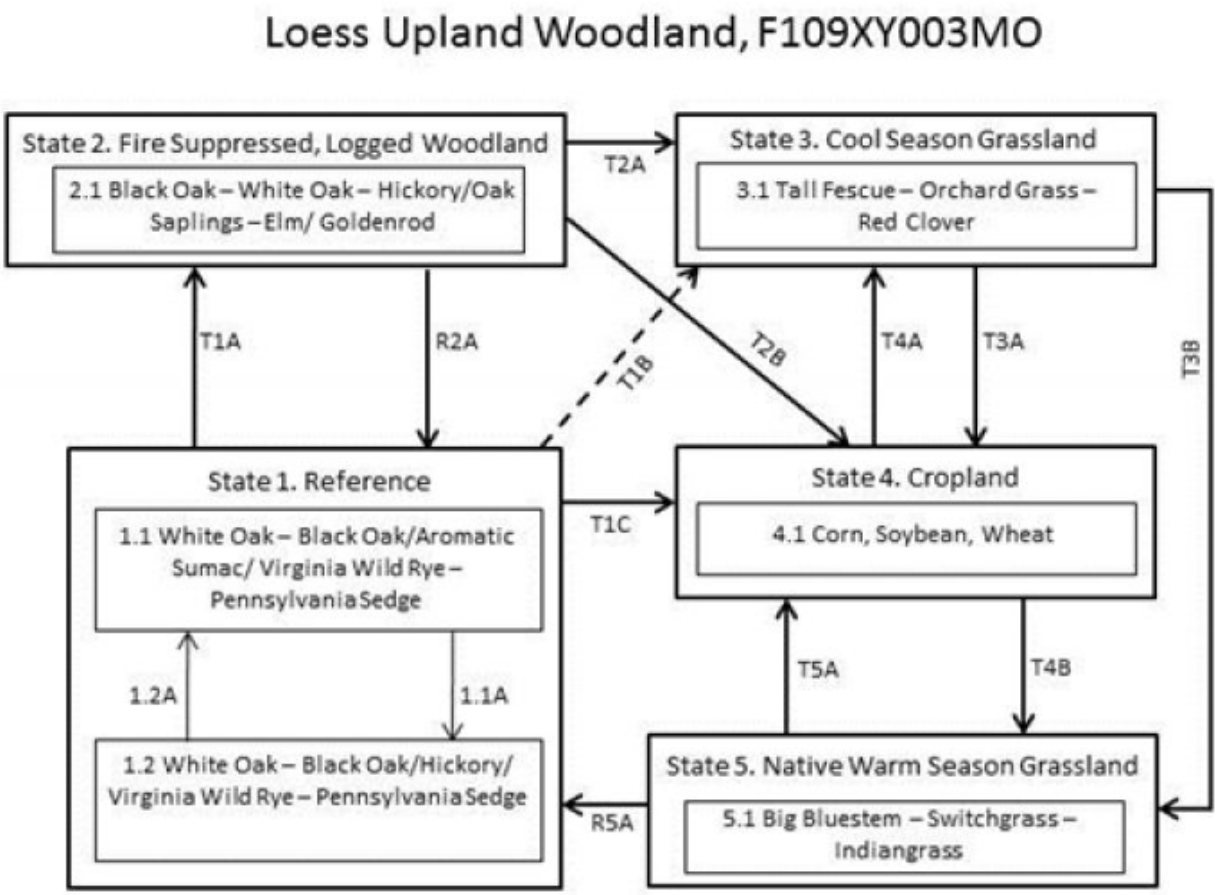
Today, many of these ecological sites have been cleared and converted to pasture or have undergone repeated timber harvest and domestic grazing. Most existing forested ecological sites have a younger (50 to 80 years) canopy layer whose species composition and quality has been altered by timber harvesting practices. In the long term absence of fire, woody species, especially hickory and sugar maple, encroach into these woodlands. Once established, these woody plants can quickly fill the existing understory increasing shade levels with a greatly diminished ground flora. Removal of the younger understory and the application of prescribed fire have proven to be effective restoration means.

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

These ecological sites are moderately productive. Oak regeneration is typically problematic. Eastern hop hornbeam and hickories are often dominant competitors in the understory. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects. Single tree selection timber harvests are common in this region and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the creation of group openings can help regenerate and maintain more desirable oak species and increase vigor on the residual trees.
Clearcutting also occurs and results in dense, even-aged stands dominated by oak. This may be most beneficial for existing stands whose composition has been highly altered by past management practices. However, without some thinning of the dense stands and the application of prescribed fire, the ground flora diversity can be shaded out and diversity of the stand may suffer.

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

State and transition model



Code	Event/Activity/Process
T1A	Fire suppression > 20 years; woody invasion; repeated timber harvests
T1B	Tillage; vegetative seeding; grassland management
T1C, T3A, T5A	Tillage; conservation cropping system
T2A	Woody removal; tillage; vegetative seeding; grassland management
T2B	Woody removal; tillage; conservation cropping system
T4A	Vegetative seeding ; grassland management
T3B, T4B	Vegetative seeding; prescribed fire; grassland management
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 1-3 years
R2A	Woody removal; prescribed fire 1-3 years
R5A	Vegetative seeding; prescribed fire 1-3 years

Figure 8. Loess Upland Woodland

State 1

Reference

The historical reference state for this ecological site was old growth oak woodland. The woodland was dominated by white oak and black oak. Maximum tree age was likely 150-300 years. Periodic disturbances from fire, wind or ice as well as grazing by native large herbivores maintained the woodland 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 has 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, domestic grazing or clearing and conversion to grassland or cropland.

Community 1.1
White Oak-Black Oak/Aromatic Sumac/Virginia Wild Rye-Pennsylvania Sedge

This phase has an overstory that is dominated by white oak and black oak with hickory and post oak also present. This woodland community has a two-tiered structure with an open understory and a dense, diverse herbaceous ground flora. Periodic disturbances including fire, ice and wind create canopy gaps, allowing white oak and black oak to successfully reproduce and remain in the canopy.

Forest overstory. The Forest Overstory Species list is based on commonly occurring species listed in Nelson (2010).

Forest understory. The Forest Understory Species list is based on commonly occurring species listed in Nelson (2010).

Community 1.2
White Oak-Black Oak/Hickory/Virginia Wild Rye-Pennsylvania Sedge

Figure 9. Dark Hollow Conservation Area

This phase is similar to community phase 1.1 but oak and hickory understory densities are increasing due to longer periods of fire suppression. Displacement of some grasses and forbs may be occurring due to shading and competition from the increased densities of oak and hickory saplings in the understory.

Forest overstory. The Forest Overstory Species list is based on reconnaissance-level plots, as well as commonly occurring species listed in Nelson (2010). Species identified from plot data include cover percentages and canopy heights. Species not found in plots, but listed in Nelson, do not include cover and canopy data.

Forest understory. The Forest Understory list is based on reconnaissance-level plots, as well as commonly occurring species listed in Nelson (2010). Species identified from plot data include cover percentages and canopy heights. Species not found in plots, but listed in Nelson, do not include cover and canopy data. Note that plot data for canopy heights are by height class, not actual species heights.

State 2

Fire Suppressed, Logged Woodland

Composition is likely altered from the Reference State depending on tree selection during harvest. This state will slowly increase in more shade tolerant species and white oak will become less dominant and is also dense because of fire suppression. Without periodic canopy disturbance, stem density and fire intolerant species, like hickory, will increase in abundance. Uncontrolled grazing if present will also have an impact on community composition and understory quality further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper.

Community 2.1
Black Oak-White Oak-Hickory/Oak Saplings-Elm/Goldenrod

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.

Community 3.1
Tall Fescue-Orchard Grass-Red Clover

State 4
Cropland

This is a State that exists currently with intensive cropping of corn, soybeans, and wheat occurring especially when commodity prices are high. Some conversion to cool season grassland occurs for a limited period of time before transitioning back to cropland. Limited acres are sometimes converted to native warm season grassland.

Community 4.1
Corn, Soybean, Wheat

State 5
Native Warm Season Grassland

Conversion from the Cool Season Grassland (State 3) or the Cropland (State 4) to this State is increasing due to renewed interest in warm season grasses as a supplement to cool season grazing systems or as a native restoration activity. Restoration to the Reference state will require substantial restoration time and management inputs.

Community 5.1
Big Bluestem-Switchgrass-Indiangrass

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white oak	QUAL	*Quercus alba*	Native	–	40–70	–	–
black oak	QUVE	*Quercus velutina*	Native	–	20–40	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	0–10	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	–	10–30
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	5–20
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	10–20
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	5–20
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	–	5–20
big bluestem	ANGE	*Andropogon gerardii*	Native	–	5–20
parasol sedge	CAUM4	*Carex umbellata*	Native	–	10–20
Forb/Herb					
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	–	5–30
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	10–30
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	5–20
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	10–20
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	10–20
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	–	10–20
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	10–20
fourleaf milkweed	ASQU	*Asclepias quadrifolia*	Native	–	10–20
Culver's root	VEVI4	*Veronicastrum virginicum*	Native	–	5–10
bluejacket	TROH	*Tradescantia ohiensis*	Native	–	5–10
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	–	10–30
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	5–20
American hazelnut	COAM3	*Corylus americana*	Native	–	10–20

Table 7. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white oak	QUAL	*Quercus alba*	Native	50–75	10–75	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	30–75	10–50	–	–
black oak	QUVE	*Quercus velutina*	Native	50–75	5–25	–	–

Table 8. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Pennsylvania sedge	CAPE6	*Carex pensylvanica*	Native	0.3–3	0.1–50
hairy woodland brome	BRPU6	*Bromus pubescens*	Native	0.3–3	0.1–1
Muhlenberg's sedge	CAMU4	*Carex muehlenbergii*	Native	0.3–3	0.1–1
big bluestem	ANGE	*Andropogon gerardii*	Native	–	–
parasol sedge	CAUM4	*Carex umbellata*	Native	–	–
Virginia wildrye	ELVI3	*Elymus virginicus*	Native	–	–
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	–	–
little bluestem	SCSC	*Schizachyrium scoparium*	Native	–	–
Forb/Herb					

pointedleaf ticktrefoil	DEGL5	*Desmodium glutinosum*	Native	0.3–3	5–25
panicledleaf ticktrefoil	DEPA6	*Desmodium paniculatum*	Native	–	0.1–1
soft agrimony	AGPU	*Agrimonia pubescens*	Native	0.3–3	0.1–1
American hogpeanut	AMBR2	*Amphicarpaea bracteata*	Native	0.3–3	0.1–1
shining bedstraw	GACO3	*Galium concinnum*	Native	0.3–3	0.1–1
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	0.3–3	0.1–1
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	0.3–3	0.1–1
wild blue phlox	PHDI5	*Phlox divaricata*	Native	0.3–3	0.1–1
smooth blue aster	SYLAC	*Symphyotrichum laeve var. concinnum*	Native	–	–
bluejacket	TROH	*Tradescantia ohiensis*	Native	–	–
Culver's root	VEVI4	*Veronicastrum virginicum*	Native	–	–
fourleaf milkweed	ASQU	*Asclepias quadrifolia*	Native	–	–
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	–	–
eastern purple coneflower	ECPU	*Echinacea purpurea*	Native	–	–
slender lespedeza	LEVI7	*Lespedeza virginica*	Native	–	–
eastern beebalm	MOBR2	*Monarda bradburiana*	Native	–	–
Canadian blacksnakeroot	SACA15	*Sanicula canadensis*	Native	–	–
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	1–10	25–50
coralberry	SYOR	*Symphoricarpos orbiculatus*	Native	0.3–10	0.1–2
burningbush	EUAT5	*Euonymus atropurpureus*	Native	0.3–3	0.1–1
Missouri gooseberry	RIMI	*Ribes missouriense*	Native	0.3–3	0.1–1
Carolina rose	ROCA4	*Rosa carolina*	Native	0.3–3	0.1–1
northern dewberry	RUFL	*Rubus flagellaris*	Native	0.3–3	0.1–1
stiff dogwood	COFO	*Cornus foemina*	Native	0.3–3	0.1–1
common serviceberry	AMAR3	*Amelanchier arborea*	Native	0.3–10	0.1–1
New Jersey tea	CEAM	*Ceanothus americanus*	Native	–	–
American hazelnut	COAM3	*Corylus americana*	Native	–	–
Tree					
hophornbeam	OSVI	*Ostrya virginiana*	Native	1–30	0.1–50
shagbark hickory	CAOV2	*Carya ovata*	Native	0.3–10	0.1–10
white ash	FRAM2	*Fraxinus americana*	Native	1–10	1–5
white oak	QUAL	*Quercus alba*	Native	0.3–3	2–5
black oak	QUVE	*Quercus velutina*	Native	0.3–10	0.1–5
black oak	QUVE	*Quercus velutina*	Native	0.3–10	0.1–5
American elm	ULAM	*Ulmus americana*	Native	0.3–10	0.1–2
shingle oak	QUIM	*Quercus imbricaria*	Native	0.3–3	0.1–1
black cherry	PRSE2	*Prunus serotina*	Native	0.3–3	0.1–1
Vine/Liana					
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0.3–3	1–5

Animal community

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 the Loess Upland Woodland 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. (MDC 2006)

Other information

Forestry
Management: Site index values range from 55 to 65 for 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 group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality, may not be fitting, or should be used with caution on a particular site if timber management is the primary objective. Favor white oak and northern red oak on higher productivity sites and post oak, chinkapin oak, black oak and scarlet oak on lower productivity sites.

Limitations: No major equipment restrictions or limitations exist. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35%, traction problems increase and equipment use is not recommended.

Inventory data references

Tier II (reconnaissance) plots used to populate species in Reference State community 2:
Plot DAHOCA03
Dark Hollow Conservation Area (MDC), Sullivan County, MO.
Latitude: 40.323068
Longitude: -92.926944
Gorin series

Plot THHISP04
Located in Thousand Hills State Park, Adair County, MO.
Latitude: 40.154722
Longitude: - 92.641504
Gorin series

Other references

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

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

Nelson, Paul W. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

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

Seaholm, James E. 1981. Soil Survey of Wapello County, Iowa. U.S. Dept. of Agric. Soil Conservation Service.

Contributors

Doug Wallace
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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:**

   _____

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):**

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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:**
