USDA Natural Resources
Conservation Service

Ecological site F116CY003MO
Dry Igneous Upland Woodland

Accessed: 04/19/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

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): 116C–St. Francois Knobs and Basins

The St Francois Knobs and Basins is the structural center of the Ozark Dome. Elevation ranges from about 450 feet along the rivers in the southern part of the area, to 1,772 feet on the summit of Taum Sauk Mountain, the highest point in Missouri. Prominent features of this major land resource area (MLRA) are the Precambrian igneous knobs and hills that rise conspicuously to various elevations, interspersed with smooth-floored basins and valleys overlying dolomite and sandstone. Ecological sites defined for this MLRA are associated with the igneous parent materials, either in knob or basin positions. Areas influenced primarily by dolomite and/or sandstone are included in ecological sites within MLRA 116A (Ozark Highlands).

Classification relationships

Atlas of Missouri Ecoregions (Nigh and Schroeder 2002):
This ecological site occurs primarily within the following Land Type Association:
OZ10a St. Francois Igneous Glade/Oak Forest Knobs

Terrestrial Natural Community Type (Nelson, 2010):
The reference state for this ecological site is most similar to: Dry Igneous Woodlands

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to: (CEGL005029) *Quercus velutina* - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa Woodland

Ecological site concept

Dry Igneous Upland Woodlands occur throughout the MLRA and on outlying igneous knobs in adjacent counties. Soils are moderately deep, often with abundant volcanic rock fragments, and are low in bases. These sites are often adjacent to both Igneous Upland Woodland and Shallow Igneous Knob Glade ecological sites, and in places, are mapped in complex with them. Igneous Upland Woodland sites do not have root-restricting bedrock in the upper part of the soil profile, whereas Shallow Igneous Knob Glade sites are shallow to bedrock and are interspersed with rock outcrop. Vegetation of the reference state is woodland dominated by short, open-grown post oak mixed with scattered northern red, blackjack and black oaks.

Associated sites

F116CY002MO	**Igneous Upland Woodland** Igneous Upland Woodlands are often upslope from Dry Igneous Upland Woodlands, but are intermingled in other areas and mapped as a complex.
F116CY005MO	**Dry Igneous Protected Backslope Woodland** Igneous Protected Backslope Woodlands are typically downslope from Dry Igneous Upland Woodlands, and are steeper.
F116CY011MO	**Dry Igneous Exposed Backslope Woodland** Dry Igneous Exposed Backslope Woodlands are typically downslope from Dry Igneous Upland Woodlands, and are steeper.
R116CY006MO	**Shallow Igneous Knob Glade** Shallow Igneous Knob Glades have shallow soils with significant amounts of bedrock outcrop. These two ecological sites are typically intermingled, and mapped as a complex.

Similar sites

F116CY011MO	**Dry Igneous Exposed Backslope Woodland** Dry Igneous Exposed Backslope Woodlands are typically downslope from Dry Igneous Upland Woodlands, and are steeper but similar in species composition.

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus rubra*
Shrub	(1) *Rhus aromatica*
Herbaceous	(1) *Danthonia spicata* (2) *Schizachyrium scoparium*

Physiographic features

This site is on upland summit crests, shoulders and backslopes with slopes of 3 to 15 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Simmons et al., 2006) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the igneous uplands. The site is within the area labeled “3”, generally upslope from steeper, backslope ecological sites.

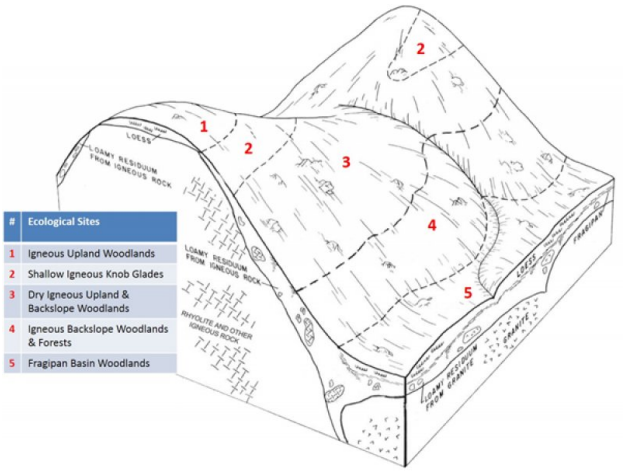


Figure 2. Major ecological sites of the igneous uplands.

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Interfluve (3) Hill (4) Knob
Flooding frequency	None
Ponding frequency	None
Elevation	600–1,700 ft
Slope	3–15%
Water table depth	24–60 in
Aspect	Aspect is not a significant factor

Climatic features

The St. Francois Knobs and Basins have 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 St. Francois Knobs and Basins experience few regional differences in climates. The average annual precipitation in this area is 42 to 46 inches. The average annual temperature is about 54 to 56 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 somewhat along a west to east gradient. The rainfall is fairly evenly distributed throughout the year. Snow falls nearly every winter, but the snow cover lasts for only a few days.

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 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. For example, air drainage at night may produce temperatures several degrees lower in the basin and floodplain ecological sites downslope from this ecological site. At critical times during the year, this phenomenon may produce later spring or earlier fall freezes in basins and valleys. Nearby glade ecological sites

may have higher daytime temperatures due to bare rock and higher reflectivity of these un-vegetated surfaces. 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 micro-climate within closed-canopy woodland communities is measurably different from the micro-climate of open-canopy woodlands within this ecological site.

References:
University of Missouri Climate Center. Accessed May 2012. http://climate.missouri.edu/climate.php.

United States Department of Agriculture, Natural Resources Conservation Service. 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	137-145 days
Freeze-free period (characteristic range)	164-169 days
Precipitation total (characteristic range)	45-47 in
Frost-free period (actual range)	136-148 days
Freeze-free period (actual range)	163-170 days
Precipitation total (actual range)	45-47 in
Frost-free period (average)	141 days
Freeze-free period (average)	166 days
Precipitation total (average)	46 in

Climate stations used

- (1) FARMINGTON [USC00232809], Farmington, MO
- (2) FREDERICKTOWN [USC00233038], Fredericktown, MO
- (3) ARCADIA [USC00230224], Arcadia, MO

Influencing water features

This ecological site is not influenced by wetland or riparian water features. This site generates runoff to adjacent, downslope ecological sites. The water features of this upland ecological site include evapotranspiration, surface runoff, and drainage. Each water balance component fluctuates to varying extents from year-to-year. Evapotranspiration remains the most constant. Precipitation and drainage are highly variable between years. Seasonal variability differs for each water component. Precipitation generally occurs as single day events. Evapotranspiration is lowest in the winter and peaks in the summer. Water stored as ice and snow decreases drainage and surface runoff rates throughout the winter and increases these fluxes in the spring. The surface runoff pulse is greatly influenced by extreme events. Conversion to cropland or other high intensities land uses tends to increase runoff, but also decreases evapotranspiration. Depending on the situation, this might increase groundwater discharge, and decrease baseflow in receiving streams.

Soil features

These soils have rhyolitic volcanic bedrock at 20 to 40 inches, and acidic subsoils that are low in bases. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium and residuum weathered from acid igneous rock such as rhyolite. Some areas on summit crests have loess in the upper part. They have loam surface horizons that range to very gravelly and cobbly, and typically have skeletal subsoils with high amounts of volcanic gravel and cobbles. These soils are not affected by seasonal wetness. Soil series associated with this site include Irondale and Knobtop.

The accompanying picture of the Knobtop series shows a thin, light-colored silt loam surface horizon over a brown

silty clay loam subsoil. Igneous rock fragments are shown in this profile below about 2 feet. Hard igneous bedrock is at the bottom of the picture, just above 3 feet. Scale is in feet.

Figure 9. Knobtop series

Table 4. Representative soil features

Parent material	(1) Slope alluvium–rhyolite (2) Residuum–rhyolite
Surface texture	(1) Gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	20–40 in
Surface fragment cover <=3"	5–40%
Surface fragment cover >3"	5–40%
Available water capacity (0-40in)	2–4 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)	3.5–6
Subsurface fragment volume <=3" (Depth not specified)	10–45%
Subsurface fragment volume >3" (Depth not specified)	5–55%

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.

Dry Igneous Upland Woodlands are dominated by short (30 to 50 feet) open grown post oak (*Quercus stellata*), with scattered northern red oak (*Quercus rubra*), blackjack oak (*Quercus marilandica*) and black oak (*Quercus velutina*) and an occasional shortleaf pine (*Pinus echinata*). Canopy closure varies with aspect and the soil depth range within the soil component. This created conditions from open 30 to 50 percent canopy on the most exposed positions and shallower soil ranges, to a more closed 50 to 80 percent canopy on protected positions and the deeper soil depth ranges for this soil component. The understory is open with a dense ground flora of native grasses and forbs (Nelson, 2010).

The somewhat shallow soils and upland landscape position of Dry Igneous Upland Woodlands limits the growth of trees and supports an abundance of native grasses and forbs in the understory. Fire played an important role in the maintenance of these systems as well. It is likely that these ecological sites, along with adjacent knobs burned at least once every 5 years. These periodic fires would have kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs (Ladd, 1991; Frost, 1996).

These sites were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores, such as bison (Bison bison), elk (Cervus Canadensis), and white-tailed deer (Odocoileus virginianus). 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 sun-loving ground flora species.

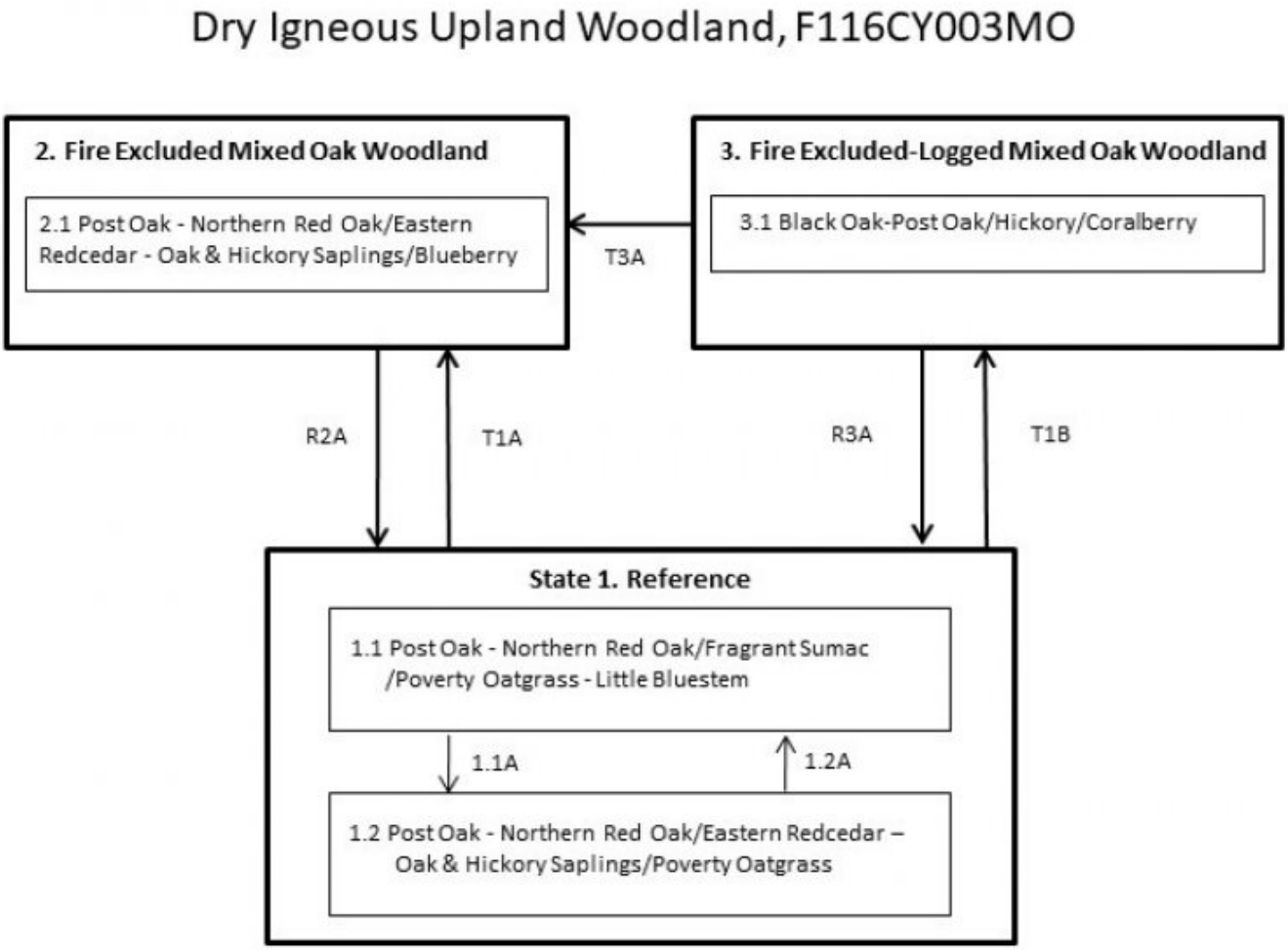
In the long term absence of fire, woody species have encroached into these woodlands. Once established, these species can quickly increase in density. Most occurrences today are dense and shady with a greatly diminished ground flora. Removal of the younger understory and the application of prescribed fire have proven to be effective management tools.

Currently, domestic grazing is absent or very limited on these sites due to lack of water, access issues, and high amounts of acorns on the ground in the fall that are detrimental to cattle. Timber harvesting also occurs but is restricted on these sites because of the lower site productivity. Where deeper soil depths range for this soil component, occasional oaks are harvested. They are excellent wildlife sites. (Missouri Department of Conservation, 2006)

A state and transition model for the Dry Igneous Upland Woodland Ecological Site (F116CY003MO) follows this narrative. Descriptions of each state, transition, plant community, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases. The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model



Code	Event/Process
T1A, T3A	Fire suppression > 20 years
T1B	Fire suppression; logging
R2A	Forest stand improvement ; prescribed fire
R3A	Prescribed fire
1.1A	Fire-free interval 10-15 years
1.2A	Fire interval 3-5 years

Figure 10. State and Transition Diagram

State 1

Reference State

The reference state was old growth woodland dominated by short (30 to 50 feet) open grown post oak, with scattered blackjack oak, northern red oak, and black oak and an occasional shortleaf pine. Canopy closure varies with aspect and soil depth from open 30 to 50 percent canopy, on most exposed positions, on shallower soils, to more closed, 50 to 80 percent canopy on more protected positions with deeper soil profiles. The understory is open with a dense ground flora of native grasses and forbs. Fire played an important role in the maintenance of this state as well. It is likely that these ecological sites, along with adjacent knobs burned at least once every 5 years. These periodic fires would have kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. Soil fertility and site productivity are low. Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency. Old growth woodlands are very rare today.

Dominant plant species

- post oak (*Quercus stellata*), tree
- northern red oak (*Quercus rubra*), tree
- black oak (*Quercus velutina*), tree
- black hickory (*Carya texana*), tree
- shagbark hickory (*Carya ovata*), tree
- mockernut hickory (*Carya tomentosa*), tree
- scarlet oak (*Quercus coccinea*), tree
- blackjack oak (*Quercus marilandica*), tree
- shortleaf pine (*Pinus echinata*), tree
- farkleberry (*Vaccinium arboreum*), tree
- fragrant sumac (*Rhus aromatica*), shrub
- winged elm (*Ulmus alata*), shrub
- Carolina rose (*Rosa carolina*), shrub
- Blue Ridge blueberry (*Vaccinium pallidum*), shrub
- St. Andrew's cross (*Hypericum hypericoides*), shrub
- common serviceberry (*Amelanchier arborea*), shrub
- flowering dogwood (*Cornus florida*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- poverty oatgrass (*Danthonia spicata*), grass
- rock muhly (*Muhlenbergia sobolifera*), grass
- whitetinge sedge (*Carex albicans*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- big bluestem (*Andropogon gerardii*), grass
- slimleaf panicgrass (*Dichanthelium linearifolium*), grass
- cypress panicgrass (*Dichanthelium dichotomum*), grass
- ribbed sedge (*Carex virescens*), grass
- fuzzy wuzzy sedge (*Carex hirsutella*), grass
- blue sedge (*Carex glaucodea*), grass
- nakedflower ticktrefoil (*Desmodium nudiflorum*), other herbaceous
- shrubby lespedeza (*Lespedeza frutescens*), other herbaceous
- birdfoot violet (*Viola pedata*), other herbaceous
- elmleaf goldenrod (*Solidago ulmifolia*), other herbaceous
- downy ragged goldenrod (*Solidago petiolaris*), other herbaceous
- perplexed ticktrefoil (*Desmodium perplexum*), other herbaceous
- hairy sunflower (*Helianthus hirsutus*), other herbaceous
- smooth violet prairie aster (*Symphyotrichum turbinellum*), other herbaceous
- wild quinine (*Parthenium integrifolium*), other herbaceous
- stiff tickseed (*Coreopsis palmata*), other herbaceous

Community 1.1
Post Oak-Northern Red Oak/Aromatic Sumac/Poverty Oat Grass-Little Bluestem

This phase has scattered post oak and northern red oak with little bluestem and poverty oat grass dominating the dense ground layer. Numerous forbs are also present and locally abundant.

Forest overstory. Post oak and northern red oak are typical overstory species. Other oak species and hickories are also usually present. Canopy cover can range from 30 percent to nearly 70 percent.

Forest understory. Little bluestem and poverty oat grass dominate the dense ground layer. Numerous forbs are also present and locally abundant.

Table 5. Soil surface cover

Tree basal cover	1-2%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0.1-1.0%
Forb basal cover	0.1-1.0%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	60-80%
Surface fragments >0.25" and <=3"	0-2%
Surface fragments >3"	0-2%
Bedrock	0-5%
Water	0%
Bare ground	0-5%

Table 6. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	0-1%
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	0-1%
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	0-1%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	0-2%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0-1%
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	0-2 per acre
Tree snag count** (hard***)	0-2 per acre

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.

*** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	0-5%
>1 <= 2	–	5-10%	5-10%	5-20%
>2 <= 4.5	0-5%	10-30%	20-60%	10-40%
>4.5 <= 13	0-5%	–	–	–
>13 <= 40	20-60%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Post Oak-Northern Red Oak/Eastern Redcedar-Oak and Hickory Saplings/Poverty Oat Grass

This phase is similar to community phase 1.1, but oak and hickory species are increasing due to longer periods of fire suppression. Some displacement of some grasses and forbs may be occurring due to shading and competition from the increased densities of oaks and hickories.

Forest overstory. Post oak and northern red oak are typical overstory species. Other oak species and hickories are also usually present. Canopy cover can range from 50% to nearly 80%.

Forest understory. Poverty oat grass is the dominate grass. Numerous forbs and other grasses are also present and locally abundant. Shrubs and oak and hickory saplings are increasing.

Table 8. Soil surface cover

Tree basal cover	1-2%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0.1-1.0%
Forb basal cover	0.1-1.0%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	60-80%

Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0-1%
Bedrock	0-5%
Water	0%
Bare ground	0-5%

Table 9. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	0-1%
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	0-1%
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	0-1%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	0-2%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0-1%
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	0-2 per acre
Tree snag count** (hard***)	0-2 per acre

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	0-5%	5-10%
>1 <= 2	–	5-10%	5-20%	5-10%
>2 <= 4.5	5-10%	10-30%	20-40%	20-40%
>4.5 <= 13	5-10%	–	–	–
>13 <= 40	30-70%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2

Post Oak-Northern Red Oak/Aromatic Sumac/Poverty Oat Grass-Little Bluestem

Post Oak-Northern Red Oak/Eastern Redcedar-Oak and Hickory Saplings/Poverty Oat Grass

This pathway results from fire suppression of 10 to 15 years in length. Fire suppression is causing oak and hickory species to increase. Displacement of some grasses and forbs may be occurring due to shading and competition from the increased densities of oaks and hickories.

Pathway 1.2A
Community 1.2 to 1.1

Post Oak-Northern Red Oak/Eastern Redcedar-Oak and Hickory Saplings/Poverty Oat Grass

Post Oak-Northern Red Oak/Aromatic Sumac/Poverty Oat Grass-Little Bluestem

This pathway has increased fire frequencies that is keeping woodlands open, removing the litter, and stimulating the growth and flowering of the grasses and forbs.

Conservation practices

Prescribed Burning
Upland Wildlife Habitat Management

State 2
Fire Excluded Mixed-Oak Woodland

This state is dominated by post oak and northern red oak. They can form relatively even-aged stands, dating to when fire suppression became the dominant management characteristic on the site. This stage can occur relatively quickly (10 to 20 years). Canopy closures can approach 80 percent with little or no ground flora. Without active management or long term presence of fire, woody species will encroach into these woodlands. Once established, these woody species can quickly fill the woodland system. Most occurrences of this state today are dense, and shady with a greatly diminished ground flora. Removal of the younger understory, opening the upper canopy, and the application of prescribed fire has proven to be effective management tools. Timber harvesting is very limited on these sites because of the poor quality and tree size. This state is an excellent wildlife site.

Dominant resource concerns

- Plant productivity and health
- Plant structure and composition
- Plant pest pressure
- Wildfire hazard from biomass accumulation

Community 2.1
Post Oak-Northern Red Oak/Eastern Redcedar-Oak and Hickory Saplings/ Huckleberry

Due to fire exclusion, this phase has higher densities of eastern redcedar, oak and hickory saplings. Grass and forb diversity and ground cover is decreasing. A restoration pathway consists of the removal of eastern redcedar and

oak and hickory saplings. Prescribed fire should be reestablished on a periodic basis of every 5 years.

Forest overstory. Post oak and northern red oak are common overstory species. Canopy cover can range from 50 percent to nearly 80 percent.

Forest understory. Eastern redcedar and oak and hickory saplings are increasing in densities. Grass and forb diversity and ground cover is decreasing with increasing canopy cover.

State 3
Fire Excluded-Logged Mixed-Oak Woodland

In the long term absence of fire, woody species have encroached into this woodland state. Once established, these woody species will quickly fill the woodland system. Removal of the younger understory and the application of prescribed fire have proven to be effective management tools. Timber harvesting is very limited on these sites because of the poor quality and tree size. This state, while of limited timber value, has experienced occasional uncontrolled harvesting (high grading) of northern red oak and white oak that has reduced the densities of these species causing an increase in black oak and blackjack oak.

Dominant resource concerns

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

Community 3.1
Black Oak-Post Oak/Hickory/Buckbrush

This long-term fire exclusion phase has experienced occasional harvesting (high grading) of northern red oak and post oak that has reduced the densities of these species, causing an increase in black oak, hickories, and blackjack oak. The remaining red oaks and post oaks are generally of lower quality. A restoration pathway results in the removal of eastern redcedar, black oak and buckbrush. Post oak and northern red oak species are favored to be retained. Prescribed fire is reestablished on a periodic basis of every 5 years. This restoration time may take 20 to 30 years before a reference community is reestablished.

Forest overstory. Northern red oak and post oak have reduced densities, with an increase in black oak, hickories, and blackjack oak.

Forest understory. Repeated unmanaged harvesting allows an increase in buckbrush and a decrease in forbs and grasses.

Transition 1A

State 1 to 2

This transition is the result of fire suppression that exceeds 20 years.

Transition 1B
State 1 to 3

This transition is the result of fire suppression that exceeds 20 years and periodic indiscriminant logging of the higher quality oaks.

Restoration pathway 2A
State 2 to 1

This restoration pathway results in the removal of eastern redcedar and oak and hickory saplings. Prescribed fire is reestablished on a periodic basis of every 5 years.

Conservation practices

Prescribed Burning
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Restoration pathway 3A
State 3 to 1

This restoration pathway results in the removal of eastern redcedar, black oak, and buckbrush. Post oak and northern red oak species are favored to be retained. Prescribed fire is reestablished on a periodic basis of every 5 years. This restoration time may take 20 to 30 years before a reference community is reestablished.

Conservation practices

Brush Management
Prescribed Burning
Restoration and Management of Rare and Declining Habitats
Forest Stand Improvement

Transition 3A
State 3 to 2

This transition is the result of cessation of periodic indiscriminate logging operations.

Additional community tables

Table 11. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
post oak	QUST	*Quercus stellata*	Native	24–40	20–40	5–15	–
northern red oak	QURU	*Quercus rubra*	Native	30–50	10–30	5–25	–
black hickory	CATE9	*Carya texana*	Native	24–40	10–20	11–13	–
shortleaf pine	PIEC2	*Pinus echinata*	Native	30–50	5–20	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	24–40	5–20	5–9	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	15–30	5–20	–	–
black oak	QUVE	*Quercus velutina*	Native	30–50	5–20	–	–
white oak	QUAL	*Quercus alba*	–	20–40	1–10	11–15	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	2–30	0–5	–	–

Table 12. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	0.1–3	10–20
fuzzy wuzzy sedge	CAHI6	*Carex hirsutella*	Native	0.1–2	5–10
poverty oatgrass	DASP2	*Danthonia spicata*	Native	0.1–2	5–10
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	0.1–2	5–10
whitetinge sedge	CAAL25	*Carex albicans*	Native	0.1–2	5–10
ribbed sedge	CAVI4	*Carex virescens*	Native	0.1–2	5–10
Forb/Herb					
downy ragged goldenrod	SOPE	*Solidago petiolaris*	Native	0.1–3	5–10
perplexed ticktrefoil	DEPE80	*Desmodium perplexum*	Native	0.1–2	5–10
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	0.3–3	5–10
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	0.1–0.3	5–10
St. Andrew's cross	HYHY	*Hypericum hypericoides*	Native	0.5–3	5–10
skyblue aster	SYOO	*Symphyotrichum oolentangiense*	Native	0.5–2	5–10
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	0.1–2	5–10
shrubby lespedeza	LEFR5	*Lespedeza frutescens*	Native	0.1–1	5–10
birdfoot violet	VIPE	*Viola pedata*	Native	0.1–0.3	5–10
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	0.1–2	5–10
licorice bedstraw	GACI2	*Galium circaezans*	Native	0.1–0.2	5–10
stiff tickseed	COPA10	*Coreopsis palmata*	Native	0.1–0.5	5–10
wild quinine	PAIN3	*Parthenium integrifolium*	Native	0.1–3	5–10
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0.5–5	10–30
winged elm	ULAL	*Ulmus alata*	Native	2–6	5–20
lowbush blueberry	VAAN	*Vaccinium angustifolium*	Native	0.3–3	5–20
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	0.5–1	5–10
Tree					
common serviceberry	AMAR3	*Amelanchier arborea*	Native	5–10	0–5
sassafras	SAAL5	*Sassafras albidum*	Native	5–10	0–5

Table 13. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
post oak	QUST	*Quercus stellata*	Native	24–40	30–40	5–15	–
northern red oak	QURU	*Quercus rubra*	Native	30–50	20–30	5–25	–
shortleaf pine	PIEC2	*Pinus echinata*	Native	30–50	5–20	–	–
blackjack oak	QUMA3	*Quercus marilandica*	Native	15–30	10–20	–	–
black oak	QUVE	*Quercus velutina*	Native	30–50	10–20	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	24–40	10–20	5–9	–
black hickory	CATE9	*Carya texana*	Native	24–40	10–20	11–13	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	2–30	5–10	–	–
white oak	QUAL	*Quercus alba*	Native	20–40	1–10	11–15	–

Table 14. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
poverty oatgrass	DASP2	*Danthonia spicata*	Native	0.1–2	10–20
whitetinge sedge	CAAL25	*Carex albicans*	Native	0.1–2	5–10
fuzzy wuzzy sedge	CAHI6	*Carex hirsutella*	Native	0.1–2	5–10
ribbed sedge	CAVI4	*Carex virescens*	Native	0.1–2	5–10
rock muhly	MUSO	*Muhlenbergia sobolifera*	Native	0.1–2	5–10
little bluestem	SCSC	*Schizachyrium scoparium*	Native	0.1–3	5–10
Forb/Herb					
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	0.1–0.3	5–10
wild quinine	PAIN3	*Parthenium integrifolium*	Native	0.1–3	5–10
downy ragged goldenrod	SOPE	*Solidago petiolaris*	Native	0.1–3	5–10
elmleaf goldenrod	SOUL2	*Solidago ulmifolia*	Native	0.1–2	5–10
manyray aster	SYAN2	*Symphyotrichum anomalum*	Native	0.1–3	5–10
skyblue aster	SYOO	*Symphyotrichum oolentangiense*	Native	0.1–2	5–10
stiff tickseed	COPA10	*Coreopsis palmata*	Native	0.1–0.5	5–10
perplexed ticktrefoil	DEPE80	*Desmodium perplexum*	Native	0.1–2	5–10
licorice bedstraw	GACI2	*Galium circaezans*	Native	0.1–0.2	5–10
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	0.1–2	5–10
St. Andrew's cross	HYHY	*Hypericum hypericoides*	Native	0.5–3	5–10
shrubby lespedeza	LEFR5	*Lespedeza frutescens*	Native	0.1–1	5–10
birdfoot violet	VIPE	*Viola pedata*	Native	0.1–0.3	5–10
nakedflower ticktrefoil	DENU4	*Desmodium nudiflorum*	Native	0.5–1	5–10
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	1–5	15–30
winged elm	ULAL	*Ulmus alata*	Native	2–6	10–20
lowbush blueberry	VAAN	*Vaccinium angustifolium*	Native	0.5–3	10–20
Tree					
black hickory	CATE9	*Carya texana*	Native	5–10	5–10
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.2–10	5–10
blackjack oak	QUMA3	*Quercus marilandica*	Native	5–10	5–10
black oak	QUVE	*Quercus velutina*	Native	5–10	5–10
sassafras	SAAL5	*Sassafras albidum*	Native	5–10	5–10
common serviceberry	AMAR3	*Amelanchier arborea*	Native	5–10	5–10

Animal community

Wildlife (MDC, 2006):
Wildlife habitat: Oaks on this site provide abundant hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food.

Sedges and native cool-season grasses provide green browse; 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 and herbaceous cover habitat is important for turkey poults and quail chicks.

Birds species associated with this site are Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Summer Tanager, Eastern Wood-Pewee, Whip-poor-will, Chuck-will's widow, and Red-eyed Vireo.

Reptiles and amphibians associated with this ecological site include ornate box turtle, northern fence lizard, five-lined skink, coal skink, broad-headed skink, six-lined racerunner, western slender glass lizard, prairie ring-necked snake, flat-headed snake, rough earth snake, red milk snake, western pygmy rattlesnake, and timber rattlesnake.

Domestic livestock:
Currently, domestic cattle grazing is absent or very limited on these sites due to lack of water, access issues, and high amounts of acorns on the ground in the fall that are detrimental to cattle.

Hydrological functions

The water features of this upland ecological site include evapotranspiration, surface runoff, and drainage. Each water balance component fluctuates to varying extents from year-to-year. Evapotranspiration remains the most constant. Precipitation and drainage are highly variable between years. Seasonal variability differs for each water component. Precipitation generally occurs as single day events. Evapotranspiration is lowest in the winter and peaks in the summer. Water stored as ice and snow decreases drainage and surface runoff rates throughout the winter and increases these fluxes in the spring. The surface runoff pulse is greatly influenced by extreme events. Conversion to cropland or other high intensities land uses tends to increase runoff, but also decreases evapotranspiration. Depending on the situation, this might increase groundwater discharge, and decrease baseflow in receiving streams.

Recreational uses

Hunting, bird watching, horseback riding, camping, and hiking are recreational uses of this ecological site. Reference and well managed sites provide good hunting for turkey, white-tailed deer, and squirrel. Recreational uses are reduced in the highgraded state.

Wood products

This ecological site is not productive but some managed, limited harvesting can occur. Care must be taken to maintain the integrity and character of the site.

Potential wood products include lower grade lumber and pallet materials.

Management: Field measured site index values averaged 47 for black oak and 52 for shortleaf pine (NRCS, 2014). Timber management opportunities are fair. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. This site responds well to fire. Using prescribed fire can be an effective management tool.

Limitations: Large amounts of coarse fragments throughout profile; bedrock may be within 60 inches. Surface stones and rocks are problems for efficient and safe equipment operation and will make equipment use somewhat difficult. Disturbing the surface excessively in harvesting operations and building roads increases soil losses, which leaves a greater amount of coarse fragments on the surface. Hand planting or direct seeding may be necessary. Seedling mortality due to low available water capacity may be high. Mechanical tree planting will be limited. Erosion is a hazard when slopes exceed 15 percent. On steep slopes greater than 35 percent, traction problems increase and equipment use is not recommended (NRCS, 2002).

Other products

Additional opportunities exist in the reference and well managed woodland states for possible agroforestry wild crafting activities, such as harvesting spring and summer florals and native blueberries.

Other information

Historically, black bears were common across the area. Their reduced numbers were directly correlated with the

westward expansion of the European settlers and uncontrolled hunting. Like other mobile animals in the area, bears would have used multiple ecological sites. Other predators like the mountain lion and wolf have also disappeared from these sites in a similar manner. Today sightings of black bears and mountain lions are increasing due a natural migration of these species from other states and regions.

Table 15. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
shortleaf pine	*PIEC2*	48	52	64	72	50	–	–	
black oak	*QUVE*	40	55	26	38	50	–	–	
northern red oak	*QURU*	38	44	25	29	50	–	–	
post oak	*QUST*	23	35	19	25	50	–	–	

Inventory data references

The data contained in this document is derived from analysis of inventories, ecological interpretation from field evaluations, and various reference papers and books.

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

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Sampling methods (nested plots/transects/relevee)

Reference Inventory Plots:
BUMOCA03 Buford Mountain CA; Irondale
PERACA05 Peck Ranch CA; Knobtop
RUMOCA01 Russell Mountain CA; Irondale

Level 2 and reconnaissance inventory:

2003: Nigh/Meinert-Initial reconnaissance/Mapping. Three weeks of recon on numerous 116C mountains.

2007: Reconnaissance plots on Stegall Mountain and Taum Sauk.

2012: Field stops on igneous sites during the Central States Forest Soils Workshop.

2013: Reconnaissance on numerous mountains working on reference plots. Taum Sauk, Hughes, Peck Ranch, Russel Mountain, Johnson Shut-Ins, Mill Mountain NA, Buford

Type locality

Location 1: Iron County, MO	
Township/Range/Section	T35N R3E S34
UTM zone	N
UTM northing	4174905
UTM easting	703390
Latitude	37° 41′ 55″
Longitude	-90° 41′ 34″
General legal description	Dry Igneous Upland Woodland at Buford Mountain Conservation Area.

Location 2: Carter County, MO	
Township/Range/Section	T28N R2W S19
UTM zone	N
UTM northing	4104426
UTM easting	659528
Latitude	37° 4′ 21″
Longitude	-91° 12′ 19″
General legal description	Dry Igneous Upland Woodland on Stegall Mountain at Peck Ranch Conservation Area.
Location 3: Iron County, MO	
Township/Range/Section	T33N R3E S3
UTM zone	N
UTM northing	4160455
UTM easting	703204
Latitude	37° 34′ 7″
Longitude	-90° 41′ 56″
General legal description	Dry Igneous Upland Woodland at Russell Mountain Conservation Area.

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University of Missouri Climate Center - http://climate.missouri.edu/climate.php

Contributors

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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	04/19/2024
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:**