# Ecological site F116CY009MO
# Fragipan Basin Woodland

Last updated: 9/24/2020
Accessed: 09/07/2026

## 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.

## 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 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

Terrestrial Natural Community Type (Nelson, 2010): The reference state for this ecological site is most similar to a Dry Igneous 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 Woodland. National Vegetation Classification System Vegetation Association (NatureServe, 2010): The reference state for this ecological site is most similar to a Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium Woodland (CEGL002149). Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002): This ecological site occurs primarily within the following Land Type Associations: Roselle Oak Woodland Upland Igneous Plain St. Francois Igneous Glade/Oak Forest Knobs

## 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”. Fragipan Basin Woodlands occur throughout the area, and on outlying igneous knobs and basins in adjacent counties. Soils have root-restricting fragipans. These sites are often adjacent to Claypan Basin Flatwood ecological sites, which are in broad concave positions and are wetter. Fragipan Basin sites are typically adjacent to many of the upland Igneous woodland and forest site, none of which have a root-restricting fragipan. The reference plant community is woodland with an overstory dominated by post oak, with blackjack oak, hickory, white oak, and black oak, and a ground flora of wet-tolerant grasses, sedges, and forbs.

## Associated sites

| | |
|---|---|
| F116CY004MO | **Igneous Protected Backslope Forest**<br><br>Igneous Protected Backslope Forests are on steeper slopes, and do not have a root-restricting fragipan. |
| F116CY003MO | **Dry Igneous Upland Woodland**<br><br>Dry Igneous Upland Woodlands are generally on steeper slopes, and have bedrock within the soil profile. |

| | |
|---|---|
| **F116CY005MO** | **Dry Igneous Protected Backslope Woodland**<br>Igneous Protected Backslope Woodlands are on steeper slopes, and have bedrock within the soil profile. |
| **F116CY008MO** | **Claypan Basin Flatwoods**<br>Claypan Basin Flatwoods are on lower, more concave positions within the basin landscape. |
| **F116CY010MO** | **Igneous Exposed Backslope Woodland**<br>Igneous Exposed Backslope Woodlands are on steeper slopes, and do not have a root-restricting fragipan. |
| **F116CY011MO** | **Dry Igneous Exposed Backslope Woodland**<br>Dry Igneous Exposed Backslope Woodlands are on steeper slopes, and have bedrock within the soil profile. |
| **F116CY002MO** | **Igneous Upland Woodland**<br>Igneous Upland Woodlands are generally on steeper slopes, and do not have a root-restricting fragipan. |

## Similar sites

| | |
|---|---|
| **F116CY003MO** | **Dry Igneous Upland Woodland**<br>Dry Igneous Upland Woodlands are generally on steeper slopes, and have bedrock within the soil profile but have similar canopy structure and composition. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Quercus stellata*<br>(2) *Quercus velutina* |
| Shrub | (1) *Hypericum hypericoides* |
| Herbaceous | (1) *Schizachyrium scoparium*<br>(2) *Carex* |

## Physiographic features

This site is in both basin and mountain landscapes, on summit crests and shoulders with slopes of 1 to 15 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Brown and Gregg, 1991) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the igneous basins.

**Figure 1. Major ecological sites of the igneous basins**

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Ridge<br>(2) Interfluve<br>(3) Divide<br>(4) Basin-floor remnant |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 150 – 370 m |
| Slope | 0 – 20 % |
| Water table depth | 50 – 80 cm |
| 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 this and in nearby basin ecological sites relative to upslope sites. At critical times during the year, this phenomenon may produce later spring or earlier fall freezes in this ecological site. Upslope Glade ecological sites may have higher daytime temperatures due to bare rock and higher reflectivity of these un-vegetated surfaces. Finally, the climate within closed-canopy woodland communities is measurably different from the climate of open-canopy woodlands within this ecological site.

References:
University of Missouri Climate Center - 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) | 140-150 days |
| Freeze-free period (characteristic range) | 160-170 days |
| Precipitation total (characteristic range) | 1,140-1,190 mm |
| Frost-free period (actual range) | 140-150 days |
| Freeze-free period (actual range) | 160-170 days |
| Precipitation total (actual range) | 1,140-1,190 mm |
| Frost-free period (average) | 140 days |
| Freeze-free period (average) | 170 days |
| Precipitation total (average) | 1,170 mm |

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

### Influencing water features

This ecological site is influenced by a seasonal high-water table, perched on a fragipan in the subsoil. Some depressional areas pond for short periods of time, mostly in the spring. Unaltered areas are Emergent Palustrine Temporarily Flooded and Intermittently Flooded wetlands (Cowardin et al., 1979).

### Soil features

These soils have a root-restricting fragipan at about 24 inches. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. They have silt loam surface horizons, and loamy subsoils that have low to moderate amounts of volcanic gravel with depth. Parent material is loess over slope alluvium and residuum weathered from acidic volcanic rock such as granite. A seasonal high water table is perched above the fragipan during the spring months in most years. Soil series associated with this site include Delassus.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Loess<br>(2) Slope alluvium<br>(3) Residuum – granite |

| | |
|---|---|
| Surface texture | (1) Silt loam<br>(2) Gravelly silt loam |
| Family particle size | (1) Loamy |
| Drainage class | Moderately well drained |
| Permeability class | Very slow |
| Soil depth | 30 – 60 cm |
| Surface fragment cover <=3" | 0 – 20 % |
| Surface fragment cover >3" | Not specified |
| Available water capacity (0-101.6cm) | 12.7 – 17.78 cm |
| Calcium carbonate equivalent (0-101.6cm) | Not specified |
| Electrical conductivity (0-101.6cm) | Not specified |
| Sodium adsorption ratio (0-101.6cm) | Not specified |
| Soil reaction (1:1 water) (0-101.6cm) | 3.5 – 10 |
| Subsurface fragment volume <=3" (Depth not specified) | 0 – 20 % |
| Subsurface fragment volume >3" (Depth not specified) | 0 – 10 % |

## 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.

Fragipan Basin Woodlands are dominated by relatively short (40 to 60 feet) open grown post oak, with scattered blackjack oak, hickory and black oak. Canopy closure is 50 to 80 percent. The understory is open with a dense ground flora of native grasses and forbs. The fragipan soil of this site 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 glades and woodlands burned at least once every 5 to 10 years. These periodic fires would have kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs.

These sites 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 large herbivores, such as bison, elk and white-tailed deer, 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 woodies can quickly fill the woodland system. 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.

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 coralberry, gooseberry, and Virginia creeper. Grazing also promotes the invasion of eastern red cedar. These grazed sites also have a more open understory in addition to soil compaction, soil erosion and lower productivity problems.

Timber harvesting is very limited on these sites because of the poor quality and tree size. They are excellent wildlife sites.

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

**Figure 8. State and transition diagram for this ecological site**

## Additional community tables

**Table 5. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 6. Community 1.1 forest overstory composition**

| Common Name | Symbol | Scientific Name | Nativity | Height M | Canopy Cover (%) | Diameter Cm | Basal Area (square M/hectare) |
|---|---|---|---|---|---|---|---|
| **Tree** | | | | | | | |
| post oak | QUST | *Quercus stellata* | Native | – | 20-40 | – | – |
| black oak | QUVE | *Quercus velutina* | Native | – | 20-40 | – | – |
| blackjack oak | QUMA3 | *Quercus marilandica* | Native | – | 5-20 | – | – |
| northern red oak | QURU | *Quercus rubra* | Native | – | 5-20 | – | – |
| black hickory | CATE9 | *Carya texana* | Native | – | 5-20 | – | – |
| white oak | QUAL | *Quercus alba* | Native | – | 5-20 | – | – |

**Table 7. Community 1.1 forest understory composition**

| Common Name | Symbol | Scientific Name | Nativity | Height (m) | Canopy Cover (%) |
|---|---|---|---|---|---|
| **Grass/grass-like (Graminoids)** | | | | | |
| little bluestem | SCSC | *Schizachyrium scoparium* | Native | – | 20-30 |

| | | | | | |
|---|---|---|---|---|---|
| rock muhly | MUSO | *Muhlenbergia sobolifera* | Native | – | 5-20 |
| Bosc's panicgrass | DIBO2 | *Dichanthelium boscii* | Native | – | 5-20 |
| slender spikerush | ELTE | *Eleocharis tenuis* | Native | – | 5-20 |
| broomsedge bluestem | ANVI2 | *Andropogon virginicus* | Native | – | 5-10 |
| shallow sedge | CALU5 | *Carex lurida* | Native | – | 5-10 |
| fuzzy wuzzy sedge | CAHI6 | *Carex hirsutella* | Native | – | 5-10 |
| sweet woodreed | CIAR2 | *Cinna arundinacea* | Native | – | 5-10 |
| slender spikerush | ELTEV | *Eleocharis tenuis var. verrucosa* | Native | – | 5-10 |
| **Forb/Herb** | | | | | |
| handsome Harry | RHVI | *Rhexia virginica* | Native | – | 5-20 |
| ashy sunflower | HEMO2 | *Helianthus mollis* | Native | – | 5-20 |
| skyblue aster | SYOO | *Symphyotrichum oolentangiense* | Native | – | 5-20 |
| prairie blazing star | LIPY | *Liatris pycnostachya* | Native | – | 5-20 |
| white wild indigo | BAAL | *Baptisia alba* | Native | – | 5-20 |
| American ipecac | GIST5 | *Gillenia stipulata* | Native | – | 5-20 |
| elmleaf goldenrod | SOUL2 | *Solidago ulmifolia* | Native | – | 5-20 |
| common cinquefoil | POSI2 | *Potentilla simplex* | Native | – | 5-20 |
| narrowleaf mountainmint | PYTE | *Pycnanthemum tenuifolium* | Native | – | 5-20 |
| nakedflower ticktrefoil | DENU4 | *Desmodium nudiflorum* | Native | – | 5-20 |
| rue anemone | THTH2 | *Thalictrum thalictroides* | Native | – | 5-20 |
| **Shrub/Subshrub** | | | | | |
| St. Andrew's cross | HYHY | *Hypericum hypericoides* | Native | – | 5-20 |
| Carolina rose | ROCA4 | *Rosa carolina* | Native | – | 5-20 |
| fragrant sumac | RHAR4 | *Rhus aromatica* | Native | – | 5-20 |

**Table 8. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 9. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 10. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 11. Community 4.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

**Table 12. Community 4.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production () | Foliar Cover (%) |
|---|---|---|---|---|---|

## Animal community

Wildlife (MDC 2006) 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. (MDC, 2006)

## Hydrological functions

A seasonal high water table is perched above the fragipan during the spring months in most years.

## Other information

Forestry (NRCS 2002; 20014) Management: Estimated site index values for oaks range from 40 to 50. Timber management opportunities are poor to fair. These sites have a root-restricting fragipan which impedes rooting. Reduced rooting depth restricts tree growth and increases windthrow hazards. These groups respond well to even-aged management. 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. These sites respond well to prescribed fire as a management tool. Limitations: Restricted rooting depth; seasonal wetness. Unsurfaced roads and traffic areas tend to be slippery and form ruts easily. Graveling roads facilitates year-round use. Equipment use when wet may compact soil and damage tree roots. Planting is difficult during wet spring periods. Seedling mortality may be high due to excess seasonal wetness, shallow effective rooting depths or sodium. Ridging the soil and planting on the ridges may increase survival. The use of equipment can become restricted in spring and other excessively wet periods.

## Inventory data references

Potential Reference Sites: Fragipan Basin Woodland Plot BISMACA03 – Delassus soil Located in Bismarck CA, St. Francois County, MO Latitude: 37.716939 Longitude: -90.652623

## Other references


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### Contributors

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### Approval

Nels Barrett, 9/24/2020

### 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 | 09/11/2020 |
| Approved by | |
| 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:**

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