

## *Ecological Site Description*

### **Fragipan Upland Woodland**

**F116BY001MO**

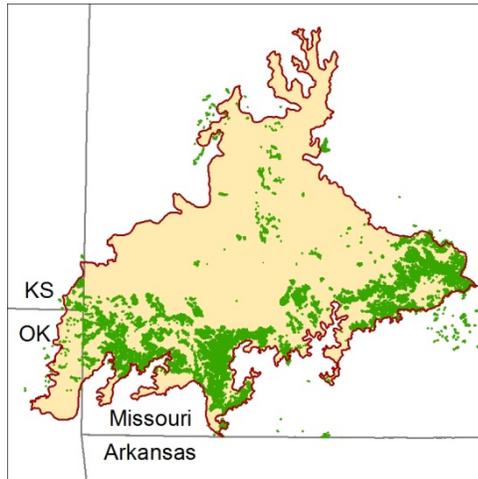
- (*Quercus stellata* - *Quercus marilandica* /*Rhus aromatica*/*Schizachyrium scoparium* - *Desmodium*)
- (post oak – blackjack oak /aromatic sumac/little bluestem – tick trefoil)

An Ecological Site Description (ESD) is a reference document of ecological knowledge regarding a particular land area (ecological site). An ESD describes ecological potential and ecosystem dynamics of land areas and their potential management. Ecological sites are linked to soil survey map unit components, which allows for mapping of ecological sites. *(NOTE: This is a “provisional” ESD, and is subject to change. It contains basic ecological information sufficient for conservation planning and land management in Missouri. After additional information is developed and reviewed, a “Correlated” ESD will be published and will be available via the Web Soil Survey <http://websoilsurvey.nrcs.usda.gov> .)*

**Major Land Resource Area:** 116B – Springfield Plain

### **Introduction**

The Springfield Plain (area outlined in red on the map) is in the western part of the Ozark Uplift. It



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

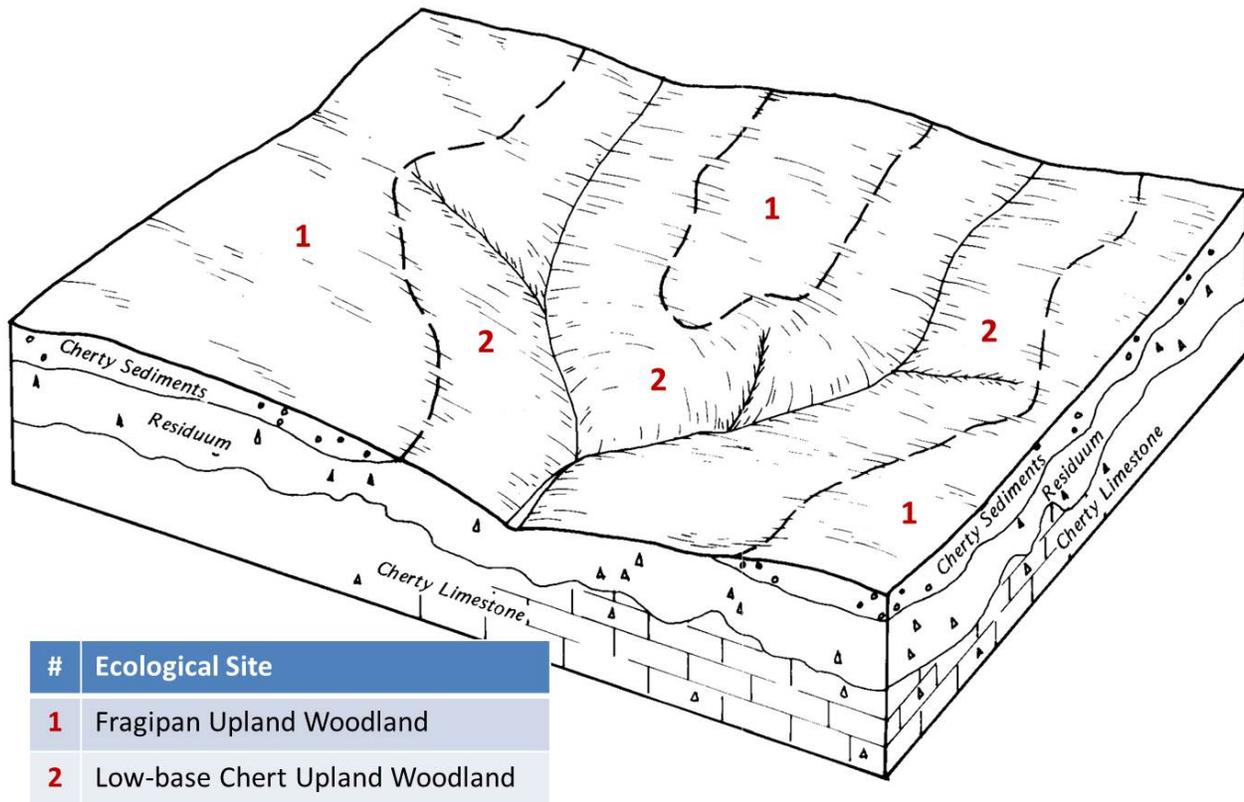
Fragipan Upland Woodlands (green areas on the map) within the Springfield Plain are confined mainly to the flat to gently rolling, loess covered dissected plains in the southern half of the region, particularly around the James River, and Finley and Shoal Creeks. Soils have root-

restricting fragipans.

### **Physiographic Features**

This site is on level to broadly convex upland summits that include broad shallow depressions in some areas. Slopes range from 0 to 8 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Aldrich, 1989) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. The site is within the area labeled “1”, on broadly convex upland summits. Low-base Chert Upland Woodland sites are often directly downslope, and are included within the area labeled “2”.



**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 silty clay loam subsoils. Soil materials in and below the fragipan may be very gravelly. Parent material is a thin layer of loess over residuum derived primarily from cherty limestone. These soils are affected by seasonal wetness in spring months from a water table perched on the fragipan. Soil series associated with this site include Captina, Hobson, Tonti, and Viraton.

**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.*

Historically, Fragipan Upland Woodlands were dominated by drought and fire-tolerant post and blackjack oaks. Their landscape position and juxtaposition to prairies lead to a high fire frequency (every 1 to 3 years). The flatwoods ranged from savannas near the prairie edge to open, park-like

woodlands farther away. Canopy closure varied from 40 to 70 percent and tree height from 35 to 50 feet.

Native prairie grasses dominated the open understory, along with a diverse mix of native legumes, asters, sunflowers and other forbs. Dense thickets of oak sprouts occurred during periods of less-frequent fire, but periodic fire would eventually clear them out. Grazing by native large herbivores also influenced the understory, keeping it more open and structurally diverse.

Today, this community has been cleared and converted to pasture, or has grown dense in the absence of fire. Most occurrences exhibit canopy closure of 80 to 100 percent. In addition, the sub-canopy and understory layers are more developed. Post and blackjack oak share dominance with black oak, black hickory and an occasional white oak. Under these denser, more shaded conditions, the original sun-loving ground flora has diminished in diversity and cover. While some woodland species persist in the ground flora, many have been replaced by more shade-tolerant species.

Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing invasive species that are tolerant of grazing, such as buckbrush, gooseberry, Virginia creeper and, in severely overgrazed situations, mosses and lichens.

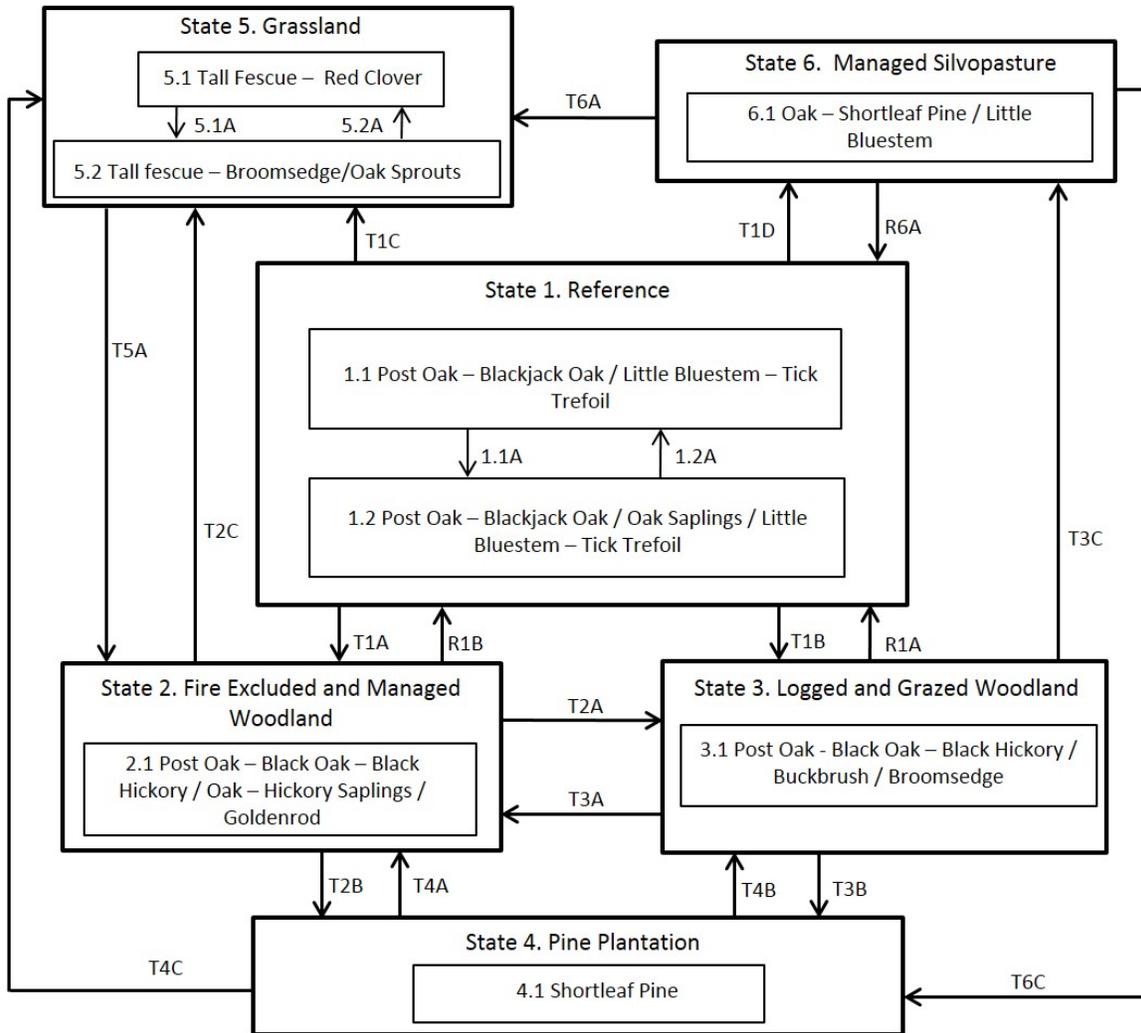
Although timber products from Fragipan Upland Woodlands are of limited value, logging does occur, and influences the community. Occasional partial cuts provide sunlight to the woodland floor, stimulating native woodland ground flora. However, in the absence of fire and continual cultural treatments, oaks sprout and grow into a dense stand, again shading out the sun-loving ground flora.

Partial cutting and prescribed fire can, however, restore the more open structure and diversity of ground flora species. Managed areas show an exceptional resiliency. This type of management may provide timber products, wildlife habitat, and potential native forage.

A State and Transition Diagram is depicted in Figure 1. 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.

**Figure 1: State and transition diagram**

**Fragipan Upland Woodland, F116BY001MO**



Code	Event/Activity/Process
T1A	Fire suppression; managed timber harvest
T1B	Fire suppression; high grading timber harvest; uncontrolled domestic grazing
T1C, T2C, T4C, T6A	Clearing; grassland planting; grassland management
T1D	Thinning; prescribed fire; managed grazing
T2B, T3B	Clearcut; pine planting; Exclude domestic grazing
T2A	Uncontrolled domestic grazing; high grading harvests
T3A	Exclude domestic grazing
T4A	Pine harvest; fire exclusion
T4B	Pine harvest; fire exclusion; domestic grazing
T5A	Tree planting; long-term succession; grazing exclusion
T6C	Pine planting; selective oak harvest

Code	Event/Activity/Process
1.1A	Fire-free interval, 5-10 years
1.2A	Fire 2-5 years
5.1A	Over grazing; no fertilization
5.2A	Brush management; prescribed grazing

Code	Event/Activity/Process
R1A	Exclude domestic grazing; thinning; prescribed fire - 2-5 years
R1B	Thinning; prescribed fire - 2-5 years
R6A	Exclude domestic grazing; prescribed fire 2-5 years

## Ecological States

### State 1: Reference

These open woodland communities were strongly influenced by fire. Herbivory by native (now expatriated) ungulates also played a role. Consequently, this maintained drought and fire-tolerant post, black and blackjack oaks over a ground flora of tallgrass prairie grasses, sedges and wildflowers. There are two phases associated with this Reference State.

#### *Post Oak – Blackjack Oak / Little Bluestem – Tick Trefoil - Community Phase 1.1*

The overstory in this phase is dominated by post oak and blackjack oak, with black oak and black hickory also present. This open woodland community typically has a two-tiered structure, with canopy height of 40 to 60 feet and 40 to 70 percent closure. The abundant herbaceous layer is dominated by little bluestem, big bluestem and Indiangrass. Fire frequency was every 1 to 3 years. This continued fire and natural native grazing would have maintained the more open canopy and profusion of ground flora species.

#### *Post Oak – Blackjack Oak / Oak Saplings / Little Bluestem – Tick Trefoil - Community Phase 1.2*

This phase is similar to community phase 1.1. Due to fire-free intervals that ranged from 5 to 10 years, this brushy woodland community typically has a three-tiered structure, with 50 to 80 percent closure. It is characterized by a thick understory of oak saplings, and shrubs. The herbaceous layer is dominated by little bluestem.

### State 2: Fire Excluded and Managed Woodland

Most current areas of Fragipan Upland Woodlands have suffered fire exclusion for decades. In the absence of fire, ongoing recruitment of trees develops into a closed canopy, shading out the rich herbaceous ground flora. This results in the formation of the post oak - black oak – black hickory closed woodland. Black oak and white oak increase in the canopy. Herbaceous cover and diversity greatly diminishes, leaf litter builds up, and only a few shade-tolerant woodland species persist, such as elm-leaved goldenrod, panic grass and spreading aster. The understory also develops with oak and hickory saplings along with sassafras and black cherry. Single-tree timber harvest often occurs, resulting in a stimulation of understory saplings and herbaceous vegetation. However, without fire, the reference species richness and open structure do not return.

### State 3: Logged and Grazed Woodland

Although many of the closed Fragipan Upland Woodlands are now fenced, most have been heavily grazed by domestic livestock at some point in their history. Grazing decreases the cover and abundance of saplings, shrubs and herbaceous ground flora, opening up the understory. Weedy native shrubs and vines, such as buckbrush, gooseberry, poison ivy and Virginia creeper, often flourish after grazing, and exotic species like fescue and sericea lespedeza increase in abundance. Poorly managed grazing can cause compaction and denudation of the soil surface, allowing mats of lichens and mosses to flourish. Soil compaction may also further limit height growth of trees. With poorly managed grazing, this can result in an increase in weedy natives such as broom sedge, and exotics such as sericea lespedeza if they are present. Single-tree timber harvesting also occurred, resulting in a high grading of the canopy structure, creating many stands with poorly formed trees.

**State 4: Pine Plantation**

The Pine Plantation state results from clearing the oak woodlands and planting shortleaf pine. Shortleaf pine grows well on less-productive sites, so the practice was common during reforestation of the Ozarks. The plantations are typically dense, mature stands of pine with deep leaf litter and little understory or ground flora vegetation. A return from this condition to a flatwoods state requires enormous cost and management inputs.

**State 5: Grassland**

Conversion of these woodlands to planted, non-native grassland species such as tall fescue and red clover has been common occurrence. Clearing is often done by bulldozing. This practice often strips the thin topsoil along with most of the native ground cover plants. Occasionally, clumps of trees will be left in small groves for shade, giving the structural appearance of historic woodlands. However, Fragipan Upland Woodlands have most often been converted into wide, open fescue grasslands, adjacent to densely overgrown and grazed woodlots. A return from this condition to a reference state requires enormous cost and management inputs.

**State 6: Managed Silvopasture**

Although this state is currently uncommon, Fragipan Upland Woodlands have the potential to support controlled grazing while maintaining a near-reference composition and structure. Short periods of rotational grazing, especially during the hot, dry summer season, along with thinning and prescribed fire, has the potential to create an open, diverse woodland with abundant native forage. Controlled grazing may emulate historical grazing by native herbivores and create a structural diversity in the ground flora that may be beneficial to ground-nesting birds.

The Managed Silvopasture State has an open, two-tiered structure of post oak and shortleaf pine over native grasses and forbs. Canopy height is typically 40 to 60 feet, with canopy closure of 20 to 60 percent. Native grasses include little bluestem, big bluestem and Indiangrass.

**Reference State Plant Community**

Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
POST OAK	<i>Quercus stellata</i>	30-60	50
BLACK HICKORY	<i>Carya texana</i>	10-30	40
BLACKJACK OAK	<i>Quercus marilandica</i>	20-40	30
BLACK OAK	<i>Quercus velutina</i>	10-30	50
SASSAFRAS	<i>Sassafras albidum</i>	0-20	20
SHORTLEAF PINE	<i>Pinus echinata</i>	0-10	60

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
FRAGRANT SUMAC	<i>Rhus aromatica</i>	10-20	3
HAZELNUT	<i>Corylus americana</i>	0-20	3
NEW JERSEY TEA	<i>Ceanothus americanus</i>	0-20	3
BLACK HUCKLEBERRY	<i>Gaylussacia baccata</i>	0-20	2

## Forbs

Common Name	Botanical Name	Cover % (low-high)
PUSSYTOES	<i>Antennaria parlinii</i>	5-10
BRISTLY SUNFLOWER	<i>Helianthus hirsutus</i>	5-20
WHITE WILD INDIGO	<i>Baptisia alba</i>	5-20
SPREADING ASTER	<i>Aster patens</i>	5-20
ELM-LEAVED GOLDENROD	<i>Solidago ulmifolia</i>	5-20
COMMON CINQUEFOIL	<i>Potentilla simplex</i>	5-20
SMALL-LEAF TICK TREFOIL	<i>Desmodium marilandicum</i>	5-20
PANICLED TICK TREFOIL	<i>Desmodium paniculatum</i>	5-20
PENCIL FLOWER	<i>Stylosanthes biflora</i>	5-20
GOAT'S RUE	<i>Tephrosia virginiana</i>	5-20
HAIRY HAWKWEED	<i>Hieracium gronovii</i>	5-20
HAND COREOPSIS	<i>Coreopsis palmata</i>	5-20
BIG-FLOWERED GERARDIA	<i>Aureolaria grandiflora</i>	5-20
HOG PEANUT	<i>Amphicarpeaea bracteata</i>	5-10
SLENDER LESPEDEZA	<i>Lespedeza virginica</i>	5-20

## Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	30-50
BIG BLUESTEM	<i>Andropogon gerardii</i>	10-20
INDIANGRASS	<i>Sorghastrum nutans</i>	10-20
POVERTY OAT GRASS	<i>Danthonia spicata</i>	10-20
VIRGINIA WILD RYE	<i>Elymus virginicus</i>	10-20
HIRSUTE SEDGE	<i>Carex complanata</i>	10-20
BLUE SEDGE	<i>Carex glaucoidea</i>	10-20
BROOMSEDGE	<i>Andropogon virginicus</i>	5-10

## Site Interpretations

## Wildlife

- Oaks provide hard mast; numerous native legumes provide high-quality wildlife food;
- Native warm-season grasses provide extensive cover and nesting habitat; and forbs provide a diversity and abundance of insects.
- Bird species associated with early-successional Upland Flatwoods are Northern Bobwhite, Painted Bunting, Prairie Warbler, Field Sparrow, Blue-winged Warbler, Yellow-breasted Chat, Brown Thrasher, and Bachman's Sparrow.
- Birds associated with mid- to late successional sites 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 Upland Flatwoods 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.

### Forestry

- **Management:** Field collected site index values average 50 for white oak/post oak, 56 for shortleaf pine, and 62 for black oak. Generally, the deeper the restricting layer, the higher the site index values. Timber management opportunities are fair. These sites have a root-restricting fragipan or an abrupt textural change or sodium horizon, which impedes rooting. Reduced rooting depth restricts tree growth and increases windthrow hazards. 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, group selection cuttings of ½ to 1 acre, or crop tree release are other options that can be used if clear cutting is not desired or warranted. These sites also respond well to prescribed fire as a management tool. Favor black oak, post oak, and white oak.
- **Limitations:** Restricted rooting depth; seasonal wetness. Unsurfaced roads and traffic areas tend to be slippery and form ruts easily when wet. 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 and shallow effective rooting depths. 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.

### Supporting Information

*Relationship to Other Established Classifications:*

Terrestrial Natural Community Type (Nelson, 2010):

The Reference State for this Ecological Site is most similar to an Upland Flatwoods.

Missouri Department of Conservation Forest and Woodland Communities (MDC, 2006):

The Reference State for this Ecological Site is most similar to Post Oak Woodland.

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

The Reference State for this Ecological Site is most similar to *Quercus stellata* - *Quercus marilandica* / *Schizachyrium scoparium* Wooded Herbaceous Vegetation.

### Glossary

*Backslope* – a hillslope profile position that forms the steepest and generally linear, middle portion of the slope.

*Backswamp* – marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces

*Calcareous* – the presence of calcium carbonate in the soil parent material within the rooting zone; relatively alkaline

*Claypan* – a dense, compact, slowly permeable layer in the subsoil having much higher clay content than the overlying material

*Chert* – hard, extremely dense or compact crystalline sedimentary rock, consisting dominantly of interlocking crystals of quartz

*Cliff* – a significant vertical, or near vertical, rock exposure

*Dolomite* – a type of sedimentary rock that is a carbonate mineral composed of calcium magnesium carbonate

*Drainageway* – the upper most reach of a stream channel system characterized by little meandering

*Dry* – a site where soil moisture is limiting during the growing season; low available water capacity

*Dune* – a low mound, ridge, bank or hill of loose, wind-blown sand

*Exposed* – steep, south and west-facing slopes, which are warmer and drier than other slope aspects

*Flatwoods* – a type of woodland that occurs on soils with a root restricting subsoil layer within 20 to 30 inches, resulting in very slow runoff and ponding that remains saturated for most of the winter and early spring months but dries out and becomes very dry in the summer months; plants that grow there must be adapted to both conditions

*Floodplain* – the nearly level plain that borders a stream and is subject to inundation under flood-stage conditions

*Footslope* – a hillslope position at the base of a slope where hillslope sediment (colluvium) accumulates

*Forest* – a vegetative community dominated by trees forming a closed canopy and interspersed with shade-tolerant understory species

*Fragipan* – a dense, brittle subsoil horizon that is extremely hard and compact when dry

*Glade* – open, rocky, barren vegetative community dominated by drought-adapted forbs and grasses, typically with scattered, stunted woody plants

*Igneous* –bedrock formed by cooling and solidification of magma. Granite and rhyolite are typical igneous bedrocks in Missouri

*Limestone* – a type of sedimentary rock composed largely of calcium carbonate

*Loess* – material transported and deposited by wind and consisting predominantly of silt-size particles

*Loamy* – soil material containing a relatively equal mixture of sand and silt and a somewhat smaller proportion of clay

*Marsh* – a type of wetland that is dominated by herbaceous rather than woody plant species

*Moist* – a site that is moderately well to well drained and has high available water capacity, resulting in a well-balanced supply of moisture (neither too dry nor too wet).

*Mudstone* – blocky or massive, fine-grained sedimentary rock in which the proportions of clay and silt are approximately equal

*Natric* – a soil horizon that displays a blocky, columnar, or prismatic structure and has a subhorizon with an exchangeable-sodium saturation of over 15%

*Outwash* – stratified sediments of sand and gravel removed or “washed out” from a glacier by melt-water streams

*Prairie* – a vegetative community dominated by perennial grasses and forbs with scattered shrubs and very few trees

*Protected* – steep, north- and east-facing slopes, which are cooler and moister than other slope aspects

*Residuum* - unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place

*Riser* – a component of terraces and flood-plain steps consisting of the steep side slope; the escarpment

*Riverfront* – a vegetative community in the floodplain immediately adjacent and generally parallel to a river or stream channel

*River hills* – a geographic area characterized by thick, dissected loess deposits, formed immediately adjacent to the edges of the Missouri and Mississippi River floodplains

*Sandy* – a coarse-sized soil containing a large mixture of sand and gravels and a somewhat smaller proportion of silts and clays with excessive drainage

*Sandstone* – a sedimentary rock containing dominantly sand-size particles

*Savanna* – grasslands interspersed with open-grown scattered trees, groupings of trees, and shrubs

*Shale* – a sedimentary rock formed from clay, silty clay, or silty clay loam deposits and having the tendency to split into thin layers

*Shallow* – a site with bedrock within 20 inches of the surface

*Shoulder* – the slope profile position that forms the convex surface near the top of a hill slope; it comprises the transition zone from summit to backslope

*Sinkhole* – a closed, circular or elliptical depression, commonly funnel-shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock or by collapse of underlying caves within bedrock

*Summit* – the top or highest area of a hillslope

*Swale* – shallow, closed depressions irregularly spaced across a floodplain or terrace with an irregularly undulating surface.

*Swamp* – an area of low, saturated ground, intermittently or permanently covered with water, and predominantly vegetated by shrubs and trees.

*Talus* – rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope.

*Terrace* – a step-like surface, bordering a valley floor that represents the former position of a flood plain

*Till* – dominantly unsorted and unstratified soil material deposited directly by a glacier

*Upland* – a general term for the higher ground of a region, in contrast with a low-lying, adjacent land such as a valley or floodplain

*Wet* – a somewhat poorly, poorly or very poorly drained site that has an oversupply of moisture during the growing season

*Woodland* – a highly variable vegetative community with a canopy of trees ranging from 30 to 100 percent closure with a sparse midstory and a dense ground flora of grasses, sedges and forbs

## References

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