

## *Ecological Site Description*

### **Igneous Upland Woodland**

**F116CY002MO**

- (*Quercus alba* - *Quercus rubra*/*Vaccinium angustifolium*/*Danthonia spicata* - *Schizachyrium scoparium*)
- (white oak – northern red oak/low bush blueberry/poverty oat grass – little bluestem)

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:** 116C – St. Francois Knobs and Basins

### **Introduction**

The St Francois Knobs and Basins (area outlined in red on the map) is the structural center of the

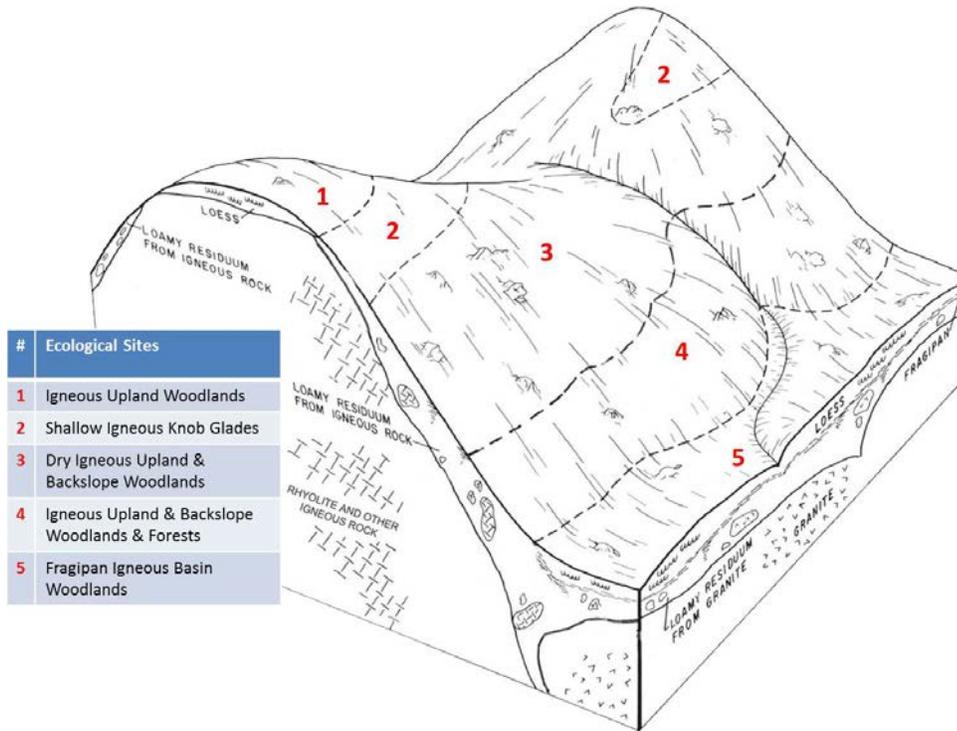


Ozark Dome. Elevation ranges from about 450 feet along the rivers in the southern part of the area, to 1,772 feet on the summit of Taum Sauk Mountain, the highest point in Missouri. Prominent features of this MLRA are the Precambrian igneous knobs and hills that rise conspicuously to various elevations, interspersed with smooth-floored basins and valleys overlying dolomite and sandstone. Ecological Sites defined for this MLRA are associated with 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).

Igneous Upland Woodlands (green areas on the map) occur in the central and southern part of the MLRA. Soils are over 40 inches to igneous bedrock, and are low in bases. These sites are often adjacent to Dry Igneous Upland Woodland ecological sites, and in places are mapped in complex with them. Dry Igneous sites have root-restricting bedrock in the upper part of the soil profile, as do the nearby Shallow Igneous Knob Glade sites. Vegetation of the reference state is woodland with a moderately developed canopy dominated by white oak and northern red oak.

### **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 adjacent 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. This ecological site occurs in both units “1” and “4” on the diagram. Sites on summit crests and shoulders (labeled “1”) have more loess influence in the soil than do sites lower on the slopes (labeled “4”),

which are generally upslope from steeper, backslope ecological sites.

**Soil Features**

These soils have 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 diorite. Sites on summit crests generally have loess in the upper part. They have silt loam surface layers that range to gravelly and very gravelly and cobbly, particularly on lower slope positions, with loamy subsoils that have moderate amounts of volcanic gravel and cobbles. These soils are not affected by seasonal wetness. Soil series associated with this site include Hassler, Mudlick, and Trackler.

**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.*

The reference community for Igneous Upland Woodland has a moderately developed canopy (50 to 70 feet tall and 60 to 80 percent closure) that is dominated by white oak, black oak, and northern red oak with a sun loving woodland ground flora. Increased canopy heights and higher stocking densities of white oak are associated with the deeper soil depth ranges of the correlated soil components.

The upland woodlands had an estimated fire frequency of 3 to 5 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody species, especially black hickory, winged elm and eastern red cedar would have increased and the herbaceous understory diminished. The return of fire would have opened the woodlands up again and stimulated the abundant ground flora.

Igneous Upland Woodlands were also subjected to occasional disturbances from wind and ice, as well as grazing by native large herbivores. Wind and ice would have periodically opened the canopy up by knocking over trees or breaking substantial branches off canopy trees. Grazing by native herbivores would have effectively kept understory conditions more open, creating conditions more favorable to oak reproduction and sun-loving ground flora species. In the long term absence of fire, woody species will encroach into these woodlands. Once established, these woody plants can quickly fill the woodland system. Most of these ecological sites today are more 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.

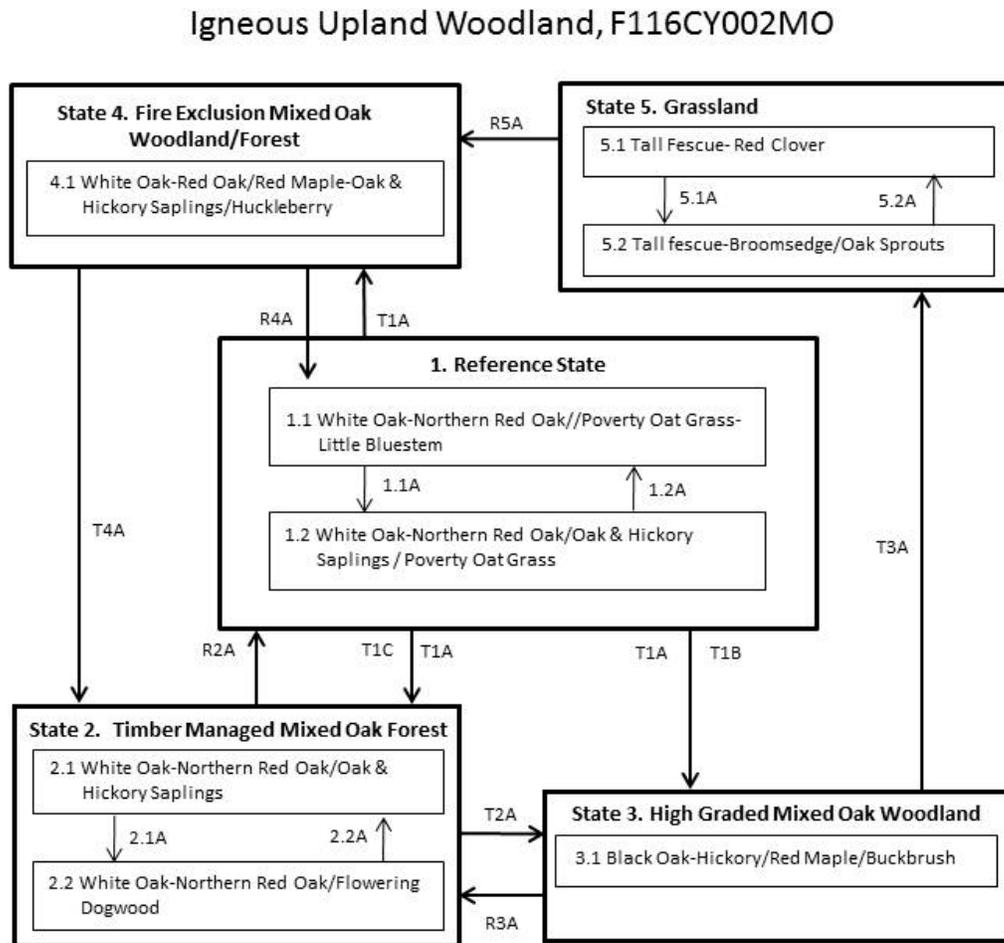
These sites have undergone periodic timber harvests and infrequent domestic livestock grazing. Most existing occurrences have a younger (50 to 80 years) canopy whose composition has been altered by timber harvesting practices. An increase in hickories over historic conditions is common. The absence of periodic fire has allowed more shade-tolerant tree species, such as red maple, winged elm and hickories to increase in abundance. Some less sloping sites have been cleared and converted to non-native cool season grassland.

Igneous Upland Woodlands are moderately productive timber sites. Unmanaged timber harvests in this region typically results in removal of the most productive trees, or high-grading of the stand. This can result in poorer quality residual timber and a shift in species composition away from more valuable oak species. Carefully planned single tree selection or the creation of small group openings can help regenerate more desirable oak species and increase vigor on the residual trees. Clear-cutting does occur and results in dense, even-aged stands of primarily oak. This may be most beneficial for existing stands whose composition has been highly altered by past management practices. Thinning and prescribed fire can play a beneficial role in the management of this ecological site.

Some soil properties may vary with ecological dynamics and management regimes, particularly in the upper part of the soil profile. Unrestricted grazing in woodland communities generally results in an increase in bulk density of the surface horizon and a decrease in infiltration rates. Long-term fire exclusion allows for a buildup of leaf litter increasing surficial organic material over time.

Conversion to grassland may result in soil loss from the clearing process and from erosion before the grassland is well established. Long-term, proper grassland management results in higher soil pH levels and higher levels of calcium and magnesium from pasture liming. These effects may extend a foot or more into the soil profile.

**Figure 1: State and Transition Diagram**



Code	Event/Process
T1A	Fire suppression >20 years
T1B, T2A	Logging – high grading
T3A	Clearing; grassland seeding; grassland management
T1C, T4A, 2.2A	Managed forest harvesting
1.1A	Fire-free interval 10-15 years
1.2A	Fire interval 3-5 years
2.1A	20-30 years of limited logging disturbance
5.1A	Over grazing; no fertilization
5.2A	Brush management; grassland seeding; grassland management
R2A, R4A	Selective thinning and prescribed fire interval 3-5 years
R3A	Logging cessation; selective thinning
R5A	Cessation of grazing & haying; native tree, forb and grass planting

## Ecological States

*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.*

### Reference State - State 1

The historical reference state for this ecological site was old growth oak woodland with an open understory and a dense ground flora of native grasses and forbs. This state was dominated by white oak, northern red oak, with occasional black oak, post oak, and shortleaf pine. Maximum tree age was likely 150 to 300 years. Periodic disturbances from fire, wind or ice maintained the woodland structure and diverse ground flora species. Long disturbance-free periods allowed an increase in both the density of trees and the abundance of shade tolerant species. Two community phases are recognized in the reference state, with shifts between phases based on disturbance frequency. Reference sites are very rare today.



Most of these sites have been subject to repeated, high-graded timber harvest (State 3). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora (State 4). Relatively few Igneous Upland Woodlands have been managed effectively for timber harvest (State 2), resulting in either even-age or uneven-age forests.

### Timber Managed Mixed Oak Forest - State 2

This state starts with mixed oak woodlands, which mature over time, increase in canopy cover, eventually transitioning into forest-like communities. These early woodlands tend to be rather dense with a sparse understory and ground flora. Periodic timber management, along with the absence of fire, will maintain this state. Continued exclusion of prescribed without a regular 15 to 20 year harvest re-entry into these stands, will slowly create an increase in more shade tolerant species. White oak will become less dominant and understory species such as flowering dogwood and hickory will become more dominant and cause a transition to community phase 2.2.

### High Graded Mixed Oak Woodland - State 3

This state is subjected to repeated, high-graded timber harvests resulting in a significant reduction in white oak densities and along. Fire cessation has also occurred. This state exhibits an over-abundance of black oak and hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. Proper forest management techniques can cause a transition to State 4.

**Fire Excluded Mixed Oak Woodland/Forest - State 4**

This state is dominated by white and northern red oaks. They can form relatively even-age 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 70 to 90 percent with decreasing ground flora. Without active management or long term presence of fire, woody species will continue to 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 in restoring the stage back to the reference state. Some logging typically occurs. They are excellent wildlife sites.

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**Grassland - State 5**

Conversion of wooded sites to planted, non-native grassland species such as tall fescue is a stage that is primarily associated with summit and shoulder positions of this ecological site. If active grassland management is discontinued, the site will eventually transition to Phase 5.2 with an increase in broomsedge and oak sprouts. Return to the reference state from this state may be impossible requiring a very long term series of management options and stages. Many species may need to be eventually planted or reseeded to restore the system.



Studies on Ozark woodlands indicate that conversion to grassland may result in soil loss from the clearing process and from erosion before the grassland is well established. Long-term grassland management results in higher soil pH levels and higher levels of calcium and magnesium from pasture liming. These effects may extend a foot or more into the soil profile. The effects of liming are more evident in phase 5.1 (Tall fescue – red clover).

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**Reference State Plant Community**

Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	<i>Quercus alba</i>	20-40	60
BLACK OAK	<i>Quercus velutina</i>	10-30	70
POST OAK	<i>Quercus stellata</i>	10-20	50
NORTHERN RED OAK	<i>Quercus rubra</i>	10-30	70
BLACK HICKORY	<i>Carya texana</i>	10-20	50
WHITE ASH	<i>Fraxinus americana</i>	5-20	60
SHORTLEAF PINE	<i>Pinus echinata</i>	5-20	70
PIGNUT HICKORY	<i>Carya glabra</i>	5-20	50

## Understory Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
SASSAFRAS	<i>Sassafras albidum</i>	5-10	30
RED MAPLE	<i>Acer rubrum</i>	5-10	40
FLOWERING DOGWOOD	<i>Cornus florida</i>	5-10	30
DOWNY SERVICEBERRY	<i>Amelanchier arborea</i>	5-10	20

## Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
CAROLINA BUCKTHORN	<i>Frangula caroliniana</i>	5-20	6
AROMATIC SUMAC	<i>Rhus aromatica</i>	5-20	5
LOW BUSH BLUEBERRY	<i>Vaccinium angustifolium</i>	5-20	3

## Forbs

Common Name	Botanical Name	Cover % (low-high)
NAKED FLOWER TICKTREFOIL	<i>Desmodium nudiflorum</i>	5-10
VIOLET BUSH CLOVER	<i>Lespedeza violacea</i>	5-10
VIRGINIA THREESEED MERCURY	<i>Acalypha virginica</i>	5-10
ELM-LEAF SOLIDAGO	<i>Solidago ulmifolia</i>	5-10
LICORICE BEDSTRAW	<i>Galium circaezans</i>	5-10
DOWNY RAGGED GOLDENROD	<i>Solidago petiolaris</i>	5-10
PERPLEXED TICKTREFOIL	<i>Desmodium perplexum</i>	5-10
MANYRAY ASTER	<i>Symphotrichum anomalum</i>	5-10
TRAILING BUSH CLOVER	<i>Lespedeza procumbens</i>	5-10
ST. ANDREW'S CROSS	<i>Hypericum hypericoides</i>	5-10
HAIRY SUNFLOWER	<i>Helianthus hirsutus</i>	5-10

## Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
CYPRESS PANIC GRASS	<i>Panicum dichotomum</i>	5-10
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	10-20
ROCK MUHLY	<i>Muhlenbergia sobolifera</i>	5-10
WHITE-TINGE SEDGE	<i>Carex albicans</i>	5-10
POVERTY OAT GRASS	<i>Danthonia spicata</i>	10-20

## Site Interpretations

## Wildlife

- 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, Red-eyed Vireo, Rose-breasted Grosbeak, Yellow-billed Cuckoo, and Broad-winged Hawk.

- Reptile and amphibian species include ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, six-lined racerunner, flat-headed snake, rough earth snake, and timber rattlesnake.

*Forestry*

- **Management:** Field measured site index values range from 55 for black oak and 59 for shortleaf pine. Timber management opportunities are generally good. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or small group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Using prescribed fire as a management tool could have a negative impact on timber quality, may not be fitting, or should be used with caution on a particular site if timber management is the primary objective. Favor white oak, northern red oak, scarlet oak and shortleaf pine.
- **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. Mulching or providing shade can improve seedling survival. 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.

**Supporting Information**

*Associated Sites*

Site ID	Narrative
F116CY003MO	Dry Igneous Upland Woodlands are often downslope from Igneous Upland Woodlands, but are intermingled in other areas and mapped as a complex.
F116CY005MO	Igneous Protected Backslope Woodlands are typically downslope from Igneous Upland Woodlands, and are steeper.
R116CY006MO	Shallow Igneous Knob Glades have shallow soils with significant amounts of bedrock outcrop.
F116CY010MO	Igneous Exposed Backslope Woodlands are typically downslope from Igneous Upland Woodlands, and are steeper.

*Similar Sites*

Site ID	Narrative
F116CY005MO	Igneous Protected Backslope Woodlands are downslope, on steeper slopes and have generally shallower soil depths than Igneous Upland Woodlands. The protected aspects make the site more mesic and closer in species composition to Igneous Upland Woodlands.

### **Relationship to Other Established Classifications**

*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-Mesic Igneous Woodland

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

The Reference State for this Ecological Site is most similar to: (CEGL005030) *Quercus velutina* - *Quercus alba/Vaccinium (angustifolium, pallidum)/Carex pensylvanica* Forest

### **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 created by cooling and crystallization of magma forming igneous rock. 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

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