Ecological Site Description

Low-Base Chert Upland Woodland F116BY004MO

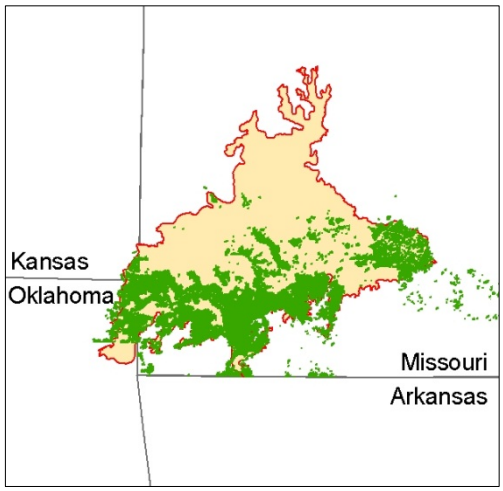
- *(Quercus velutina - Quercus alba/Vaccinium /Carex - Schizachyrium scoparium*)
- (black oak – white oak/blueberry/sedge – little bluestem)

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: 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.

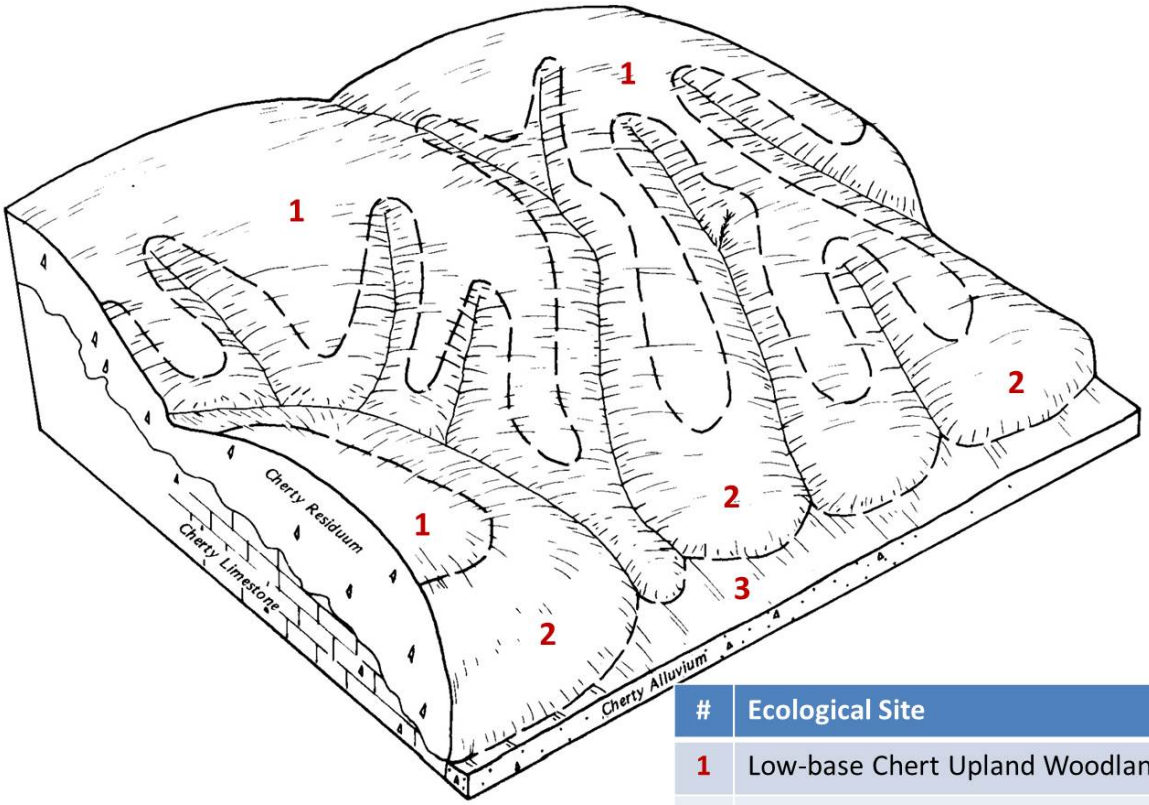


Low-base Chert Upland Woodlands (green areas on the map) occur mostly in the southern portion of the Springfield Plain on rolling hillslopes below the Plain surface, especially in the headwaters of Spring River and Shoal Creek, around the headwaters of the James River in the easternmost lobe of the Springfield Plain, and on the slopes of the lower James River watershed above Table Rock Lake. Soils are typically very deep, acidic, and low in bases such as calcium, with an abundance of chert fragments. Soil acidity is an important factor affecting the distribution of both tree and ground flora species and their growth. As a soil profile approaches or arrives at lower levels of pH, exchangeable aluminum comes into solution and can directly impact plant growth and composition. Black oak, shortleaf pine and Shumard oak are more abundant on soils with these low base concentrations or quantities. Soils having low concentrations of calcium and containing few calcium bearing minerals along with increased levels of aluminum may also be vulnerable to base depletion by timber harvesting, plant uptake, and leaching.

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 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 “2”, on upland shoulders and upper backslopes. Fragipan Upland Flatwoods sites are often directly upslope, and are included within the area labeled “1”.



#	Ecological Site
1	Low-base Chert Upland Woodland
2	Low-base Chert Backslope Woodlands
3	Gravelly Upland Drainageway Woodland

Soil Features

These soils have acidic subsoils that are low in bases. Some soils have a fragipan rooting barrier at about 24 inches. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium over residuum weathered primarily from limestone. Surface horizon textures are very gravelly or very cobbly silt loam. Subsoils are skeletal, with high amounts of coarse fragments. These soils are not affected by seasonal wetness. Soil series associated with this site include Clarksville, Crackerneck, Jollymill, Nixa, Noark, Scholten, and Wilderness.

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 plant community is well developed woodland dominated by an overstory of black oak and white oak. The canopy of Low-Base Chert Upland Woodland is moderately tall (60 to 70 feet) but less dense (65 to 85 percent canopy) than protected slopes and Chert Upland Woodlands and with the understory poorly developed with low structural diversity. Increased light from the more open canopy causes a diversity of ground flora species to flourish. Extreme soil chertiness and low soil bases are unifying soil features of these ecological sites.

In addition, proximity to shallow soil glades and open woodlands provides additional opportunity for increased light and species diversity. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species. Characteristic plants in the ground flora can be used to gauge the restoration potential of a stand along with remnant open-grown old-age trees, and tree height growth.

Fire played an important role in the maintenance of these systems. It is likely that these ecological sites burned at least once every 5 to 10 years. These periodic fires kept woodlands open, removed the litter, and stimulated the growth and flowering of the grasses and forbs. During fire free intervals, woody understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

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

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

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

These ecological sites are only moderately productive, especially when compared to adjacent protected slopes and deeper loess covered units. Oak regeneration is typically problematic. Maintenance of the oak component will require disturbances that will encourage more sun adapted species and reduce shading effects.

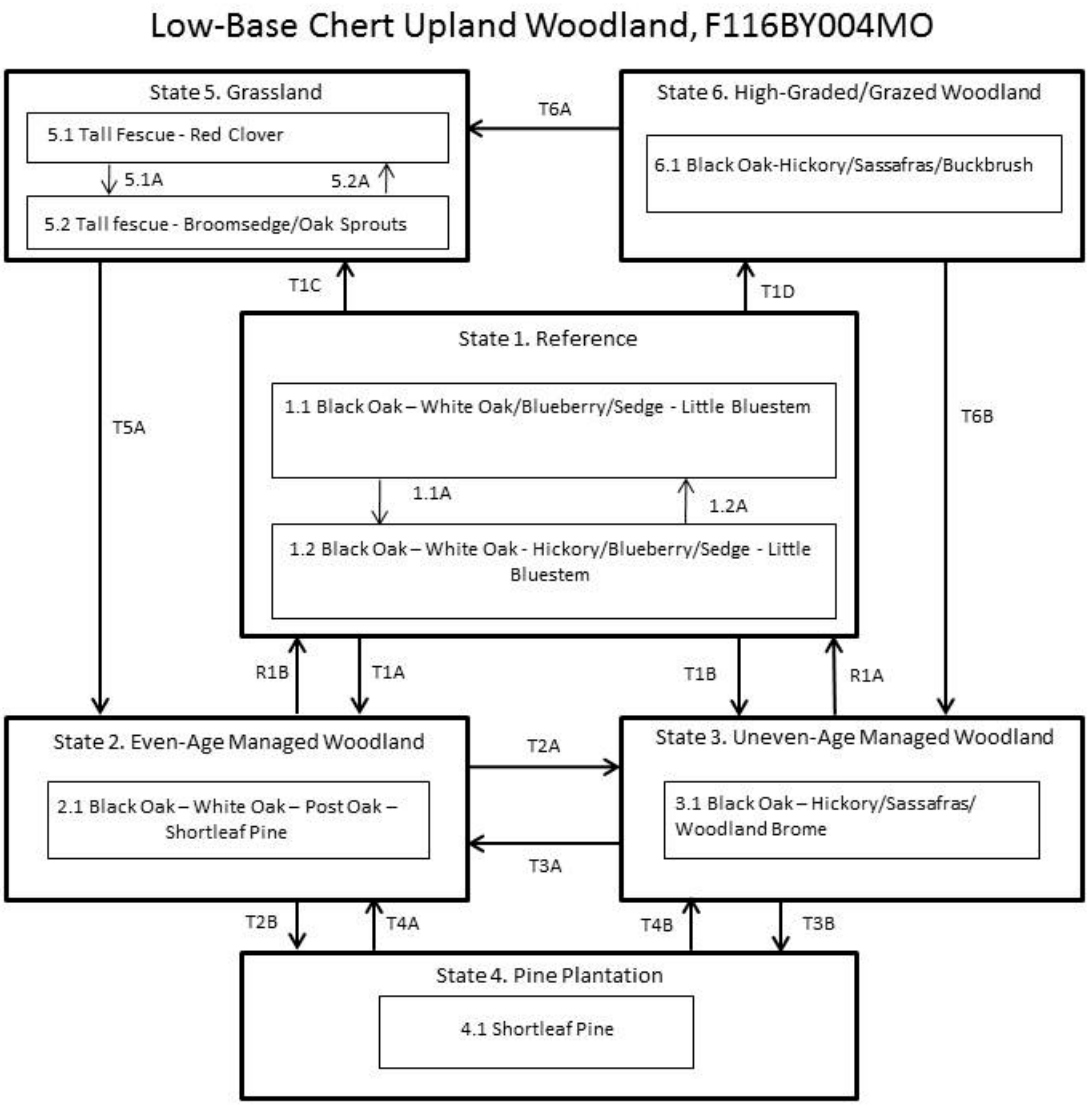
Single tree selection timber cutting is a common harvesting method and often results in removal of the most productive trees (high grading) in the stand leading to poorer quality timber and a shift in species composition away from more valuable oak species. Better planned single tree selection or the creation of group openings can help regenerate and maintain more desirable oak species and increase vigor on the residual trees.

Clearcutting also occurs and results in dense, even-aged stands dominated by oak. This may be most beneficial for existing stands whose composition has been highly altered by past management practices. However, without some thinning of the dense stands and prescribed burning the ground flora diversity can be shaded out and diversity of the stand may suffer. A number of sites in the 1950's and 1960's were cleared and planted to short leaf pine. These sites typically lacked proper management and may now have significant oak densities in the understory.

Prescribed fire can play a beneficial role in the management of this ecological site. The higher productivity of these sites makes control of woody species somewhat more difficult. The inclusion of backslope sites in larger burn units can add to the habitat diversity of the landscape.

A state-and-transition model 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**



Code	Event/Process
T1A	Even-aged management
T1B	Fire suppression; uneven-age management
T2B, T3B	Prescribed fire; clearing; pine planting
T1C, T6A	Clearing & pasture planting
T1D	Poorly planned harvest & uncontrolled grazing
T2A	Uneven-age management
T3A	Even-age management
T5A	Tree planting; long-term succession; no grazing
T6B	Uneven-age management; tree planting
T4A	Uneven-age management; thinning; no fire
T4B	Even-age management; no fire; thinning

Code	Event/Process
1.1A	No disturbance (10+ yrs)
1.2A	Disturbance (fire, wind, ice) < 10 yrs
5.1A	Over grazing; no fertilization
5.2A	Brush management; grassland seeding; grassland management

Code	Event/Process
R1A	Prescribed fire & extended rotations
R1B	Uneven-age mgt, extended rotations

Ecological States

State 1: Reference
The historical reference state for this Ecological Site was old growth oak woodland. The woodland was dominated by black oak, post oak and white oak. 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. Unaltered reference sites are rare today. Many sites have been converted to grassland (State 5). Others have been subject to repeated, high-graded timber harvest coupled with domestic livestock grazing (State 6). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Many former reference sites have been managed effectively for timber harvest, resulting in either even-age (State 2) or uneven-age (State 3) woodlands.

State 2: Even-Age Managed Woodland
These woodlands tend to be rather dense, with a sparse understory and ground flora. Thinning can increase overall tree vigor and improve understory diversity. These woodlands tend to be rather dense, with a sparse understory and ground flora. Thinning can increase overall tree vigor and improve understory diversity. However, in the absence of fire, the diversity and cover of the ground flora is still diminished. Continual timber management, depending on the practices used, will either maintain this state, or convert the site to uneven-age (State 3) woodlands.

State 3: Uneven-Age Managed Woodland
Uneven-Age Managed Woodlands resemble their reference state. The biggest differences are tree age, most being only 50 to 90 years old and denser understories. Composition is also likely altered from the reference state depending on tree selection during harvest. Scarlet oak is often more abundant than historically. In addition, without a regular 15 to 20 year harvest re-entry into these stands, they will slowly increase in more shade tolerant species and white oak will become less dominant. Without periodic disturbance, stem density and fire intolerant species, like hickory, increase in abundance.

State 4: Pine Plantation
Many areas were planted to plantations of shortleaf pine from the 1940's to the early 1960's. They are now mature plantations that are usually a mono-culture of a dense pine overstory with a brushy understory of oaks and hickories and a dense carpet of pine needles on the ground. They lack the diversity and structure. Restoration to phase 1.2 of the Reference state is a long-term prospect, requiring extensive thinning, long-term prescribed fire, and perhaps planting of native ground flora species.

State 5: Grassland
Conversion of woodlands to non-native cool season grassland species such as tall fescue has been common. Low available water, abundant surface fragments, low organic matter contents and soil acidity make non-native grasslands difficult to maintain in a healthy, productive state on this ecological site. Occasionally, these pastures will have scattered patches of tall, mature pine. If

grazing and pasture management is discontinued, oak sprouts will occur and the site will eventually transition to State 2. Forest Stand Improvement and Tree Planting practices can hasten this process.

State 6: High-Graded Grazed Woodland

Timbered sites subjected to repeated, high-graded timber harvests and domestic grazing transition to this state. This state exhibits an over-abundance of hickory and other less desirable tree species, and weedy understory species such as buckbrush, gooseberry, poison ivy and Virginia creeper. The vegetation offers little nutritional value for cattle, and excessive stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff. Exclusion of cattle from sites in this state coupled with uneven-age management techniques will cause a transition to State 3 (*Uneven-Age).* This state will be transitioned to a grassland state through clearing and grassland planting or to a pine plantation through clearing, tree planting and fire control.

Reference State Plant Community

Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	*Quercus alba*	20-40	60
BLACK OAK	*Quercus velutina*	30-60	70
MOCKERNUT HICKORY	*Carya alba*	10-30	60
POST OAK	*Quercus stellata*	10-30	60
SHAGBARK HICKORY	*Carya ovata*	10-20	60
SASSAFRAS	*Sassafras albidum*	10-20	40
SHORTLEAF PINE	*Pinus echinata*	0-10	70

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
AROMATIC SUMAC	*Rhus aromatica*	10-20	5
LOW BUSH BLUEBERRY	*Vaccinium pallidum*	10-30	3
LEADPLANT	*Amorpha canescens*	10-20	3

Forbs

Common Name	Botanical Name	Cover % (low-high)
VIRGINNIA SPIDERWORT	*Tradescantia virginiana*	10-30
WHORLED MILKWEED	*Asclepias quadrifolia*	10-20
BABY WHITE ASTER	*Symphyotrichum anomalum*	10-30
LARGE FLOWER TICK CLOVER	*Desmodium glutinosum*	10-30
ELM-LEAVED GOLDENROD	*Solidago ulmifolia*	10-30
SMALL-LEAF TICK-TREFOIL	*Desmodium marilandicum*	10-30
NAKED-FLOWER TICK-TREFOIL	*Desmodium nudiflorum*	10-20
EASTERN BEEBALM	*Monarda bradburiana.*	5-20
PURPLE CONEFLOWER	*Echinacea purpurea*	10-30
HAIRY SUNFLOWER	*Helianthus hirsutus*	10-30
MANY-RAY ASTER	*Symphyotrichum anomalum*	10-20
GRAY GOLDENROD	*Solidago nemoralis*	10-20

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
PENNSYLVANIA SEDGE	*Carex pensylvanica*	10-30
WOODBANK SEDGE	*Carex cephalophora*	10-20
LITTLE BLUESTEM	*Schizachyrium scoparium*	20-40
HAIRY WOODLAND BROME	*Bromus pubescens*	10-30
BOTTLEBRUSH GRASS	*Elymus hystrix*	10-20
FUZZY SEDGE	*Carex hirsutella*	10-20

Site Interpretations

Wildlife

- Wild turkey, white-tailed deer, and eastern gray squirrel depend on hard and soft mast food sources and are typical upland game species of this type.
- Oaks provide abundant hard mast; scattered shrubs provide soft mast; native legumes provide high-quality wildlife food;
- Sedges and native cool-season grasses provide green browse;
- Post-burn areas can provide temporary bare-ground – herbaceous cover habitat important for turkey poults and quail chicks.
- Bird species associated with early-successional woodlands are Northern Bobwhite, Prairie Warbler, Field Sparrow, Blue-winged Warbler, Yellow-breasted Chat, and Brown Thrasher.
- Bird species associated with mid- to late successional woodlands 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 associated with woodlands 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 collected site index values average 59 for white oak and 64 for black oak. 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 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 black oak, white oak, scarlet oak and shortleaf pine.

- Limitations: Large amounts of coarse fragments throughout profile; 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

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

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