

Ecological Site Description

Claypan Summit Prairie

R113XY001MO

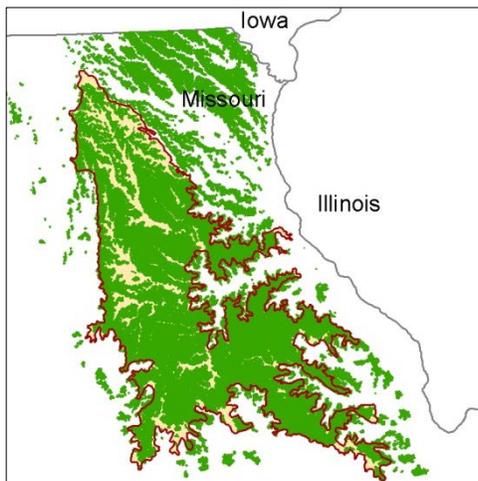
- (*Amorpha canescens* - *Rosa carolina*/*Schizachyrium scoparium* - *Parthenium integrifolium*)
- (lead plant - Carolina rose/little bluestem - wild quinine)

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: 113 – Central Claypan Area

Introduction

The western, Missouri portion of the Central Claypan (area outlined in red on the map) is a weakly dissected till plain. Elevation ranges from about 1,000 feet in the north along the divide between



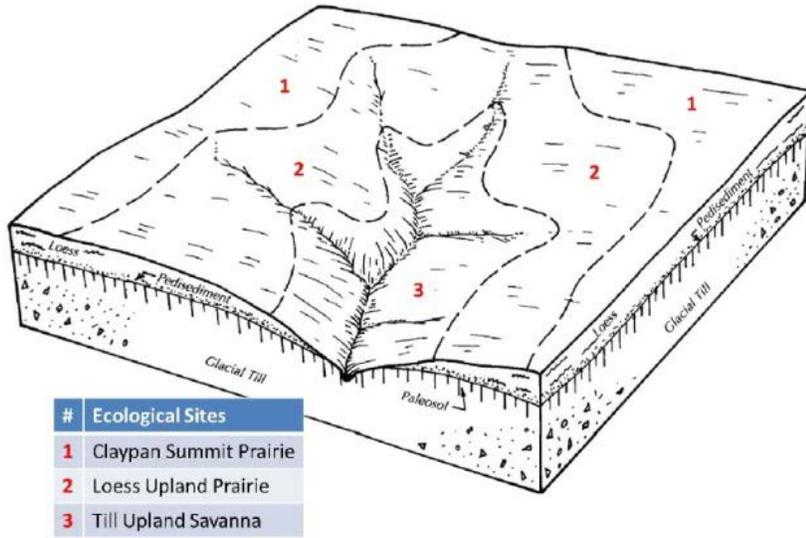
the Missouri and Mississippi River watersheds to about 625 feet where the North Fork of the Salt River flows out of the area. Relief is generally low, with low slope gradients and relatively narrow drainageways. Most of the Central Claypan is in the Salt River watershed. The characteristic “claypan” occurs in the loess that caps the pre-Illinoian aged till on the broad interfluves that characterize this region. Till is exposed on lower slopes. The underlying Mississippian aged limestone and Pennsylvanian aged shale is exposed in only a few places along lower slopes above the Salt River.

Claypan Summit Prairies (green area on the map) occur throughout the Central Claypan on broad interfluve summits, and are the dominant ecological sites in the region. They are associated with Loess and Till prairie and savanna ecological sites, which are downslope. Soils have a silty clay subsoil that perches water in the spring, and affects rooting depth and species composition.

Physiographic Features

This site is on broad upland summit interfluves and divides, with slopes of 0 to 5 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Young & Geller, 1995) shows the typical landscape position of this ecological site, and landscape relationships among the three dominant upland ecological sites in this MLRA.



Soil Features

These soils have an abrupt textural change to silty clay at about 10 to 14 inches, or clayey subsoil that is similar to an abrupt textural change. Abrupt textural changes impede but do not exclude rooting. The soils were formed under prairie vegetation, and have dark, organic-rich surface horizons. They have silt loam surface horizons, and silty clay to clay subsoils. Parent material is loess underlain by pediment derived from loess and till. A seasonal high

water table is perched above the abrupt textural change or clayey subsoil during the spring months in most years. Soil series associated with this site include Adco, Mexico, and Putnam.

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, tallgrass prairies covered extensive parts of Nebraska, Illinois, Iowa, Missouri and Kansas and extended far into the more eastern states in the Midwest. (Sims and Risser, 2000) Tallgrass prairie is made up primarily of native perennial grasses and forbs, with occasional shrubs and trees and is further characterized by relatively moist, productive soils. Prairies depend on fire to maintain the ecosystem stability and diversity. Some of the benefits of fire in this community is the elimination of invasive plants, control of woody encroachment, and maintenance of site productivity, thereby helping to shape and sustain the prairie. (Schroeder, 1981)

Claypan Summit Prairies were a part of the tallgrass prairie with native grasses and forbs, but also had a substantial component of wet tolerant sedges. This expanse of grass stretched for miles and was only interrupted by shallow drainages whose wetness lessened the influence frequent, intense fires. Here the prairie transitioned into shrubby thickets and savannas with scattered trees. Leadplant, Carolina rose and New Jersey tea were typical low growing shrubs that occurred over the site. Unlike most shrubs, these plants are both quite tolerant to fire. Islands of other shrubs such as dogwood, coral berry and prairie rose were also found on the site.

With little to interrupt fire, this ecological site burned every 1 to 3 years. Fire removed dead plant litter and provided room for a lush growth of prairie vegetation. Fire also kept woody species at bay. Grazing by native large herbivores, such as bison, elk, and deer, also impacted these sites. Their activities would have altered composition and structure of the vegetation. Fuel loads would have been altered by heavy grazing and fire behavior affected, providing for a diversity of structure and composition. The partially wooded draws would have burned less intensely and frequently. During fire free intervals woody species would have increased in abundance and spread out onto the prairie.

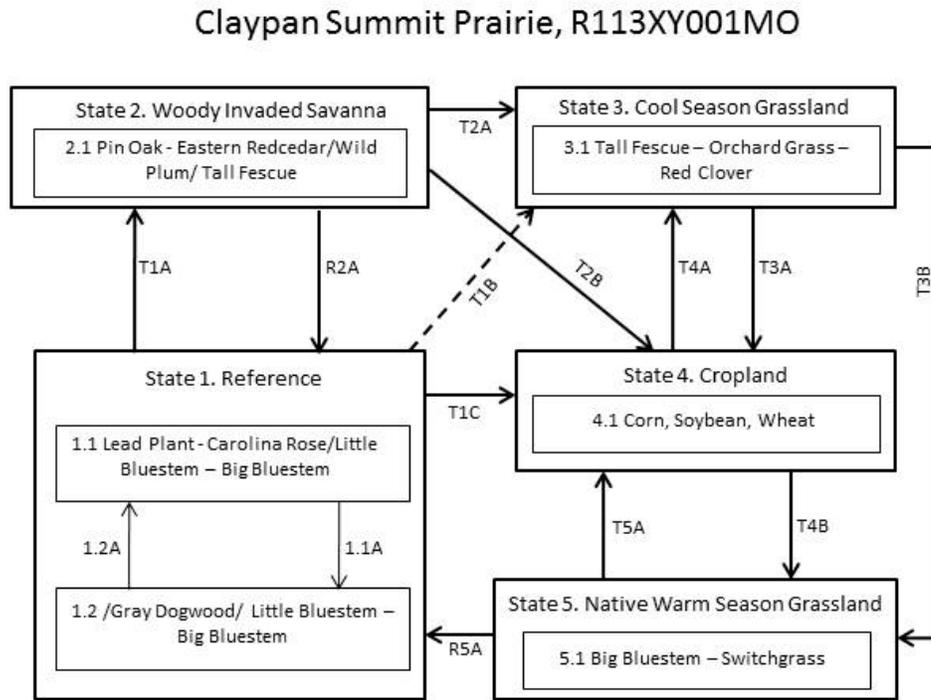
Few known remnants exist and most are degraded by fire suppression or grazing by domestic livestock. The one exception is Tucker Prairie, the only sizable remnant of claypan-soil tallgrass prairie that once blanketed central and northeast Missouri. Tucker Prairie Natural Area is a 146 acre gently rolling, upland claypan prairie over silt loam soils derived from loess. Over 200 plant species are found here in 70 families and in more than 140 genera. The grasses are important as dominants, making up on the average over 50% of the plant cover. The principal grasses are big and little bluestem. Indian grass and prairie dropseed are also prevalent. Switch grass and prairie cordgrass grass are more localized in wetter areas. Numerous flowering plants such as asters, sunflowers, goldenrods, baptisia, leadplant and ragwort are common. The prairie tract was acquired as a scientific facility by the University of Missouri in 1957 and dedicated in 1958. It has been designated as a Registered Natural Landmark by the National Park Service (University of Missouri, 1959).

Soils that are associated with this “claypan” ecological site concept occur on broad level summits. The term “claypan” refers to a clayey subsoil underlying loamy topsoil. The abrupt textural change between the silt loam topsoil and the silty clay subsoil, causes water to perch on the claypan during periods of soil wetness. Claypans with an abrupt textural change that underlie silt loam topsoil at 10-30 cm normally have low permeability, restrict soil, air, and water movement, have a perched water table in the spring and are acidic (Clark and others, 1998). Surface layers will become saturated and remain extremely wet for extended periods of time following heavy rainfall events. Subsoils may store large amounts of water, but usually much of this moisture is tightly held (bonded) so, during periods of below normal precipitation, plants stress quickly, reducing productivity. This claypan soil with its seasonal saturation supports populations of grassland crayfish whose burrows are used by northern crawfish frogs. (Schmidt and Kucera, 1975)

Today, the reference state of Claypan Summit Prairies are nearly extirpated from the region as the former prairies have been converted to intensive agriculture or non-native cool season grasslands. This transition to row crop management and its effect on soil loss have significantly altered the hydraulic properties of this ecological site. Values of coarse and fine pores for cropland (100 years of cropping) were almost half those values from the reference native prairie site (unplowed Tucker Prairie). The mean value of the ease with which pores in a saturated soil transmit water (Ksat) was 57 times higher in the native prairie site than in a cropped field for the first 10 cm interval. The bulk density of the surface layer at the Tucker Prairie site was two-thirds of the value at the cropped field site and was significantly different throughout the soil profile, except for the 20 to 30 cm depth. These conditions, higher bulk density, lower soil water capacity, and lower hydraulic conductivity increase the runoff potential and soil erosion. Therefore, it is expected that surface runoff and associated pollutant loads will be higher for cropped fields than for reference site conditions (native prairie). (Mudgal and others, 2010)

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 may change as knowledge increases.

Figure 1: State and transition diagram



Code	Event/Activity/Process
T1A	Fire suppression > 20 years; woody invasion
T1B	Tillage; vegetative seeding; grassland management
T1C, T3A, T5A	Tillage; conservation cropping system
T2A	Woody removal; tillage; vegetative seeding; grassland management
T2B	Woody removal; tillage; conservation cropping system
T4A	Vegetative seeding ; grassland management
T3B, T4B	Vegetative seeding; prescribed fire; grassland management
1.1A	Fire-free interval 10+ years
1.2A	Fire interval 1-3 years
R2A	Woody removal; prescribed fire 1-3 years
R5A	Vegetative seeding; prescribed fire 1-3 years

Ecological States

State 1: Reference

This State is native tall grass prairie dominated by little bluestem, switchgrass and forbs, but also a substantial component of wet tolerant sedges. This State occurs on level to gently sloping soils that have a seasonal high water table that is perched above the abrupt textural change or clayey subsoil during the spring months in most years. This condition influences the species composition and site productivity. Two phases can occur that will transition back and forth depending on fire frequencies. Longer fire free intervals will allow woody species to increase such as gray dogwood and eastern redcedar. When fire intervals shorten these woody species will decrease.

This state is extremely rare. Only one documented reference site in the Missouri portion of this MLRA still exists. Nearly all sites have been converted to cool season grassland and cropland.

State 2: Woody Invaded Savanna

Degraded Reference States that have experienced fire suppression for 20 or more years will transition to this State. With fire suppression, woody species such as pin oak and eastern redcedar will begin to dominate transitioning this state from a prairie to a Woody Invaded Savanna. Native ground cover will also decrease and invasive species such as tall fescue may begin to dominate. Transition to cool season grasslands (State 3) or intensive cropland (State 4) is very common.

State 3: Cool Season Grassland

Conversion of other states to non-native cool season species such as tall fescue and red clover has been common in the Missouri Central Claypan area. Occasionally, these pastures will have scattered pin oaks. Long term uncontrolled grazing can cause significant soil erosion and compaction. A return to the Reference State may be impossible, requiring a very long term series of management options.

State 4: Cropland

This is the dominant state that exists currently with intensive cropping of corn, soybeans, and wheat occurring. Some conversion to cool season hay land occurs for a limited period of time before transitioning back to cropland. Limited acres are sometimes converted to native warm season grassland.

State 5: Native Warm Season Grassland

Conversion from the Cool Season Grassland (State 3) or the Cropland (State 4) to this State is increasing due to renewed interest in warm season grasses as a supplement to cool season grazing systems or as a native restoration activity. This State is the most easily transformable state back to a Reference State. Substantial restoration time and management inputs will be needed.

Reference State Plant Community

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
CAROLINA ROSE	<i>Rosa carolina</i>	5-10	2
NEW JERSEY TEA	<i>Ceanothus americanus</i>	5-10	4
LEAD PLANT	<i>Amorpha canescens</i>	5-10	3
GRAY DOGWOOD	<i>Cornus racemosa</i>	5-10	6
CORAL BERRY	<i>Symphoricarpos orbiculatus</i>	5-10	3

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
LITTLE BLUESTEM	<i>Schizachyrium scoparium</i>	30-50
MEAD'S SEDGE	<i>Carex meadii</i>	5-10
BUSH SEDGE	<i>Carex bushii</i>	5-10
SPIKE RUSH	<i>Eleocharis tenuis</i>	5-10
SIDEOATS GRAMA	<i>Bouteloua curtipendula</i>	5-10
BIG BLUESTEM	<i>Andropogon gerardii</i>	30-50
INDIAN GRASS	<i>Sorghastrum nutans</i>	10-20
SWITCH GRASS	<i>Panicum virgatum</i>	5-10
EASTERN GAMAGRASS	<i>Tripsacum dactyloides</i>	5-10

Forbs

Common Name	Botanical Name	Cover % (low-high)
WILD QUININE	<i>Parthenium integrifolium</i>	5-20
BUTTERFLY WEED	<i>Asclepias tuberosa</i>	5-20
BLAZING STAR	<i>Liatris pycnostachya</i>	5-20
MISSOURI GOLDENROD	<i>Solidago missouriensis</i>	5-20
ASHY SUNFLOWER	<i>Helianthus mollis</i>	5-20
RATTLESNAKE MASTER	<i>Eryngium yuccifolium</i>	5-20
CREAM WHITE INDIGO	<i>Baptisia bracteata</i>	5-20
WHITE WILD INDIGO	<i>Baptisia alba</i>	5-20
PRAIRIE MILKWEED	<i>Asclepias sullivantii</i>	5-20
FIELD MILKWORT	<i>Polygala sanguinea</i>	5-10
WHORLED MILKWORT	<i>Polygala verticillata</i>	5-10
ROSINWEED	<i>Silphium integrifolium</i>	5-20
ILLINOIS BUNDLE FLOWER	<i>Desmanthus illinoensis</i>	5-10
TEXAS STAR	<i>Sabatia campestris</i>	5-10
INDIAN PLANTAIN	<i>Arnoglossum plantagineum</i>	5-10
ARROWLEAF VIOLET	<i>Viola sagittata</i> Aiton var. <i>sagittata</i>	5-10

Site Interpretations

Influencing Water Features

- Cowardin wetland types include: Palustrine Emergent Temporarily Flooded and Intermittently Flooded (high-water table may cause soil saturation in late winter and early spring).

*Wildlife**

- Game species that utilize this ecological site include:
Northern Bobwhite will utilize this ecological site for food (seeds, insects) and cover needs (escape, nesting and roosting cover).

Cottontail rabbits will utilize this ecological site for food (seeds, soft mast) and cover needs.

Turkey will utilize this ecological site for food (seeds, green browse, soft mast, insects) and nesting and brood-rearing cover. Turkey poult feed heavily on insects provided by this site type.

White-tailed Deer will utilize this ecological site for browse (plant leaves in the growing season, seeds and soft mast in the fall/winter). This site type also can provide escape cover.

Migratory Waterbirds: Sora, Common Snipe and Virginia Rail

- Bird species associated with this ecological site's reference state condition: Breeding birds as related to vegetation structure (related to time since fire, grazing, haying, and mowing):

Vegetation Height Short (< 1.5 feet, low litter levels, bare ground visible):

Grasshopper Sparrow, Horned Lark, Upland Sandpiper, Greater Prairie Chicken, Northern Bobwhite

Mid-Vegetation Height (1.5 – 3 feet, moderate litter levels, some bare ground visible):

Eastern Meadowlark, Dickcissel, Field Sparrow, Upland Sandpiper, Greater Prairie Chicken, Northern Bobwhite, Eastern Kingbird, Bobolink, Lark Sparrow

Tall Vegetation Height (> 3 feet, moderate-high litter levels, little bare ground visible):

Henslow's Sparrow, Dickcissel, Greater Prairie Chicken, Field Sparrow, Northern Bobwhite, Sedge Wren, Northern Harrier, *Red-Winged Blackbird*, *American Bittern*

Brushy – Mix of grasses, forbs, native shrubs (e.g., *Rhus copallina*, *Prunus americana*, *Rubus* spp., *Rosa carolina*) and small trees (e.g., *Cornus racemosa*): Bell's Vireo, Yellow-breasted Chat, Loggerhead Shrike, Brown Thrasher, Common Yellowthroat

Winter Resident: Short-Eared Owl, Le Conte's Sparrow

Migratory birds: Sora, Virginia Rail, Sedge Wren, American Bittern, Yellow Rail and Common Snipe.

- Amphibian and reptile species associated with this ecological site's reference state condition: prairies with or nearby to fishless ponds/pools (may be ephemeral) may have Eastern Tiger Salamander (*Ambystoma tigrinum tigrinum*) and Western Chorus Frog (*Pseudacris triseriata triseriata*); Northern Crawfish Frog (*Rana areolata circulosa*), Ornate Box Turtle (*Terrapene ornata ornata*), Western Slender Glass Lizard (*Ophisaurus attenuatus attenuatus*), Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*), Prairie Ring-necked Snake (*Diadophis punctatus arnyi*), and Bullsnake (*Pituophis catenifer sayi*).
- Small mammals associated with this ecological site's reference state condition: Least Shrew (*Cryptotis parva*), Franklin's Ground Squirrel (*Spermophilus franklinii*), Plains Pocket Gopher (*Geomys bursarius*), Prairie Vole (*Microtus ochrogaster*), Southern Bog Lemming (*Synaptomys cooperi*), Meadow Jumping Mouse (*Zapus hudsonius*), Thirteen-lined Ground Squirrel (*Spermophilus tridecemlineatus*) and Badger (*Taxidea taxus*).
- Invertebrates: Many native insect species are likely associated with this ecological site, especially native bees, ants, beetles, butterflies and moths, and crickets, grasshoppers and

katydids. However information on these groups is often lacking enough resolution to assign them to individual ecological sites.

Insect species known to be associated with this ecological site's reference state condition: Regal Fritillary butterfly (*Speyeria idalia*) whose larvae feed primarily on native prairie violets (*Viola pedata*, *V. pedatifida*, and *V. sagittata*); Mottled Dusky Wing butterfly (*Erynnis martialis*), Golden Byssus butterfly (*Problema byssus kumskaka*), Delaware Skipper butterfly (*Atryone logan logan*), and Crossline Skipper butterfly (*Polites origenes*). The larvae of the moth *Eucosma bipunctella* bore into compass plant (*Silphium laciniatum*) roots and feed and the larvae of the moth *Eucosma giganteana* bore into a number of *Silphium* species roots and feed. Native bees, important pollinators, that may be associated with this ecological site's reference condition include: *Colletes brevicornis*, *Andrena beameri*, *A. helianthiformis*, *Protandrena rudbeckiae*, *Halictus parallelus*, *Lasioglossum albipennis*, *L. coreopsis*, *L. disparilis*, *L. nymphaeum*, *Ashmeadiella buconis*, *Megachile addenda*, *Anthidium psoraleae*, *Eucera hamata*, *Melissodes coloradensis*, *M. coreopsis*, and *M. vernoniae*. The Short-winged Katydid (*Amblycorypha parvipennis*), Green Grasshopper (*Hesperotettix speciosus*) and Two-voiced Conehead katydid (*Neoconcephalus bivocatus*) are possible orthopteran associates of this ecological site.

Other invertebrate associates include the Grassland Crayfish (*Procambarus gracilis*).

*This section prepared by Mike Leahy, Natural Areas Coordinator, Missouri Department of Conservation, 2013

Forestry

- Management: **This ecological site is not recommended for traditional timber management activity.** Historically this site was dominated by a ground cover of native prairie grasses and forbs. Some scattered open grown trees may have also been present. May be suitable for non-traditional forestry uses such as windbreaks, environmental plantings, alley cropping (a method of planting, in which rows of trees or shrubs are interspersed with rows of crops) or woody bio-fuels.

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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