Ecological Site Description

Shale Upland Woodland F109XY011MO

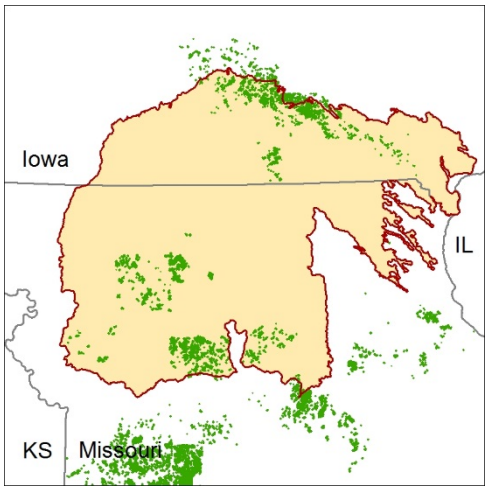
- *(Quercus alba - Quercus velutina/Rhus aromatica/Schizachyrium scoparium - Carex pensylvanica)*
- (white oak – black oak/aromatic sumac/little bluestem – Pennsylvania sedge)

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: 109 – Iowa and Missouri Heavy Till Plain

Introduction

The Iowa and Missouri Heavy Till Plain (area outlined in red on the map) is an area of rolling hills interspersed with interfluve divides and alluvial valleys. Elevation ranges from about 660 feet along the lower reaches of rivers, to about 980 feet on stable interfluve summits in southern Iowa. Relief is about 80 to 160 feet between major streams and adjacent interfluve summits. Most of the till plain drains south to the Missouri River via the Grand and Chariton River systems, but the northeastern portion drains southeast to the Mississippi River. Loess caps the pre-Illinoisan aged till on interfluves, whereas the till is exposed on side slopes. Mississippian aged limestone and Pennsylvanian aged sandstone and shale crop out on lower slopes in some areas.



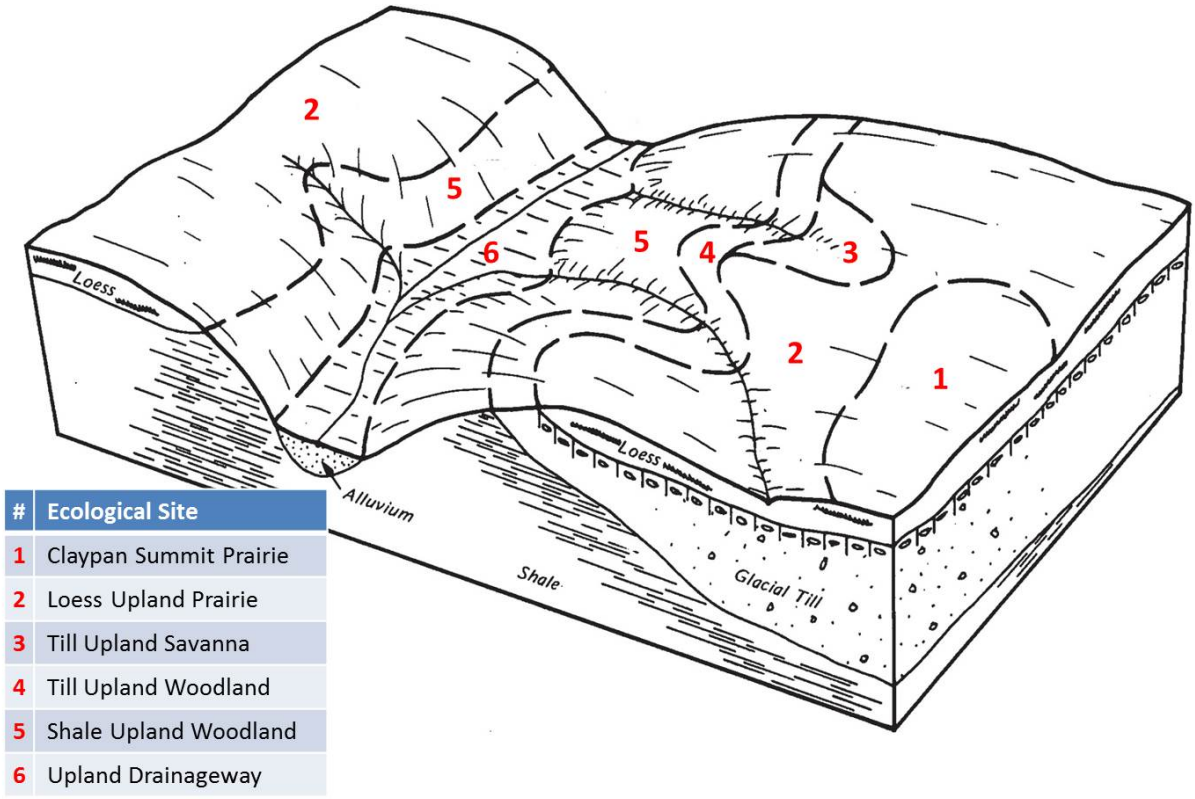
Shale Upland Woodlands are within the green areas on the map (Missouri portion only; Iowa distributions are currently under review). Sites are primarily in the southern part of the MLRA, and adjacent areas to the south and east. They are often below Till or Loess Upland Prairies and above both wooded and prairie lowlands. This ecological site is on Pennsylvanian aged shale. Soils are moderately deep to deep over shale bedrock and typically have shale fragments in clayey subsoils.

Physiographic Features

This site is on upland summits, shoulders and backslopes with slopes of 5 to 14 percent. The site generates runoff to adjacent, downslope ecological sites. This site does not flood.

The following figure (adapted from Oelmann, 1984) shows the typical landscape position of this ecological site, and landscape relationships among the major ecological sites in the uplands. The

site is within the area labeled “5”, and is typically downslope from Till Upland Woodland or, less commonly, Loess Upland Prairie ecological sites. In most areas, Upland Drainageway or Floodplain ecological sites are directly downslope.



#	Ecological Site
1	Claypan Summit Prairie
2	Loess Upland Prairie
3	Till Upland Savanna
4	Till Upland Woodland
5	Shale Upland Woodland
6	Upland Drainageway

Soil Features

These soils are underlain with shale bedrock at 20 to 60 inches deep. The soils were formed under woodland vegetation, and have thin, light-colored surface horizons. Parent material is slope alluvium and residuum weathered from shale, overlying shale bedrock. In most areas the shale is acidic, but some areas are calcareous. They have silty clay loam or silt loam surface layers. Subsoils are silty clay loam to silty clay. A few of these soils are slightly affected by seasonal wetness. Soil series associated with this site include Gosport, Mandeville, Munterville, and Vanmeter.

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 woodland dominated by an overstory of white oak and black oak. This woodland type has a moderate canopy closure (50 to 80 percent), with an open understory and a dense, diverse herbaceous ground flora. Historically, white oak dominated the canopy, along with black oak and occasional hickories, bur oak and post oak. Woodlands are distinguished from forest, by their relatively open understory, and the presence of sun-loving ground flora species including the dominant prairie grasses. 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. Because these sites normally occur next to the prairie edge, it is likely that these ecological sites burned at least once every 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 understory species increased and the herbaceous understory diminished. The return of fire would open the woodlands up again and stimulate the abundant ground flora.

Today, this community has either been cleared and converted to pasture or cropland, or has grown dense in the absence of fire. Most occurrences today exhibit canopy closure of 80 to 100 percent. In addition, the sub-canopy and understory layers are better developed. Black oak and hickory now share dominance with white oak and there are considerable more saplings in the understory. 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.

In the long term absence of fire, woody species, especially hickory, hornbeam and gooseberry encroach into these woodlands. Once established, these woody plants can quickly fill the existing understory increasing shade levels greatly diminishing the ground flora. Removal of the younger understory and the application of prescribed fire have proven to be effective management tools.

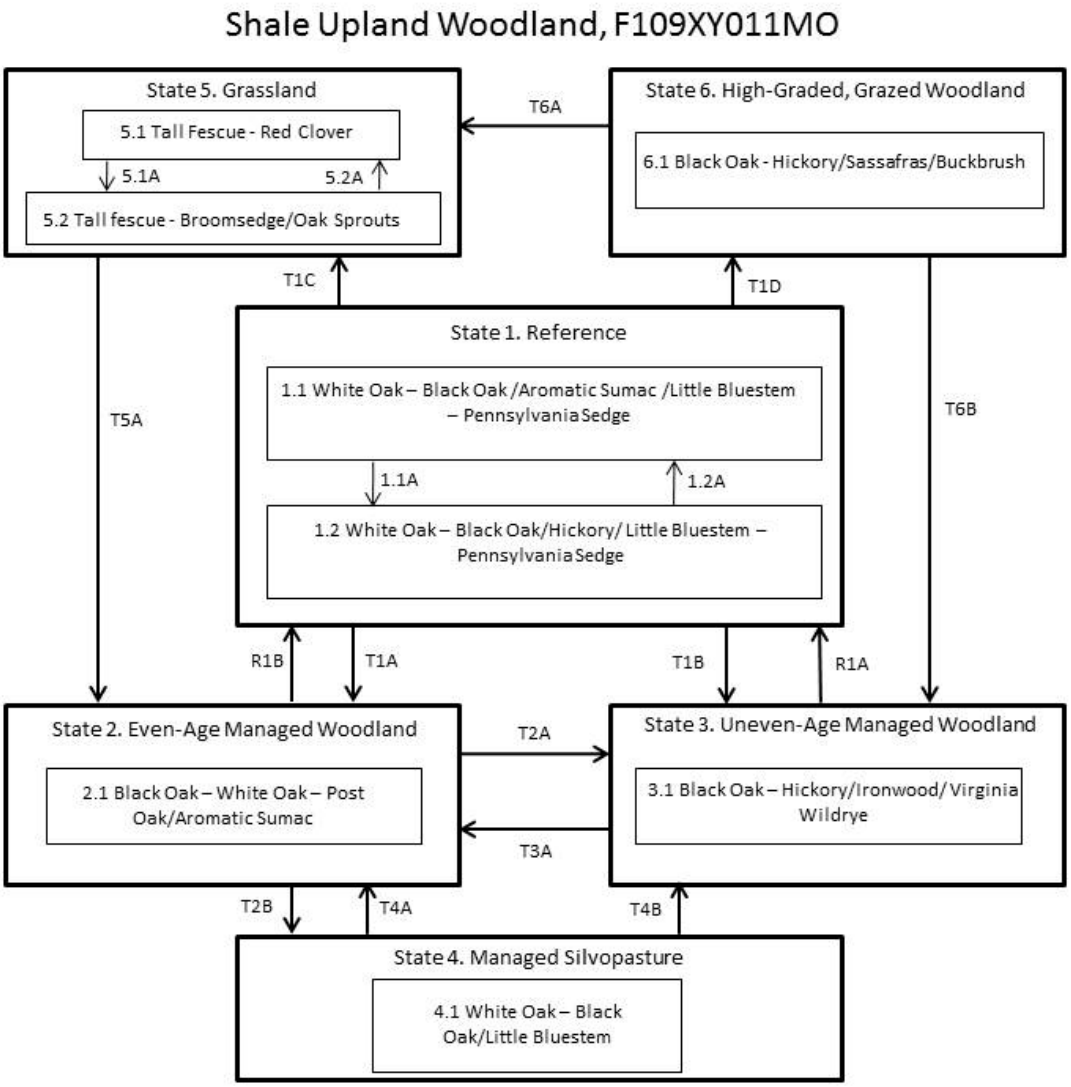
Uncontrolled domestic grazing has also impacted these communities, further diminishing the diversity of native plants and introducing species that are tolerant of grazing, such as buckbrush, gooseberry, and Virginia creeper. Grazed sites also have a more open understory. In addition, on grazed sites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

This ecological site, if managed properly, can be a source for timber products especially white oak. Most areas on this ecological site have been repeatedly logged and high graded. Even-age management, using clearcut, or shelterwood and seed-tree harvest systems without fire will perpetuate the overly dense, shaded conditions. Thinning and/or occasional partial cuts, using an uneven-age management system can provide sunlight to the woodland floor, stimulating native woodland ground flora.

However, in the absence of fire and continual cultural treatments, oak sprouting creates a dense stand, again shading out the sun-loving ground flora. Partial cutting and prescribed fire can restore the more open structure and diversity of ground flora species. This type of site with proper management can 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



Code	Event/Process
T1A	Even-aged management
T1B	Fire suppression; uneven-age management
T2B	Prescribed fire; thinning; grazing management
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; no grazing
T4A	Uneven-age management; no grazing
T4B	Even-age management; no grazing

Code	Event/Process
1.1A	No disturbance (10+ years)
1.2A	Disturbance (fire, wind, ice) < 10 years
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 management, 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 white oak and black oak. Maximum tree age was likely 150-300 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 states are very rare today. Many sites have been converted to grassland (State 5). Others have been subject to repeated, high-graded timber harvest coupled with uncontrolled domestic livestock grazing (State 6). Fire suppression has resulted in increased canopy density, which has affected the abundance and diversity of ground flora. Most reference states are currently altered because of timber harvesting, 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. However, in the absence of fire, the diversity and cover of the ground flora is 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 difference is tree age, most being only 60 to 90 years old. Composition is also likely altered from the reference state depending on tree selection during harvest. 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. Uneven Age Managed Woodland is also dense because of fire suppression. Without periodic canopy disturbance, stem density and fire intolerant species, like hickory, will increase in abundance.

State 4: Managed Silvopasture
The Managed Silvopasture state results from managing woodland communities (States 2 or 3) with prescribed fire, canopy thinning, and controlled grazing. This state can resemble the reference state, but with younger maximum tree ages, more open canopies and lower ground flora diversity. Sensation of grazing and controlled harvesting will allow transition to various managed woodland states.

State 5: Grassland
Conversion of woodlands to planted, non-native grassland species such as tall fescue has been common for this region. Steep slopes, surface fragments, low organic matter contents and soil acidity make grasslands harder to maintain in a healthy, productive state on this ecological site.

Two community phases are recognized in the Grassland state, with shifts between phases based on types of management. Poor management will result in a shift to community 5.1A that shows an

increase in oak sprouting and increases in broomsedge densities. If grazing and active pasture management is discontinued, the site will eventually transition to State 2 from this phase.

State 6: High-Graded Grazed Woodland
States that were subjected to repeated, high-grading timber harvests and uncontrolled domestic grazing transitioned to a High-Graded, Grazed Woodland 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 existing vegetation offers little nutritional value for cattle, and excessive cattle stocking damages tree boles, degrades understory species composition and results in soil compaction and accelerated erosion and runoff.

Two common transitions from this state are woody clearing and conversion to State 5, Grassland or removing livestock, limited harvesting, and allowing long term succession to occur to some other woodland state.

Reference State Plant Community
Canopy Trees

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
WHITE OAK	*Quercus alba*	30-50	70
BLACK OAK	*Quercus velutina*	20-40	80
MOCKERNUT HICKORY	*Carya alba*	0-10	60
BUR OAK	*Quercus macrocarpa*	0-10	70
POST OAK	*Quercus stellata*	0-10	60
SHAGBARK HICKORY	*Carya ovata*	0-10	60
CHINKAPIN OAK	*Quercus muehlenbergii*	0-10	60

Shrubs

Common Name	Botanical Name	Cover % (low-high)	Canopy Height (ft)
HAZELNUT	*Corylus Americana*	10-20	4
FRAGRANT SUMAC	*Rhus aromatica*	10-30	3
NEW JERSEY TEA	*Ceanothus americanus*	5-20	3

Forbs

Common Name	Botanical Name	Cover % (low-high)
ELM-LEAFED GOLDENROD	*Solidago ulmifolia*	5-30
HAIRY SUNFLOWER	*Helianthus hirsutus*	10-30
SMOOTH BLUE ASTER	*Aster laevis*	10-30
PURPLE CONEFLOWER	*Echinacea purpurea*	5-20
NAKED FLOWER TICK TREFOIL	*Desmodium nudiflorum*	10-20
SLENDER LESPEDEZA	*Lespedeza virginica*	10-20
CANADIAN BLACKSNAKEROOT	*Sanicula canadensis*	10-20
EASTERN BEEBALM	*Monarda bradburiana*	10-20
WHORLED MILKWEED	*Asclepias quadrifolia*	10-20
CULVER'S ROOT	*Veronicastrum virginicum*	5-10
SMOOTH SPIDERWORT	*Tradescantia ohiensis*	5-10

Grasses and sedges

Common Name	Botanical Name	Cover % (low-high)
WOODLAND BROME	*Bromus pubescens*	5-20
BIG BLUESTEM	*Andropogon gerardii*	5-20
LITTLE BLUESTEM	*Schizachyrium scoparium*	10-30
PENNSYLVANIA SEDGE	*Carex pensylvanica*	5-20
PARASOL SEDGE	*Carex umbellata*	10-20
ROCK MUHLY	*Muhlenbergia sobolifera*	5-20
VIRGINIA WILD-RYE	*Elymus virginicus*	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 hard mast; scattered shrubs provide soft mast.
- Native legumes provide high-quality wildlife food; sedges and native cool-season grasses provide green browse.
- Patchy 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 – herbaceous cover habitat important for turkey poults and quail chicks.
- Bird species associated with mature communities include Indigo Bunting, Red-headed Woodpecker, Eastern Bluebird, Northern Bobwhite, Eastern Wood-Pewee, Broad-winged Hawk, Great-Crested Flycatcher, Summer Tanager, and Red-eyed Vireo.
- Reptile and amphibian species associated with this site include tiger salamander, small-mouthed salamander, ornate box turtle, northern fence lizard, five-lined skink, broad-headed skink, flat-headed snake, and rough earth snake.

Forestry

- Management: Site index values for oak range from 51 for post oak, 62 for red oak and 54 for white oak. Higher site index values are usually associated with protected and lower slopes and deeper soil depths. Timber management opportunities are fair to 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. These sites respond well to prescribed fire as a management tool. Favor white oak and northern red oak on higher productivity sites and black oak, post oak, chinkapin oak, and Shumard oak on lower productivity sites.

- Limitations: Clay in soil profile; seasonal wetness. Clayey soils have reduced traction and compact easily when wet. Unsurfaced roads and skid trails may be impassable during rainy periods. Restrict activities to dry periods or surfaced areas. Seedling mortality may be high during the summer because of lack of adequate soil moisture, especially on south facing slopes. The use of equipment is restricted in spring and other wet periods. The surface layer is firm when dry and sticky when wet and becomes cloddy if tilled. 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

References

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