

Clegg Garden: Description of Ecosystems and Trails

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An ecosystem is a community of organisms and their physical environment. Some major ecosystems are forests, savannas, grasslands, deserts, and wetlands. Ecosystems depend greatly on temperature and the amount of water available for plant growth. Ecosystems change gradually with time, but a reference point in time for the US is when European settlers first arrived in what later became the United States. The vegetation at that time has been called *pre-settlement vegetation*. Across the moderate temperature belt of the east and central US, precipitation decreases from east to west and pre-settlement vegetation ecosystems progressed in broad zones from dense forest to savanna to grasslands to desert. Smaller areas of wetlands occurred in all of these zones. Today, most of the land is farmed or logged so the *pre-settlement* ecosystems are less noticeable. Hikers, however, can observe some of these major ecosystems within Clegg Garden.

In a zone with similar temperature, the amount of water available for plant growth depends mainly on (a), precipitation; (b), the ability of the soil to retain and supply water for plants during dry periods, the soil water holding capacity - a soil *material* property; and (c), the shape of the soil surface and its orientation relative to the sun which affects the evaporation rate – a soil *landscape* property. Because precipitation is the same across all of Clegg, the kind of ecosystem established at a site depends largely on soil properties, but once established, the composition of the plant community also depends on the site's fire history.

Biological processes are also important. Hikers see remnants leaves, branches, and logs along all trails. If they look closely, they will see insects, worms, and other organisms feeding on these organic materials. If they were to use a microscope, they would find an even greater mass of *microorganisms* that are recycling energy and nutrients within the ecosystem. All biological activity depends on the decomposition processes carried out by these microorganisms.

Soil materials

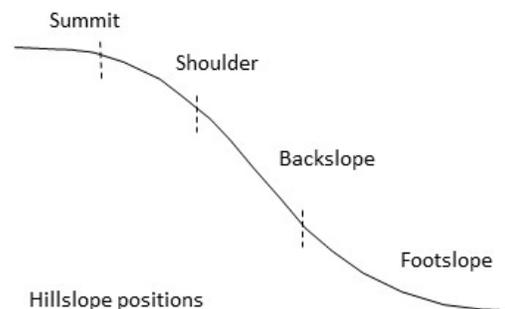
Many soil properties are inherited from the geologic material from which the soil formed, its *parent material*. Parent materials at Clegg were transported by *glaciers* (large ice sheets) thousands of years ago. The material deposited directly by glacial ice is called *till*, and that deposited by water released when ice melted is called *outwash*.

Till is formed from rock material ground up by glacial action. It consists mainly of sand and finer particles (silt and clay). Much of the bedrock over which the glacier travelled was limestone, so the till contains substantial amounts of limestone (calcium carbonate). Importantly, the till was compacted by the weight of thousands of feet of ice, so it has a high bulk density (weight/volume). During soil formation, however, the density decreased by dissolution of limestone, root activity, and other processes. The moderate content of silt and clay in till-derived soil material provides an adequate water holding capacity, so the water holding capacity of a soil profile depends on the depth of soil formation and the depth to un-weathered dense till.

Outwash, on the other hand, contains mostly sand and gravel; the silt and clay were washed out by the melting water. It is very permeable for roots and water, but has a low water holding capacity so soils on outwash tend to be dry. At Clegg, there are alternating layers of till and outwash. Water percolates down through outwash until it hits a layer of till, and then moves over the till until it resurfaces on a hillside as a seep.

Soils landscapes

Soil landscape properties include the hillslope position (see diagram), the steepness of the slope, and its direction relative to the sun. Backslopes that join in a V constitute a *ravine*. Runoff water (surface flow) moves most rapidly on steep slopes, so backslopes are especially prone to erosion. Water percolating into the soil often seeps out on footslopes, at Clegg especially near Wildcat Creek. Soils on south- and west-facing slopes tend to be dry because of the direct exposure to the hot afternoon sun, while those in shaded ravines tend to be wetter.



Fire

It is likely that Native Americans occupied this area for thousands of years before Europeans settlers arrived, and these people used fire to alter ecosystems to their advantage. Fire kills many small trees and thus tends to favor grassland and savanna vegetation over dense forest. Within a forest, fire keeps the canopy open (more sun, less shade) so fire favors trees, that

reproduce in sunny openings, such as oaks, but fire *suppression* favors maples that reproduce well in the shade. Since European settlement, fire has been largely suppressed. At the present day, compared to pre-settlement times, forest ecosystems have more maples and fewer oaks, savanna ecosystems have more trees (including maples) and less open area, and grasslands have more scattered trees.

Ecosystems

The main ecosystems along the trails in Clegg are forests, savannas, grasslands, and wetlands. The locations of these ecosystems are shown on the trail maps. **Forests** are mainly along shaded ravines, especially those on lower hillslope positions where there is moderate evaporation and the soils have moderately high water-holding capacity. The most common tree species in our forest are northern red oak, white oak, chinkapin oak and sugar maple. Chinkapin oak tends to be on the drier parts of the forest, nearby the savanna areas. Maple trees tend to be smaller than oaks because they came in later after the beginning of fire suppression. Less abundant tree species in the forest include ash (various species, most being killed by the emerald ash borer, an invasive beetle that established itself in the eastern woodlands in the early 2000s), basswood, black cherry, black locust, black oak, black walnut, American sycamore, hackberry, musclewood, Ohio buckeye, pignut hickory, shagbark hickory, and tulip poplar.

The **grassland** at Clegg is on a steep southwest-facing slope that is exposed to the hot afternoon sun. The soils are mainly formed from outwash, except on the shoulder where they formed from till, but are shallow. Thus, all the soils are droughty (dry). The area has been called the Gravel Hill Prairie. Common species include prairie dock, smooth yellow false foxglove, northern sea oats, Indian grass, bottlebrush grass, and tall goldenrod. Some trees have been moving in because fire has been suppressed.

The **savanna** zone is on the exposed summit between the forest and grassland. Typically, savannas have 10 to 50% tree cover, leaving much exposed understory. Here the understory includes goldenrod, raspberry, shooting star, and many of the grassland species. In the canopy, the trees are mainly chinkapin oak, northern red oak, and white oak. The percentage of tree cover is increasing because of fire suppression. Since taking over the property in 2014, NICHES has done two controlled burns to reduce the population of trees in the savanna and the grassland to restore these ecosystems to their pre-settlement conditions.

Wetlands are areas where the soils have a high water table, they flood, or both. At Clegg, they are on footslopes where water seeps out to the surface. Creek flood waters periodically cover these wet soils and also soils that do not have high water tables. These areas are very narrow, so some species are the same as those of nearby ecosystems. Horsetail (*Equisetum*) and skunk cabbage grow along the southern part of Peters Mill trail. *Equisetum* is very old evolutionarily and it reproduces by spores instead of seeds; skunk cabbage can heat up the soil in which it grows, being able to push its flower through closed snow cover in early spring. There are a few American sycamore trees in the wetland.

How this map was made: GPS and UTM

A Global Positioning System (GPS) is a system in which a receiver communicates with satellites to determine the position of the receiver on the surface of the Earth. Universal Transverse Mercator (UTM) is a map projection system that represents a location in meters north of the equator (northing) and east of a north-south line in Illinois (easting), and thus can be readily graphed. We used a smart phone with a GPS app to draw the trail map. The map includes labels on its horizontal and vertical axes, like atlas maps and road maps. *Nodes* on the map are intersections or endpoints of trails, similar to exit numbers on interstate highways. The map can be used without referring to the graph axes, but some hikers might wish to learn about GPS and UTM by using a GPS receiver or a UTM app on their phones.

The system for displaying the map and directions to nearby nodes on black posts is patterned after the system used in Michigan State Parks.

Other Trails – On Land and Water

NICHES Land Trust owns more than 40 properties in 10 counties in Indiana, many of which have trails. It also has several sites on Wildcat Creek where people can access the stream for canoeing, kayaking or other activities. One of them, Peters Mill Landing, is shown on the map. It includes facilities for launching canoes and kayaks, Check our website, nicheslandtrust.org, for details.