Oak Systems in the Chicago Region

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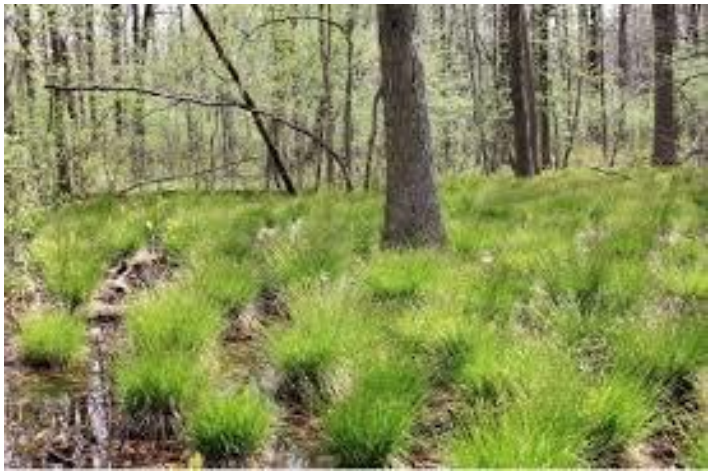
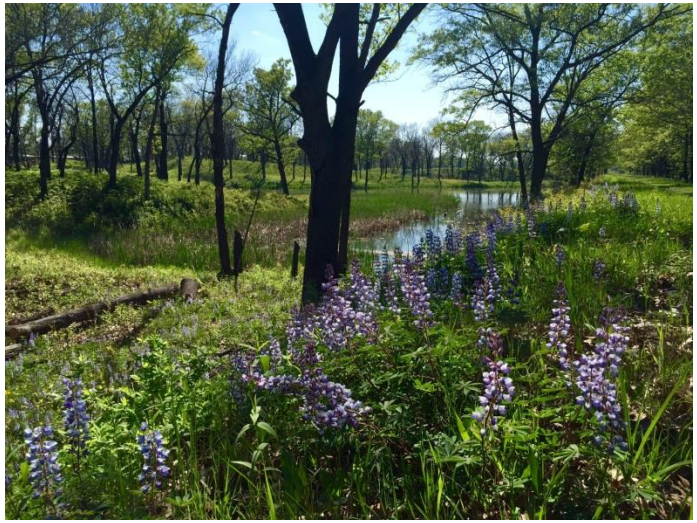
Oak Systems

There are several manifestations of ecosystems in the Chicago region that can be characterized as dominated by oak species or have oaks as significant subdominant trees. Traditionally, research into the ecology of these systems has focused on the oaks themselves, their autecology and reproduction. Consequently much is known about their life history. Too often, however, I think their inhabitancy and vitality in aboriginal systems is conflated with arboriculture, where the focus is wholly on singular aspects of individual seedlings or trees.



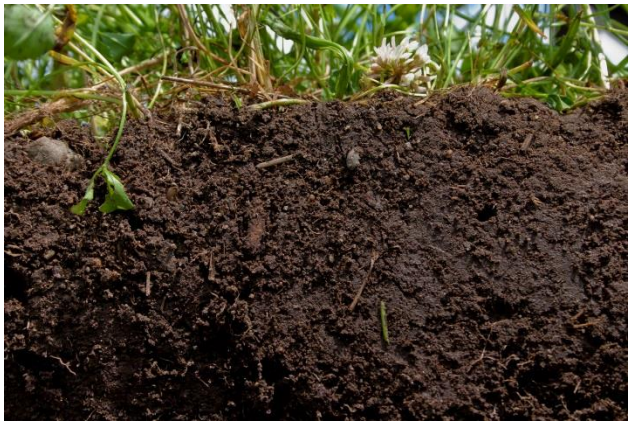


Perhaps too overlooked is the health of the system that husbands oak inhabitancy over the long term. In an aboriginal system it is not the individual trees that matter so much as the ability of the systems of which they are a part to produce acorns sufficiently adapted to the edaphic and light regimes, to germinate and produce new generations of long-lived uneven-aged stands---without significant age gaps or with trees so densely disposed that they generate overwhelming numbers. In an acre of oak system, with 20-40 canopy trees per acre, the survival of replacement germinations needs very few healthy new trees per year---certainly fewer than one.

Important to these systems is the sustained vitality of the rhizosphere, where organic matter below the surface is sustained and there is sufficient oxygen and water for fine-root development in the spring, and good soil moisture throughout the growing season.

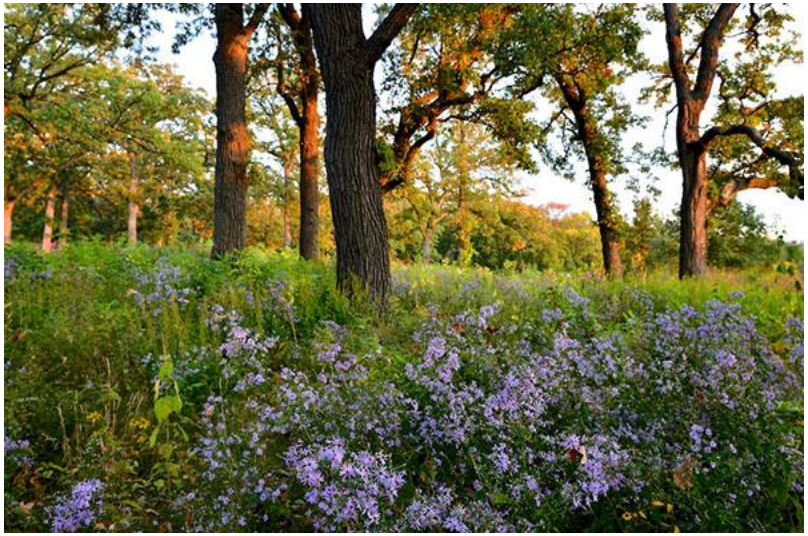
As perennial systems, the only physical tactic north-temperate systems have developed to sustain both soil organic carbon and soil organic matter below the surface is for fine-rooted graminoid species to prosper throughout the systems and produce roots that are constantly dying and rendering the rhizosphere with decaying root mass. In oak timber systems, such species are in the sedge genus *Carex*, of which there are about 25 regularly encountered species locally. Those in the Section Acrocystis appear to be most closely associated with sustaining soils where, with sufficient light energy available, they can restore enough organic matter each year to keep up with the oxidation rate.

Regularly decomposing organic matter sustains sufficient soil moisture to link the surface soils with the zone about 25 centimeters below where one usually can measure a constant average daily temperate. This linkage keeps the rhizosphere from changing temperature too quickly over the course of the growing season for ectothermic organisms to respond. Plant root systems, fungal hyphae, and soil invertebrates are, of course, largely ectothermic. In salty or clayey soils, soil organic matter can absorb nearly or quite all the rain that falls, obviating concerns over the loss of nutrients and physical soil to soil erosion. In sandier soils, soil organic matter can obviate concerns over the loss of nutrients to leaching.

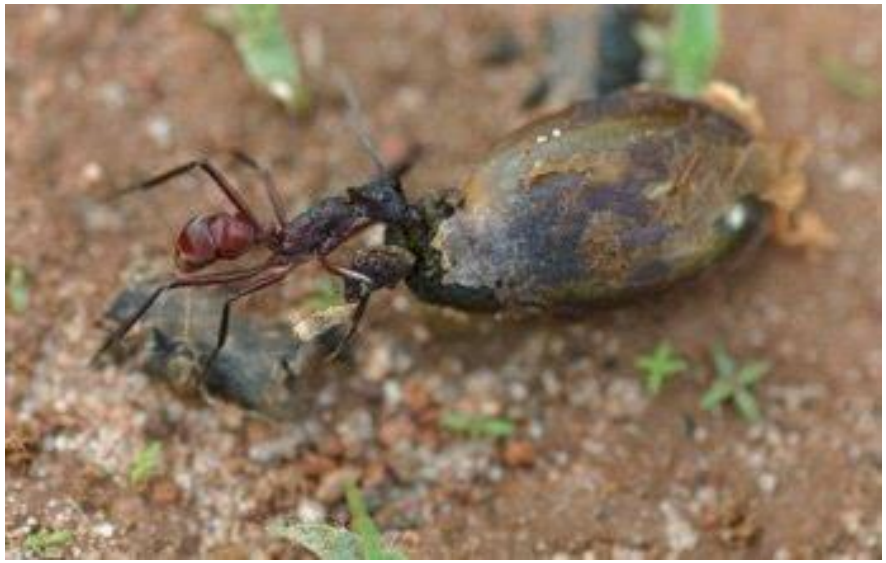


Another natural feature of oak systems is the abundance of forbs, which in healthy systems are ubiquitous throughout the growing season and numbered as many as 150 species per acre. The presence of forbs and their multiplicity of nectaries, pollen, seeds, and the like are a vital system in and of themselves, but they also provide the living matrix within which oaks and their seedlings prosper.

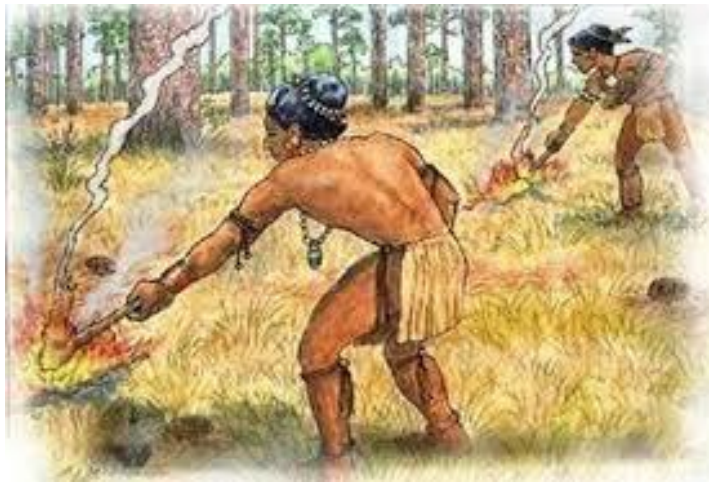
The vernal flora, which appears about a month before the oak leaves, coincides phenologically with the development of the oak's fine roots for the season---which need sufficient oxygen and water for their growth. The spring forbs begin the process of transpiring the excessive moisture that has accumulated over the winter and during early spring snow melt. The absence or depletion of such forbs can leave the trees with poor fine roots entering the growing season and hampered in their ability to absorb nutrients and water during the drier periods of summer.



Many of these spring forbs, as well as many *Carex* species, depend on ants to move their seeds throughout the system. Ant species diversity and colony health is stressed by the loss of organic matter where soil temperature changes and excessive water or the lack of it can stress their ability to thermoregulate their larvae and pupae.



Much research needs to be done in this dimension of oak system rhizosphere health. Oaks inhabit an array of different soils and moisture regimes, but most oak systems today are characterized by soils, heavily impacted by deficits of organic matter, compaction, erosion, and excessive competition from a array of allochtonous trees. It has become clear to us that organic matter is crucial to the characteristics of soil in which significant portions of an oak's life has intimate relations. Also clear is that, in much of the temperate zone, Holocene-aged human cultures, with their applications of fire and harvesting patterns are as important to the understanding oak systems as the biotic and abiotic attributes.



If our oak systems are to be restored and sustain, our contemporary culture must attend to the health of the whole system that husbands oaks and integrate it into our own. Science must become comfortable taking into account not just the biotic and abiotic features of oak systems, but also the cultural systems that spawned them.