

Tree Biology and Care:

THE WAY OF COMMUNITY

by Jack Phillips

My teacher Alex Shigo had many wonderful things to say. That is, he taught the wonder of trees but I often wondered what he meant. For example, he often said that “trees are not individuals.” It is obvious that trees live naturally in communities, but the way that a tree is community is more difficult to discern. Science has only recently discovered that individual trees are a composite of organisms, but grasping this concept is very important for good tree care.


Trees have survived for eons without human help. They nourish the web that sustains them. Photosynthesis made life on earth possible, and the life of every tree is made possible by the universe of creatures it directly or indirectly feeds. Therefore, sound arboriculture is the culture of community. This inevitably includes the world of roots, which is also the world of fungi.

Many tree-lovers can identify and describe the functions of ectomycorrhizae, the external “fungus-root” organs formed in symbiosis. It is remarkable that in the long span and universal breadth human-tree relationships, fewer than 150 years have passed since Albert Frank introduced mycorrhizal relationships to science in 1885. Most botanists would agree that virtually all trees require some type of mycorrhizal infection to thrive, and the fact that endomycorrhizal types (inside the root) are not easily seen has led many to assume that they are obligate only to certain tree species. Like the coupling of single-celled organisms with chloroplasts that formed the basis for plant life when the earth was young, the union of tree and fungus in one organ is the basis for life in soil.

Infections are encouraged and enhanced by two sugary compounds: mucigel and glomalin. Mucigel coats nonwoody roots and is composed of sugars exuded by the tree, essential elements, water, and microorganisms. Growing in this soup are root hairs which are tiny extensions of individual epidermal cells that increase the surface area of the roots and transport elements into the tree. It is somewhat inaccurate to refer to this action as absorption, which sounds passive, because nonwoody roots actively take what is needed from soil with the indispensable aid of bacteria and fungi.

Glomalin serves a similar purpose, but is produced not by the tree but by mycorrhizal fungi. It is a glycoprotein (combined protein and sugar) that holds soil particles together on fungal mycelia. It further aids the element-gathering capacity of mycorrhizae and

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creates a healthy habitat for bacteria and other microbes. Glomalin is not only essential for healthy root function, but for healthy soil structure as well. Like the relatively recent discovery of mycorrhizae, the existence and importance of glomalin is new to science, having been discovered in 1996 by Sara Wright.

Mycorrhizal fungi only infect the fine tips of nonwoody roots. As the infection progresses the root is stimulated to produce more tips for infection, while a mycorrhizal mantle grows over the root. Fungal infections not only make it possible for trees to get what they need from soil (in exchange for sugar from non-woody roots) but also feed soil organisms by sloughing off deciduous root tips, mantles, and entire external mycorrhizal structures. Moreover, mycorrhizae connect trees to an incredibly vast and complex web.

In native soils, trees belong to the underground network of the string-like bodies of fungi called mycelia. The web that consists of interconnected mycelia of mycorrhizae, plant roots, and hundreds of millions of microorganisms forms a mycelial mat that have been known to occupy thousands of square acres in the wild and live to be thousands of years old. It functions like a single organism with an energy grid and neurological pathways, sharing energy and information throughout the system. Mycelial mats consist of countless and diverse species, and trees are just one of many creatures held in ancient and intimate embrace.

Intimacy requires space. Sometimes

our passion for trees means we love them to death; our aggressive designs ruin their love life when we really just need to let trees be trees. The wisdom of trees is the way of community, and wise tree care promotes healthy relationships. The vital web that has always sustained trees is too complex to recreate once damaged or destroyed, but we can preserve the vestiges of lost fertility and help create new possibilities. Sometimes this simply means staying out of the way.

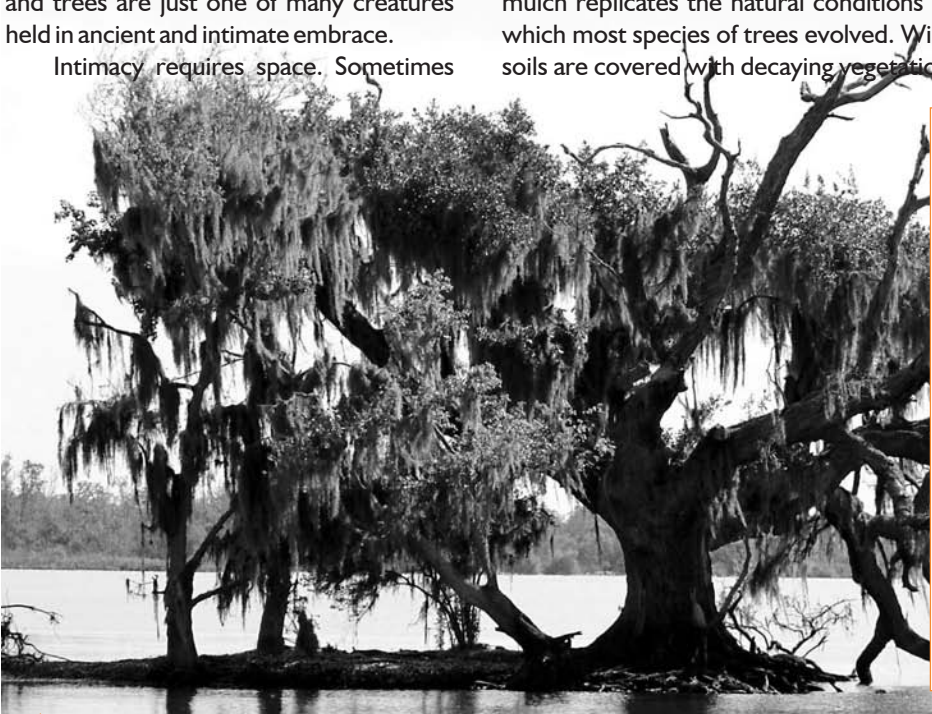
It can be said that trees don't grow in soil, they grow in air. Roots, mycorrhizae, mycelia, and countless members of the soil web live and grow in the spaces between particles. The right combination of moisture, oxygen, decaying organic matter, essential elements and everything else that keeps the community alive is destroyed by compaction. We sometimes love our trees so much that we cozy up to them, injuring soil and roots during construction of homes and roads. We apply fertilizers that are high in nitrogen, install sprinkler systems, install fabric and rock, drench or inject soil with broad-spectrum pesticides, sometimes doing more harm than good. Many common practices increase compaction and make normal life in the rhizosphere more difficult or impossible.

The most reliable way to relieve compaction and grow subterranean wildlife is the simplest. Properly-applied mulch replicates the natural conditions in which most species of trees evolved. Wild soils are covered with decaying vegetation

and animals and contain varying amounts of humus in each soil layer. Compaction is relieved by the movement of soil organisms that inhabit and digest this material, creating compost and opening spaces between soil particles. Each cubic meter of wild forest soil contains hundreds of thousands of insects, mites, arthropods, worms and other small animals, and one handful of this soil contains billions of bacteria belonging to thousands of species. Soils in developed and built environments will never reach this richness or diversity, but by nurturing the life in soil we create the possibility for intimate and meaningful relationships

Every aspect of arboriculture has enormous implications for the life of trees. The ecological web to which trees belong is more vast and complex than we can imagine and is shared by countless creatures yet to be understood or even discovered. Humans are only one small part of this community, but we possess the capacity to do irreparable harm. The consequences of every treatment we impose on trees, despite our best intentions, must be carefully considered. The way of community has sustained trees for eons. The best that we can do is to approach them with a sense of wonder and the desire to learn their ways.

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