habitat restoration

Whenever native seedlings disappear under weeds or vanish with the summer drought, habitat restoration professionals may become convinced that truly self-sustaining ecosystems cannot be recreated. Irrigation systems and weeding crews are able to keep native plants alive, as with any landscape planting, but such a "restoration" project suffers when the artificial inputs are removed.

soil microbiology

A successful and functional ecosystem is based on soil biology. Nutrient cycling and soil structure are primarily a result of microbial activities. The most important microorganisms depend upon living roots, and are destroyed when a site suffers major disturbance. They move back very slowly, or perhaps never if the site is dominated by exotic weeds. The **i.e.; method** helps restoration professionals leapfrog this slow and uncertain step in the recreation of native ecosystems.

success and failure

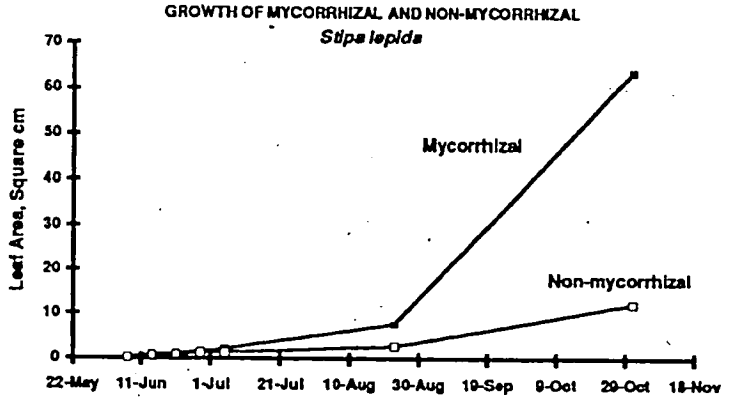
The most vital soil organisms are symbiotic mycorrhizal fungi. These fungi, unrelated to plant disease organisms, are considered essential to natural communities. Mycorrhizae form a link between the root and the soil, giving access to soil nutrients. Without mycorrhizae such factors as growth rate, root development, drought resistance, and uptake of nutrients are far below that needed for self-sufficiency. In the **i.e.; method**, mycorrhizal fungi accompany the native plants. Mycorrhizae often make the difference between success and failure in habitat restoration.

soil biology and weeds

Ruderals or "weeds" are plants which can grow quickly, reproduce abundantly, and thrive without mycorrhizae. Weeds are at their best in severely disturbed soil. Grading and erosion remove the mycorrhizal fungi, making the site suitable only for weeds. To introduce natives without mycorrhizae is to place them at the worst possible disadvantage. Miller (1985) appropriately characterized restoration without mycorrhizae as "lipstick on a corpse."

plant growth

The best-known effect of mycorrhizae is improved plant growth. The graph below shows the growth rates of a native grass species with and without mycorrhizae. Differences in growth rate were also confirmed here with *Cercis occidentalis, Cupressus forbesii, Fremontodendron mexicanum, Iris douglasiana, Malosma laurina, Rhus integrifolia, Rhus ovata, Stipa cernua* and *S. pulchra*. Several decades of published literature have shown similar results with hundreds of other native and agricultural plant species.



soil structure

Mycorrhizae have effects on the soil that may be even more important than their effects on individual plants. The fungal filaments bind small particles into aggregates that define soil structure (Tisdall and Oades 1979, Miller 1985). Since most roots cannot grow into pores less than their own diameter (Taylor 1974), growth is largely confined to the channels created by soil structure. In the absence of soil structure, the roots of many species would be unable to spread through the soil. Structured soil allows downward movement of water, reducing surface run off and recharging ground water.

mycorrhizae research

The benefits of mycorrhizae have been known to industry and government agencies for decades. The forest industries, U.S. Forest Service, U.S. Department of Agriculture, and the governments of Australia, Brazil, Great Britain, India, and New Zealand have been highly committed to mycorrhizal research. Literally thousands of technical papers have been published on every aspect of mycorrhizae. Even so, practical use of mycorrhizal fungi has been limited by the availability of inoculum and the difficulty of producing mycorrhizal plants.

The i.e.; method

In TREE OF LIFE NURSERY's **i.e.; method,** mycorrhizal fungi are introduced along with the vegetation. Specially inoculated native grasses nurture the symbionts until they can spread to native plant seedlings.

In the **i.e.; method,** plants may be "custom inoculated" with mycorrhizal fungi of job-site origin. Local fungi eliminate inadvertent displacement of native species, and assure that the symbionts are suitable for the climate and soil. Mycorrhizal plants offer improved transplant success, competitive ability, drought tolerance, growth rate, and re-establishment of soil structure. In addition, TREE OF LIFE NURSERY offers pre-planting survey work and monitoring of soil biology.

Contact restoration specialist Dr. Ted St. John for help in building the **i.e.; method** into your restoration plans.

Literature Cited

Miller, R. M. 1985. Mycorrhizae. Restoration and Management Notes 3:14-20.

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