FULL TITLES OF PROCEEDINGS ABSTRACTED IN THIS ISSUE

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Proceedings of a Conference on Native Plant Restoration and Management on Public Lands in the Pacific Northwest: Rare Plants, Invasive Species, and Ecosystem Management. Held February 11-13, 2003 in Corvallis, Oregon. Abstracts are available at www.appliedeco.org/RestorationConference2003/ConferenceProceedings03.htm.

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Prairie Mycorrhizal Fungi Inoculant May Increase Native Plant Diversity on Restored Sites (Illinois)

James D. Bever and Peggy A. Schultz, Indiana University, Dept. of Biology, Jordan Hall, Bloomington, IN 47405, 812/855-0771, Fax: 812/855-6705, jbever@indiana.edu, pschultz@bio.indiana.edu; and R. Michael Miller, Lisa Gades and Julie D. Jastrow, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439-4843, 630/252-3395, Fax: 630/252-8895, rmmiller@anl.gov, gades@aps.anl.gov, jdjastrow@anl.gov

Current prairie restoration practices can effectively reestablish the dominance of prairie plant species at a site but often fail to restore the diversity of the historical plant community. Here, we present evidence that prairie soil microorganisms, and quite possibly arbuscular mycorrhizal (AM) fungi, can increase native prairie plant diversity on formerly cultivated sites.

Arbuscular mycorrhizal fungi, which form symbiotic associations with many plant species, transport soil nutrients to the host's roots in exchange for plant carbon. Several researchers (Wilson and Hartnett 1998, Schultz and others 2001) have shown that the growth and competitive ability of native prairie species is dependent on AM fungi, and that inoculation with AM fungi can accelerate the restoration of prairie grasses (Smith and others 1998). Individual species of AM fungi are ecologically distinct, and the diversity and dynamics within the AM fungal community can directly influence the diversity and dynamics within the plant community (van der Heijden and others 1998, Bever 2002).

In an examination of spores produced in replicate traps, we found that the AM fungal species richness of a post-agricultural old field located at Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois was on average less than half that of a nearby unplowed prairie remnant (6.08 species/trap, $F_{1, 16} = 18.69$, $p < 0.0005$). Moreover, we found that the AM fungal species composition had shifted, with apparently weedy fungi species, such as *Paraglomus occultum*, increasing in density in the old field ($F_{1, 16} = 12.7$, $p < 0.003$). In contrast, other fungi species, such as *Glomus geosporum*, were absent from old-field cultures but common in prairie cultures ($\chi^2 = 8$, $p < 0.005$). We hypothesized that this reduction in diversity and shift in composition of AM fungi may impede the restoration of the native prairie plant diversity on post-agricultural lands.

We tested this possibility on an extensively cultivated site at Fermilab that had been fallow for two years and was dominated by weeds. The area was disked and divided into 24 2-m x 2-m plots laid out in a blocked design. We inoculated 8 plots with prairie soil, 8 with old-field soil, and left the remainder uninoculated. We collected prairie soil from a condemned patch of unplowed prairie adjacent to the West Chicago Prairie Preserve in DuPage County, and old-field soil from an area adjacent to our study site.

We inoculated the plots by rototilling in 10 gallons (44 L) of freshly collected field soil and covered this with 10 gallons of soil from the plot. While the soils differed in diversity and composition of AM fungi, we found that their overall mycorrhizal infection potential (using corn as a common assay host) was statistically similar. In May 1997, we seeded the plots with 0.5 gallons (2 L) of Fermilab seed mix that had been harvested from a 20-year-old restored prairie. We enriched this seed mix by adding locally collected seed of 32 prairie species (about 200 seeds/species/plot). Because drought conditions severely retarded seedling establishment, we reseeded the same 32 prairie species in May 1998.

We sampled the plots each September from 1997-2000 by visually monitoring for the presence of prairie plant species and by removing and identifying all vegetation growing within 0.4-m^2 quadrats. Naturalized species dominated the plots during the first two years of our study. Prairie species reached 60 percent of total plant biomass in the third year (1999), but we found no differences in diversity of prairie plant species among the treatments. The plots were first burned in the spring 2000. In the fall 2000,

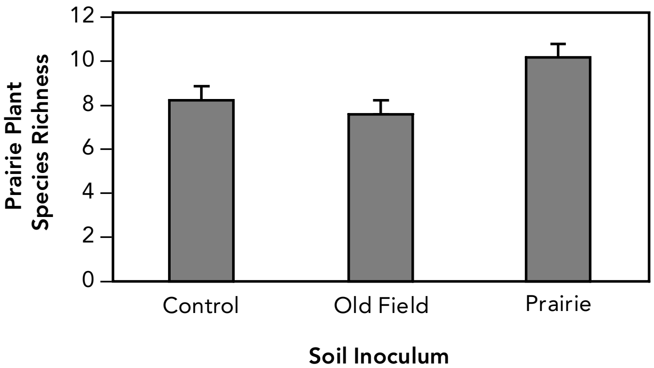

Figure 1. The average diversity of prairie plant species observed in the fourth year after start of restoration, which included inoculation of soil microorganisms.

we found significantly higher diversity of prairie plant species in plots inoculated with prairie soil than in the other two treatments plots ($F^{1, 23}$ = 9.0, $p < 0.01$, Figure 1). This effect could not be explained by variation in soil minerals between plots.

There are many soil microorganisms that can affect plant dynamics (Bever 2003), so we cannot definitively attribute our results to any one group of organisms. However, because we observed differences in the diversity and composition of the AM fungal community between the inocula, our results are consistent with the possibility that prairie AM fungi may improve the restoration of prairie plant diversity.

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Vole Herbivory Affects Well-Established Forbs in Experimental Tallgrass Planting (Illinois)

Cristina Martínez-Garza, Joel S. Brown and Henry F. Howe, Dept. of Biological Sciences (M/C 066), University of Illinois at Chicago, 845 W. Taylor Street, Chicago, IL 60607, 312/413-0023, Fax: 312/413-243, cmarti22@uic.edu

We evaluated how voles (*Microtus pennsylvanicus*) affect survival and growth of established individuals of tallgrass prairie species growing in experimental plantings at the Morton Arboretum in northern Illinois. A previous study showed that herbivory by voles on emerging seedlings had the greatest effect on low-density restoration plantings, including bundleflower (*Desmanthus illinoensis*) and purple coneflower (*Echinacea purpurea*) (Howe and Brown 1999, Howe 2002). We decided to conduct a controlled exclusion experiment to determine how vole herbivory would affect these two species once they are well established as adult plants.

In June 1997, we randomly selected 48 one-year-old plants (24 of each species), and surrounded each with a 3.9-ft (1.2-m) high, 3.2-ft^2 (0.30-m^2) diameter cylinder made of 1-cm mesh (Howe and Brown 1999, Howe 2002). We paired cylinders within each plot for each of the two species, with one cylinder having two 5-cm x 5-cm gates that allowed voles access. We measured plant height in fall 1998 and 1999, and then measured height, harvested, oven-dried to constant mass, and weighed the survivors in October 2000.

Rodent censuses conducted from October 1997 through October 2000 showed that the minimum number of voles per hectare at the site ranged from four in April 1998 to 155 in May 2000 (Turner 2003). We did not find effects of vole herbivory on plants in cylinders in 1998 and 1999, when vole abundances were low during the growing season. However, by October 2000, after a season during which voles increased dramatically, only three bundleflowers and 12 coneflowers were alive in the open cylinders, while 83 percent of individuals of both plant species survived in the closed cylinders.

Although bundelflower individuals in closed cylinders were taller and heavier (182±11 cm and 170±55 g) than in open cylinders (167±15 cm and 157±26), so few survived in the open cylinders that size comparisons are not reliable. Despite significant mortality in cylinders accessible to voles, enough coneflowers survived to show a statistically significant 46 percent loss in height (38±9 cm, open; 83±0 cm, closed) and an apparent, but not statistically significant, 60 percent loss in biomass in open (6±2 g) as compared with closed cylinders (10±3 g).

Voles are more common in fields of forage crops, pastures, or old field successions than in native prairies because pasture legumes and grasses are more palatable than native prairie plants (Lindroth and Batzli 1984). The reduction or elimination of bundleflower, the only common native legume in our synthetic