Fire-Based Restoration of Biodiversity in Ecosystems Dominated by Nonnative Grasses (awarded 2002)

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The introduction of nonnative species in the United States has resulted in significant environmental damage and economic losses exceeding $130 billion per year. Using a rigorous experimental framework, we assessed the influence of nonnative species on biological diversity in the southwestern United States in grasslands and savannas prone to fire. Our specific objectives were to (1) determine effects of fire season on responses of biotic communities, and (2) quantify relationships between biological guilds before and after burning and through post-fire recovery. The research is ongoing.

This experiment is taking place within grasslands and *Prosopis* savannas at the Fort Huachuca Military Reservation, in southern Arizona (31º 34' N, 110º 26' W). The experiment evaluates the main and interactive effects of dominance by nonnative plants and fire season with three replicates in each of two years.

A slight negative relationship was evident between biomass of *Eragrostis lehmanniana*—the dominant nonnative grass in these systems—and diversity and richness of native plant species. Proportion of *Eragrostis lehmanniana* as a function of total biomass was reduced following fires. This reduction persisted for more than two years post-fire, and the degree of response was dependent on annual precipitation and fire season: little reduction was caused by spring fires during a year with above-average precipitation, whereas considerable reduction was caused by summer fires during a dry year. Plant species richness was not altered by fire treatments but remained lower on plots dominated by *E. lehmanniana* and higher on plots dominated by native plants. Richness appears to be influenced to a greater extent by seasonal and interannual variation in precipitation than by fire treatments.

In general, species richness and relative abundance of small mammals decreased in the first year following fire. However, values approached those observed in unburned areas within 2 years post-fire.

From a community perspective, species richness and density of individual birds and their nests were relatively constant between burned and unburned areas and were consistent across the gradient of nonnative grass. Nest species richness and density of nests (at three spatial scales) were positively associated with increasing nonnative grass dominance.

Extensive anthropogenic manipulation of fire regimes in these systems is ongoing, and will proceed as managers become increasingly confident in their ability to safely apply prescribed fires. This research provides a rigorous scientific basis for the determination of an appropriate fire regime, as dictated by specific management objectives and relative abundance of nonnative species.

Funding provided by the Center for Invasive Plant Management (CIPM) allowed us to continue this research during a crucial period, when other sources of funding were not available. Specifically, CIPM funding allowed extension of the initial research to a second set of plots (replication in time) and to the first year post-fire. A progress report for each year of the study, complete with detailed descriptions of methods and results, is posted online at <http://www.u.arizona.edu/~elg/fort.html>.