COMPARING RICHNESS & DIVERSITY WITH DISCRIMINANT FUNCTION ANALYSIS OF HERBIVORE COMMUNITIES ON A POLLUTION GRADIENT

Michele Eatough Jones and Timothy D. Paine

Department of Entomology, University of California, Riverside, CA 92521, USA

The mixed conifer forest of the San Bernardino Mountains has been impacted by air pollution arising from the Los Angeles basin. Ozone has decreased in recent years, but nitrogen deposition in the forests of Southern California is expected to increase as urban centers continue to grow. Both these pollutants alter patterns of plant growth and allocation, and affect nutritional quality of foliage for insects which may subsequently affect the diversity and abundance of insect herbivore communities. If atmospheric pollution inputs lead to ecologically significant changes plant growth and chemistry, then the composition of the herbivore insect community of those plants may also be altered. Loss of species richness and diversity are commonly associated with deleterious impacts of human activity, and frequently used to assess anthropogenic impacts. Measurements of richness and diversity do not, however, indicate what specific components of a community are changing. In contrast, discriminant function analysis of herbivore groups indicates which groups are associated with overall community differences. The goal of this research was to examine changes in the herbivore communities three prominent plant species (ponderosa pine, California black oak and bracken fern) along an air pollution gradient. We sampled insect communities at six sites. Three western sites were associated with high ozone and high nitrogen input, while three eastern sites were expected to have lower atmospheric input. Insects were extracted from foliage samples collected in spring, as plant tissue reached full expansion. Community differences were evaluated using total herbivore abundance, morphotaxa richness, Shannon-Weiner diversity, and discriminant function analysis. Total oak herbivore abundance tended to be higher at high pollution sites, but fern and pine herbivore abundance did not show any trend. There were no consistent patterns associated with herbivore richness or diversity along the air pollution gradient for any of the three plant species examined. But even without conspicuous changes in total numbers, diversity or richness of herbivores, herbivore groups on all three plant species showed patterns of change that followed the air pollution gradient that were apparent through discriminant function analysis. For bracken fern and oak chewing insects were more abundant at high pollution sites. On pine, some groups of sucking insects had increased abundance on high pollution sites, while chewing insects were more abundant on low pollution sites.