Factors Determining Species Diversity in Postfire California Chaparral and Sage Scrub

Diversity of mediterranean-type ecosystems is of interest because these are hotspots of species richness and diversity is typically highest in the early postfire years in California shrublands. However, as shown in recent research by USGS scientists Drs. Jon E. Keeley and James B. Grace and colleagues, this generalization is overly simplistic and diversity is determined by a complex of temporal and spatial effects.

In *Diversity and Distributions,* the authors found that determining the factors responsible for community-scale plant diversity in California shrublands is a multifaceted problem. Important factors include: 1) life history specialization to temporal heterogeneity in resources created by fire; 2) species-specific responses to characteristics of disturbance events (e.g., fire severity); 3) niche specialization between life forms; 4) growth forms that further subdivide resources along other axes such as soil characteristics, phenology, etc.; 5) species-specific differences in response to annual fluctuations in resource availability, in particular precipitation; and 6) mass effects due to metapopulation dynamics whereby fluctuations in disturbances and resource availability result in occasional localized expansion of highly successful core species' populations. While diversity in these shrublands appears to be driven by disequilibrial processes, the important role of residual species suggests a long-term equilibrium, whereby composition has stabilized according to species-specific niche specialization.

Structural equation modeling (SEM) was used to relate plant species richness to plant abundance, fire severity, abiotic conditions, within-plot heterogeneity, stand age, and position in the landscape in the *Ecological Applications* study. These models indicate that postfire richness is strongly influenced by local conditions that are, in

Management Implications:
- Fire severity is increased in older stands of chaparral and sage scrub and this is tied to reduced plant diversity after fire.
- Prescription burning of older stands can be done under conditions that generate lower intensity burning and thus lower fire severity. This could act to enhance postfire diversity; however, the effect is short-lived and no relationship between fire severity and diversity is to be expected after the first year.

turn, predictably related to landscape-level conditions. For example, it was observed that older shrublands were characterized by more severe fires, which were associated with reduced plant cover and richness in the immediate postfire year. This finding has potential application to fuel management. Prescription burning is often considered as a method of modifying fuels to reduce wildfire hazard. Typically, the intent of such activities is to burn under conditions that result in less severe fires than those associated with uncontrolled wildfires. This study suggests that prescribed burning could enhance postfire diversity of older chaparral shrublands. However, this consideration is not likely to be a major factor in fuel modification because the effect of fire severity is short-lived and no effect of fire severity is evident on diversity during the subsequent four postfire years.

Keeley, J. E., C. J. Fotheringham, and M. Baer-Keeley. 2005. Factors affecting plant diversity during postfire recovery and succession of mediterranean-climate shrublands in California, USA. Diversity and Distributions 11:525–537.

Grace, J. B., and J. E. Keeley. 2006. A structural equation model analysis of postfire plant diversity in California shrublands. Ecological Applications 16:503-514.