

Western Ecological Research Center

Publication Brief for Resource Managers

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Species Diversity Patterns in Mediterranean-Climate Ecosystems

Biodiversity of mediterranean-climate ecosystems is of particular interest, as all five regions are hotspots of plant diversity and of human population growth. Thus, factors driving plant diversity patterns in these regions are of immense concern to resource managers.

One approach to understanding drivers of species diversity is through comparative study of species area relationships. In recent years these relationships have attracted a great deal of attention, perhaps because the rule that the number of species increases with increasing area may be viewed as one of the few real laws in ecology. In recent publications, USGS scientist Dr. Jon Keeley and C.J. Fotheringham, University of California, Los Angeles, investigated a wide range of California ecosystems to determine what is the most appropriate mathematical model to describe species area relationships and what are the underlying ecological explanations for different relationships.

The species area relationship for California shrublands fits a very different mathematical model than for certain other mediterranean-climate ecosystems, despite similar total species richness. It appears that structural differences in the chaparral and coastal sage scrub communities account for the different species area curves and are tied to patterns of dominance, equitability, and life form distribution. Dominance-diversity relationships for western Australia heathlands exhibited a close fit to MacArthur's "broken stick" model, indicating more equitable distribution of species. In contrast, California shrublands, both postfire and mature stands, best fit the geometric model indicating strong dominance and many minor subordinate species. These regions differ in life form distribution, with annuals being a major component of diversity in California. Australia heathlands are dominated by perennials, and annuals are largely absent.

Management Implications:

- Patterns of biodiversity in California shrublands change with scale, and this greatly affects ability of managers to make landscape-scale predictions from community-scale data.
- Under postfire conditions, much of the natural diversity is present in small, localized samples. In later successional or mature communities, diversity is low at the community scale and is more evident at landscape scales.

Inherent in these systems is cyclical disequilibrium caused by periodic wildfires. The potential for community reassembly is greater in California shrublands, where only a quarter of the flora resprouts, whereas three quarters resprout in Australia heathlands. It is hypothesized that differences in life form distribution lead to patterns of dominance-diversity and species area relationships.

Similar species area relationships are evident in other California ecosystems, including coniferous forests, oak savannas, and desert scrub. The primary driver appears to be the presence of an herbaceous element that includes numerous uncommon species, and the woody element alone more closely approximates an exponential species area model. Desert scrub communities illustrate dramatic changes in both species diversity and dominance-diversity relationships in high and low rainfall years, due to changes in life form distribution.

Keeley, J. E. and C. J. Fotheringham. 2003. Species area relationships in mediterranean-climate plant communities. Journal of Biogeography 30:1629-1657.

Keeley, J. E. 2003. Species abundance and species area relationships in two mediterranean-climate communities. Diversity and Distributions 9:253-259.