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Plant Functional Traits in Relation to Fire in Shrubland Crown-Fire Ecosystems

Fire is a dominant disturbance factor in many ecosystems, and fire regimes are expected to change over the next century in response to land-use change and global warming. Understanding how vegetation responds to fire is important for predicting the properties and the distributions of many ecosystems. Today there is much effort focused on the use of plant functional types to predict vegetation change. The advantage of this approach is that it allows one to reduce the overall range of possible combinations of life-history traits and species into a set of functional groups that best represent the range of strategies present in fire-prone ecosystems. By simplifying the great diversity of plant species into a smaller number of functional types, large-scale modeling, and hence predictability, become much more feasible, although grouping species may reduce accuracy.

Research by USGS scientist Dr. Jon Keeley and colleagues published recently in *Ecology* examined the utility of plant functional traits for global prediction in crown-fire ecosystems. The existence of functional types suggests the existence of certain underlying constraints or trade-offs (e.g., vegetative vs. sexual regeneration) that limit the possible combinations of life-history traits. Fire may act as an evolutionary filter against certain traits, and therefore the scientists expected different combinations of traits in systems with different fire history. For crown-fire ecosystems, the main plant traits related to postfire persistence are the ability to resprout (persistence of individuals) and the ability to retain a persistent seedbank (persistence of populations). In this context, they asked two questions: To what extent do different life-history traits co-occur with the ability to resprout and the ability to retain a persistent seedbank among differing ecosystems? To what extent do combinations of fire-related traits (fire syndromes) change in a fire regime gradient?

Management Implications:

- Within broad regions such as California, there are important generalizations that can be drawn about how different functional types will respond to wildfire.
- The presence of resprouting ability is one of the critical elements of postfire response that has much predictive value.
- Resprouting is clearly the dominant fire response on mesic slopes, and thus these moister sites are typically more resilient to frequent fire.

The investigators explored these questions by reviewing the literature and by analyzing databases compiled from different crown-fire ecosystems (mainly eastern Australia, California, Mediterranean basin). The review suggests that the pattern of correlation between the two basic postfire persistent traits and other plant traits varies between continents and ecosystems. From these results the investigators predict, for instance, that not all resprouters respond in a similar way everywhere, because the associated plant traits of resprouter species vary in different places. Thus, attempts to generalize predictions on the basis of the resprouting capacity may have limited power at a global scale. They provided an example for Australia heathlands: By considering the combination of persistence at individual (resprouting) and at population (seedbank) levels, the predictive power at a local scale was significantly increased.

Pausas, J. G., R. A. Bradstock, D. A. Keith, J. E. Keeley and the GCTE Fire Network. 2004. Plant functional traits in relation to fire in crown-fire ecosystems. Ecology 85:1085–1100.