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Fire and Plants: What determines response patterns?

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Plant Survival in a Fire-Prone Landscape

Plant species are commonly classified by their ability to resprout and regenerate from seed after fire.

Research Aim: To develop a detailed understanding of how the composition of plant communities, in relation to seeders and resprouters, varies across habitats in a mountainous fire-prone landscape.

Study Area

An altitudinal gradient across the Australian High Country, extending from Burrinjuck (NSW) to the Brindabella Range and Namadgi (NSW/ACT border), to Kosciuszko and Merambego (VIC/NSW border).

Classifications Don't Always Get it Right

Following the extensive bushfires of January 2003, five research teams[1] surveyed the response of 814 species at 284 sites across Australia's mountainous region.

This project brings these five datasets together in a comprehensive meta-analysis.

The Five Datasets Reveal Within-Species Variation

Species were varied in their post-fire response between sites (Fig. 1). Furthermore, the fire responses of several species differed from their classifications listed in the NSW Flora Fire Response Database.

Distribution of Fire Response Types

Using Generalised Linear Models, we tested the relative importance of fire regimes, habitat and resource gradients in influencing the proportion of fire-response types within communities.

Unexpectedly, the final models showed that the most important factor was 'dataset' – i.e. the collector of the post-fire survey data. Some traits were over- or under-represented in the different datasets. Habitat type (Fig. 2), the number of short inter-fire intervals (< 6 years) and understorey cover were the next most important factors in influencing the proportion of fire-response types (Fig. 3).

Case Study: Woody Obligate Seeders

Model prediction (Figs 2 & 3):

Factor	Dataset	Habitat type	No. short inter-fire intervals < 6 years
Deviance explained	27.9 %	4.9 %	4.3 %

Although the proportion of woody obligate seeders was low (Fig 3), these species are often the dominant canopy species within a community (e.g. *Eucalyptus delegatensis*, *Banksia marginata*). Loss of such species from a community can have significant impacts. Understanding where these types of species occur is critical in ensuring their persistence.

Future Directions

The Relative Importance of Fire

Results suggest that fire is not the only factor influencing where seeders and resprouters occur. Habitat characteristics may also play a significant, if not more important, role. This partially conforms to existing theories which suggest that habitat, fire and resources interact to influence response patterns. Future research will help reveal the complex interaction between plants, fire and the environment.

Why Are There Differences Between Datasets?

The differences between the datasets may be due to:
  (1) Differences in classification methods used
  (2) Differences in the objectives for site selection
Improved standardisation of site selection and species' classifications should be a priority for fire ecology research and management.

Improvements to Fire Response Classifications

This research has enormous potential to lead to improvements in the current systems of plant classifications, and the expansion of current databases to include more details of plant fire responses and within-species variation. Collaboration with fire ecologists and land managers will ensure that future improvements will be beneficial for both management and research purposes.
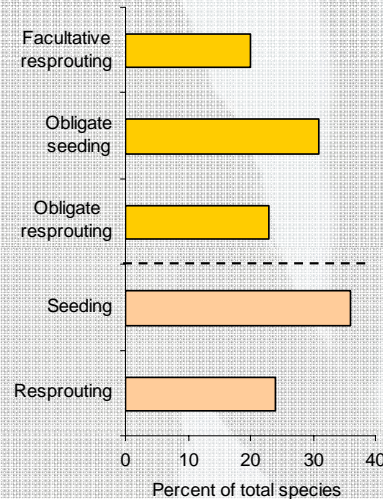

Figure 1: The percentage of species that could be variably classified for each fire response. For instance, 36% of species could be classified as seeders in one site but not in another (813 species surveyed in total).

Figure 2: Rock outcrop habitat in Brindabella National Park, New South Wales: an important habitat for woody obligate seeders
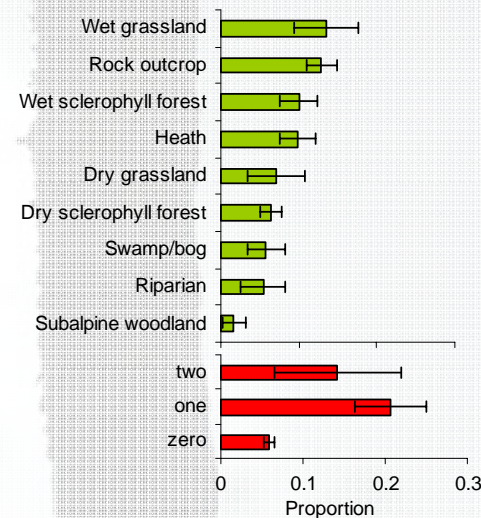

Figure 3: The proportion of woody obligate seeders predicted within habitat types (green bars) and at sites burned with zero, one or two 'short' inter-fire intervals of less than 6 years (red bars)

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