Background briefings on emerging issues for fire managers from AFAC and Bushfire CRC.

bushfire CRC afac

FIRE NOTE

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PLANTS AND FIRE: SURVIVAL IN THE BUSH

Management of fire for ecological and fuel reduction objectives requires knowledge of how plants are likely to respond to fire. This research investigates the composition of plants with different fire response traits across a mountainous region of south-eastern Australia, and the role fire plays in determining these patterns.

BACKGROUND

Fire management is underpinned by our understanding of the interaction between plants and fire. Plants have a variety of traits that allow them to survive in fire-prone landscapes.

Fire ecologists have developed a range of classification schemes to categorise plants according to their fire-response traits (see 'Classifying plants' box). Two key traits are post-fire seeding and resprouting. However, the probability that a plant population will persist is dependent on a range of other factors, such as fire severity and the length of the intervals between fires. For instance, obligate seeders, which are killed by fire but regenerate from seed, can become locally extinct if a fire occurs before they have sufficient time to establish a large enough seed bank.

In 2003, bushfires burned across south-eastern Australia. This project analyses a large body of data on seeding and resprouting responses to these fires, with the aim of developing a detailed understanding of where particular fire-response traits occur across the landscape.

BUSHFIRE CRC RESEARCH

The extensive bushfires of January 2003 provided a unique opportunity to study the effects of fire on vegetation at a landscape level. These fires burned over 1.4 million hectares in Victoria, New South Wales and the Australian Capital Territory. A year after these fires, teams from five different organisations[1] surveyed the resprouting and seeding response of 814 plant species at 284 sites across a steep elevation gradient in Australia's mountainous region from Burrinjuck (NSW) to the Brindabellas (ACT), Kosciuszko and Merambego (NSW/VIC border).

▲ A rock outcrop in Brindabella National Park, near the border of New South Wales and the Australian Capital Territory. Rock outcrops tended to support high proportions of obligate seeders.

SUMMARY

Resprouting and seeding are traits that enable plants to survive in fire-prone landscapes. This research brings together a large body of data to investigate how the proportion of resprouters and seeders varies in response to historic fire regimes and other environmental factors.

The survey data, as well as data on fire history and environmental characteristics for each site, were made available for this research and were compiled into a large database for analysis. At every site, the proportion of each fire-response trait was calculated. The key issues studied were: (1) What are the spatial patterns in fire-response traits across the study area? (2) What are the relationships of these patterns to fire regimes, habitat type and resource gradients in the study area?

ABOUT THIS PROJECT

This research is from B1.2: Fire Regimes and Sustainable Landscape Risk Analysis, and part of Program B: Managing Prescribed Fire in the Landscape

THE AUTHOR: Lyndsey Vivian (pictured) is a PhD candidate at the Australian National University and the recipient of a Bushfire CRC scholarship.

For more information about this research, visit the Education page at www.bushfirecrc.com or contact the author at lyndsey.vivian@anu.edu.au

Banksia marginata was recorded as an obligate seeder in Namadgi National Park, Australian Capital Territory, after the January 2003 fires. Other populations of this species have been recorded as resprouters.

RESEARCH OUTCOMES

Overall, the proportion of resprouting species across the study area was very high: almost 80% were recorded as resprouting after the 2003 fires in at least one site they previously occurred in. The proportion of fire-response traits was strongly associated with habitat type, understorey cover and the number of short intervals of less than six years.

Importantly, this research identified two unexpected outcomes. Firstly, a large amount of within-species variation was detected: 24% of species were found to vary in their resprouting behaviour between sites, and 36% of species were variable in whether or not they regenerated from seed. Also, many species responded differently to that previously reported in other plant fire response databases, such as the New South Wales Flora Fire Response Database. This is a significant finding because current classification methods for plant fire-responses provide little flexibility for incorporating within-species variation.

Secondly, the results suggested significant differences in the proportion of fire-response traits between the five original sets of data used in the analysis. This suggests there were unexpected differences between the original datasets that were not accounted for in the models, such as: (1) different methods used for selecting the survey sites, and/or (2) differences in the way observers classified the species. This result suggests that improved standardisation in surveying the post-fire response of plants is needed.

END USER STATEMENT

"This research investigates how plants vary in their response to fire. It is based on extensive data on the seeding and resprouting responses of plants affected by the 2003 bushfires in south-eastern Australia, which burnt over 1.4 million hectares in Victoria, New South Wales and ACT. The research provides a much more detailed understanding of the role fire plays in plants' persistence, in particular, the impact and importance of within-species variation. This new information will help expand and improve classification methods for plant fire-responses, allowing agencies to fine-tune fire management. This research provides more information to assist in achieving a balance in fire management planning and conservation."

– Neil Cooper,
Manager Fire, Forest and Roads
ACT Parks, Conservation and Lands
Department Territory and Municipal Services

HOW THE RESEARCH COULD BE USED

One area in which this research has the potential to make a substantial difference is in improved classification of plants according to their response to fire. Currently, fire-response classifications apply a trait (e.g. seeding/resprouting; see 'Classifying plants' box) to an entire species, and are often standardised as the response to 100% canopy scorch in the adult phase of life. They do not incorporate within-species variation and are difficult to apply when fire severity is less than full canopy scorch. Also, managers and researchers often use different classification schemes.

This research has shown considerable variability in seeding and resprouting traits within a species, to a single fire. Although the purpose of trait classifications is to generalise and simplify, the application of a fire-response to an entire species could result in negative implications for the management of some species. For instance, understanding within-species variation may be particularly important for species or populations of conservation significance.

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 future improvements will be beneficial for both management and research purposes.

FUTURE DIRECTIONS

Management of vegetation in fire-prone landscapes is undertaken for a range of objectives, including biodiversity conservation,

▲ One of the few eucalypts classified as an obligate seeder, the majestic Alpine Ash (*Eucalyptus delegatensis*) was not always recorded as fire-killed after the 2003 fires.

the protection of water resources, provision of fauna habitat and for the reduction of fuel: all of which rely upon accurate knowledge of how plants respond to fire. One of the findings of this study is that the composition of seeders and resprouters in the landscape is not just influenced by the fire regime; other factors such as habitat type and post-fire competition may also be important. Future research will help reveal the complex interaction between plants, fire and the environment.

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COMMONLY-USED SCHEMES FOR CLASSIFYING PLANT RESPONSES TO FIRE

(1) Simple Classification for Woody Plants - Gill (1981)

A. Non-resprouters
Seed stored on plant…I
Seed stored in soil…II
No seed storage in burnt area…III

B. Resprouters
From below-ground root suckers, horizontal buds…IV
From below-ground basal stem buds, vertical rhizomes…V
From epicormic aerial buds…VI
From continued outgrowth of active aerial pre-fire buds…VII

(2) Vital Attributes – Noble and Slatyer (1980)

- Method of Persistence after Disturbance: *vegetative resprouting (adult and juvenile plants), seed recruitment, canopy/soil seed banks, seed dispersal*
- Conditions Required for Establishment: *immediately after disturbance, during later successional stages, any time*
- Timing of Critical Life Stages: *time to reproductive maturity, life span, time to local extinction*

(3) Seeder/Resprouter – Bond and van Wilgen (1996)

Obligate seeders: *killed, post-fire seed recruitment*
Obligate resprouters: *resprout, no post-fire seed recruitment*
Facultative resprouters: *resprouting and post-fire seed recruitment*
Fire intolerant: *killed, no post-fire seed recruitment*

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AFAC is the peak representative body for fire, emergency services and land management agencies in the Australasia region. It was established in 1993 and has 26 full and 10 affiliate members.