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Fire mosaics can enhance macrofungal biodiversity

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Background

Fungi comprise a major component of the biodiversity of eucalypt forest ecosystems and within themselves are incredibly diverse in respect to species richness, abundance, and the roles they play in forest ecosystems. Fungi are essential for healthy ecosystem functioning and play important roles in;

- the decomposition of organic matter
- nutrient recycling and
- nutrient uptake into plants via mycorrhiza formation.

Fruit bodies of underground truffle-like species also form a significant part of the diet of many native Australian mammals.

In older trees and forests, decay fungi contribute to the development of suitable habitat for many native birds and animals.

Fire is an integral component of the Australian landscape and prescribed fire is also used in forest management, so it is important to know how fungi adapt and respond to fire.

A number of macrofungi only fruit after fire. *Neolentinus dactyloides* (above) can be prolific, producing up to 10 000 fruits per hectare from underground sclerotia.

Findings

Fire regimes and macrofungal diversity

Fungi fruit body production was monitored for five years on burnt and unburnt sites immediately following a wildfire in karri regrowth forest. Immediately after the fire, species diversity was lower on burnt sites but their abundance was much higher. Fungal community structure on burnt sites differed each year following the fire for at least five years. A small number of fungi respond immediately to fire but during a post-fire succession phase 64 species (19% of all the species recorded) were found to be associated with the forest having been burnt. Of these, 41 were recorded only in the first year following the fire.

A small number of species fruited for two to three consecutive years, but with decreasing abundance. Over time, these species were gradually replaced by species more commonly found on long unburnt sites.

The change in species composition initially occurred within those species fruiting on the soil, and then by species associated with the gradual build-up of leaf and twig litter and soil organic material. By comparing the number of species present at any one time or at a combination of times since fire showed that a mosaic of fire ages across a landscape (Fig. 1) has the potential to enhance fungal diversity within that landscape.

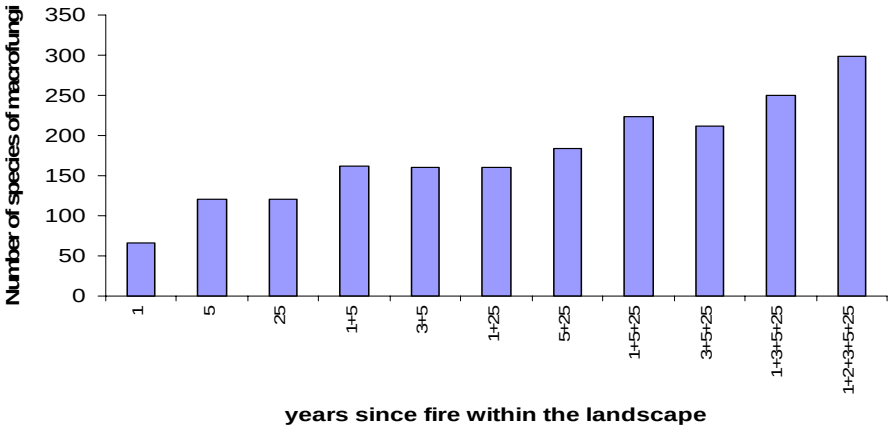

Figure 1. The potential number of macrofungal species that may colonise karri forest following either a single fire event across the landscape or multiple fire events within different patches of the landscape

Fire adapted fungi

Several Basidiomycetes including *Neolentinus dactyloides, Laccocephalum mylittae* and *L. tumulosus* respond immediately to the fire by developing fruit bodies from subterranean sclerotia, and in the autumn *Ramaria capitata,* and many other species adapted to utilise recently burnt sites, fruit.

In the autumn, a number of Ascomycetes, including *Peziza tennacella* and *Anthrocobia muelleri* also appear. They germinate from resting spores in the soil and proliferate in the alkaline soil conditions that result following fire. These and similar species only fruit in the first year following fire when the alkaline conditions give them a competitive advantage over other fungi.

Laccocephalum mylittae, removed from the ground, showing large fruits and sclerotium

Laccocephalum tumulosus (left) fruits can appear two days after fire and *Ramaria capitata* (right) fruits on recently burnt sites in the autumn

Management Implications

Fire causes changes in local fungal species diversity but spatial and temporal separation of fires of differing intensity and intervals (a mosaic) has the potential to increase species diversity by stimulating dormant fire-dependent species and by providing habitat for specialist species that would otherwise not fruit in or inhabit unburnt forest. At the sub-regional scale, the diversity of fungi is enhanced by a mosaic of vegetation at different post-fire phases (seral stages) and fires at different intensities. There is still much to learn about the ecology and taxonomic status of the majority of Australian macrofungi, but diversity of fire regimes will enhance diversity of fungi.

Peziza tenacella (left) and *Anthrocobia Muelleri* (right)

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