Changes in Vegetation Structure and Composition after Fire in two Australian Mediterranean-climate Plant Communities

Carl R Gosper[1,2], Suzanne M. Prober[2], Colin J. Yates[1] and Blair C. Parsons[2]
[1]Science Division, Dept of Environment and Conservation, Kensington WA, Australia; [2]CSIRO Sustainable Ecosystems, Floreat WA, Australia

Introduction

Native vegetation remnants in agricultural landscapes can be characterised by long intervals between fires. In fire-prone communities where fire is absent over long periods, the vegetation could:

(i) change little in composition or structure, being limited by non-fire factors
(ii) decline and senesce, as species exceed their longevity
(iii) continue to develop in stature, but change little in composition, or
(iv) be replaced by very different communities regulated by climate.

Understanding community changes related to time since fire is a critical component in identifying appropriate fire return intervals for biodiversity conservation, especially where fire regimes have diverged from historic bounds.

In agricultural regions of South-west Western Australia, remaining fragments of native vegetation experience fires very rarely. We assessed changes in vegetation structure and composition with time since fire in two widespread vegetation communities (mallee and mallee-heath) occurring in a mosaic across this fire-prone landscape (Fig. 1).

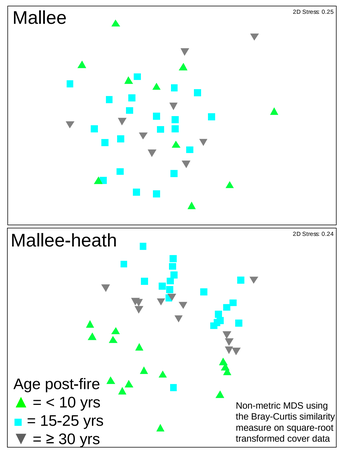
mallee 6 yrs post-fire | **mallee 39 yrs** | **mallee-heath 6 yrs** | **mallee-heath > 45yrs**

Figure 1: A younger and older example of each vegetation community. Mallees are multi-stemmed *Eucalyptus* spp. that resprout from underground lignotubers after disturbance. These can be the dominant component of the community (mallee) or occur as scattered emergents over a thick and diverse shrub layer (mallee-heath).

Methods

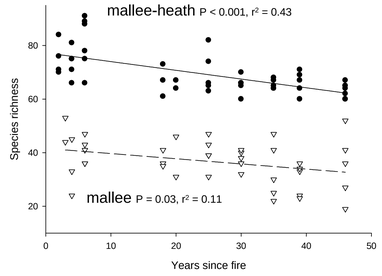
The habitats were stratified by age since the last fire, mapped using remote sensing. Where no fires were recorded, the minimum possible age of 45 yrs was used in analyses. In each age in each habitat, 5-8 10 x 10 m plots were sampled for floristic richness and cover, with vegetation intercepts and litter sampled every 2 m over 100 m transects to derive vegetation structure profiles.

Results



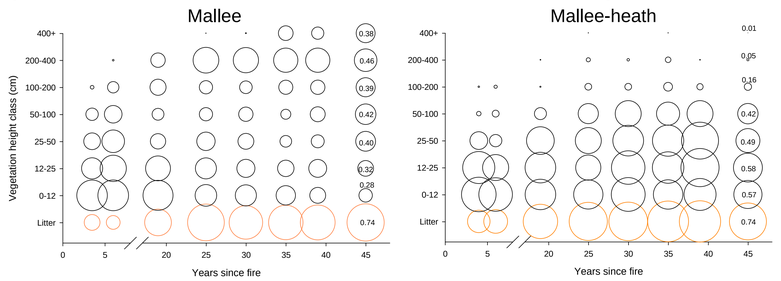
• Vegetation composition in mallee did not change consistently with age post-fire (left)

• Composition changed with time since fire in mallee-heath, with vegetation <10 years post-fire highly distinct from older vegetation



• Species richness declined with increasing time post-fire in both habitats (above)

• Mallee increased in stature and accumulated leaf litter through the entire span of ages sampled post-fire, whereas in mallee-heath these attributes slowly declined after about 30 years (below). Proportional cover is shown for bubbles for the > 45 yrs treatment for scale.



Conclusions and further work

Appropriate fire-return interval ranges for mallee-heath appear shorter than for mallee; differences possibly driven by plant functional trait composition. Mallee-heath, dominated by obligate seeders, declines in structure and changes in composition with greater age; changes not evident in sprouter-dominated mallee. Obligate seeder-dominated communities may be more vulnerable to changes associated with long inter-fire intervals; such as those now typical of many agricultural landscapes.

Further work aims to assess if fire-return intervals derived from community-level data are compatible with individual life-histories; *e.g.* time to reproduction & senescence in obligate seeders.

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Further information

contact: Carl Gosper
phone: ++ 61 8 9333 6442
email: carl.gosper@csiro.au
web: http://www.csiro.au/science/WAFireFragment.html

www.csiro.au