Fire, fragmentation, weeds and conservation of plant diversity in Wheatbelt Nature Reserves

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The widespread clearing of native vegetation has disrupted patterns of fire ignition and spread in South West Western Australia's (SWWA) highly fragmented agricultural landscapes. Recent analysis of satellite imagery shows that in wheatbelt remnants, fires have become less frequent compared to analogous continually vegetated landscapes and that occurrence declines as remnants become smaller [1].

What could this mean for biodiversity? We know that in fire-prone ecosystems, including SWWA, many plant species recruit predominately in the first years following fire and others may have limited longevity and senesce in long-unburnt vegetation. Atypically long fire intervals may be detrimental for these species, but empirical evidence is sparse [2]. Atypically long fire intervals may also affect vegetation composition and structure and reserve values [3]. Alternatively, some fauna species require habitat features that only develop in long-unburnt vegetation, and many plants require a minimum fire-free period to accumulate a large enough seed bank to replace themselves.

These apparently disparate responses to fire indicate that a single fire regime applied widely across space and time, as is the present trend for many wheatbelt reserves, may not support existing biodiversity, and that variability in the fire regime within ecologically defined bounds may be more desirable. Identifying the range of appropriate fire intervals is thus crucial for management of wheatbelt reserves. Yet this information is lacking for most species.

Fire management in wheatbelt nature reserves must also take into account the landscape context. Introduction of fire in some circumstances could reduce the resistance of native vegetation to invasion by weeds which are abundant in the surrounding agricultural landscape. This creates a conundrum for conservation managers. Should fire be excluded in wheatbelt nature reserves because of the potential threat of weeds, even if atypically long periods without fire are undesirable for biodiversity, and if fire is introduced, how long should it be before an area is burnt again?

To address these questions we measured changes to mallee and mallee-heath vegetation across a time since fire gradient in the Lake Magenta region. We predicted fire interval bounds from assessment of vital attributes for key species and vegetation structural and compositional change. In addition, we experimentally investigated the effect of fire and fragmentation on resistance of mallee vegetation to weed invasion.

Species diversity declined with time since fire in mallee-heath but not in mallee. Mallee-heath exhibited senescence when > ~45-55 years since fire, with increasing standing dead vegetation, bare ground, and declining vigour in sprouting *Eucalyptus* spp. Mallee showed no such evidence of senescence, and continued to increase in stature at the upper end of our time since fire gradient [4].

Serotinous non-sprouters were more effective for predicting fire interval bounds than serotinous sprouters. Consistent with this mallee-heath, dominated by non-sprouters, is more vulnerable to variation in fire interval than mallee, dominated by sprouters. We propose that fire-return intervals of ~35-80 yrs are acceptable in mallee-heath and ~30 years to beyond the range of vegetation ages sampled in mallee at c. 350mm mean annual rainfall [Gosper, Prober, Yates unpubl. data].

Landscape position had a greater impact than fire on weed invasion. Weeds grew well at reserve edges with paddocks independent of fire. In contrast, fire did not exacerbate weed growth in intact mallee where soil nutrients were low, and consequently could be used in reserve interiors. Managers should avoid burning reserve edges if resources are not available for weed control [5].

References

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