



## Fire regimes and forest tree health

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### Background

Regular fuel reduction burning is an important management strategy for mitigating the severity of wildfires in south-west Australian eucalypt forests. Firefighters recognize the benefits of this in aiding wildfire suppression and reducing wildfire damage but the long term effects on tree growth, health and stand productivity are not well understood. There is debate about the role of fire in tree and forest health with some claiming that frequent burning is detrimental while others claim that a long period of fire exclusion is detrimental. Trees are long-lived keystone species in forest ecosystems so are useful surrogates for assessing aspects of forest productivity and health.

Five treatments, including frequent (four times in 20 years) and infrequent (once in 20 years) low intensity burning, and 25 years of fire exclusion (1981-2006), were applied to small (4 ha) experimental plots in a low rainfall (~700 mm per annum) mixed jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) forest to investigate the effects of these treatments on tree stem diameter growth, stand basal area increment, crown condition and tree mortality as measures of forest productivity and health. These attributes were measured on more than 1,000 trees across five treatments in 1986 and again in 2006 to see whether there were differences that could be attributed to fire treatment.

### Findings

- Tree dominance condition explained most variation in growth rate. Dominant and co-dominant trees grew most and small, suppressed trees grew least. Marri grew slightly faster than jarrah.
- Fire treatment had a small effect on soil nutrients and tree growth. Nutrients were generally higher in the long unburnt plots but tree growth was generally lower compared with plots that had been burnt, although the difference between some burnt plots and the long unburnt plots was not significant.
- Long unburnt plots had a relatively high stocking of small trees and a denser woody understorey so the lower tree growth rates were probably due to increased competition for water.
- Tree mortality rate over 20 years was low (~8%) across all treatments with most deaths being small suppressed trees or very large, old trees.
- Apart from differences in growth rates, there was no evidence that any of the treatments (frequently burnt or long unburnt) resulted in a chronic decline in tree health.
- Over the 20 year study period, average annual rainfall was ~18% lower than the long term average, consistent with recent drying trends in the region.



Photo by Lachie McCaw

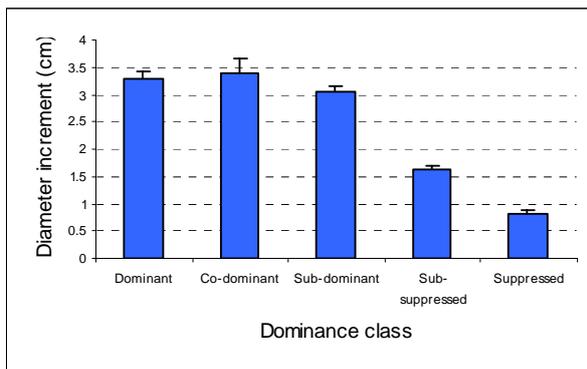


Figure 1: Mean tree stem diameter increment measured over 20 years by tree dominance condition in a low rainfall jarrah & marri forest.

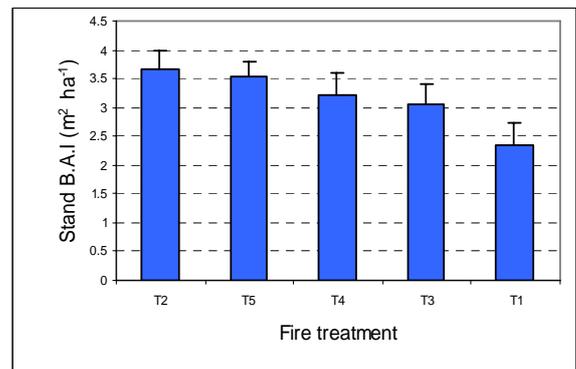


Figure 2: Stand basal area increment measured over 20 years by fire treatment: T1 = 1 autumn fire; T2 = 4 autumn fires; T3 = No fire; T4 = 2 spring fires; T5 = 1 spring fire.

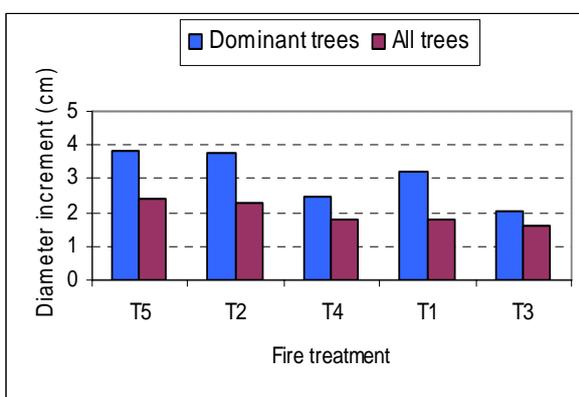


Figure 3: Mean tree stem diameter increment measured over 20 years by fire treatment for i) all trees and ii) dominant trees in a low rainfall jarrah and marri forest. See Fig. 2 above for fire treatments.

## Management Implications

- There was no evidence from this study that regular low intensity burning has adverse impacts on tree growth, productivity and health, but long periods of fire exclusion can result in reduced tree growth rates probably because of increased competition for water.
- As the climate in the region continues to dry, and water becomes more limiting, it will be necessary to regularly introduce low intensity fire into these ecosystems to maintain tree health and productivity.
- Long periods of fire exclusion over large areas, and associated build-up of flammable live and dead vegetation, will result in harmful wildfires.
- Aside from risk of wildfire damage and reduced tree growth rates, *occasional* long periods of fire exclusion are unlikely to have significant long term or chronic effects on tree health and may have other biodiversity and scientific benefits.



Photo by Lachie McCaw