Fire Regime Effects on the Structure and Floristic Composition of Jarrah Forests

Research Summary (March 1995)
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Background

Plants and animals in south-west forests have evolved a wide range of physical and behavioural traits which enable them to persist in this fire-prone environment. Today, rotational fuel reduction burning is crucial for minimising the impact of forest wildfires which threaten human life and property and which damage timber and conservation values. In some instances, prescribed fire is used to manage vegetation for habitat and to regenerate desirable species such as eucalypts and legumes.

CALM's fire management goal is to minimise the adverse impacts of wildfires and to maintain biodiversity. To this end, it is necessary to understand the long term ecological effects of fire regimes, whether they be prescribe burn regimes or "no burn" regimes. While forest ecosystems have evolved with fire, they have not necessarily evolved to cope with all possible fire regimes. Nationally and Internationally there is a substantial amount of scientific literature on the "one off" effects of a fire, but very little published data on the long term effects of applied fire regimes. Recognising the importance of long term fire ecology information, Dr Per Christensen established a series of fire ecology plots in Lindsay forest (west of Manjimup) in 1970. In 1984, Dr Neil Burrows expanded the study to two other sites - McCorkhill forest (west of Nannup) and Yackelup forest (east of Manjimup). This study is one of only three such studies in Australian forests. The other two, one in the ACT and the other in Victoria, were commenced later than 1970, but the future of these studies is in doubt.

Aims

The study aims to:

1. Investigate the long term effects of fire frequency and season on the structure and floristic composition of upland jarrah forests. Specifically, to measure over time:

- plant species richness
- species composition and understorey structure
- seedling regeneration and development
- post-fire regeneration strategies
- age to first flowering (and flowering calendar) and age to seed production after fire
- soil seed bank
- growth rate of jarrah and marri trees

2. To provide current fire ecology information to CALMFire operations to ensure that fire regimes are applied which meet protection and conservation objectives.

Methods

A series of 4 ha plots have been established at three locations (see above). Five fire regime treatments are applied to two plots at each location;

- No fire
- Burn as frequently as fuels will carry fire (2-4 years in autumn)
- Repeat burn in **spring** at the normal fuel reduction burn interval (5-8 years)
- Repeat burn in **autumn** at the normal fuel reduction burn interval (5-8 years)
- Repeated burning in spring at twice the normal fuel reduction burn interval (10-16 years).

Plots are assessed and measured prior to and annually after burning. Flowering inspections are made every 3-4 weeks. A detailed description of methodology is available from Dr Neil Burrows, CALM, SID Como.

Results to Date

An enormous amount of data have been gathered over the last 25 years. Collation and analysis of these data is ongoing. A fire response data base has been established and contains information about post-fire regeneration strategies and age to first flowering after fire for some 500 species. Some of the findings to emerge from this study include;

- 72% of species at the study sites re-sprout following fire and 28% depend on seed stored either in the soil or in the canopy for regeneration.
- Time to first flowering after fire depends on species, season of the fire, season of flowering and on rainfall, but is independent of regeneration strategy. In intermediate rainfall (1,000-1,200 mm/annum) jarrah forests, about 98% all recorded understorey species at the study sites flowered within 36 months of fire and 100% within 48 months of fire. In low rainfall forest (750 mm/annum), time to first flowering was 12-18 months longer for the same species.
- Time to first flowering depends on the season of fire and the season of flowering. e.g., at one site, *Baeckia camphorosmae* flowered in February, 6 months after a spring burn and at nearby site, plants first flowered in February, 11 months after an autumn burn. On the other hand, some plants such as *Burnettia nigricans* flowered in September, 12 months after a spring fire, but at an adjacent site, flowered in September 6 moths after an autumn fire.
- The season of fire does not appear to significantly affect the floristic composition of seedling regeneration, but dry soil fires (summer/autumn) result in higher numbers of initial seedlings and higher survival rates in the first year. Hard seeded species (e.g., legumes) are favoured by "dry soil" fires. There is very little or no germination of woody shrubs in the absence of fire.
- Species richness is greatest in the first 4 years after fire, then steadily declines.
- At this stage, there is no significant difference in species composition between plots burnt in spring and plots burnt in autumn every 5-8 years. However, some obligate seed species (e.g., *Crowea angustifolium* var *dentata*, *Bossiaea laidlawiana)* appear to be gradually declining in numbers on sites burnt very frequently (2-3 years) over 25 years.
- No species have gone extinct as a result of any of the above fire regimes, although some species are not present in plant form on the long unburnt plots (seeds still in soil though).
- There is no significant difference in tree growth rate due to the treatments

This study needs to be expanded into other forest habitat types, particularly seasonally wet habitats such as creeks, swamps and around granite outcrops where fire vulnerable flora are most likely to occur.