SPRING AND AUTUMN BURNING IN SOUTH-WEST FORESTS

A DISCUSSION PAPER FOR THE NPNCA

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1. INTRODUCTION

This is the third in a series of discussion papers on fire I have presented to the Authority.

The first dealt with ecological impacts, and the second with the decision-making processes involved in fire management. This deals with the issue of spring and autumn burning.

Burning is carried out by CALM in South-West forests basically as a wildfire mitigation measure. However, our policy also commits us to ensuring management practices do not degrade ecosystems. It is postulated in some quarters that if burning must be done, autumn burning is less ecologically damaging than spring burning.

The following summarises scientific knowledge gathered over 30 years, on the ecological effects of low intensity spring and autumn fires prescribed to reduce fuel quantities in forest areas of the South-West.

While fire ecology is complex and our knowledge far from complete, it is very evident that West Australian native forests are resilient to a range of fire regimes. The visual effects of any low intensity fire are obvious soon after the event, but within two or three years are difficult to discern. There have been no reported losses of species or of community types as a result of low intensity spring or autumn fire. The most devastating fire regime that could apply to South-West forests would be one of frequent large, uncontrolled and intense wildfires. CALM's prescribed burning program is implemented to help ensure this does not happen.

Information summarised in this paper is derived from:

Christensen, P.E.S. and Abbott, I. (1989). Impact of fire in the eucalypt forest ecosystem of southern Western Australia: a critical review. Australian Forestry, 5(2), 103-121.

Burrows, N.D. (1990). Seasoned with fire. Landscope 5, 28-34.

2. SOILS AND LITTER

- Hatch (1969) found no significant difference in pH, macro and micro nutrients between jarrah forest burnt in spring every three years for 15-25 years and forest long unburnt (25 years). Abbott et al (1984) reported similar findings.

- Soil surface temperatures during spring fires are considerably lower than those measured in autumn (Shea et al 1979, Burrows 1987) but in both cases, is highly variable (Christensen and Kimber 1975). O'Connell and Menage (1983) found that the fire history of three jarrah forest sites had an insignificant effect on litter decomposition.
- Fuels are considerably drier during autumn so autumn fires consume a higher proportion of the forest litter (leaves, twigs and logs) than spring fires (Burrows 1987). Spring fires tend to leave unburnt patches, autumn fires do not.

Although there is no research to support the fact, observation suggests that soil erosion is more likely following autumn than spring burns, since spring burnt areas have more advanced regeneration at the time of the onset of winter rains.

3. MICRO-ORGANISMS

There is little published work on this group and nothing published which compares spring and autumn fires. Malajczuk and Hingston (1981) and Malajczuk et al (1987) have shown that numbers of ectomycorrhizal root types in jarrah forest were highest in a stand unburnt for 45 years and lowest in a stand burnt one year previously.

4. VASCULAR PLANTS

Low intensity autumn fires cause considerably more physical crown and bole damage to trees and shrubs than low intensity spring fires (Burrows 1987). During autumn fires, heavy fuels such as logs and limbs are dry and ignite, causing damage to nearby trees. Hollow-butt and fire-injured trees often burn down in autumn fires, but persist in spring fires. Tree crowns damaged (scorched) by spring fire recover more quickly than those damaged by autumn fire (Kimber 1978, Peet and McCormick 1971, Burrows 1988 unpubl.).

Low intensity fires (spring or autumn) have no long-term effects on the survival or growth of jarrah (Peet and McCormick 1971, Abbott and Loneragan 1983).

No changes in the number of understorey species were recorded by Christensen and Kimber (1975) and by Abbott (1984) following a series of low intensity fires in spring and autumn. This is supported by Bell and Koch (1980).

A study of the long-term effects of frequent (spring and autumn) fire on plants in high rainfall forest near Manjimup has shown no significant change in species numbers. Only four species showed significant changes in numbers; three species increased under an autumn burn regime and one species increased under a spring burn regime (Christensen unpubl.).

Legumes which rely on soil stored seed for regeneration following fire increase in numbers following an autumn fire under dry soils. Repeated spring burning under moist conditions can reduce the number of above-ground plants, although the soil store of seed from which plants can regenerate is not affected (Shea et al 1979, Skinner 1984, Christensen and Kimber 1975, Christensen and Skinner 1978). Frequent (two to three years) repeated autumn burning would diminish above-ground plants and the store of seed in the soil.

A study of seedling regeneration of understorey species following spring and autumn fires in jarrah forests near Nannup revealed no significant difference in number of species, but significant difference in numbers of individuals. One year after fire, numbers of individual seedlings were higher following an autumn burn (Burrows unpubl.).

Species which require ashbed for seed regeneration, such as *Eucalyptus wandoo*, are favoured by autumn fires under dry conditions for their regeneration.

Both spring and autumn fires disrupt flowering. About 70% of plants flower in spring. Almost all forest plants (understorey) flower within three years of fire. Most forest areas are burnt on a cycle of five to seven years or more, thus allowing adequate time for plants to flower and seed.

Infrequent autumn fires are necessary to regenerate thicket forming species which rely on capsule stored seed (eg, *Melaleuca viminea*). These thickets often form important animal habitat (Christensen 1980).

5. INVERTEBRATES

Research has shown no consistent pattern. Some taxonomic groups are temporarily favoured by spring burns, some by autumn and some by no fire at all. Further research is needed on the long-term effects of various fire regimes on invertebrate taxa (Christensen and Abbott 1989). The recent outbreaks of jarrah leaf miner are being examined to determine whether prescribed burning is implicated (Abbott pers. comm.), but to date there is no indication that spring burning is the cause.

6. BIRDS

Kimber (1974) found an immediate, temporary reduction in the bird populations after a spring fire followed two years later by an increase. Similar responses were observed by Christensen et al (1986), Tingay and Tingay (1984) and Wooller and Brooker (1980) for both spring and autumn fires. All workers report that the level of disturbance to the bird population is proportional to the level of vegetation scorched or damaged by fire and the rate of vegetation recovery. Therefore, low intensity spring burns only affected birds utilising the ground and low shrubs, whereas autumn burns which scorched the entire forest profile, affected most bird species.

There is probably some mortality of nestlings following spring fires, especially of those species which nest near the ground. However, 70% of breeding is completed by the time spring fires are set. Also, parent birds are highly mobile, and the lengthy breeding season in the South-West allows disturbed birds to nest elsewhere. More than 80% of the forest is unburnt in any year.

7. MAMMALS

Mammals are affected according to the impact of fire on their food and shelter. Impact is greatest when fires are large, intense and frequent. Spring fires cause less damage to live and dead vegetation (including hollow logs and trees) than do summer or autumn fires. Spring fires are patchy, with moist gullies and areas carrying light fuels remaining unburnt. Autumn fires burn the entire forest. In the presence of foxes, some animals, such as the Tammar wallaby, depend on infrequent (20-30 years) summer or autumn fire to regenerate the thickets they depend upon for cover. Some animals, such as the mardo, favour long unburnt areas (Christensen and Abbott 1989). Others, such as the chuditch appear to be favoured by areas burnt in the spring (Morris pers. comm.)

8. WEED INVASION

Invasion of burnt areas by exotic weed species appears to be more prevalent after autumn than after spring burns. Weed invasion is most likely where forests adjoin farm paddocks.

9. OPERATIONAL ASPECTS

Spring burning has major operational and cost advantages over autumn burning. In spring, fuels are moist, weather is more stable, so fires are safer and easier to implement. There are more days in spring when prescribed fires can safely be set. Control and mop-up costs are substantially less in spring and the risk of fires escaping are also less than in autumn. In autumn, many trees burn down, often across roads, farmers fences or power lines.

CALM attempts to maximise autumn burning and at present as much as a third of the program is in autumn. In the longer term a mix of seasons will be used for the same area.

10. CONCLUSION

Fire is a complex environmental factor which continues to be studied. Experience and knowledge to date reveal that there are advantages and disadvantages associated with both spring and autumn burning. The most appropriate regime is one which maximises the benefits and minimises the adverse effects of each. Therefore, a variety of spring and autumn burns, together with extended periods without fire, is the regime which best meets both protection and environmental needs of the forest, and is the regime CALM is steadily implementing.

Summary

Prescribed burning for fuel reduction in south west forests: Spring vs Autumn Burning

Definitions:

<u>Autumn:</u> The beginning of the rainy season which establishes rapidly and is usually characterised by conditions experienced in March - May. Wetting of a dry soil, vegetation and fuel profile.

<u>Spring:</u> The end of the rainy season which tapers off into a dry summer period and is usually characterised by conditions experienced in September - November. Drying of a wet soil, vegetation and fuel profile.

Spring Burning	Autumn Burning
Operational Considerations	
• More days available to safely execute fuel reduction burns, therefore: • better able to achieve protection program.	• Fewer days available
• Fire weather and behaviour more predictable and stable, therefore: • facilitates good planning and efficient resource allocation. • low risk of escapes. • lower intensities ∴ easier, cheaper control. • low ignition rate of logs etc. so reduced pre-suppression and mop-up costs.	• Fire weather and behaviour less predictable and more unstable, therefore: • burning opportunistic, poorer allocation of resources. • high risk of escapes. • higher fire intensities so increased costs. • higher ignition rate of logs and trees, so increased pre-suppression and mop-up costs.
• Low impact on commercial and aesthetic values.	• High impact on commercial and aesthetic values.
• Risk of re-ignition over following summer.	• No risk of re-ignition over following summer.
Environmental Considerations	
• Less physical damage to vegetation/habitat.	• More physical damage (higher levels of scorch and defoliation).
• Incomplete removal of litter and vegetation.	• complete removal of fuel, especially leaf litter, scrub, logs and some trees.
• Burns patchy, with pockets of unburnt vegetation especially along streams ∴ greater habitat diversity, refuge areas.	• Burns complete, entire area including streams burnt ∴ reduced habital diversity, no refuge sites.
• High retention of hollow logs , dead and old trees ∴ available habitat.	• High consumption of logs, dead trees and old trees often burnt down.
• Lower losses of volatile nutrients (function of fuel consumption).	• Higher losses of volatile nutrients especially from green foliage burnt.
• Disruption to flowering at peak flowering period.	• Flowering not disrupted during peak flowering period.
• Gradual depletion of soil stored seed (but not eliminated).	• Superior germination of soil stored seed.
• Lower germination and seedling survival rate.	• High seed germination and survival rate.
• Change in abundance of hard seeders (acacias, legumes, obligate seed species), but these are not eliminated.	• Increased abundance of hard seeders and obligate seed species.
• No effect on resprouting vegetation. These are often favoured.	• Resprouting vegetation can be reduced in density, but not eliminated.
• Low impact on fauna (mammals, birds).	• High adverse short term impact on fauna.
• Short term disruption to birds nesting nand foraging in low shrubs.	• Short term disruption to birds using shrubs and trees for food and shelter.
• Lower emmission of green house gasses, esp CO_2.	• High emmission of green house gasses due to higher levels of fuel consumption.