



The Use of Fire in Small Remnants

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Location: south-west Western Australia

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INTRODUCTION

Many landowners see a need to “clean up” their bushland by putting a fire through it to reduce the fire hazard and hopefully cause regeneration. However, in these altered landscapes the result may not be what we expect.

With flammable vegetation, dry summers and sources of ignition, it is not surprising that fires are an important component of ecosystems in south-west Australia. Over millions of years, native plants and animals have evolved various strategies to cope and persist in this fire-prone environment.

Today, however, trying to manage fire in small isolated remnants of native vegetation, while at the same time trying to conserve that bushland and all its native flora and fauna, presents an enormous challenge.

In this Wildlife Note we explore some of the issues and consequences of using fire in small remnants and provide a checklist to help you in your decision-making.

WHY BURN BUSHLAND?

Planned fire may be prescribed to remove a perceived fire hazard or to promote regeneration (‘ecological renewal’).

Removing a perceived fire hazard

In areas where there is danger to life and property from wildfire, for example adjoining houses, fuel reduction for safety is a vital consideration. For example, burning sections during the cooler months of the year when the fire can be more easily contained and may go out overnight could be a suitable regime.

Nevertheless, conservation of the values of the natural community should be included in the fire management plans and compatible strategies considered, such as burning

If we wish to use fire for any reason at all, but especially for nature conservation, we need to be aware that the bush community's response to that fire may be very different to the response which would have occurred prior to European settlement.

sections in rotation, and having permanent low fuel zones adjacent to the infrastructure being protected.

Promoting regeneration

Nothing lives for ever. All living things must reproduce a new generation; in vegetation communities we call this ‘regeneration’. Without regenerative processes, a gradual decline of mature plants will eliminate them from an area, leaving no replacement seedlings. Work done in almost all south-west Australian vegetation communities shows that a ‘disturbance factor’ induces regeneration. One such disturbance factor could be fire.

There are two ways in which trees and shrubs respond to fire:

- the whole plant is killed and a new generation grows from seed (reseeders) or
- only parts of the plant are killed, and new growth arises from stem or rootstock (resprouters).

On extremely infertile and difficult soils, the most important role of fire may be in recycling nutrients. Without rapid decomposition by fungi or termites, or extensive leaf herbivory where the fauna recycle nutrients in their wastes, the nutrients remain held in living and dead plant material, so there is little left in the soil to fuel new growth. Both reseed and resprouter plants take advantage of this release of nutrients to grow rapidly after fire.



Fig. 1: Very soon after a fire, Kingias can be seen resprouting. No seedlings have yet germinated.
Photo: N. Burrows.

EFFECTS OF FIRE ON NATURAL COMMUNITIES

The effect of fire on natural communities depends on many factors. Some of the most important are the frequency between fires, the season, its intensity, climatic events before and after the fire, the patchiness of the fire, the condition, size and connectivity of the bushland and the fauna present.



Fig. 2: Fire can change the composition of a plant community. The wandoo woodland in Wyalkatchem Nature Reserve had not burnt for over 60 years, and the ground layer consisted of perennials, grass-like plants and everlastings, as can be seen in the front of the photo. A very hot fire in the summer of 1999 through part of the reserve caused a massive germination of shrubs, which dominate the regeneration area. This change in community structure can clearly be seen in the centre of the photograph. Photo: P. Hussey

EFFECT OF FIRE ON NATIVE PLANT COMMUNITIES

Fire frequency



Fig. 3: Fire frequencies can affect vegetation communities. A fire in the 1960s led to the regeneration of sheoaks throughout this area. However, a fire four years later, which was stopped at the roadway, killed the regenerating sheoaks which had not been able to set seed, leaving room for powderbark wandoos, from a mature stand at the top of the ridge that had not been affected by the fire, to colonise the area. Photo: A. Baxter.

For many plants to persist after a fire, they must be able to reach maturity and set seed (the reseeder). Since plants

vary in the length of time they take to do this, it follows that the frequency of the fires will have a distinct effect on the composition of the vegetation community. For example, in woodlands, the understorey follows a cyclical pattern of growth / decline / renewal, often on a shorter timescale than the tree species.

As a general rule of thumb fire intervals should be at least twice as long as it takes the slowest maturing plant to flower and produce seed, and before older plants are no longer able to reproduce.

Fire season

The time of the year in which the fire occurs will make a considerable difference. There are three possible fire seasons: midsummer/autumn, winter, spring/early summer.

Midsummer / early autumn fires

These fires are usually intense and difficult to control, they will consume most of the above ground material and most likely burn down mature trees. In doing so they remove herbivores (eg sap sucking insects) and parasite (eg mistletoe or dodder) from the population. Heat penetration of the dry soil is maximised, which will break the dormancy for some buried seeds such as wattles and peas. The chemicals produced by the fire will also encourage germination (see Fig. 2).

If the season is kind, then seeds which are stimulated to germinate by these fires will be supported by winter rain and plants that resprout from lignotubers will have water available to manufacture new food, using the released mineral nutrients to fuel the new growth. In adverse seasons the soil surface is exposed to potential wind and water erosion both from the bushland and into it from surrounding paddocks.

Winter fires

These low intensity fires will leave patches of unburnt vegetation. However, the new seed crop within the burnt patches may be destroyed before maturity, and plants such as everlastings and orchids, which have not evolved adaptations to survive fire during their growing season, will be damaged. Also, the fire may not trigger germination of the native seed stored in the soil, but could encourage the growth of grass weeds if they are present in the system.



Fig. 4: A winter burn in weedy bushland encouraged the growth of exotic grasses. Photo: A. Baxter

Spring/early summer

These fires are low to moderately intense, depending on the air temperature and humidity, the amount and moisture content of the fuel and soil, and the wind strength. Some of the tree crowns will be scorched and some patches may be left unburnt. They will destroy that year's seed crop for many plants. Seeds on the surface will be stimulated to germinate, but the fire may not be hot enough to crack the dormancy of buried seed. They also encourage the growth of already established perennial grass weeds such as veldt grass. Germinating plants may not survive until the autumn break of the season. However plants that resprout will grow well over summer and out-compete seeders.

We recommend autumn burning for most regeneration burns, especially where regrowth of wattle and pea thickets is important. If, however, the potential intensity of the fire is a management concern, then the fire can be timed for after the first winter rains, which will reduce the fire intensity, but be prior to the active plant growth.

Climatic events

The impact of unpredictable climatic events is enormous. Heavy rain after a fire can remove the ash, its mineral nutrients and germinating seed from the site. Weed seeds and artificial fertilisers can also be blown or washed in from surrounding paddocks. Regenerating plants can be affected by prolonged dry periods or frost, especially on granites and sandy soils.

Patchiness of fire

Burning small patches at a time creates an uneven aged bushland which has many advantages for both plants and animals. Seeds from unburnt patches can reinvade the burnt areas and recently burnt patches can be used as a break for the next planned fire. This more diverse environment generally makes it more resilient to fire – a case of not putting all your eggs in one basket!

A 'safe' plan is to use only small patches of fire within a remnant, to create a mosaic of vegetation of different ages which maximises the resources for fauna and makes the remnant more resilient to fire.

EFFECT OF FIRE ON NATIVE FAUNA

Fire may kill some animals, whilst those that survive by sheltering in burrows may die of starvation or predation soon afterwards. If the remnant is connected to or near other bushland, then recolonisation can occur. If the whole block is burnt and migration is not possible, the animal may go locally extinct. Hence, burning small patches within a remnant to create a mosaic of different ages will allow animals to persist in an area.

The fire frequency that favours particular animals varies considerably from animal to animal. Some animals require long unburnt vegetation, for example, mallee fowl which require leaf litter for nest building are more common in mallee and broombush which has not been burnt for more than 40 years. A study in the Fitzgerald River National Park found that capture rates of honey possums were low

for four to five years after a fire and peaked at 30 years - this pattern follows the amount of cover available.

Winter fires will disrupt the breeding cycle of some animals and spring fires may kill some young animals, for example nesting birds.

Hollows are also very important. Ironically, fire consumes hollows in trees and logs on the ground, and it creates them. Many animals including bats and 18% of Australian birds have been shown to use tree hollows for nesting or cover; numbats and some lizards need hollow logs on the ground. For these animals, the effects of fire can improve or destroy the habitat that they require. To save hollows, you may need to remove any debris that has accumulated against the trunks of favoured trees and around logs on the ground.

EFFECT OF FIRE ON SMALL REMNANTS

Disturbance is a key factor in opening up the bush to change, and fire is a major disturbance.

Small bush remnants are very often isolated and subject to far more disturbing factors than they would have suffered prior to European settlement, putting the natural communities under great stress. They are less resilient and often degrade to a simpler community.

Generally, the greater the 'edge-to-area ratio', the more effect the stress factors will have and the more quickly the bush is likely to degrade. Linear strips such as roadsides are the classic example.

Weeds

Having opened up the bushland it is very easy for weed invasion to occur at the edges and quickly cover the whole patch. Many introduced plants – especially pasture and crop weeds – enjoy disturbance and will displace native disturbance opportunists such as everlasting daisies. Similarly perennial/woody weeds, such as tagasaste, will displace shrub species.

This leads to a change in community structure, which will provide different resources for fauna and in turn respond differently to fire.

Many weeds will change the fire's characteristics including its readiness to burn, how easily it will spread, and the temperature at ground level. Bunch grasses which evolved in southern Africa under a regime of annual burning (eg African love grass, tambookie, veldt grass), cause a massive change in the fire response when they come to dominate the ground layer of Western Australian communities. Veldt grass in banksia woodland is a good example of this bad problem.

You can use the period immediately after a fire, (whether the fire was planned or unplanned) to undertake control of some difficult perennial weeds such as African love grass or bridal creeper. They will respond to the fire with rapid growth from underground reserves, often before native plants have started to resprout or seeds to germinate. Thus they can be hit immediately with a knock-down herbicide, without danger of damaging desirable native plant regeneration. In addition, because the fire opens up

an area, it is easier to reach dense infestations, and to locate all sites for control work.

WHEN NEVER TO USE FIRE FOR REGENERATION

When the soil is buried by wind-deposited material

Sometimes the natural soil surface (including rootstocks) is covered by a non-wetting layer of soil (usually sand), straw, weed seeds and sheep droppings blown in from an adjoining paddock. This prevents heat cracking the buried seeds and the chemicals leached from combustion products from reaching seeds and so stimulating germination. Buried rootstocks will often not regrow. Such a site, very common along sandplain roadsides, is gone for ever.

During or immediately after a severe drought

In this case, the plants are already under extreme stress and being forced to regenerate could totally exhaust those that resprout from lignotubers and so lead to death. Similarly there may not have been good seed set in previous years. Give the bush a couple of years of average conditions in which to recover.

When a locust plague is predicted for the following year!

SOME MANAGEMENT PRINCIPLES

The correct use of fire can stimulate regeneration and regrowth in bushland, thus creating habitats for fauna.

There is no need to "tidy up" the bush; some standing dead vegetation is beneficial in your bushland, providing habitat for many animals. As a general rule, if more than fifty percent of the understorey shrubs are dying or dead, the area is ready for a regeneration fire.

Successful regeneration of reseed species is dependent

A cautionary tale - fires can be deceptive. A landholder reported:

"On a cool May morning I lit a small fire on a 2.5ha block of bush. It burnt slowly and gradually went out. Thinking this was a very good result, I went off to town for about three hours. On returning, I found a blaze that required neighbours and the volunteer fire brigade to attend."

on the availability of viable seed. Before burning an area of bushland, monitor the plants over the previous year to ensure that they have produced viable seed. Not all plants produce seed each year and this can affect the success of the regeneration. Other species may be able to regenerate from soil seed stores. Knowing your plants can help to plan a successful regeneration burn.

If all the shrubs are gone (eg after a long period of grazing or a long period without fire) some of the small seeds which could have been stored in the soil may be absent. You may

need to introduce more seed into the system, preferably from a similar site nearby. The best way to test this out is to set up a small trial area and monitor regeneration.

Similarly, if there is not sufficient woody debris on the bushland floor, it may not carry a fire of sufficient intensity to promote regeneration of seeds such as wattles or peas, which are stored in the soil seed bank for many years.

A mosaic of small patch burns will create a greater variety of habitats for animals and allow them to recolonise an area as it regenerates. It will also prevent major losses to the bushland's resource if detrimental climatic events occur after the fire. If this is not possible, a combination of 'heap burns' (bonfires) and direct seeding is recommended, on-going in different locations every year (see Fig 5).

Aboriginal people used to burn bushland to attract grazing animals. Heavy grazing pressure can undo all the good the regeneration burn has done! Therefore after using fire, check immediately to ensure that fences are intact and stock excluded. Rabbits need to be controlled and in some instances (and under a specified management plan) kangaroos culled.

Follow the prohibited and restricted burning times for your area. Remember, nothing said here can override a landholder's responsibility under the Bushfires Act and the Fire and Emergency Services Act. You are obliged to keep the fire under control and on your property. If it escapes you could be answerable for the damage caused.

Essentially, to keep your bushland healthy, planned fire is a management tool you may need to consider. But before you get out the matches, work through the attached checklist.

Whatever strategy is chosen, there will inevitably be gains and losses. Though we may plan as well as we can, the result of fire in your small remnant is in the lap of the gods!

'Hot' fires severely damage existing trees and can affect fauna. In relatively small remnants they are neither practical nor desirable. Piling dead material into low heaps and then burning them can create the same effect in a manageable way.



Fig 5: Brushing on ashbed trial, Muresk College of Agriculture. A 'tidy-up' bonfire was burnt on this site, then a week or so later, a seed-bearing branch from a nearby York gum was placed onto the ashbed. Three years later, this vigorous young tree is the result.

Photo: P. Hussey

Small Remnant Fire Management Checklist

1. *What do you hope to achieve by burning this bushland?*

- protection of human property from wildfire?
 promote regeneration of the vegetation community?
 or both?

The answer will dictate what type of fire you use.

2. *Does the whole remnant need to be burnt, or will a smaller burn satisfy the objective?*

- whole remnant
 smaller burn

A smaller burn minimises the possibility of irreversible ecological failures (eg should a severe drought occur in the seasons following the fire).

3. *Can small areas be burnt over several years to create a mosaic of vegetation of differing ages?*

- yes
 no

Vegetation at different stages of growth is ideal for the maintenance of resources for fauna.

4. *Is the remnant connected to other remnants by a suitable bush corridor?*

- yes
 no

This will influence how fauna can get away from the fire, or return to regenerating areas.

5. *If it is not connected, can a bush corridor be planted prior to any burn being undertaken?*

- yes
 no

Consider the needs of, for example, small birds, and design the corridor to facilitate their movement.

6. *Are the major plant species setting seed?*

- yes
 no

If not, regeneration will be impeded. Allow twice the length of time to first seeding of the slowest growing plants for an appropriate interval between fires.

7. *Are there weeds in the bush?*

- yes
 no

Control prior to the burn.

8. *Is there a nearby source of weed seed?*

- yes
 no

Leave a buffer between the source of the seed and the area to be burnt.

9. *Is spread of *Phytophthora* or other plant diseases possible?*

- yes
 no

Take appropriate precautions.

10. *Is Declared Rare Flora, Threatened Fauna or a Threatened Ecological Community present?*

- yes
 no

Consult CALM.

11. *Are there special flora/fauna habitat features present, eg a wetland, or hollows in logs or trees?*

- yes
 no

They may need to be specially protected.

FURTHER READING

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Fire Management Plan

Name of bushland:

OBJECTIVES

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ISSUES

Problem	Solutions

PLAN OF ACTION

What	Who	When

MONITORING AND EVALUATION

What	Date	Results