# **HOT**SPOTS FIRE PROJECT

## MANAGING FIRE ON YOUR PROPERTY:
## A booklet for landholders in the Lachlan

Nature Conservation Council of NSW

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# WHAT DOES THIS BOOKLET COVER?



Prescribed burn. © P. Roffe, NSW Rural Fire Service.

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# 1. INTRODUCTION TO THE LACHLAN

The Lachlan region is a diverse area of NSW composed of three distinct landscapes; the tablelands, slopes, and the plains. Due to its high productivity, the Lachlan is the most agriculturally developed region in NSW and is a central component of the wheat belt that extends from Victoria through the western slopes and plains of NSW to southern QLD.

The remaining tracts of native vegetation provide important habitat and contain a rich diversity of native flora and fauna, with several species endemic to the Lachlan. Some of these intact areas of vegetation include important corridors linking the World Heritage listed Blue Mountains National Park and the Abercrombie River National Park as well as other conservation reserves.

Prescribed burn © M. Graham, Hotspots Fire Project.

The substantial difference in rainfall across the region from east to west creates high diversity in vegetation. Ranging from Grassy Wet Sclerophyll Forests on the high rainfall tablelands in the upper parts of the catchment, to mallee and Sandplain Semi-Arid Woodlands and Inland Floodplain Shrublands in the mid-reaches, and Arid Shrublands dominated by mulga (*Acacia aneura*) and chenopods in the far west of the catchment.

The Lachlan is mostly contained within the Wiradjuri Nation, but shares its land with many other Aboriginal nations including Dharug, Ngunawal, Gundungurra, Wongaibon, Barindji, Yitha Yitha, Madi Madi and Nari Nari, whose members have lived in the region for thousands of years. Wiradjuri country is the largest in NSW, stretching from the eastern boundary of the Great Dividing Range, to Gilgandra and Albury in the north and south, and the line between Hay and Nyngan approximates the western boundary.

Aboriginal people have a strong connection with the Lachlan catchment through the rivers, creeks and abundant wetlands. As traditionally important routes, the rivers provide water, food and shelter. There are many heritage sites along the rivers including scarred and carved trees, camp and burial sites and seasonal wetlands within the catchment that are culturally important.

# 2. LIVING WITH FIRE

## Fire in the Lachlan

Fire is part of life on the land in the Lachlan region of New South Wales. Some landholders use fire as a land management tool. Others are concerned about the impact of wildfire on their properties, particularly during drought conditions.

Developed specifically for the Lachlan, this booklet provides an introduction on how fire can be managed for healthy, productive landscapes and also presents a framework for incorporating fire into property management planning activities.

Knowledge about the nature of fire and its effects on the landscape will help provide greater confidence in managing fire, both for the protection of life and property, and as a land management tool.

For some landholders, this information will stimulate a new understanding of the role of fire in shaping and sustaining local landscapes and the plant and animal species they contain. For those already in the know, this information will add to existing knowledge and hopefully prompt some important new insights into fire management.

## Fire and the Australian continent

Triggered by lightning strikes and traditionally used by Aboriginal Australians, fire has shaped the character of Australian landscapes. Many plant and animal species have evolved strategies to deal with fire, and some species have developed ways to take advantage of the opportunities it creates.

Aboriginal Australians actively used fire as a management tool. In some parts of the landscape, we know Aboriginal fire management practices involved smaller and more frequent fires than would have occurred naturally by lightning strike.

There is much debate though, about the nature and extent of Aboriginal burning across the Australian continent.

Even if we knew the whole story about Aboriginal fire management, this knowledge may not give us all the answers we need for the future conservation of native plant and animal communities.

The changes to our landscapes since European colonisation have been profound. In particular we are faced with fragmented vegetation, the spread of introduced species, and changes in the abundance of native plants and animals.

We need to draw on both old and new knowledge about fire in order to protect our bush and so manage for healthy productive landscapes. Much of our new knowledge and our current understanding of how fire might best be managed comes from looking at the way plant and animal species in different communities respond to fire. This topic is the focus of the next section.

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"For me, fire is part of a bigger narrative about learning to live like an Australian, as if we intend to stay on this continent forever, for good."[1]

[1] Andrew Campbell - farmer, first national landcare facilitator, and Executive Director of Land and Water Australia speaking at the Australia Burning forum held just after the 2003 fires in Canberra. Quote taken from: Campbell, A. (2003) "Learning to live with fire" pp 243-247 in Cary, G., Lindenmayer, D., and Dovers, S. *Australia Burning: Fire Ecology, Policy and Management Issues*, CSIRO Publishing, Collingwood, Victoria.

# 3. MANAGING FIRE FOR BIODIVERSITY CONSERVATION

## Science based management

Scientists and land managers have long recognised the relationship between biodiversity (the variety of different plant and animal species) and healthy land systems.

It wasn't until the late 70's that scientists have gained a much better understanding of the significant role that fire plays in shaping these land systems and the biodiversity within them. Fire ecology is now an important area of scientific study.

For landholders, the most useful information to come out of this research relates to how different aspects of fire affect vegetation and wildlife, and how different plant and animal species respond to fire.

## Plant responses to fire

Many Australian plant species have developed reproductive strategies in close association with fire. Since fire is such a powerful disturbance force, changes in fire patterns can quickly influence which species (and reproductive strategies) will persist in an area and which won't.

Different plant species respond differently to fire: some do not tolerate fire; some tolerate it but don't rely on it for reproduction; and in many Australian plant species, one or more aspect of reproduction – flowering, seed release or germination – occur exclusively, or most abundantly, in the months or years after a fire.

Scientists describe two broad post-fire regeneration strategies that occur in areas with a long history of fire which are of particular relevance to fire managers: *obligate seeding* and *resprouting*.

Obligate seeder Pink Five-Corners (*Styphelia triflora*).
© P. Watson, Hotspots Fire Project.

### Obligate seeders

When *obligate seeder* species are exposed to a fire, all, or almost all, plants are killed. These species can persist, however, by regenerating from seed (they're *obliged* to regenerate from seed if they are to survive in an area). This seed may be stored in the soil, on the plant (e.g. in cones), or brought in from nearby unburnt patches of vegetation by wind, water, birds or other animals.

Land managers implementing fire management strategies need to consider the frequency of burning if they wish to ensure the survival of these obligate seeder species.

Fire frequency needs to take account of the life span of obligate seeders; including the amount of time it takes for these plants to experience their first flowering and to produce seeds. If the interval between two fires is too short, the second fire may wipe out an entire generation of young obligate seeders before they have reached reproductive maturity (i.e. before they have started producing seed).

On the other hand, if fire is excluded from an area for too long, a whole generation of obligate seeders may move beyond reproductive age and die off before a fire has had a chance to trigger germination. While some seeds can survive in the soil for very long periods, seeds of some species are relatively short lived.

Obligate seeders reliant on seed dispersal from other areas may also be threatened by extensive fires. This is because no or few seed supply areas escape being burnt and the likelihood of animals (or other dispersers) bringing in new seed is reduced.

Fire *intensity* can also affect obligate seeders because specific temperatures may be necessary to trigger seed release and/or germination.

Eucalypt resprouting from buds under the bark. © P. Donatiu.

### Resprouters

*Resprouters* are able to resprout after fire from woody underground lignotubers or from buds protected underneath their bark. Many landholders may be familiar with the behaviour of these plants.

Some resprouters can tolerate frequent fire, and some can live for a long time without fire. However, it is important to note that even resprouter populations may be affected by very frequent fire or by fire exclusion, and may rely on seed to ensure healthy, diverse gene pools.

Not surprisingly, in the absence of fire, those plants which come to dominate the landscape include long lived species and those which are able to regenerate without fire. These plants may competitively exclude other species from available light and space. A fire can help to open up the bush so light can reach ground level triggering resprouting, germination, and plant growth.

Eucalypt resprouting from base three months after fire.


## Fire regimes

Fire regime is the term used to describe aspects of fire that are important for managing vegetation and wildlife.

A fire regime includes the following factors:

- Fire Frequency: *the number of fires in a given time*
- Fire Extent: *the area covered by the fire*
- Fire Intensity: *how hot the fire is*
- Fire Season: *what time of year the fire occurs*

### More on fire frequency:

It is important to consider the sequence of fire events. Long term effects on landscape and biodiversity are generally the result of a pattern of fires over time, rather than of just a single fire. (Although this is not to say that a single fire doesn't have the potential to significantly impact on a given area, like in a rainforest for example).

The amount of time between fires (fire interval) and the frequency with which fires occur in a given area are important in the conservation of our plant and animal species.

Frequent burning tends to reduce shrub cover and increase grassiness in some vegetation types resulting in more open landscapes. Infrequently burnt areas may naturally be shrubbier. These differences in vegetation structure affect the animals and birds that live in the bush. Some animals need shrub cover to shelter and breed, while others need open, grassy areas to find their food.

Different vegetation types are adapted to different fire frequencies. Variability in the interval between fires is important for maintaining species diversity. Repeated fire intervals of similar length are not always good news for plants or animals.

### More on fire extent:

The area covered by any particular fire can vary. Some wildfires can be very extensive – for example in 1999 the Lochmaree campaign fire started on private property Christmas Eve near the Abercrombie River National Park, burning for over 2 weeks it burnt out approximately 28,000 hectares of private property and national park. Planned burns may range from small burns of a hectare or less, to block burns of several hundred hectares.

Within a fire perimeter, patches will often remain unburnt. Extensive fires that leave few unburnt patches may limit the ability of animals to find refuge during the fire, and food and shelter after it has passed. Unburnt patches provide a base from which animals can slowly move back into burnt areas as these recover. Those undertaking planned burns aim to leave unburnt patches.

However, small burns may also have a down side. Animals can easily move into small burnt patches from surrounding unburnt country and may place too much grazing pressure on the recovering vegetation in these small patches. This problem may be particularly prevalent where animals such as kangaroos are abundant. If a greater area is burnt, grazing pressure is more likely to be spread, reducing impacts on regenerating vegetation.

Landholders wanting to burn with biodiversity in mind may therefore want to aim for burns of varying size, while still ensuring unburnt bushland and patches remain for fauna. Burning a number of different patches at around the same time is another way to spread grazing pressure over a larger area. Previously burnt patches can provide boundaries for later patch burns.

### More on fire intensity:

A fire varies in intensity depending on factors such as wind speed, temperature, humidity, slope, fuel load and the structure of the vegetation. The most intense fires tend to occur during times of high temperatures, low humidity and strong winds.

Generally:

- Fires tend to be more intense when there is more available dry fine fuel. 'Fine fuel' is material less than a pencil width.
- After a high intensity fire, lots of seed germination may occur. Areas opened up by a high intensity fire will provide increased areas of sunlight and space for young plants to develop
- High intensity fires are more destructive and will kill more plant and animal species, but they are also naturally occurring and important in some plant communities.
- Variation in fire intensity plays a role in keeping a greater number of species in the community (i.e. maintaining biodiversity).

Fire frequency, extent, and intensity are naturally patterned across a landscape, particularly in mountainous and hilly country. This is determined largely by weather, aspect, slope and vegetation type. Fire management should therefore both respond to and make use of these patterns. For example, gullies often contain more moisture loving plant species than upper slopes and ridges. Unplanned fires are less likely to burn into gullies, since the gullies are naturally wetter; and species in gullies are more likely to be adapted to less frequent fire than species growing on higher ground. A fire management plan should account for this.

Extensively burnt areas can affect the ability of plants and animals to recover after fire. © G. Basnett, Hotspots Fire Project.

Unburnt patches will provide animals with a refuge during and after the fire. © W. Drake.

Low intensity fire. © W. Parker, Hotspots Fire Project.

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### More about fire season:

Climate and weather will influence fire season more than any other factor. In the Lachlan, bush fires generally occur in the summer but the bush fire danger period can begin as early as October and extend through to March. Depending on the seasonal weather, areas out west have been known to experience bush fires as early as September through until April.

Planned burns are, of course, constrained by the bush fire danger period and total fire bans, as well as by weather. The window of opportunity for planned burns is usually limited to autumn or spring, but burns can sometimes occur throughout winter. Spring and autumn provide the most ideal weather conditions for planned burns; however this is dependent on suitable weather conditions.

From an ecological point of view, some variability in the season in which a fire occurs is likely to be the best way to go. While the season appears to affect some individual species, scientific findings do not point to a particular season being 'better' for a whole community of plant and animal species. Where possible, it is probably better to avoid always burning at the same time of year.

### Fire regimes: implications for management

At best, fire management planning is a blunt tool and in some parts of the landscape, unplanned fire is inevitable. Prevailing weather conditions and natural landscape patterns will often influence fire season, intensity and extent. Management planning needs to be flexible enough to accommodate unplanned fire, variability in landscape and weather patterns.

Over thousands of years, much of the Australian bush has evolved ways to live successfully with fire and use it to reproductive advantage. Many vegetation types have also developed an ability to 'bounce back' from different fire regimes. This bouncing back is often termed 'resilience'.

The best approach is to vary your fire management actions over time. Talk to people with knowledge in your region, and try different things based on your own observations of vegetation responses to fire on your property.

Biodiversity is more likely to be sustained when fire management extremes are avoided. Excluding all fire from your property, or burning as soon as vegetation has sufficient fuel to support a fire, will eventually see the loss of species adapted to a more moderate or variable regime.

High intensity fire. © G. Walker, NSW Rural Fire Service.

# 4. FIRE IN THE LANDSCAPE: PUTTING THE SCIENCE INTO CONTEXT

Like many natural processes, the relationship between vegetation and fire regime is complex. However, there are some simple principles that emerge in the following stories about fire in particular plant and animal communities.

## FIRE FREQUENCY IN GRASSY WOODLANDS

Grassy Woodlands in the Lachlan, like other regions, have been extensively cleared for agriculture. Patches of good quality Grassy Woodland where native species still dominate are therefore very valuable from a conservation point of view.

A great diversity of Grassy Woodland communities occupy the Lachlan, driven by varying annual rain fall and the complex interactions of elevation, fire, topography, geology and soil formation processes. The climatic variation across the east-west gradient in the Lachlan allows for the existence of four distinct Grassy Woodland classes; Subalpine (limited to the slopes of Mt Canobolas near Orange), Southern Tablelands (eastern parts of the Lachlan), Western Slopes (south western slopes of NSW) and the Floodplain Transition Woodlands on the western alluvial plains.

Remnants with White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), and/or Blakely's Red Gum (*E. blakelyi*) with a grassy understorey are part of the Critically Endangered Ecological Community Box-Gum Grassy Woodland. Another Grassy Woodland that is recognised as an Endangered Ecological Community is Fuzzy Box (*E. conica*) Woodland on Alluvial Soils. Conservation of these remnants is essential for retaining habitat for many declining native plants and animals.

Within Grassy Woodland communities, fire frequency can affect the balance between woody species and grasses. Frequent burning tends to produce open, grassy landscapes, whereas in places where fire has been excluded or is rare, shrubs and young trees may increase in number.

In Grassy Woodlands, tussock grasses such as kangaroo grass (*Themeda australis*), snowgrass (*Poa sieberiana*) and wallaby grasses (*Austrodanthonia species*) dominate the ground layer. Smaller grasses and herbs grow in the spaces between these tussocks. Fire increases diversity by burning the dense tussocks, making space for the smaller species. Many of these grasses and herbs flower rapidly after fire, producing seeds which germinate while gaps between resprouting grass tussocks are still available. Some of the native tussock grasses, particularly kangaroo grass, are also encouraged by fire. Thus fire provides a way for large native grasses, small grasses and herbs to co-exist.

Where fire has been excluded from Grassy Woodlands, shrubs may increase or decrease depending on whether or not they rely on fire for regeneration. Shrubs and trees that are not reliant on fire and can regenerate between fires will likely increase in density in the absence of fire. If environmental conditions are favourable, these species may then progressively come to dominate the landscape shading out the grasses and herbs. Heavy litter which accumulates over time may also leave little room for small ground layer species. However, there are also shrubs that depend on fire to regenerate. These shrubs may appear in large numbers after a fire as seed stored in the soil is stimulated to germinate. These types of shrubs will tend to die off after a long time without fire, producing a more open understorey.

Both ground layer plants and shrubs form part of the rich diversity of Grassy Woodlands in the Lachlan region and fire plays an important role in regulating these woodlands. The extent of loss, fragmentation and change to Grassy Woodlands, means fire needs to be carefully managed and varying fire over time and space is likely to be important for maintaining diversity.

Grassy Woodland © M. Graham, Hotspots Fire Project.

# FIRE AND ANIMAL HABITAT

Variability in fire frequency over time and across the landscape has an important role to play in conserving habitat for many bushland animals. Fire can alter the structure and density of vegetation layers and subsequently change the species composition of bushland areas. Some birds, mammals and invertebrates may even disappear if fires occur too often or are excluded completely.

The mallee dominated landscapes of the Lachlan provide a nationally and state-significant refuge for several threatened fauna species, including the western blue-tongue skink (*Tiliqua occipitalis*), malleefowl (*Leipoa ocellata*), chestnut quail thrush (*Cinclosoma castanotum*), red lored whistler (*Pachycephala rufogularis*) and the striated grasswren (*Amytornis striatus*). Mosaics are important for many species including reptiles to survive. The shingleback lizard (*Tiliqua rugosa*) for example, can take advantage of recently burnt areas as fresh new mallee growth forms a major component of its diet.

The endangered Riverina population of the glossy black cockatoo (*Calyptorhynchus lathami*) is dependent upon the availability of fruiting she-oak (*Allocasuarina verticillata*) trees for food. Fire plays an important management role with many important stands of she-oak on the Cocoparra Range, (in the east of the Lachlan), in an advanced state of post-fire aging and are no longer producing fruit.

The bush stone curlew (*Burhinus grallarius*) has been targeted for recovery in the Lachlan and needs long un-burnt areas with time for leaf litter and shrub layer to build up for foraging and cover.

Time since fire, burn area and intensity affects the diversity of insects and plants and therefore the birds which rely on them for food, shelter and nesting. Nectarivorous birds may need to find food outside of recently burnt areas but as fire is often followed by major flowering, food can become abundant. Some warblers and wrens have been known to increase out of season breeding activity in response to a post fire increase in insect numbers.

Malleefowl on nest. © C. Allen, Bush Heritage Australia.

Common dunnart. © A. Miehs, Nature Conservation Council of NSW.

## Birds

Birds like the mallefowl will take advantage of recently burnt patches to forage for food, but require long unburnt areas with lots of decomposing litter to build its mound. Some birds need areas of old mallee greater than 30-50 years, while birds such as the chestnut quail thrush, the shy heathwren (*Hylacola cautus*) and the supurb parrot (*Polytelis swainsonii*) need, or prefer, mallee less than 10 years old.

## Mammals

As with the birds, the post-fire environment provides altered conditions that favour different small and large mammals.

The new holland mouse (*Pseudomys novaehollandiae*) and the common dunnart (*Sminthopsis murina*), seem to prefer areas in the early stages of recovery from fire where plant diversity is high and vegetation height and complexity is low. As habitat complexity increases,

with time since fire, the species diversity can change to have higher numbers of the yellow footed antechinus (*Antechinus flavipes*) for example. Spotted-tailed quolls (*Dasyurus maculatus*) also require a good range of large hollow logs which could be lost by too hot or too frequent fire.

The larger mammals such as kangaroos, wallabies and wombats tend to be associated with fairly open, grassy environments, more likely to be found in the early post-fire years and perhaps where fire has been more frequent.

Wolf spider. © G. Gowing.

## Invertebrates

Different fire regimes will also affect the invertebrates like ants, beetles and spiders. Numbers of these invertebrates can be reduced immediately post fire, but can quickly recover. Although overall diversity can be the same between areas, the frequency of fires will affect the features of the habitat and therefore which species live there.

Some plant-eating beetles, flies and spiders can take advantage of recent fires, while ants which feed in the litter layer can be more common in longer unburnt areas. Wolf spiders (Family *Lycosidae*) for example are ground hunters, preferring more open habitats to hunt while jumping spiders (Family *Salticidae)* hunt for food on understory vegetation, trees and logs provided by more complex habitats.

## Wildfire, Mosaics and Variability

In some places, fire needs to happen often enough to maintain open, grassy forest environments rich in grasses and herbs, where early-successional animal species can thrive. Other places need to support good sized patches of thicker vegetation where broadleaf shrubs and late-successional fauna can flourish. It is also important to remember some animals need access to both open areas and denser cover and a mosaic of patches can fulfil that requirement.

In some circumstances, valuable habitat features, such as tree hollows, can take hundreds of years to develop and although fire can help with hollow development, incineration of older larger trees and hollows in subsequent fire can reduce the habitat value for surviving arboreal fauna. High intensity fire therefore should be avoided in vegetation communities where hollow-bearing trees are essential to threatened wildlife. To maintain an ongoing supply of large hollow bearing trees, dead trees, logs and stumps should be left standing whenever possible.

Where native vegetation covers large areas it is likely that wildfire will fulfil this prescription. Where remnants have been cut off by clearing and urbanisation, or where fire suppression has been unusually effective, some ecological burning may need to occur. Hot fires have their place, as well as cool winter burns. A further point is the importance of topography in providing refuge areas from which re-colonisation of the post-fire environment can occur. Not only do unburnt areas serve this function, places where fire is less severe also plays this role. When thinking about the effects of fire and how best to manage it, it is instructive to consider landscape patterns: how does vegetation change with topography? How does topography affect fire behaviour and how does this enable plant and animal species to survive and thrive together in a fire prone environment?

Shingleback lizards. © M. Graham, Hotspots Fire Project.

## THE STORY OF THE WHITE CYPRESS PINE

White cypress pine (*Callitris glaucophylla*) is a prominent feature of the landscape across central western New South Wales and is a component of many vegetation classes in the Lachlan. Unlike most trees in Australia, *Callitris* species are not flowering plants; they are conifers and produce seed on the surface of cone scales.

© W. Parker, Hotspots Fire Project.

The recruitment of white cypress pine isn't triggered by fire, but rather is an occasional event associated with particularly good rainfall. The density of young pines can be quite high. Unlike eucalypts, pine seedlings can take many decades to reduce in density and thick stands of small spindly trees can remain for many years. Whilst these stands can provide good habitat for native species including terrestrial orchids and woodland birds, dense regrowth is not suitable habitat for other species. Because of this, changes in habitat structure from open woodlands to dense cypress regrowth can lead to changes in native animal populations.

The last two hundred years have seen many changes in the cypress pine woodlands. Some have been cleared for cropping, while elsewhere the density of pine has increased. The balance between eucalypts and pines, and between large and small trees, has also changed. Early 19th century leases often required landholders to remove eucalypts, shrubs and young pines. Mature pines provided excellent wood. As foresters know, pine regeneration happens readily in 'understocked' stands: where once mature eucalypts and pines left few resources for new plants, logging created gaps for young pines to come in.

The regeneration and thickening of woody native species, such as white cypress pine, in previously cleared or agricultural landscapes is regarded as a problem for agricultural productivity. On the other hand dense regeneration of white cypress pine can provide a more sheltered and cooler microclimate than surrounding open habitats. This is particularly the case during extremely hot summer days when native animals such as the koala take refuge within cooler cypress stands.

Fire regimes have also changed. Historians and scientists who have studied cypress pine forests generally agree that fires started by Aboriginal Australians and lightning probably once helped maintain a mosaic of woodland patches. In many places the understorey was open and grassy under a canopy of eucalypts and mature pines, while in other places shrubs and young cypress grew thickly or in clumps. Although challenging to know for sure, it appears with European settlement, fire became increasingly less common in the slopes and plains of NSW.

White cypress pine is much more sensitive to fire than the eucalypts that grow with it. Not all cypress plants are killed in every fire: even in hot wildfires a proportion are generally tall enough to escape most of the flames. Seedlings, however, are readily killed in a burn. Thus fire has the potential to kill very young regrowth, and to thin dense cypress stands.

Landholders who may wish to limit the density of pine stands may find fire a useful tool for managing white cypress pine seedlings. Fire and other management techniques that encourage the growth of eucalypts, native shrubs and deep-rooted perennial native grasses will in turn produce more ground fuel for fires, may discourage pine regeneration and provide habitat for those native animals that require the nectar, seeds and insects that are available from these native plants.

While fire may open up cypress pine stands, getting fire into them without burning down the neighbourhood can be challenging. The trick will be to find fire regimes that balance all the different needs of plants, animals and us – a job for landholders, people familiar with fire and scientists to tackle together.

# 5. MANAGING FIRE FOR DIFFERENT VEGETATION TYPES

If different vegetation types are adapted to different fire frequencies, how do landholders know whether their fire management actions are good for biodiversity?

To help make these decisions, the Office of Environment and Heritage (OEH) has developed fire frequency guidelines for broad vegetation types around NSW. These guidelines are periods of time (in years) bounded by 'thresholds'. Thresholds refer to the upper and lower limitations to survival for species that are particularly sensitive to very short, or very long, intervals between fires. The fire frequency guidelines aim to ensure fire intervals are long enough to let vulnerable obligate seeders grow to maturity, while also ensuring fire happens often enough to keep short lived species around.

Hotspots is working with OEH and local ecologists to further support these guidelines to take into account the considerable differences between regions within NSW. The 84,700 square kilometres covered by the Lachlan Catchment Management Authority (CMA) includes a wide range of environments, from the tablelands to the slopes and down onto the plains. Elevation in the catchment varies from over 1300m above sea level on the south-western slopes of Mt Canobolas near Orange to approximately 140m above sea level in the Great Cumbung Swamp at the confluence of the Lachlan and Murrumbidgee Rivers. Across the east to west gradient, annual rainfall varies from an average >1000mm in the east to <250mm in the west of the catchment.

Summers are relatively hot, with temperatures averaging 32-35ºC in the west compared to averages of 27ºC in the higher elevated areas to the east. Winter is cool to mild, with average temperatures of 14-16ºC in the west but average temperatures of only 10ºC in the elevated areas to the east.

All these factors affect which plants grow where, and how fast they grow. They also affect the way fire behaves. Fire frequency guidelines aim to reflect these differences.

Grassy Woodland White Box. © M. Graham, Hotspots Fire Project.

The recommended fire frequency intervals are based on what scientists currently know about fire ecology, and will continue to be refined as more information comes to hand. Upper thresholds in particular are currently based on very limited data.

Fire frequency intervals for broad vegetation types found in the Lachlan are listed on the following pages.

For further information or to find out any recent developments please refer to the NSW Rural Fire Service website at: www.rfs.nsw.gov.au.

The vegetation types are classified according to a statewide assessment made in 2004 by Dr David Keith. The groupings can be recognised by specific combinations of plant species, in some cases, these include plant species found nowhere else. The vegetation types are also based on factors such as the height and spacing of the dominant plants as well as geographic indicators of rainfall and soil type.

## Vegetation types of the Lachlan

© M. Graham, Hotspots Fire Project.

### Wet Sclerophyll Forest (grassy subformation)

Grassy subformation Wet Sclerophyll Forests are dominated by straight trunked eucalypts, with a grassy understorey and sparse shrubs which may have hard or soft leaves. This tall forest type also grows on fertile soils in high rainfall areas. It is similar to Wet Sclerophyll Forest (shrubby subformation) but has a more open canopy, less shrubs and a greater grassy or herbaceous groundcover. In the Lachlan, this vegetation community occurs in the far east of the catchment in the South Eastern Highland Bioregion.

Several NSW studies have found that fire frequency has a profound effect on vegetation structure in wet grassy forests. Frequently burnt areas are open and grassy, with a diverse herbaceous ground layer, while infrequent burning is associated with an increased abundance of shrubs and small trees. Each environment provides habitat for a distinct suite of plants, insects and small mammals.

Appropriate fire frequencies for this forest type are still being debated. The present state-wide recommendation is for fires every 10 to 50 years although occasional low intensity fire on a more frequent basis may be necessary for the maintenance of understorey diversity.

© M. Graham, Hotspots Fire Project.

### Dry Sclerophyll Forest (shrubby subformation)

This vegetation type includes forests and woodlands dominated by eucalypts but may also support white cypress pine (*Callitris glaucophylla*), bulloak (*Allocasuarina leuhmannii*) and belah (*Casuarina cristata*). The shrubby understorey of these forests contain many obligate seeders and resprouting shrubs whose flowers colour the bush in spring. The cover of grasses and sedges is sparse. Dry Sclerophyll Forests grow on poor soils in moderate rainfall areas. The shrubby forests of the western Blue Mountains, or Goobang, Nangar and Weddin Mountain National Parks are examples.

Variable fire intervals between 7 to 30 years are recommended to maintain diversity in this vegetation type.

© M. Graham, Hotspots Fire Project.

### Dry Sclerophyll Forest (shrub/grass subformation)

Dry Sclerophyll Forests (shrub/grass subformation) consist of open eucalypt forest with a sparse hard leaved shrub layer with a grassy groundcover. These forests occur on moderately fertile soils in areas of moderate rainfall. In the Lachlan there are several different forms of shrub/grass Dry Sclerophyll Forests, many intergrade with shrubby forests and the distinction among them is likely to be arbitrary in many instances. The structural differences however can affect fire behaviour. Dry Sclerophyll (shrub/grass subformation) Forests include the red stringybark (*Eucalyptus Macrorhyncha*), scribbly gums, red box and tussock grass open forest of the NSW South Western Slopes Bioregion and the white cypress pine woodland on the plains of central NSW.

Across the state, intervals in the 5 to 25 year range, with occasional intervals up to 50 years in some areas, have been recommended for these forests. The grass component is likely to be best maintained by short intervals, while the shrub component is predicted to increase with longer intervals.



## Grassy Woodland

This is open eucalypt woodland of trees that are widely spaced with crowns that rarely touch. The understorey is usually quite grassy with herbs and scattered shrubs. Grassy Woodlands grow on rolling terrain with fertile soils and moderate rainfall, and have been extensively used for grazing. In the Lachlan these are amongst the most productive of ecosystems. They mostly occupy fertile landscapes and flatter terrain. The Lachlan potentially supports the greatest diversity of Grassy Woodlands of any natural resource region in Australia. This includes the Grassy Woodlands of the Western Slopes, Southern Tablelands, Subalpine and Floodplain Transition woodlands.

Across the state, a variable fire frequency of between 5 to 40 years has been recommended. In places where plants grow relatively quickly because of higher rainfall and warmer temperatures, intervals are likely to lie towards the lower end of this range.



## Grassland

Grasslands are notable for their lack of woody plants, although a few low shrubs can sometimes be found in these communities. A wide variety of herbs grow in the spaces between tussocks of perennial native grasses such as kangaroo grass (*Themeda australis*), snowgrass (*Poa sieberiana*) and wallaby grasses (*Austrodanthonia*). Many plants in native Grasslands are often missed; some may not be visible through autumn or winter, but re-emerge to flower in spring.

Extensive natural Grasslands were a prominent feature of the pre-European vegetation of the Lachlan. Grazing and pasture improvement have extensively modified the Grasslands, so remnants where native species continue to thrive are places to be cherished.

The structural and floristic composition of these natural Grasslands varies widely as a result of the interplay between climate, fire, altitude and landscape productivity. There are four distinct classes of Grassland vegetation including Temperate Montane and Riverine Plain Grasslands.

Across the state, fires at intervals between 2 to 10 years are recommended to keep dominant grasses from overwhelming smaller herbs and to open up gaps for seedlings to germinate and grow. Fires in the upper end of existing interval might be more appropriate in sites with slower growth (high altitude Grasslands). As rainfall decreases the spaces between grass clumps may close up more slowly. Knowledge of the fire responses of Grasslands is still developing.



Heathland



Semi-arid Woodland – shrubby subformation

Heathland is dominated by hard leaved shrubs, many of which are obligate seeders. Heath grows in moderate to higher rainfall areas, shallow and infertile soils, often in exposed positions. In the Lachlan, Heathland is restricted to the limited areas in the western Blue Mountains and the Mt Canobolis areas and is described as Keith Class Northern Montane Heathlands.

The rocky areas of Mt Canobolas and surrounds also support the Endangered Ecological Community (EEC) *Xanthoparmelia* Lichen Community, one of the few EEC's listed in NSW that is not dominated by vascular plants.

Fires at a range of intervals between 7 to 30 years are recommended for maintaining biodiversity in Heathlands. Within this range, variability is important as this creates the space and opportunity for large and small species with a range of responses to fire, to live together.

Trees in the Semi-arid shrubby Woodlands subformation are generally shorter in stature than those in the grassy subformation, there is less grass cover but frequently drought-resistent shrubs are dominant. Sclerophyll trees such as eucalypts, wattles, cypress pines and she-oaks dominate. Soils vary from sandy outwash soils to red-brown loams on adjacent floodplains. The sandy soils naturally favour shrubs while the heavier floodplain soils will more likely support higher grass cover.

As with other vegetation classes, disturbance affects the density of trees, shrubs and grasses within Semi-arid Woodlands. Drought plays a major role in shaping the vegetation and also influences fire regimes. In some places where the shrubby areas have thickened up considerably since European settlement, lack of fire is thought to be one of several factors involved in this change.

There are six distinct vegetation classes within the Lachlan for Semi-arid Woodlands shrubby subformation; they include Western Peneplain Woodlands, Dune Mallee Woodlands and Inland Rocky Hill Woodland.

The most extensive mosaics of Dune Mallee and Sandplain Woodland in NSW and some of the largest in Australia occur within the western parts of the Lachlan. Conservation reserves including Nombinnie, Round Hill and Yathong protect the largest complex of these habitats in NSW. These conservation areas and adjoining private lands are a stronghold for mallee dependent species that have become extinct elsewhere in the state.

Fire frequency guidelines for Semi-arid Woodlands are particularly tentative due to lack of data, however intervals between 10 and 40 years have been proposed.

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## Semi-arid Woodland - grassy subformation

Semi-arid Woodlands cover most of the western plains and the drier half of the western slopes of NSW. The woodlands of the semi-arid zone are dominated by sclerophyll trees (eucalyptus, she-oaks, wattles, cypress pines), contain drought-resistant shrubs and are home to many ephemeral (short-term or transitory) grasses and herbs.

Grassy subformation Woodlands occur on the floodplains in areas subject to occasional flooding. These woodlands intergrade with Grasslands and Arid Shrublands. To the east these woodlands become Grassy Woodlands. Inland Floodplain Woodlands, Riverine Plain Woodlands and Brigalow Clay Plain Woodlands are the three vegetation classes found in the Lachlan.

Drought plays a major role in shaping the vegetation and also influences fire regimes. In many places fires will only burn when the grasses which flourish after good rains dry off. Fire frequency guidelines for Semi-arid Woodlands are particularly tentative due to lack of data, however intervals between 6 and 40 years have been proposed.

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## Arid Shrublands – chenopod subformation

Arid Shrublands dominated by chenopods such as saltbush (*Atriplex spp.*), roly-poly (*Sclerolaena muricata*) and bluebush (*Maireana spp.*) are common on the riverine plains in the west of the Lachlan. These vegetation communities are part of the chenopod subformation of Arid Shrublands.

Chenopod shrublands have low flammability, and are considered extremely fire-sensitive. Chenopod species are mostly obligate seeders with only local seed dispersal and no effective post-fire seedbank. Fire should be avoided in chenopod shrublands

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## Arid Shrublands – acacia subformation

Mulga (*Acacia aneura*) dominated shrublands are common in the western parts of the Lachlan, particularly on the rocky landscapes of the Cobar Peneplain. Mulga shrublands are part of the acacia subformation of the Arid Shrublands.

Mulga and other plants that comprise the acacia Shrublands have the capacity to regenerate after the infrequent (30-50 years) unplanned fires that mostly occur following fuel build-up during favourable climatic conditions such as significant La Niña events. The minimum interval for fire in mulga communities should be at least 5-6 years, and the maximum approximately 40 years, although there is a recognised lack of knowledge of the best fire regimes for this vegetation subformation.

© M. Graham, Hotspots Fire Project.

## Forested Wetlands

These forests typically feature hard leaved trees (casuarinas and eucalypts), scattered shrubs and patchy groundcover of water loving sedges and herbs. They occur on flood plains or along riparian zones. Two classes of Forested Wetland occur within the Lachlan, the Eastern Riverine Forests and the Inland Riverine Forests. The relative abundance of either river oak (Eastern Riverine) or river red gum (Inland Riverine forest) defines these two types of Forested Wetland.

Scientists have not yet studied the role of fire in this vegetation type in any detail; however variable intervals between 7 and 35 years have been suggested.

© M. Graham, Hotspots Fire Project.

## Freshwater Wetlands

Wetlands are found along inland rivers in areas that are periodically or permanently flooded with fresh water. In these floodplain areas, forests of river red gums form a mosaic with lignum shrublands and reed-beds. In their natural state these wetlands usually have a dense groundcover of water loving sedges and herbs, and provide wonderful habitat for waterbirds.

Drought, river regulation and grazing have all impacted inland wetlands. Wet-dry cycles play a vital role in maintaining their diversity, and ensuring these continue is the major issue for their survival. Fire intervals of between 6 to 35 years have been suggested for Freshwater Wetlands and variable fire regimes may play a role in the recruitment of some shrubs in drier healthy wetlands. However, for most other wetland types, fires rarely occur, if at all, and have little ecological function. The use of fire therefore is not considered to be a practical management tool and should be avoided if possible. In some cases, these wetlands can occur on peat and peat fires can have a devastating effect on these systems and should be avoided. Freshwater Wetlands are areas of great environmental sensitivity, and need to be treated with care.

© J. Plaza.

## Saline Wetlands

There are small Inland Saline Lakes in the far west of the Lachlan including the Willandra Lakes system. These lakes contain many plant species such as the slender glasswort (*Sclerostegia tenuis*) that are sensitive to fire.

Saline Wetlands are not fire-prone communities and fire exclusion from this class of vegetation is recommended.

# 6. FIRE MANAGEMENT PLANNING

## Introduction

If you live in a fire prone landscape, eliminating fire from your property is not a practical solution. Managing fire is an important part of living with fire, both to protect life and property and to respond to the needs of the bush.

Traditionally many landholders see their assets as being their house and property as well as the productivity of their land. In addition to this, a growing number of land-holders consider the different plant and animal species on their property to be assets of real value.

If you consider native vegetation and wildlife as assets, effective planning will be essential to meeting the challenges associated with fire in the Lachlan.

This planning needs to address two goals: (1) protection of life and property and (2) protection of environmental values.

Each goal requires its own particular management strategies which can be developed and implemented at the property level. However, in particular areas of your property, these two goals may come into conflict. In these instances, the relative advantages and disadvantages need to be weighed up and tradeoffs are often inevitable.

"Hotspots is a way of returning the community back to the land, with a new range of training programs and education that can provide the community with the skills and knowledge to be in the drivers seat for managing their own land. They can now set their own direction." [1]

[1] Claude McDermott, Aboriginal Heritage Officer, Office of Environment and Heritage.

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# HOTSPOTS FIRE PROJECT
## Managing fire on your property

### Protecting *all* your assets

The *Rural Fires Act* (1997) recognises ecologically sustainable development and endorses the Bush Fire Risk Management Planning Process which is designed to protect life, property and the environment.

### A zoning approach to fire management planning

The Bush Fire Risk Management Planning Process uses a zoning approach to fire management planning.

1. Asset Protection Zones are fuel reduced areas around assets or groups of assets which are adjacent to bush fire hazards. These areas contain highly modified vegetation to prevent fire from having a pathway to the assets. Asset Protection Zones provide a safe defendable space for fire fighters and homeowners to use if there is a fire.
2. Strategic Fire Advantage Zones are strategic fuel reduced areas designed to slow a fire and reduce its intensity. These areas may need to be maintained using slashing or fuel reduction burning to provide strategically located fuel reduced areas to reduce vulnerability of assets. The NSW Rural Fire Service recommends reducing fuel in these zones by 50-80%.
3. Land Management Zones are areas that are managed to maintain or enhance land management objectives, including biodiversity. Fire history, vegetation type and fire frequency are important considerations in these areas. The NSW Rural Fire Service recommends burning in these zones to maintain a mosaic of areas with varying fuel loads.
4. Fire Exclusion Zones are areas where fire is actively excluded. These areas may include rainforest and other fire sensitive vegetation and some cultural or historic heritage sites and production areas.

When planning for a prescribed burn it is important to define your objectives. The fire frequency intervals in a Strategic Fire Advantage Zone (i.e. where your objective is to protect life and property) may be shorter than those needed to protect biodiversity.

Burning native vegetation on your property requires environmental assessment and consent. Landholders need to apply to the NSW Rural Fire Service (RFS) for a Bush Fire Hazard Reduction Certificate before planning and implementing a burn. Applications for a Bush Fire Hazard Reduction Certificate are assessed under the Bush Fire Environmental Assessment Code for NSW. In processing an application to carry out a burn in a Strategic Fire Advantage or Land Management Zone, the RFS will consider the vegetation type in which the burn is to be carried out, the fire history and the recommended fire frequency intervals for that vegetation type.

A range of RFS brochures and standards are available that provide detailed information about how to undertake a low intensity burn safely and how to maintain Asset Protection Zones. Most of these are available on the RFS webpage, or from your local district office. For details on how to safely conduct a low intensity prescribed burn, refer to Standards for Low Intensity Bush fire Hazard Reduction Burning, and for details on how to maintain a suitable Asset Protection Zone, refer to Standards for Asset Protection Zones.

## Some key messages in planning for biodiversity conservation

The relationship between fire and biodiversity is complex, and there is still much for scientists and fire managers to learn.

However fire management planning for biodiversity conservation need not be a complex or difficult process. You can take the information in this book away with you, think about it and decide for yourself how you might be able to apply it on your own property.

Based on existing knowledge, and on the information contained in this book, the following key messages provide simple guidelines for fire planning to protect biodiversity on your property.

When making decisions on issues such as fire frequency it helps to be very clear about what your land management objectives are in different areas of your property.

You should anticipate the need for flexibility with regards to your management actions. For many landholders, this forms part of an overall adaptive management approach to biodiversity on their property.

When your objective is biodiversity protection:

1. Think about the key messages listed here; and
2. Use the recommended fire frequency intervals for the different vegetation types on your property as a guide.

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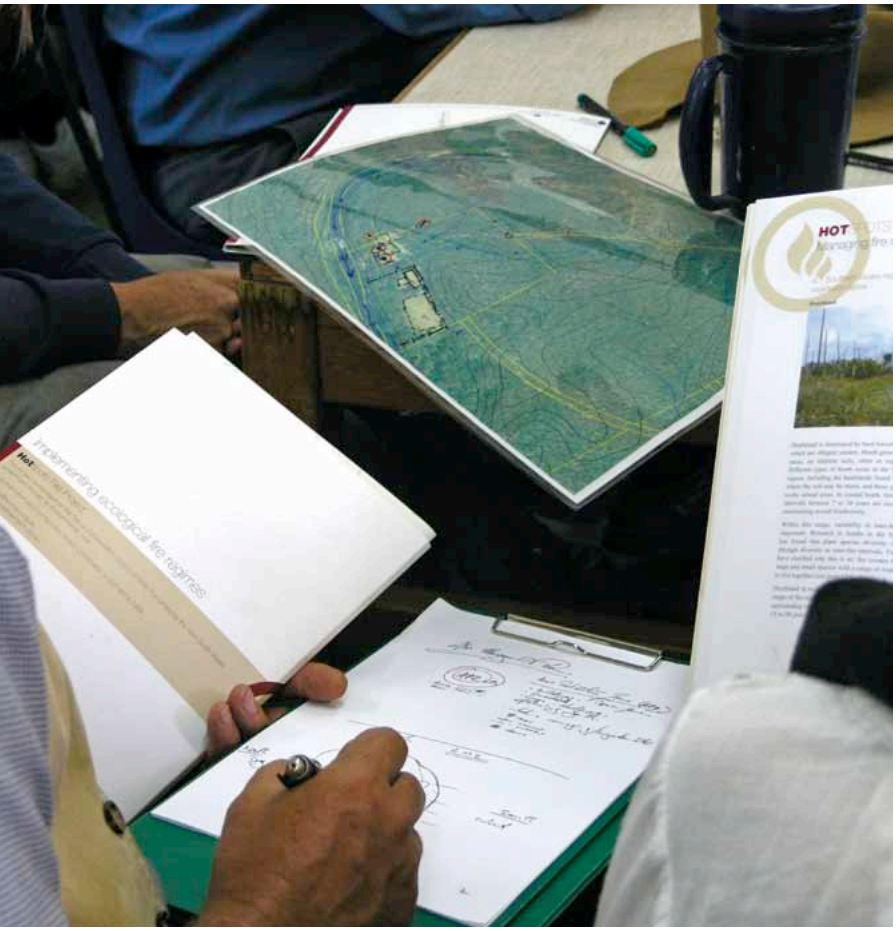
### THE KEY MESSAGES

Simple principles for management

- Both too frequent and too infrequent fire can trigger negative impacts that throw systems 'out of balance' e.g. loss of species, weed invasion.
- Even within a single vegetation type, different species have different needs in relation to fire. To address this, vary fire frequency over time and space to allow for the full range of species.
- The bush at each stage of growth after fire looks different. Each stage provides different habitat, each has value.
- Don't burn entire vegetation types at once. Patchiness provides refuges for animals and a seed source for plants to recolonise burnt areas.
- Fires occur in a landscape context. It's useful to think about how the different vegetation types in a landscape are related in terms of fire.
- Coordinate fire activities with neighbours to provide a mosaic of vegetation in different stages of post-fire development, as different animals use different stages. Remembering that fire management is a shared responsibility.
- When planning how often to burn, think about unplanned as well as planned fire. Unplanned fires may happen often enough to fulfil the needs of the bush.
- Understanding how fire behaves in different vegetation types, and the influence of weather and topography will help you to better prepare for fire.

# 7. PREPARING A PROPERTY FIRE MANAGEMENT PLAN

"Before Hotspots we were an isolated community, we felt we had to fight fire by ourselves, we were alone. But since the training, we feel part of a larger community now that we manage for fire as a community"[1]



© A. Miller, Hotspots Fire Project.

The following steps can help you prepare a property fire management plan:

## 1. Identify your property and productivity assets and map them.

- Talk to the NSW Rural Fire Service about setting up and maintaining Asset Protection Zones and Strategic Fire Advantage Zones.

## 2. Identify and map the vegetation types in your Land Management Zones.

- Make a note of the fire frequency intervals recommended for the vegetation types on your property.
- How often have these vegetation types burned in the past? Note when and where fires have occurred.
- Are past fire regimes consistent with recommended regimes? Make a note of vegetation areas on your property that don't meet recommended fire regimes.
- Think about actions you could take to bring fire frequency into line with the recommendations.

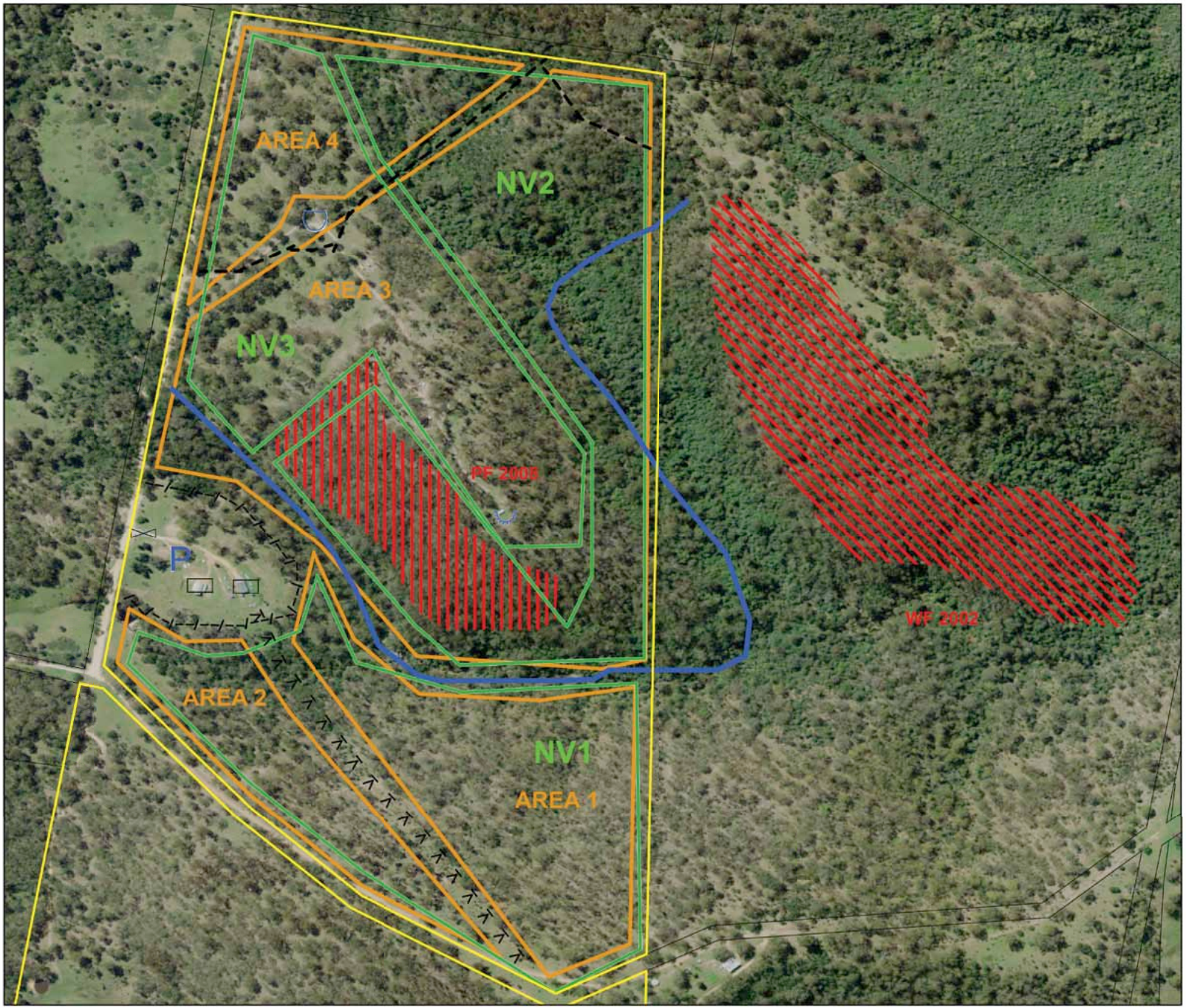
## 3. Develop and maintain a mosaic of different stages of post-fire development.

- Do you have the resources to maintain parts of your property at different stages of development after fire?
- Could you work with your neighbours to make this happen?

## 4. Monitor and review.

- Keep a record of when fires occur and what areas they cover.
- Observe what happens to the vegetation, and to different species. Like all land management planning, fire planning is partly a matter of observation and responding to the needs of the land.
- Review your plan as you learn more.

[1]Hotspots workshop participant.




Nature Conservation Council of NSW

HOTSPOTS FIRE PROJECT

**Property Owner:**
**Map #:**

Scale: 5,000

## MAPPING SYMBOLOGY

| FEATURE | SYMBOL | NOTES |
|---|---|---|
| **INFRASTRUCTURE & BUILT ASSETS** | | |
| Structural assets | | House, sheds, yards, stockyards and other buildings |
| Powerlines | | |
| Fence lines | | Internal and external fence lines |
| Gates | | |
| Tracks & Trails | | |
| **WATER FEATURES & INFRASTRUCTURE** | | |
| Pumps | P | |
| Waterways | | Rivers, creeks & drainage lines |
| Water Tanks | | Indicate if this is marked as a static water supply (SWS) |
| Farm dams | | Indicate overflow with arrow |
| **NATIVE VEGETATION** | | |
| Native Vegetation Areas | eg. WSFS, GW | Mark in boundary of native vegetation using green lines and name accordingly<br>e.g. WSFS = Wet sclerophyll<br>GW = Grassy Woodlands |
| **FIRE HISTORY** | | |
| Planned fire | PF 'Year' | Prescribed hazard reduction/ ecological burn<br>Record year alongside fire type<br>e.g. PF 2005<br>most recent<br>2nd most recent<br>3rd most recent<br>4th most recent<br>Indicate extent & most recent in symbol line |
| Unplanned (wildfire) | WF 'Year' | Record year alongside fire type<br>e.g. WF 2005<br>Indicate extent & most recent in symbol line |
| **MANAGEMENT AREAS** | | |
| Management Areas | AREA 1 | Mark areas on your property using a BROWN line which form distinctive management areas e.g. AREA 1 |

## PRODUCTION INFORMATION

**Map Details:**
Base Data: LPMA Cadastre and Topo Database
Map Projection: (MGA Zone XX (GDA94) )
Print Date / Time: (DD/MM/YYYY / HH:MM)
Produced by: (Name)

N W E S

## WARNING INFORMATION

1. This map has been prepared by a NSW Government Agency ("the Agency") using data supplied to it by other agencies and entities.
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3. There will be a margin of error in relation to the location of features recorded on the map. The Agency is unable to specify the extent or magnitude of that margin of error.
4. Significant changes may have occurred:
   i. in the time between which the data was originally collected and the map produced; and
   ii. since the map was produced.
5. Users must, wherever possible, ground truth the map before relying on it or the accuracy of the map or the information recorded on the map for any purpose.
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## VEGETATION FIRE THRESHOLDS

| Vegetation | Min Fire Interval | Max Fire Interval | Mapping Code |
|---|---|---|---|
| Rainforest | No burning | N/A | R |
| Wet Sclerophyll (shrubby) | 30 | 60 | WSFS |
| Wet Sclerophyll (grassy) | 15 | 50 | WSFG |
| Grassy Woodlands | 8 | 40 | GW |
| Grasslands | 3 | 10 | G |
| Dry Sclerophyll (shrub/grass) | 8 | 50 | DSFG |
| Dry Sclerophyll (shrubby) | 10 | 30 | DSFS |
| Heathland | 10 | 30 | H |
| Alpine Complex | No burning | N/A | A |
| Freshwater Wetlands | 10 | 35 | W |
| Forested Wetlands | 10 | 35 | FW |
| Saline Wetlands | No burning | N/A | SW |
| Semi-arid Woodlands (grassy) | 9 | N/A | SAWG |
| Semi-arid Woodlands (shrubby) | 15 | N/A | SAWS |
| Arid Shrublands (chenopod) | No burning | N/A | ASC |
| Arid Shrublands (acacia) | 15 | N/A | ASA |

An example Hotspots fire management plan.

# 8. FIRE AND CLIMATE CHANGE

It is now generally accepted that the world is undergoing a significant change in climate.

The impacts of climate change in Australia are not yet clear although an increase in extreme weather conditions including drought, storms, floods as well as changes in rainfall (increase or decrease in different places) are anticipated.

It is possible that the frequency and intensity of fire may increase as conditions for fire (such as hot, dry conditions) increase. By 2020 in south-east Australia, days of high or extreme fire danger are forecast to increase by 5 to 25 per cent if the effects of climate change are low and by 15 to 65 per cent if they are high[1].

'A warming of 1.0°C and a 5% decrease in rainfall (a moderate scenario for 2030) would make the climate of Forbes similar to the current climate of Warren, over 200 km to the north west'[2]

White-browed woodswallows (*Artamus (Campbellornis) superciliosus*)
© A. Miehs, Nature Conservation Council of NSW.

## Climate change in the Lachlan

Since 1950, the region has experienced warming of around 0.8ºC. This is likely to be partly due to human activities. Rainfall has declined by around 20–30 mm per decade. The contribution of human activities to this rainfall decline is hard to distinguish from natural variability. The future climate of the Lachlan Catchment is likely to be warmer and drier. Such trends would also increase evaporation, heat waves, extreme winds and fire risk. Nevertheless, despite this trend toward drier conditions, there is also potential for increases in extreme rainfall events. These projections account for a broad range of assumptions about future global greenhouse gas emissions, as well as differences in how various climate models represent the climate system[2].

However, it is not just climate change that will influence future fire regimes and subsequent fire management planning. Human development, settlement patterns and the changing landscape will also play an important role.

'Altered fire regimes are expected, over the coming decades, and may be one of the major ecological challenges for Australia'[3]

1 CSIRO (2007) report *Bushfire Weather in South-East Australia: Recent Trends and Projected Climate Change Impacts*.

2 CSIRO (2007) report Climate Change in the Lachlan Catchment. Prepared for the New South Wales Government by the CSIRO.

3 Morton SR, Hoegh-Guldberg O, Lindenmayer DB, Harriss Olson M, Hughes L, McCulloch MT, McIntyre S, Nix HA, Prober SM, Saunders DA, Anderson AN, Burgman MA, Lefroy EC, LonsdaleWM, Lowe I, McMichael AJ, Parslow JS, Steffen W, Williams JE & Woinarski JCZ (2009) The big ecological questions inhibiting effective environmental management in Australia. *AustralEcology* 34: 1-9.

# 9. WORKING TOGETHER TO MANAGE FIRE ACROSS THE LANDSCAPE

## Cooperation in the Lachlan region

Fire management planning to protect life, property and the environment requires collaboration within communities, between agencies and across tenures.

In the Lachlan, this is already happening. Fire management planning, using a risk management approach, is being undertaken across the wider landscape in national parks, state forests and on public lands.

By working together, individual landholders can be part of a much broader process of fire management, whilst being able to make independent choices about fire management on their own land.

This process has a number of individual and potentially far reaching benefits. Among other things, it encourages landholders to:

- Plan and talk together about assets and how best to protect them;
- Listen to others with knowledge and ask them challenging questions; and
- Protect all of the aspects of the landscape most valued by landholders.

© L. Andrews, NSW Rural Fire Service.

# **HOT**SPOTS FIRE PROJECT

## Managing fire on your property

Landholders and agency staff at a Hotspots demonstration burn in Kangaroo Valley © L. Andrews, NSW Rural Fire Service.

## Partners and collaborators

This booklet has been compiled for the Hotspots Fire Project, with input from and in consultation with a wide range of stakeholders. The information contained herein reflects our understanding at the time of publication. We are learning more about fire and the environment every day and anticipate that some recommendations may change as new information comes to hand.

This booklet was written by Nicole Conroy and Penny Watson, with assistance from Julie Hinchliffe, Christine Pfitzner, Kate McShea and Waminda Parker for the Hotspots Fire Project.

The Hotspots Fire Project is jointly managed by the Nature Conservation Council of NSW and the NSW Rural Fire Service.

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The NSW Office of Environment and Heritage, NSW Catchment Management Authorities, NSW Farmers, The Southeast Queensland Fire and Biodiversity Consortium, Forests NSW, NSW Local Government and Shires Association, National Parks and Wildlife Service, and University of Wollongong's Centre for Environmental Risk Management of Bush Fires.

The following agencies have useful websites and may be of assistance:

Hotspots Fire Project
www.hotspotsfireproject.org.au

NSW Rural Fire Service
www.rfs.nsw.gov.au

Lachlan Catchment Management Authority
www.lachlan.cma.nsw.gov.au

Nature Conservation Council of NSW Bushfire Program
www.nccnsw.org.au/bushfires

Forests NSW
www.dpi.nsw.gov.au/forests

NSW State Emergency Services
www.ses.nsw.gov.au

NSW National Parks & Wildlife Service
www.nationalparks.nsw.gov.au

Southeast Queensland Fire and Biodiversity Consortium
www.fireandbiodiversity.org.au

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Front cover photograph © M. Graham, Hotspots Fire Project
Back cover photograph © W. Parker, Hotspots Fire Project
Design: Ben Lewis, These Designs.com

**Photographs Credit**

**Arid Shrublands chenopod subformation:** classification from Benson, J.S., Allen, C., Togher, C. & Lemmon, J. (2006) New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains. Cunninghamia 9(3): 383-451. Photo ID164 Cotton Bush (Maireana aphylla) and Bromus diandra shrubland, NSW; September 1990; M.F. Porteners. From Benson, J.S. (2006) New South Wales Vegetation Classification and Assessment: Introduction - the classification, database, assessment of protected areas and threat status of plant communities. Cunninghamia 9(3): 331-382.

**Saline Wetlands Inland Saline Lakes:** classification from Benson, J.S., Allen, C., Togher, C. & Lemmon, J. (2006) New South Wales Vegetation Classification and Assessment: Part 1 Plant communities of the NSW Western Plains. Cunninghamia 9(3): 383-451. Photo ID018 Sclerostegia tenuis - Atriplex vesicaria chenopod shrubland near Nitchie Lake, [AGD66 33°27'27.6"S 141°49'45.0"E], 14/4/02, Jaime Plaza. From Benson, J.S. (2006) New South Wales Vegetation Classification and Assessment: Introduction - the classification, database, assessment of protected areas and threat status of plant communities. Cunninghamia 9(3): 331-382.

# **HOT**SPOTS FIRE PROJECT

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