HOTSPOTS FIRE PROJECT

MANAGING FIRE ON YOUR PROPERTY

A booklet for landholders in the Namoi Region

NSW Rural Fire Service

Nature Conservation Council

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The Hotspots Fire Project acknowledges that the preparation and implementation of this guide occurs on the traditional lands of First Nations peoples and that this management has and continues to shape the landscape we see today.

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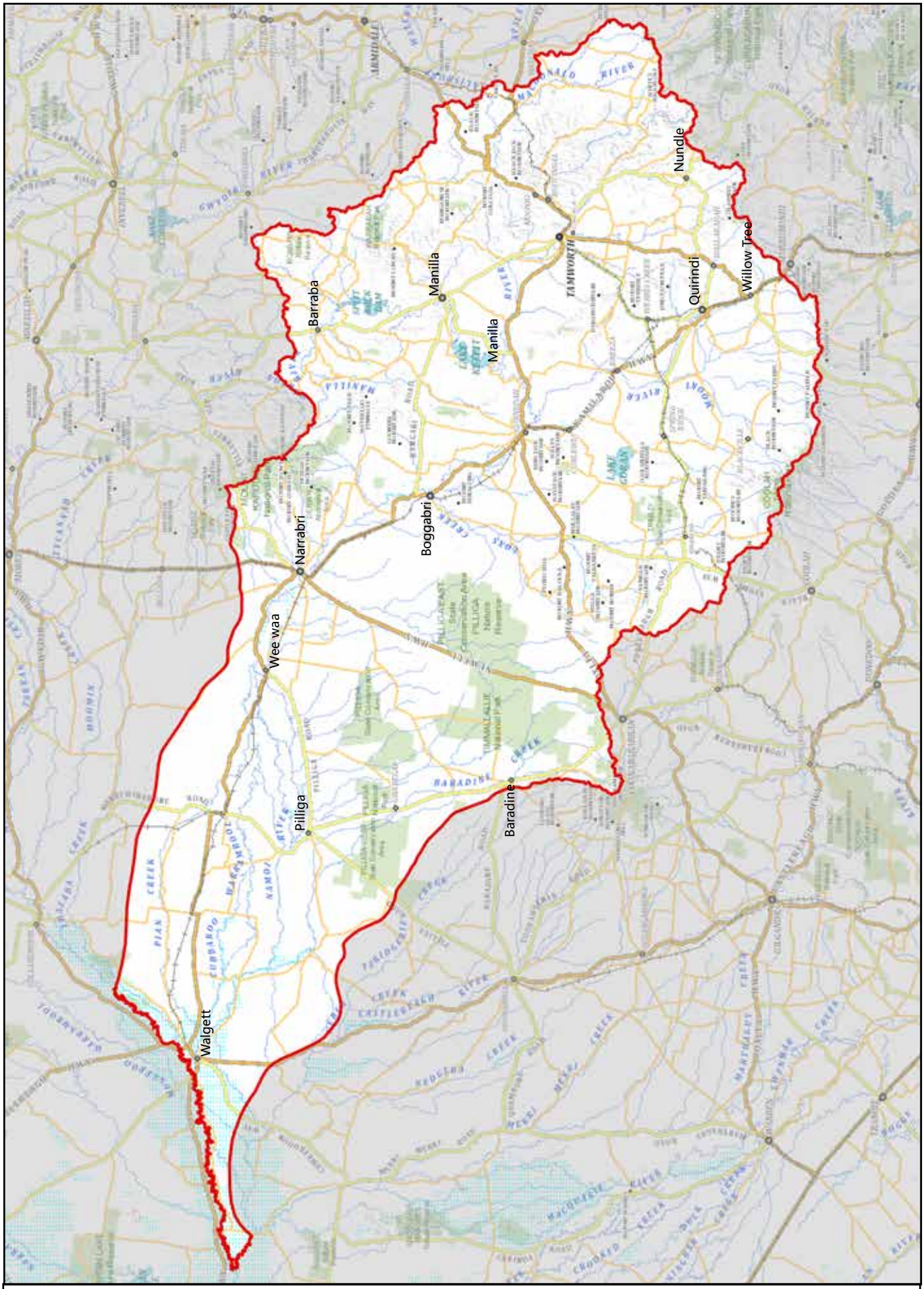
The Hotspots Fire Project is jointly delivered by the
Nature Conservation Council of NSW and the NSW Rural Fire Service

WHAT DOES THIS BOOKLET COVER?



Namoi Region

1 INTRODUCTION TO THE NAMOI REGION

The Namoi Region covers approximately 42,000 square kilometres, bounded by the Great Dividing Range in the east, the Liverpool Ranges and Warrumbungle Ranges in the south and the Nandewar Ranges and Mount Kaputar to the north. The Namoi Region boasts a diverse landscape that transitions from hills and mountains over 1500m in elevation in the east to flat alluvial plains in the west to 100m elevation.

The Namoi region lies within the traditional lands of the Gomeroi/Kamilaroi Nation, whose people have been caretakers of this area for over 60,000 years.The catchment is now home to approximately 100,000 people who live mainly along the Namoi River and its tributaries between Tamworth and Narrabri.

The Namoi Catchment is a productive agricultural area with summer dominant rainfall which allows for cropping and pasture growth all year round. During winter, the region experiences cold days, particularly in more elevated parts.

Although many of these landscapes have been altered by development and agriculture, over half the catchment is forested, and about 15% remains in conservation reserves.

The Pilliga Scrub, the largest remaining dry sclerophyll forest west of the Great Dividing Range in NSW, covers over 1,800 square kilometres in the catchment. Downstream of Narrabri, there are numerous small lagoons, wetlands, and anabranches associated with the river. Lake Goran, a large internally draining basin covering more than 60 square kilometres, serves as a habitat for waterbirds and is listed as a wetland of national significance.

2 LIVING WITH FIRE

Fire in the Namoi Region

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

Large fires moving from west to east during spring and summer have been recorded regularly, sometimes with devastating impacts. The Pilliga has experienced large fire events, most extensively in 2006-07 when 97,000ha were burnt. The fast moving Wambelong fire across the southern border of the region burnt 55,000ha and destroyed a number of properties. The Kaputar fire of 2019 burnt 19,000ha and eastern headwaters of the catchment were subject to the extensive 2019-20 Black Summer fires. The warming climate, topography and vegetative cover increasingly facilitates the formation of intense fire events.

This booklet provides an introduction to how fire can be managed for the protection of life and property, and for healthy, productive landscapes. Developed specifically for the Namoi, this booklet 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 in building healthy land systems.

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

Fire has shaped the character and biodiversity of Australian landscapes for millions of years prior to the arrival of people. Many plant and animals species evolved strategies for coping with fire with the ability to survive fire directly and/or taking advantage of the post-fire environment.

Changes to ancient fire regimes accelerated as Australia drifted north over the last 70 million years, which led to the gradual drying of the continent and fires ignited by lightning strikes and volcanic activity. On a continental scale, this process contributed to the expansion and dominance of fire tolerant and drought resistant species such as sclerophyllous vegetation, especially eucalypts. This in turn led to the contraction of fire sensitive areas such as rainforest to more naturally fire protected and wetter locations[1].

First Nations Australians have a long history over thousands of years of using fire as a land management tool and cultural practice. These practices helped shape a cultural landscape that left the legacy of Australia's unique biodiversity and ecosystems prior to European colonisation. Fire sensitive vegetation communities such as rainforest were protected from bush fire where possible by carefully burning fire tolerant areas as a firebreak on the perimeter. This ensured the health of these rainforest areas and the plants and animals that people depended on for food and resources. Pathways or walking tracks across the region between different areas were often kept open and grassy with cultural burning to allow for better access and to encourage animals to forage on the regrowth.

In more recent times, several First Nations groups have been working to reintroduce cultural burning practices back on to Country in the Namoi region. The most important principle of cultural burning is ensuring the appropriate First Nations people for each area are involved. Other common principles of cultural burning include only burning small areas in calm, cooler conditions to create low intensity fires that do not impact the tree canopy and only burn the ground layer. This leaves unburnt patches and promotes habitat and resources for native animals. In some areas where knowledge and cultural practices of fire have been interrupted by colonisation, knowledge is now being renewed through regional collaboration, practicing the principles of cultural burning and observing the change and ecological health of the landscape over time. In turn this supports the strengthening of connection and knowledge between First Nations people and Country and the skills and experience to manage these areas for future generations.

The changes to our landscapes since 1788 have been profound and ongoing. We are now faced with fragmented vegetation and the combined impacts of invasive plants and animals as well as extensive and frequent bush fires.

We need to draw on both old and new knowledge about fire in order to protect people, natural and built assets and cultural values, and so manage for healthy and 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.

[1] Bowman, D. M. J. S. (2000). *Australian rainforests: islands of green in a land of fire.* Cambridge: New York: Cambridge University Press, http://www.loc.gov/catdir/toc/cam025/99024978.html

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. Fire is a natural disturbance pattern that can significantly shape both land systems and biodiversity.

For landholders, the most useful information to come from fire ecology research relates to how different plant and animal species respond to fire, and how fire regimes affect plant and animal populations and communities.

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 can tolerate fire and others rely on it for reproduction. For many Australian plants one or more of their reproduction processes (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.

Plants respond differently after fire to ensure their survival. Eucalypts most often reshoot to eventually reform healthy crowns, while others are more sensitive to fire and rely on seed to reestablish.

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). 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, and the time required for species to reproduce, if they wish to ensure the survival of these obligate seeder species.

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, while some seeds may be killed at very high temperatures. Fire season can affect post-fire recruitment for species with specific seasonal germination requirements.

Obligate seeder *Petrophile pulchella* stores seed in woody capsures. Fire triggers release of this seed. © P. Watson, Hotspots Fire Project.

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.

Resprouters

Resprouters are able to resprout after fire from woody underground lignotubers or epicormic buds protected underneath their bark. Some 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.

Planchon's stringybark (*Eucalyptus planchoniana*) resprouting from epicormic buds
© P. Donatiu, QFBC

Fire regimes

Fire regime is the term used to describe aspects of, and the landscape context of, fires. These aspects 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 Season:** what time of year the fire occurs
- **Fire Extent:** the area covered by the fire
- **Fire Intensity:** how hot the fire is

More on fire frequency:

After a fire there are obvious changes over time as plants grow back and begin to flower and fruit, which affects what habitat and food are available for animals. While a single fire may have a significant impact on fire sensitive vegetation types such as rainforest and mangroves, long term effects on most vegetation types are the result of a pattern of fires over time. Hence it is important to consider the sequence of fire events within the landscape.

The time that has passed since the last fire (time since fire), the amount of time between subsequent fires (fire interval) and the number of fires that occur within a given time span (fire frequency) are all important factors 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. However, too frequent burning may also favour highly invasive perennial grass species such as African lovegrass (*Eragrostis curvula*), Chilean needle grass (*Nassella neesiana*) and serrated tussock (*Nassella trichotoma*). Infrequently burnt areas may naturally be shrubbier and are more likely to provide large trees and hollows. These differences in vegetation structure affect the animals that live in the bush. Some animals need shrub cover and hollows 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 intervals of similar lengths will favour some species at the expense of others.

Under certain fire regimes (intermediate fire frequency), *Banksia ericifolia* can competitively exclude other plant species from available space and sunlight. © W. Parker, Hotspots Fire Project

More about fire season:

Climate and weather influence fire season more than any other factor. In the Namoi, bush fires generally occur in the summer but the danger period can begin as early as August and extend through to March or April. Weather conditions associated with bush fire season include moderate to high daytime temperatures and low relative humidity with winds from the north-west.

In some areas the window of opportunity for planned burns is divided into two time frames; April to June and August to end of September. Autumn is the most popular to conduct prescribed burns, however waiting until frost forms on grasses in the understorey is preferable before burning in some regions. The implementation of any planned burn is dependent on the weather conditions on the days leading up to and on the day of the burn. It is also important to check the forecast for the days following a planned burn to ensure it can be safely contained. A burn may can be conducted during the bush fire danger period if the weather is appropriate, as long as a permit has been approved by the NSW Rural Fire Service (NSW RFS).

The season in which a fire occurs can influence the recovery of plants and animals. While some of these effects are related to weather (e.g. post-fire rain) and fire severity, others are direct seasonal effects on growth and reproduction. Some plant species show a better resprouting, flowering, or germination response following fires in certain seasons. Many animals are more vulnerable to fire during their breeding season as it is harder to escape a fire when caring for young.

More on fire extent:

Within a fire perimeter, patches will often remain unburnt. Unburnt patches provide a base from which animals can slowly move back into burnt areas as they recover. 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. Some bush fires can be very extensive – the Coonabarabran fires in December 2006 to January 2007 are an example. More than 113,000 hectares of private property, national park and state forest were burnt. Planned burns may range from small burns of a hectare or less, to larger burns of several hundred hectares. Those undertaking planned burns should aim to leave unburnt patches, a process called mosaic burning.

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. 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 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 weather, topography, and the quantity and structure of the fuel. The most intense fires tend to occur during times of high temperatures, low humidity and strong winds, especially when the fuel is dry after several days of extreme heat or in periods of drought.

Fires also burn faster and more intensely when running uphill, as the available fuel is preheated by the flames and ignites more easily. Other topographical features may reduce fire intensity, such as gullies, shadier southern aspects, and large rock platforms.

Fire severity refers to the impact that fire intensity has on the amount of vegetation that is burnt during the fire.

Generally:

- Fires tend to be more intense when there is more available dry fine fuel. 'Fine fuel' is material less than a pencil width (6 mm).
- High intensity fires are more destructive and will kill more plant and animal species, but they also have an important role in some plant communities.
- 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.
- Variation in fire intensity plays a role in keeping a greater number of species in the community (i.e. maintaining biodiversity).

Low intensity burn at Jaaningga Nature Reserve © S. Hemer

Severly burnt areas affect the ability of plants to recover after fire © M. Graham, Hotspots Fire Project

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

Fire regimes: implications for management

In some parts of the landscape bush fire is inevitable due to fuel accumulation, climatic conditions and likely ignition sources such as lightning, arson, escaped burn-offs and campfires. Prevailing weather conditions and natural landscape patterns will often influence fire season, intensity and extent. Management planning needs to be flexible enough to accommodate for bush fires.

Over many millions of years, much of the Australian bush has evolved ways to live successfully with fire and to use it for 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 regimes 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 TEMPERATE GRASSY WOODLANDS

Managing forests so they can maintain their diversity over time is a challenging task. The grassy woodlands on the slopes and tablelands of the Namoi region, 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. Remnants characterised by the presence of white box (*Eucalyptus albens*), yellow box (*E. melliodora*), and/or Blakely's red gum (*E. blakelyi*) are indicative of the critically listed Box-Gum Grassy Woodland Endangered Ecological Community. Conservation of these remnants is essential for retaining habitat for many declining native plants and animals.

Kangaroo Grass, *Themeda triandra*
© J. Tann

Within these 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.

Plant diversity in grassy woodland is concentrated in the ground layer. Here, tussock grasses such as kangaroo grass (*Themeda triandra*), snowgrass (*Poa sieberiana*) and wallaby grasses (*Rytidosperma* spp.) dominate. Smaller grasses and herbs grow in the spaces between these tussocks. Fire burns the dense tussocks back, making space for smaller species. Many grasses and herbs flower rapidly after fire, producing seeds that germinate while gaps between resprouting grass tussocks are still available. Some native tussock grasses, particularly kangaroo grass, are 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 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.

Grassy box woodland © S. Hunt, Hotspots Fire Project

Both ground layer plants and shrubs form part of the rich diversity of grassy woodlands in the Namoi region. Varying fire frequency over time and space is important for maintaining this diversity. Patchy fires help to ensure enough space for all species including shrubs, grasses and herbs.

ENCOURAGING DIVERSITY IN WHITE CYPRESS PINE

White cypress pine (*Callitris glaucophylla*) is a prominent feature of the landscape across central western New South Wales. Like many trees west of the Divide, the recruitment of white cypress pine isn't triggered by fire, but rather an occasional event associated with particularly good rainfall. The density of young cypress pines can be very high. Unlike eucalypts, cypress pine seedlings don't easily self-thin; thick stands of small spindly trees can remain for decades. Whilst these stands provide perches and nest sites for some birds and other animals, dense regrowth is less than ideal habitat for many fauna species and the loss of habitat diversity can reduce the types of animals and plants that can live there.

The last two hundred years have seen many changes in cypress pine woodlands. Some have been cleared for cropping, while elsewhere the density of cypress pine has increased. The balance between eucalypts and cypress pines, and between large and small trees, has also changed.

Early 19th century leases often required landholders to remove eucalypts, shrubs and young cypress pines. Mature cypress pines provided excellent wood. As foresters know, cypress pine regeneration happens readily in 'understocked' stands: where once mature eucalypts and cypress pines left few resources for new plants, logging created gaps for young cypress pines to establish. Thickening and encroaching native scrub, including white cypress pine, remains a key natural resource issue across many areas west of the divide.

Fire regimes have also changed. Historians and scientists who have studied cypress pine forests generally agree that fires started by First Nations peoples 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 cypress pines, while in other places shrubs and young cypress pines grew thickly or in clumps. White cypress pine is much more sensitive to fire than the eucalypts that grow with it. Not all cypress pine plants are killed in every fire; even in hot bush fires 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 pine stands.

Landholders who wish to encourage native plants and animals may find fire a useful tool for managing white cypress pine seedlings. Fire and other management techniques that encourage the growth of eucalypts, non-invasive shrubs and deep-rooted perennial native grasses will in turn produce more ground fuel for fires, discourage cypress pine regeneration and directly benefit native birds and animals through providing food (nectar, seeds, insects) and nest sites.

While fire may open up cypress pine stands and is likely to increase their habitat value, 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 people – a job for landholders and scientists to tackle together.

White cypress pine © W. Parker

ANIMAL RESPONSES TO FIRE FREQUENCY AND FIRE EXTENT

Variability in fire frequency over time and across the landscape plays an important role in providing the habitat that bushland animals need. Fire alters the structure and density of vegetation layers and can change the species composition of bushland areas. Some birds, mammals and invertebrates may even disappear if fires occur too often or are excluded completely. Landscapes in the Namoi provide a significant refuge for many nationally vulnerable fauna species.

Hollows as Habitat

Long unburnt forests have numerous hollow-bearing trees that provide habitat for an abundance of fauna. Many fauna species are dependent on hollows for key parts of their life cycle. Providing places for animals to feed, shelter and breed. Hollows can take many centuries to develop or be replaced when lost from a landscape.

Fires can burn through significant hollow-bearing trees and cause them to fall. This leads to a loss of valuable habitat and causes increased competition for remaining hollows. Maintenance of hollow-bearing trees and enhancement of these valuable habitats wherever possible, is needed to ensure the survival of many native species.

Hollows as habitat
© M. Graham, Hotspots Fire Project

Mammals and Birds

Some small birds, like the hooded robin (*Melanodryas cucullata*) take advantage of the open spaces provided by frequent fire in more open woodland habitats. Similarly, many birds of prey will utilise open woodland spaces. By excluding fire completely from woodland and forest landscapes, animals that require open spaces tend to be replaced by species adapted to more shrubby environments.

The tiny eastern pygmy-possum (*Cercartetus nanus*) seems to prefer the more shrubby environments associated with an understorey of hard-leaved shrubs, like banksias and bottlebrush. Here they feed on the nectar and pollen of woodland and forest flowers, supplementing their diet with insects and soft fruits. The eastern pygmy-possum also requires tree hollows and/or loose bark in the forks of trees to nest and breed. By increasing the frequency of fires and removing shrub thickets across the landscape, animals that rely on these environments will eventually disappear.

Eastern pygmy-possum,
Cercartetus nanus
© P. Spark

Some animals will use both open and shrubby environments. Restricted to the low-nutrient deep soils of the Pilliga scrub, the Pilliga mouse

(*Pseudomys pilligaensis*), is one such example. Living in habitat with a good coverage of shrubs, recent studies have found that the Pilliga mouse seems to prefer foraging in recently burnt moist gullies where there are few shrubs but plenty of low grasses and sedges and ash can still be found on the ground. The malleefowl (*Leipoa ocellata*) will also take advantage of recently burnt patches to forage for food, but requires long unburnt areas with lots of decomposing litter in which to build its mound. Fires that create a mosaic of burnt and unburnt patches across the landscape can help to retain the range of habitats necessary for the many animals that use both open and shrubby environments in the long term.

Hooded Robin,
Melanodryas cucullata
© B. Shepherd

Recovery of animal populations in the months and years after a fire will depend on many different factors including fire intensity and frequency as well as the presence of nearby unburnt areas. 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.

Varying fire across time and space can help maintain patches of different vegetation structure and habitat type across the landscape. This variability can help to ensure the habitat needs of many birds, mammals and reptiles including some threatened species. By ensuring that some patches remain unburnt, animals and plants will also have a better chance to recolonise from nearby areas.

Invertebrates

Different fire regimes will also affect invertebrates like ants, beetles, dragonflies 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. Excess nutrients from bush fire debris can reduce aquatic macro-invertebrate (e.g. insect, crustacean and mollusc) populations post fire, however they can also be quick to recover.

Wolf Spider
Lycosidae
© G. Gowing

Some plant-eating beetles, flies and spiders can take advantage of recent fires, while ants that 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 in understory vegetation, trees and logs provided by more complex habitats.

Bush Fire, Mosaics and Variability

Maximising biodiversity, creating refuges and allowing breeding cycles are only a few factors that will be improved by mosaic burning. 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 to feed and denser cover to shelter and a mosaic of patches can fulfil this requirement.

Where native vegetation covers large areas it is likely that bush fires will naturally introduce variability in intensity and patchiness across the landscape. Large, widespread, high intensity megafires, however, can work against fire regime variability. Where remnants have been isolated by clearing and urbanisation, or where fire suppression has been unusually effective, some prescribed burning may be appropriate. 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 play 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 and aspect influence veegetation classess and affect fire behaviour and how does this enable plant and animal species to survive and thrive, in a fire-prone environment?

Variability across the landscape © A. Busse

5 MANAGING FIRE FOR DIFFERENT VEGETATION TYPES

© P. Watson, Hotspots Fire Project

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

To help make these decisions, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) has developed tolerable fire interval guidelines for vegetation types around NSW. Tolerable fire intervals (TFI) 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 TFI 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. Fire frequency has a large influence on the dynamics of the understorey species in many vegetation types. While repeated fire intervals outside the range of the TFIs will lead to the loss or decline of some species, always burning at the same interval even within TFIs will lead to the dominance of some species over others.

Extending from the Great Dividing Range down to the north west plains, the rainfall gradient averages 800mm in the east decreasing to an average of 500mm near Walgett on the catchment's western boundary with slightly higher rainfall at places like Mt Kaputar. Summer temperatures across this range are generally hot to very hot, the number of frost days is variable and soils change. These environmental influences all shape the occurrence of, and variability in, both vegetation communities and fire regimes. Fire frequency intervals for broad vegetation types found in the Namoi are listed on the following pages.

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

Vegetation in NSW is described in a tiered system (Keith, D., 2003. *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT.* Department of Environment and Conservation NSW). Vegetation formations are broad groups based on major structural (e.g. tree height and canopy cover) and geographical (e.g. climate and geology) features. Within a formation, vegetation classes are groupings of similar plant species and habitat defined by differences at a finer geographic scale (e.g. rainfall, soil type, landscape position). We describe here the vegetation formations that occur in the region, and some of the variation among vegetation classes.

Vegetation types of the Namoi Region

Rainforests

© G. Basnett, Hotspots Fire Project

Rainforests are usually dominated by soft leaved trees with vines, ferns and palms in the understorey, and grow on moist sites with fertile soils. In the Namoi region, rainforests are very limited and occur as either small pockets of subtropical rainforest or as dry rainforest and western vine thicket on steep or rocky slopes. Western vine thicket is restricted to the dry hills and flats west of the New England plateau and slopes. The closed canopy in rainforests generally shades out the more flammable species that fuel fires, thereby protecting most of the forest from normal fire events. Weed species such as lantana and buffel grass may increase the likelihood of fire coming into these areas.

Although a bush fire may occasionally go through a rainforest and the community may be able to recover slowly, rainforest is very sensitive to recurring fire, and fire should therefore be excluded where possible.

Wet Sclerophyll Forests (shrubby subformation)

© G. Basnett, Hotspots Fire Project

The term sclerophyll refers to the hard, leathery leaves of many distinctly Australian trees and shrubs. Shrubby wet sclerophyll forests are tall eucalypt forests with a dense understorey of ferns, herbs, and shrubs with broad soft leaves. These forests grow on relatively fertile soils in high rainfall areas.

In the Namoi region, this vegetation type is limited but may occur in the Nandewar Range, toward the east. Although it is understood that fire is important in these forests, the fire intervals needed to preserve the dominant eucalypts and safeguard other biodiversity values are still unclear. Shrubby wet sclerophyll forests are likely to experience occasional intense bush fires, perhaps every 40 to 100 years. Intense fire may be needed for eucalypts to regenerate. Less intense but more frequent understorey fire may have a role in maintaining shrubs, ferns and herbs.

Currently, variable fire intervals in the range 30 to 60 years are recommended for shrubby subformation wet schlerophyll forests across the state. However, as research into the effects of fire frequency in shrubby wet sclerophyll forests in NSW is still in its infancy, these recommendations may best be viewed as a first approximation which can be refined as we learn more.

Wet Sclerophyll Forests (grassy subformation)

© P. Watson, Hotspots Fire Project

Grassy wet sclerophyll forests of the Namoi region are dominated by straight trunked eucalypts, with a grassy understorey and sparse shrubs which may have hard or soft leaves. These forests grow on relatively fertile soils in high rainfall areas. It is similar to shrubby wet sclerophyll forest but has a more open canopy, less shrubs and a greater grassy or herbaceous groundcover.

In the Namoi region, this vegetation type extends from the tablelands along the Liverpool Range. Appropriate fire frequencies for this forest type are still debated. The present state-wide recommendation is for fire every 15 to 50 years although occasional low intensity fire on a more frequent basis may be necessary for the maintenance of understorey diversity.

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, birds and small mammals. To provide for the full range, it is probably important to keep some parts of the landscape open with relatively frequent fire, while other places are burnt less often to allow thicker habitat to develop.

Dry Sclerophyll Forests (shrubby subformation)

© K. McShea, Hotspots Fire Project

This vegetation type covers forests and woodlands dominated by eucalypts but may also support white cypress pine (*Callitris glaucophylla*), bulloak (*Allocasuarina luehmannii*) and belah (*Casuarina cristata*). The shrubby understorey of these forests contains 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 eastern Pilliga and the ranges around Mt Kaputar are examples of shrubby dry sclerophyll forest.

Variable fire intervals between 10 to 30 years are recommended to maintain diversity in this vegetation type.

Dry Sclerophyll Forests (shrub/grass subformattion)

© G. Basnett, Hotspots Fire Project

Dry sclerophyll shrub/grass forest consists of open eucalypt forest with a sparse hard leaved shrub layer and a grassy groundcover. These forests occur on moderately fertile soils in moderate rainfall areas, have been used for pasture, and are extensive in the Namoi region. Examples occur on the outwash plains of the Pilliga.

The grassier open forests may require slightly more frequent fire with an occasional longer interval between fires. The grass component is likely to be best maintained by short intervals, while the shrub component is predicted to increase with longer intervals.

Across the state, intervals in the 8 to 50 year range, including occasional intervals of greater than 25 years in some areas, have been recommended for these forests.

Grassy Woodlands

© K. Nicolson, NCC Bushfire Program

These are open eucalypt woodlands that have 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.

Remnant grassy woodlands in the Namoi region are now mostly found on the high altitudes of the New England Tablelands although scattered remnants occur on the western slopes. As the slopes give way to the plains the species composition of grassy woodlands shifts towards plants that are able to cope with a drier climate.

In places where plants grow relatively quickly because of higher rainfall and warmer temperatures, intervals compatible with retaining a diverse, grassy understorey along with some shrubs are likely to lie towards the lower end of this range. On the western slopes where rainfall is moderate, plants may grow more slowly, and somewhat longer fire intervals may be more appropriate. Across the state, a variable fire frequency of between 8 to 40 years has been recommended.

Semi-arid Woodlands

© M. Graham, Hotspots Fire Project

Semi-arid woodlands cover most of the western plains and the drier half of the western slopes of New South Wales. Sclerophyllous trees such as eucalypts, wattles, cypress pines and she-oaks dominate these areas with drought-resistant shrubs and grasses making up the understorey. Grasses are likely to be more abundant on the occasionally inundated floodplains (grassy subformation), while shrubs are thicker on uplands (shrubby subformation). Semi-arid woodlands are also home to many short-lived grasses and herbs.

Drought plays a major role in shaping this vegetation and also influences fire regimes. In many places fires will only burn when the grasses which flourish after good rains dry off. Though shrubs have always occurred in semi-arid woodlands, in some places they have thickened up considerably since European settlement, and lack of fire is thought to be one of several factors involved in this change. Fire frequency guidelines are particularly tentative due to lack of data, however intervals between 9 and 40 years have been proposed for grassy semi-arid woodlands and 15 to 40 years for shrubby semi-arid woodlands.

Grasslands

© K. McShea, Hotspots Fire Project

Grasslands are notable for their lack of woody plants, although some shrubs and trees 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 triandra*), common tussock grass (*Poa labillardieri*), and wallaby grasses (*Rytidosperma* spp). Many plants in native grasslands may not be seen by the casual observer; some may not even be visible through autumn or winter, but re-emerge to flower in spring.

Grasslands make up a considerable proportion of the north-east of the Namoi region, with extensive areas in the central areas and some fragmented areas across the north-west. Grazing and pasture improvement have extensively modified the grasslands, so remnants where native species continue to thrive are places to be highly valued.

Across the state, fires at intervals between 3 to 10 years are recommended to keep dominant grasses from overwhelming smaller herbs and to open up gaps for seedlings to germinate and grow. A slightly longer interval might be more appropriate in sites with slower growth (high altitude grasslands). As rainfall decreases, the spaces between grass clumps may also close up more slowly. Knowledge of the fire responses of grasslands is still developing.

Forested Wetlands

© K. McShea, Hotspots Fire Project

These forests typically feature hard leaved trees (paperbarks, casuarinas, eucalypts), scattered shrubs and patchy groundcover of water loving sedges and herbs. They occur on flood plains or along riparian zones.

Scientists have not yet studied the role of fire in this vegetation type in any detail; however variable intervals between 10 and 35 years have been suggested.

Freshwater Wetlands

© W. Parker, Hotspots Fire

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 gum 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 essential 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 cycles continue is the major issue for their survival. Fire intervals of between 10 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 heathy 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.

Heathlands

© K. McShea, Hotspots Fire Project

Heathlands are dominated by hard leaved shrubs, many of which are obligate seeders. Heath grows in high rainfall areas, on infertile soils, often in exposed positions.

In the Namoi, heathland is usually found in association with elevated rocky outcrops (dry heath) and on sandstone ridges and slopes where soils are not deep or fertile enough to support trees, such as in the southern tip of the New England Tableland bioregion, south east of Walcha.

Fires at a range of intervals between 10 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.

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 ecological needs of the bush.

Many landholders see their assets as being their house and property as well as the productivity of their land. In addition to this, the natural and cultural values of a property are also valuable assets.

Property planning at Hotspots workshop © M. Rose

Effective planning will be essential to meeting the challenges associated with fire in the Namoi region. This planning needs to address two goals: (1) protection of life and property and (2) protection of environmental and cultural 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.”
>
> – Claude McDermott, former Aboriginal Heritage Officer, Department of Planning and Environment

PROTECTING *ALL* YOUR ASSETS

The bush fire risk management planning process applies a zoning approach to fire management planning. Zones are a way of identifying areas in the landscape for planning and risk management purposes. There are five types of zones which have different intents.

- **Asset Protection Zones** (APZs) are fuel reduced areas surrounding a built asset or structure which is managed progressively to minimise fuel loads in order to reduce the potential radiant heat levels, flame contact, ember and smoke attack. Vegetation within these zones should be managed to ensure it does not provide a path for the transfer of fire from unmanaged vegetation to the asset either from the ground level or through the tree canopy. Refer to the NSW RFS Standards for APZs and seek NSW RFS advice to determine the recommended width of your APZ. Environmental approval to undertake vegetation clearance may be required.

- **Strategic Fire Advantage Zones** (SFAZs) are large scale, strategically determined areas which are regularly burnt to reduce fuel loads. These fuel reduced areas are designed to slow a fire, reduce its intensity in the landscape and provide a valuable opportunity for active firefighting during a bush fire. They can be located in areas of known fire paths or adjacent to APZs. These zones are determined by each Bush Fire Management Committee during the development of a Bush Fire Risk Management Plan.

- **Ignition Management Zones** (IMZs) are an area in the landscape that is maintained at a reduced fuel level in order to minimise the propagation of ignitions and limit the rapid escalation of fires, often along ridgetops. IMZs are similar to Strategic Fire Advantage Zones but are treated more regularly and thoroughly than a SFAZ.

- **Land Management Zones** (LMZs), the main focus of the Hotspots Fire Project, 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 RFS recommends burning in these zones to maintain a mosaic of areas with varying fuel loads.

- **Fire Exclusion Zones** (FEZs) 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. Planning decisions with respect to these zones should be heavily guided by the NSW RFS.

When planning for a prescribed burn it is important to define your objectives, acknowledging that there is a greater focus on hazard reduction works closer to assets (e.g. APZs and SFAZs) and a better balance between land management objectives (e.g. biodiversity conservation) and fire management in LMZs.

Burning native vegetation on your property requires environmental assessment and consent. Landholders need to apply to the NSW RFS for a Bush Fire Hazard Reduction Certificate (HRC) before planning and implementing a burn. Applications for a HRC are assessed under the Bush Fire Environmental Assessment Code for NSW. Assessments are made based on potential impacts to biodiversity, threatened species, cultural heritage, waterbodies and soil erosion.

In processing a HRC application to carry out a burn in a SFAZ or LMZ, the NSW 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. The SFAZ minimum intervals represent an absolute minimum (i.e. their intent is to minimise environmental harm in areas where fire is managed primarily for fuel reduction). LMZ minimum intervals (those described in Chapter 5) represent a more sustainable minimum (considered more appropriate where biodiversity management is the primary goal).

A range of NSW 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 NSW RFS website, or from local district offices. 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.*

© K. McShea, Hotspots Fire Project

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 and cultural values 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.

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. Remember 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.

"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."

– Hotspots workshop participant

7 PREPARING A PROPERTY FIRE MANAGEMENT PLAN

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

Think about how you manage your property, what you want to achieve and how this might affect your fire management goals. Consider: risk, production, conservation and cultural values.

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

- Most properties will benefit from at least one Asset Protection Zones (APZ), based around your main property asset/s. The NSW Rural Fire Service have resources which can assist you in determining the size, placement and management of these.

2. Identify and map the vegetation types on your property as well as any known fire history.

- 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. What is the fuel load?
- 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, as well as to reduce fuel in strategic areas.

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 changes to vegetation and 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.

8 CLIMATE CHANGE AND FIRE REGIMES

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

Climate change influences both climatic averages (e.g. increased temperature, reduced rainfall, increased evaporation, lower humidity) and the frequency and severity of extreme weather events and consequent natural disasters such as bush fire, floods, storms, drought, and heatwaves. These influences were seen in the drought leading up to and during Black Summer (2019-20) and are expected to continue for the foreseeable future[1].

> "Dangerous bush fire weather has approximately doubled as predicted over the past decade and this trend is projected to continue in southern and eastern Australia" [1]

Climate change in the Namoi Region

Climate change is affecting the Namoi Region, particularly temperatures which have been increasing since 1960. Projections show temperatures are expected to keep rising, and cold nights will decrease especially in the east of the catchment, while the number of high temperature days will increase in the west.

There is already considerable variation in rainfall, across the catchment, and between seasons and years. Although rainfall totals are modelled to increase across the Nanmoi, winter rainfall is predicted to continue to decrease sharply with increases in summer and autumn. The shifting patterns will likely lead to more time in drought generally, while short-duration heavy-rainfall events are expected to increase in the warmer months[2].

The Namoi is already experiencing a trending increase in the severity and frequency of fire weather. Progressively longer fire seasons are predicted, as is an increase in the number of dangerous fire weather days in the west[2].

Climate change and fire regimes

As the bush fire season is getting longer and the frequency, severity and size of bush fires are increasing, fire regimes are changing. Changes in fire regime are likely to impact plants and animals through a range of mechanisms as discussed in Chapters 3-5, with the potential to alter some ecosystems through changes in species composition and structure. More intense or

frequent fires increase the chance of mortality of habitat trees, resulting in younger forests with a marked reduction in hollow-bearing trees.

Globally the incidence of mega-fires (extensive, high severity fires, such as seen in Black Summer) is increasing. Such events have devastating immediate effects on wildlife, but also reduce refugia, increase the likelihood of burning fire sensitive areas (such as rainforest and peat soils), and expose large areas to altered fire regimes[3].

Independently of fire, other climate change effects (such as heatwaves and drought conditions) impact ecosystems by increasing forest and species mortality and reducing species reproduction. Drought affected ecosystems need longer fire-free periods to recover yet become more susceptible to fire, exacerbating the impacts of increased fire frequency[3].

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

> “The concept of a ‘normal’ bush fire season is rapidly changing, as bush fires are increasing in number and extent, and burn for longer.” [4]

© A. Busse

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3. Le Breton et al. (2022) *Megafire-induced interval squeeze threatens vegetation at landscape scales. Frontiers in Ecology and the Environment*. https://esajournals.onlinelibrary.wiley.com/doi/10.1002/fee.2482

4. Hughes, Lesley, (2014) *Be prepared: Climate Change and the NSW Bushfire Threat*. Climate Council of Australia.

9 WORKING TOGETHER TO MANAGE FIRE ACROSS THE LANDSCAPE

Cooperation in the Namoi Region

Fire management planning to protect life, property and the environment requires collaboration within communities, between agencies and across tenures. Bush Fire Management Committees are responsible for Bush Fire Risk Management Plans. There are 6 committees that cover the Namoi region: the Namoi/Gwydir, Tamworth, New England, Liverpool Range, Castlereagh and North West.

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.

Landholders at the Watsons Creek workshop © K. McShea, Hotspots Fire Project

Participants observe a prescribed burn in Thirldene © K. Mcshea, Hotspots Fire Project

About the Hotspots Fire Project

Based on best available science and operational knowledge, the Hotspots Fire Project delivers workshops and resources to landholders and land managers to provide them with the skills and knowledge they need to participate in fire management planning.

Hotspots operates on a core belief that well-informed and well-prepared communities complement the roles of land managers and fire agencies and that a shared approach to fire management is critical to any form of planning.

Under the guidance of the nine project partners in the Advisory Committee, Hotspots is delivered through the coordinated efforts of the NSW Rural Fire Service and the Nature Conservation Council of NSW.

> “The workshop really brought the community together to implement not just individual property level planning but also a far reaching and coordinated approach to managing fire risk as well as biodiversity.”
>
> – Hotspots workshop participant

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 contributions from Julie Hinchliffe, Christine Pfitzner, Dave Tierney, Waminda Parker, Sally Hunt, Kate McShea, Kevin Taylor, Neale Watson and Lucy Tremain 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 Nature Conservation Council of NSW
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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

Local Land Services - North West Region
www.lls.nsw.gov.au/regions/north-west

Nature Conservation Council of NSW Bushfire Program
www.nature.org.au/bushfire_program

Forestry Corporation of NSW
http://www.forestrycorporation.com.au

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

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

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

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NSW Rural Fire Service

Nature Conservation Council