HOTSPOTS FIRE PROJECT

MANAGING FIRE ON YOUR PROPERTY:
A booklet for landholders in the hunter-central rivers

NSW GOVERNMENT
NSW Environmental TRUST
Nature Conservation Council of NSW

This project has been assisted by the New South Wales Government through its Environmental Trust.

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Managing fire on your property

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Matchum Fire Shed, © D. Tierney.

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WHAT DOES THIS BOOKLET COVER?

Prescribed Burn © W. Parker, Hotspots Fire Project.

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1. LIVING WITH FIRE

© C. Wade, NSW Rural Fire Service.

Fire in the Hunter-Central Rivers

Fire is part of life on the land in the Hunter-Central Rivers 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 Hunter-Central Rivers region, 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.

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Fire and the Australian continent

Triggered by lightning strikes and traditionally used by Aboriginal Australians, fire has shaped the character of Australian landscapes for millions of years. 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.

"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]

© A. Busse, Hotspots Fire Project.

[1] Andrew Campbell - first national landcare facilitator, former Executive Director of Land and Water Australia and current director of Triple Helix Consulting. 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.

2. 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.

Only in the last 20 to 30 years, however, have Australia's scientists gained a 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; in many Australian plant species, one or more aspects of reproduction – flowering, seed release or germination happens exclusively, or more 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 relevant to fire managers: *obligate seeding* and *resprouting*.

Obligate seeders

When *obligate seeder* species are exposed to a fire, all, or almost all, plants are killed. These species can persist, 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 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.

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

In this Obligate seeder, fire can trigger release of seed stored in woody capsules © W. Parker, Hotspots Fire Project.

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

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.
© P Watson, Hotspots Fire Project.

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 more shrubby. 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 – the New Years Day fires of 2006 around Mt White burnt out 1342 hectares and damaged 63 houses. Planned burns may range from small burns of a hectare or less, to burns of several hundred hectares. Prescribed burns in Strickland Forest in August of 2009 burnt 84 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 often 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 a 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 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.
- 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.
- 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).

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 fire 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. © R Poole, NSW Rural Fire Service.

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

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

More about fire season:

Climate and weather will influence fire season more than any other factor. In the Hunter-Central Rivers bush fires generally occur in the summer but the bush fire danger period can begin as early as October and extend through to March or 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 early spring and late autumn.

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.

3. 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.

VARIABLE FIRE REGIME TO SAVE A SPECIES

Managing forests so they can maintain their diversity over time is a challenging task. Plants respond differently to different disturbances and some require fire in order to regenerate and retain their place in the plant community. Others seem to thrive in the absence of fire but can come to dominate and shade out other species.

Intense fires occur in the shrubby wet sclerophyll forests of the Hunter-Central Rivers, perhaps every 50 to 100 years. These forests, characterised by tall eucalypts with a dense understorey of ferns, herbs and shrubs are referred to as wet sclerophyll forests due to the dominance of 'sclerophyllous' or hard leaved trees and shrubs. These forests usually occur adjacent to rainforest and often have rainforest elements themselves, particularly in sheltered pockets or in wetter gullies.

Although it is understood that fire is important in these forests, the fire regime needed to preserve the dominant eucalypts and safeguard other biodiversity values is still unclear.

Intense fire is needed for seeds of some eucalypt trees and some understorey species to germinate and survive. However, other understorey species, particularly those on rainforest margins, are fire sensitive and may not recover from a high intensity fire.

Tranquility Mintbush *(Prostanthera askania)* is an understorey shrub which grows to 3 metres and typically occurs in shrubby wet sclerophyll to rainforest margins. An endangered plant known from only 10 locations in a 50 km^2 area between Gosford and Wyong, *Prostanthera askania* is helping forest managers understand more about the fire ecology of wet sclerophyll forests.

Prostanthera askania plants and their seed can be killed by high intensity fire, yet field observations have found that a low intensity, or cooler fire, can benefit this species by triggering mass germination. Follow up experiments have also found a link between smoke and heat treatments for the seed, in that smoke promotes germination while heat depresses it. This supports the view that a low intensity fire may be optimal for the germination of this species.

Although wet sclerophyll forests experience intense, or hot fires occasionally and some of the species of this environment rely on it for regeneration, there will also be some species, like *Prostanthera askania* that live in these forests, and on the rainforest margins that have different needs for long term survival. To cater for these different species and different needs, a variable fire regime that allows for some low intensity fire may be important in helping to maintain the range of species that occur in this environment.

Tranquility Mintbush *Prostanthera askania*.

FIRE AND ANIMAL HABITAT

Differences in the structure and density of vegetation layers can affect the animals and birds that live in the bush. Although there will always be exceptions, areas which are burnt more often tend to have more open spaces, areas burnt less often tend to be thicker and denser.

Doug Beckers with New Holland Mouse. © M. Ghosn.

The Scarlet Robin (*Petroica multicolor*) for example, takes advantage of the open spaces provided by frequent fire. The lack of dense undergrowth makes it much easier for them to see and pounce on their ground dwelling prey. Similarly the New Holland Mouse (*Pseudomys novaehollandiae*) tends to inhabit areas with sparse ground litter and few low shrubs, as occurs in areas recently burnt. Years of observations in Munmorah State Conservation Area have found this ground-dwelling native prefers recently burnt scribbly gum woodland and wallum heath and often appears within a year after a fire. By excluding fire from woodland and forest landscapes, animals that require open spaces tend to be replaced by species adapted to more shrubby environments.

On the other hand, birds such as the White-Browed Scrubwren (*Sericornis frontalis*) forages for insects on the foliage and bark of shrubs or enjoys feeding amongst the leaf litter under sheltered thickets. This shrub dependent species generally takes up to three years to return to regenerating shrubby areas after a single fire; by increasing the frequency of fires and removing shrub thickets across the landscape, animals that rely on these environments, will eventually disappear.

Some animals require a variety of different vegetation structures. For example, some birds perch on trees and shrubs in environments with a dense understorey, and forage in open grassy areas. The Powerful Owl (*Ninox strenua*) is a good example of this. The Powerful Owl lives in wet and dry sclerophyll forests in eastern Australia from the coast to the tablelands. This bird seems to prefer long-unburnt areas of forest for its nesting and roosting locations. However, it is known to forage in open forest areas. Patchy, frequent fires provide the open, accessible forest areas in which small birds and mice become easy prey. Variability in fire frequency over time and across the landscape has an important role to play in conserving biodiversity.

The Powerful Owl responds well to patchy vegetation. © You Shoot.tv.

In summary, both open and dense patches are important in conserving the range of animal species found in the bush. Recovery of animal populations in the months and years after a fire may depend on many different factors including such things as the vegetation type and the presence of nearby unburnt areas, as well as fire intensity and frequency. Variable fire intervals across time and space will help ensure the habitat needs of a full range of species are met within the landscape.

FIRE FREQUENCY IN GRASSY WOODLANDS

Grassy woodlands have been used extensively for grazing across much of New South Wales. In the Hunter-Central Rivers region they occur in the upper Hunter Valley to the Liverpool Ranges and on the Merriwa Plateau. Patches of good quality grassy woodland where native species still dominate are therefore very valuable from a conservation point of view.

Plant diversity in grassy woodland is concentrated in the ground layer. Here, tussock grasses such as Kangaroo Grass (*Themeda australis*), Snowgrass (*Poa sieberiana*) and Wallaby Grasses (e.g. *Austrodanthonia/Danthonia spp)*) dominate the ground layer. Smaller grasses and herbs grow in the spaces between these tussocks. Fire burns the dense tussocks back, making space for the smaller species. Many grasses and herbs flower rapidly after fire, producing seeds which 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 live together.

Where fire has been excluded from grassy areas, shrubs may increase or decrease depending on whether or not the species present rely on fire for regeneration. Shrubs that depend on fire to regenerate will die off after a long time without fire, producing a more open understorey than in the years following fire. When a fire next comes along, these shrubs may reappear in large numbers as seed stored in the soil is stimulated to germinate. Some shrubs, however, can regenerate between fires. Where this is the case, the density of these shrubs will increase in the absence of fire. Where fire frequency is low, and environmental conditions are right, these species may progressively come to dominate the landscape.

In some situations, shrub density may increase to the point where grasses and herbs are shaded out. Heavy litter which accumulates as time goes by may also leave little room for small ground layer species. Thus, relatively frequent fire may be important for maintaining vibrant populations of grasses and herbs, as well as the animals which feed on them.

Both ground layer plants and shrubs form part of the rich diversity of grassy woodlands in the Hunter-Central Rivers. 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.

4. 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 Department of Environment, Climate Change and Water (DECCW) 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 DECCW and local ecologists to further develop these guidelines to take into account the considerable differences between regions within NSW. The region covered by the Hunter-Central Rivers Catchment Management Authority includes a very wide range of environments, from the north coast to the central western slopes. Across this gradient rainfall varies from 800 to 1500mm on the north coast, to 449mm to 1025 mm toward the west. Summer temperatures vary from mild to very hot, frost days decrease and soils change towards the coast. 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.

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 Hunter-Central Rivers are listed on the following pages.

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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.

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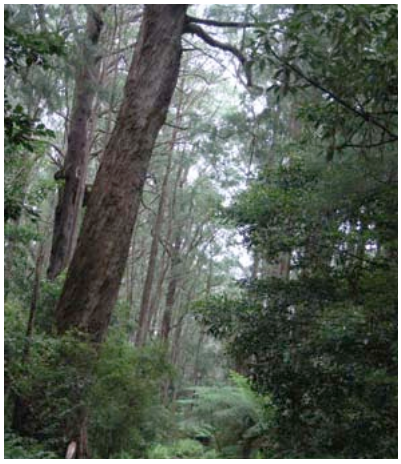
Vegetation types of the Hunter-Central Rivers

© G. Basnett, Hotspots Fire Project.

Rainforest

Rainforests are usually dominated by soft leaved trees with vines, ferns and palms in the understorey. These forests grow on moist sites with fertile soils. The Hunter-Central Rivers region supports many different types of rainforest from littoral rainforests on the back of coastal dunes to the high altitude cool temperate rainforests of the Barrington Tops. The moist environment shades out the more flammable species that fuel fires, thereby protecting most of the forest from fire events. Although a wildfire may occasionally go through a rainforest (and the community may be able to recover slowly), rainforest is very sensitive to recurring fires. Fire should therefore be excluded where possible.



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Wet Sclerophyll Forest (shrubby subformation)

The term *sclerophyll* refers to the hard, leathery leaves of many distinctly Australian trees and shrubs

Wet sclerophyll forests (shrubby subformation) 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 Hunter-Central Rivers region, this vegetation type is extensive and occurs along the coastal plains and the slopes of the ranges. 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 subformation wet sclerophyll forests are likely to experience occasional intense wild fires, perhaps every 50 to 100 years. Intense fire may be needed for eucalypts to regenerate. Less intense but more frequent understorey fires may have a role in maintaining shrubs, ferns and herbs. Currently, variable fire intervals in the range 25 to 60 years are recommended for shrubby subformation wet schlerophyll forests across the state. However these recommendations may be reviewed and refined as we learn more.

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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 Hunter-Central Rivers region, this vegetation type often occurs on the foothills of the ranges. 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.

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 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.

E. Geraghty, Hotspots Fire Project.

Dry Sclerophyll Forest (shrubby subformation)

This vegetation type includes forests and woodlands dominated by eucalypts with an understory of hard leaved shrubs, many of which are obligate seeders. Grasses and sedges are sparse in these plant communities. Dry sclerophyll shrub forests grow on poor to moderate soils in moderate rainfall areas. The forests of Towarri National Park in the upper Hunter Valley and the forests of the foothills and ridges of the Central Coast are examples of this vegetation type.

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

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Dry Sclerophyll Forest (shrub/grass subformation)

Dry sclerophyll forests (shrub / grass subformation) consist of open eucalypt forest with a sparse hard leaved shrub layer. This vegetation type differs from the shrubby subformation in having a more grassy groundcover. These forests occur on moderately fertile soils in areas of moderate rainfall. Several rather different forms of shrub/grass dry sclerophyll forest are found in the Hunter-Central Rivers, 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 Spotted Gum and Ironbark Forests of the Hunter and the Central Coast.

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.

© K. Nicolson, NCC Bush Fire Program.

Grassy Woodland

This is open eucalypt woodland where the crowns of the trees generally do not touch and the understorey consists of grasses, 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 Hunter-Central Rivers, remnant grassy woodlands are found across the Upper Hunter to the Liverpool Ranges and the Merriwa Plateau. On the western part of the dividing range, the species composition of grassy woodlands shifts towards plants that are able to cope with a drier climate.

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. In the elevated country of the Barrington Tops, where plants grow more slowly and snow gums are sometimes found, somewhat longer intervals may be more appropriate.

© G. Basnett, Hotspots Fire Project.

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* species). Many plants in native grasslands are often missed; some may not be visible through autumn or winter, but re-emerge to flower in spring. Grasslands in the Hunter-Central Rivers occur on the Merriwa Plateau with some fragmented grasslands remaining on the steep slopes of coastal headlands. Grazing and pasture improvement have extensively modified the grasslands, so remnants where native species continue to thrive are places to be cherished.

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. 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. There are very few studies on coastal headlands.

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Heathland

Heathland is 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 Hunter-Central Rivers, heathland is found in many scattered coastal areas on the back of dunes. Examples can be found in Myall Lakes National Park and Munmorah State Conservation Area. Heath may also be found inland on sandstone ridges and slopes where soils are not deep or fertile enough to support trees. 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.

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Forested Wetlands

These forests typically feature hard leaved trees (paperbarks, casuarinas, eucalypts), scattered shrubs and a continuous groundcover of water loving sedges and herbs. They grow in high rainfall areas on coastal dune swales, flood plains and riparian zones. 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.

Freshwater Wetlands

Freshwater wetlands include those wetlands found typically along the coast but may also occur in association with inland rivers. They usually have a dense groundcover of sedges and may contain a wide range of shrubs. 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.

Estuarine and Saline Wetlands

Estuarine and saline wetlands include mangroves and salt marshes that occur along the edge of coastal estuaries. These communities are not fire prone and excluding fire is appropriate.

5. 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 landholders 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 Hunter-Central Rivers Region.

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.

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.

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 usually 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 are available that provide detailed information about how to undertake a low intensity burn safely and how to maintain Asset Protection Zones.

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 fine 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/historic heritage sites and production areas.

HOTSPOTS FIRE PROJECT
Managing fire on your property

Some key messages in planning for bio-diversity 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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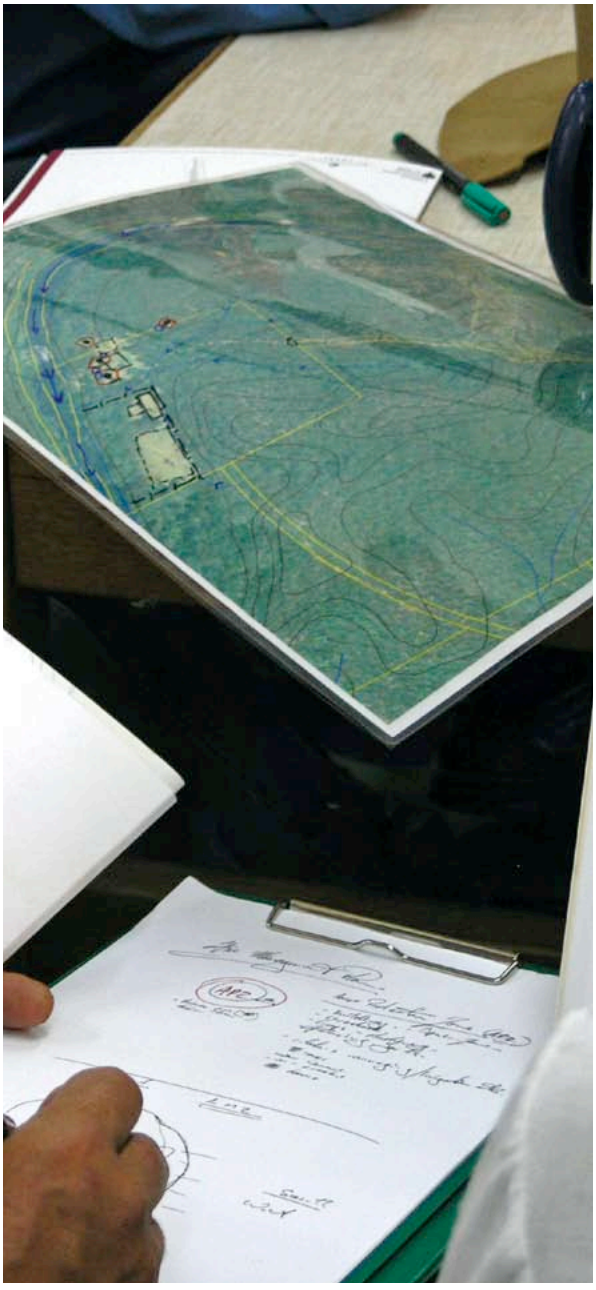
THE KEY MESSAGES

Simple principles for management

- Different vegetation types are adapted to different fire regimes.
- 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.
- Do not 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.
- 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.

6. PREPARING A PROPERTY FIRE MANAGEMENT PLAN



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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.

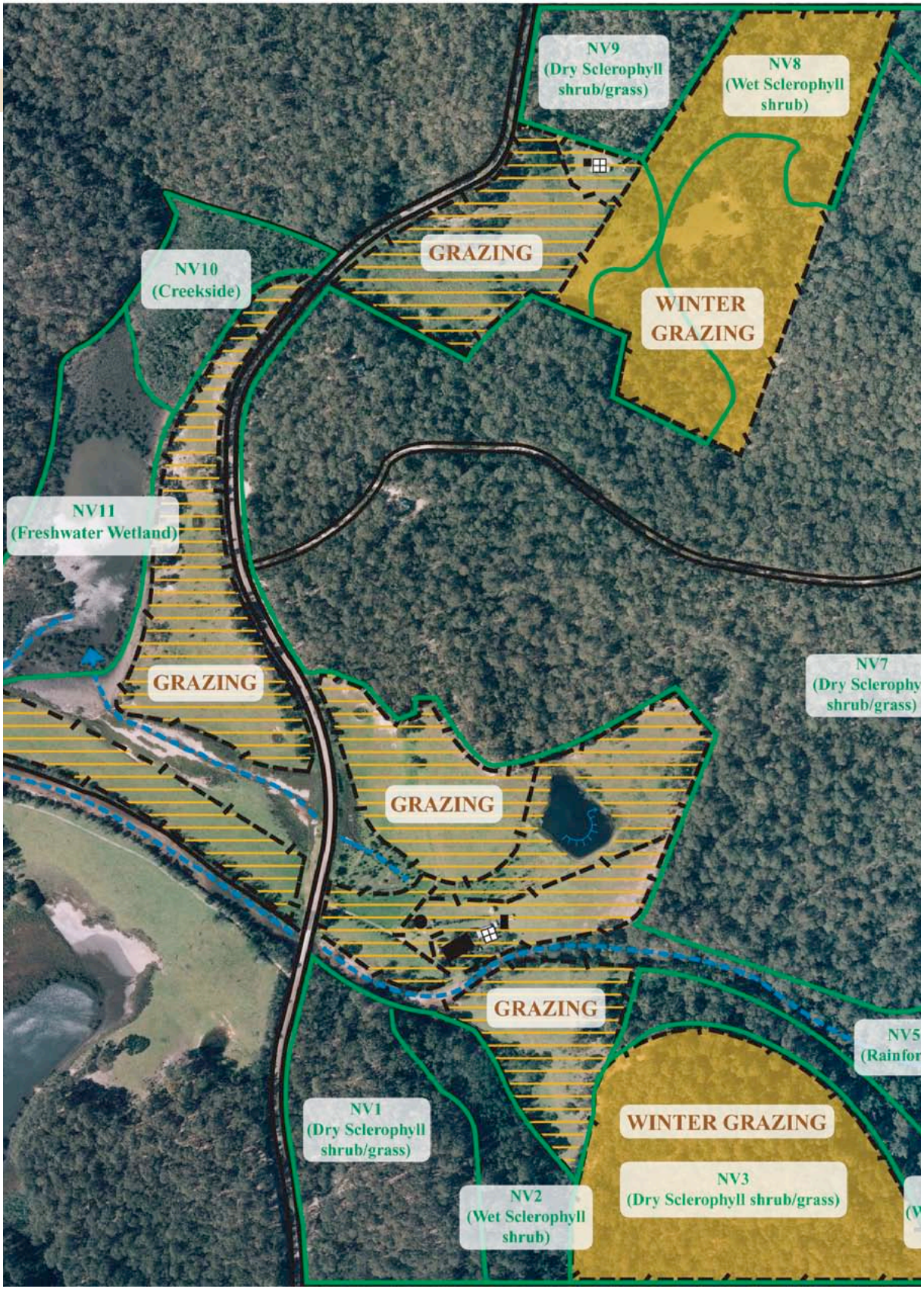
- Make a note of the fire frequency intervals recommended for the vegetation types on your property.
- How often have these vegetation types burned in the past? Note when and where fires have occurred.
- Are past fire regimes consistent with recommended regimes? Make a note of vegetation areas on your 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.



Sample Map. © Photo supplied by the Department of Lands Panorama Avenue Bathurst 2795. www.lands.nsw.gov.au.

7. FIRE AND CLIMATE CHANGE

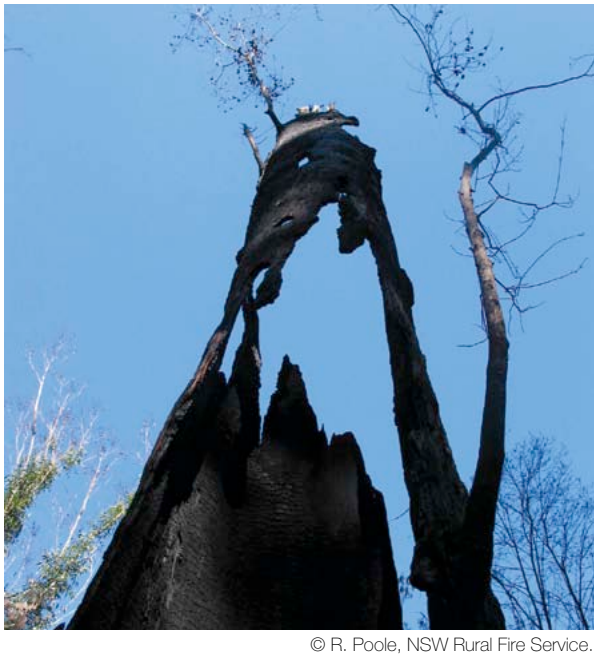
It is now generally accepted that the world is undergoing a significant change in climate.

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].

For the Hunter region, climate change will mean warmer temperatures. By 2050, temperatures in the Hunter region are projected to be hotter over all seasons by 1-3°C degrees, with more hot days[2]. The frequency and intensity of bush fires in the region is projected to increase, with a longer fire season as a result of warmer temperatures and higher evaporation rates. Bush fires and increased temperatures will significantly impact on biodiversity and protected forests, woodlands and wetlands such as the Barrington Tops National Park.[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.



© R. Poole, NSW Rural Fire Service.

'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 *Bush fire Weather in South-East Australia: Recent Trends and Projected Climate Change Impacts*.

2 The Australian Government, Dept. of Climate Change www.climatechange.gov.au

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.

8. WORKING TOGETHER TO MANAGE FIRE ACROSS THE LANDSCAPE

Cooperation in the Hunter-Central Rivers region

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

In the Hunter-Central Rivers region, 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.

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.

For further information on this initiative contact the Hotspots Project Coordinator on (02) 9279 2466 or visit the project website: www.hotspotsfireproject.org.au

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The NSW Rural Fire Service, the NSW Department of Environment, Climate Change and Water, NSW Catchment Management Authorities, NSW Farmers Association, the Southeast Queensland Fire and Biodiversity Consortium, Forests NSW, NSW Local Government & Shires Association, National Parks and Wildlife Service, and University of Wollongong's Centre for Environmental Risk Management of Bush fires.

Hotspots also has close affiliations with the NSW Land and Property Management Authority and the NSW Landcare Inc.

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

- Hotspots Fire Project
  www.hotspotsfireproject.org.au
- Hunter-Central Rivers Catchment Management Authority www.hcr.cma.nsw.gov.au
- NSW Rural Fire Service
  www.rfs.nsw.gov.au
- Nature Conservation Council of NSW Bush fire Program
  www.nccnsw.org.au/bushfires
- Forests NSW
  www.dpi.nsw.gov.au
- Southeast Queensland Fire and Biodiversity Consortium
  www.fireandbiodiversity.org.au
- NSW State Emergency Services
  www.ses.nsw.gov.au
- NSW National Parks & Wildlife Service
  www.environment.nsw.gov.au

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Landholders and agency staff working together at a Hotspots workshop. © K. McShea, Hotspots Fire Project.

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