Bushfire, Forests and Land Management Policy Under a Changing Climate

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Bushfire is a key component of Australia's environment, having evolved in response to a hot and dry climate. However, forest fires in southern Australia have increased in scale and intensity in recent times. Many stakeholders attribute this disturbing trend to the lack of a comprehensive landscape approach to fire risk management. Concurrently, forestry on rural lands is increasing with climate change policy encouraging afforestation for carbon storage and related benefits. While on-site risks for plantations and carbon sink forests are managed through regulation and prudent commercial practice, the broader risks from passively managed public land remains an issue. Effective bushfire management appears to be a problem of social and political commitment to preventative land management rather than a case of scientific complexity. A well coordinated land management strategy could help reduce fire risk, complement climate change policy and provide multiple economic, environmental and public safety benefits.

Fire

Fire is an inherent part of the Australian environment, with many forests dependant on fire disturbance for growth and regeneration. Fires can create a mosaic of disturbance patterns across a forest and enhance habitat diversity. However, fires can have beneficial or detrimental effects on ecosystems, depending on such factors as scale, frequency and intensity. The complexity of fire management is perhaps best summarised by the Council of Australian Governments (2004):

> Bushfires have a fundamental and irreplaceable role in sustaining many of Australia's natural ecosystems and ecological processes and are a valuable tool for achieving land management objectives. However, if they are too frequent or too infrequent, too severe or too mild, or mistimed, they can erode ecosystem health and biodiversity and compromise other land management goals.

In addition to natural processes such as lightning strikes, the interaction of Indigenous management practices that included regular forest burning over thousands of years, together with more recent European interventions such as the exclusion of fire in many cases, have consequently influenced the fire regimes we have today.

However, over the past decade there has been an alarming trend with fires of increasing scale and intensity in southern Australia, including south-west Western Australia, South Australia, Victoria and south-eastern New South Wales (Table 1). High intensity 'mega-fires' have caused significant damage to lives and property, biodiversity, watersheds and natural resource dependant industries such as agriculture and forestry. This phenomenon contrasts with evidence that earlier Indigenous burning practices had a direct impact on limiting the severity of fires, whereby:

> Australian bushfire scientists and anthropologists generally agree that, before European settlement, Indigenous people carried out frequent, regular and wide-scale burning, especially in the drier forest types. The net result was a mosaic of burnt and unburnt patches that limited the extent and intensity of fire under severe weather conditions. (Montreal Process Implementation Group for Australia 2008)

Table 1: Mega-fires in southern Australia, 1993 to 2007.

Fire season	Location	Area burnt (hectares)[a]
1993–94	Sydney/Blue Mountains/North Coast, NSW	800,000 +
1995	Southeast Qld	333,000
1997–98	Hunter/Blue Mountains/Shoalhaven, NSW	500,000 +
1997–98	Caledonia River, Gippsland, Vic	32,000
2001–02	Greater Sydney, NSW	744,000
2002	Stanthorpe/Toowoomba, Qld	40,000
2002–03	Eastern Highlands, Vic	1.1 million
2002–03	Brindabella Ranges/Canberra, ACT/NSW	157,000 +
2002–03	NSW east coast/Greater Sydney, NSW	1.46 million
2002–03	Arthur-Pieman, Tas	100,000
2005	Eyre Peninsula, SA	145,000
2006–07	Eastern Highlands, Vic	1.05 million

a Total area burnt, including vegetation types other than forests.

Source: Montreal Process Implementation Group for Australia (2008).

The impacts of mega-fires such as the February 2009 Victorian bushfires continue to fuel policy debate on long-term causes and preventative measures for dealing with bushfires (or unplanned fires). Bushfires depend on such factors as fire history, topography, forest type, weather and human induced changes such as lack of disturbance (eg build up in fuel loads from fire exclusion). These issues are discussed with respect to broader land management and climate change policies, given their role in influencing long-term fire mitigation and land use.

Land Management

There is growing recognition that the problem of mega-fires is essentially a land management issue (Williams 2007). Many fire scientists and commentators believe there has been a gradual shift in fire management policy toward fire suppression and response at the expense of longer-term fire prevention and fuel reduction (Devine 2003). High fire risk is attributed to a passive land management approach that has altered natural fire regimes and allowed an excessive build up in forest fuel loads. Effective land management for fuel reduction is further exacerbated by a range of factors, including:

- population growth and encroachment in peri-urban areas with high forest cover
- multiple land management agencies and tenures with responsibilities for fire management in addition to other objectives
- a political and institutional environment that has resulted in the transfer of large areas of multiple-use state forest to formal conservation reserves with a passive approach to fuel reduction.

Population pressures

The Australian population is concentrated in the higher rainfall and coastal areas of the country, particularly along the south-eastern seaboard. The majority of Australians reside in major cities and inner regional areas, representing nearly 90 per cent of the total population (or 18.5 million persons). By contrast the remote and very remote categories comprise less than three per cent of the population and are largely distributed through the rangelands and arid interior.

The less remote areas with higher population density also support the majority of woody vegetation such as forests and woodlands, reflecting patterns of economic development based on higher rainfall and land productivity. These trends have continued with ongoing population growth and expansion of existing cities, together with increasing numbers of people

moving into peri-urban areas as part of rural land sub-divisions and 'lifestyle' or 'tree change' factors. High population growth in the inner and outer regional areas, as well as the peri-urban areas of major cities, has increased the risks of managing for fire safety due to high remnant woodland and forest cover in these regions.

Managing for fuel loads

Fire is influenced by three important factors: weather, topography and fuel. Native eucalypt forests can reach high fuel levels within five to ten years after a fire and fuel loads can vary between 10 to 40 tonnes per hectare (Figure 1). As fuel falls within the direct control of management, significant research has been directed into fire behaviour and fuel management.

The principle of reducing the risks posed by bushfires by reducing the amount of fuel available to be burned is well established and supported by empirical studies (Council of Australian Governments 2004). In the dry eucalypt forests of south-west Western Australia, for example, it has been demonstrated that hazard reduction by prescribed burning will reduce the rate of spread, flame height and intensity of a fire and reduce the potential for spotting (Gould et al. 2007). The aims of prescribed burning are to reduce the quantity and alter the structure of fine fuels, so that the intensity of subsequent unplanned fires is moderated to a level where suppression is effective (Luke & McArthur 1978). Fuel reduction is not considered a panacea for fire prevention and management, but if conducted across a large enough area and at the right intervals can assist with fire suppression for a range of weather conditions (Figure 2).

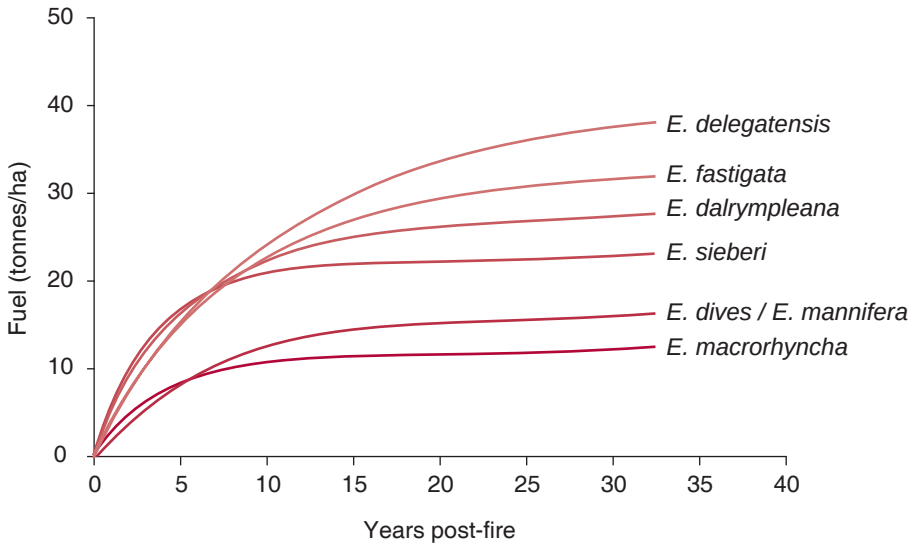

Figure 1: Representative fuel accumulation curves for some vegetation associations.

Source: Good (1994).

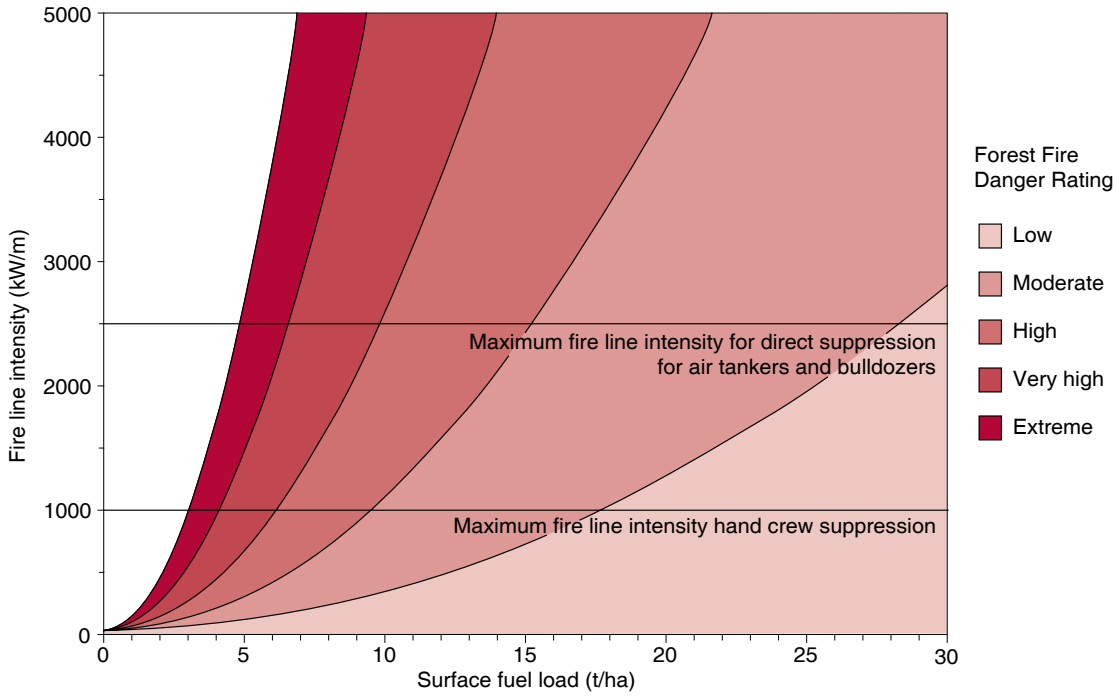

Figure 2: Relationship between fuel load and fire intensity as the forest fire danger rating changes.

Source: CSIRO submission to Council of Australian Governments (2004).

However, from a policy and public land management perspective the use of fuel reduction strategies for long-term fire prevention has been problematic. Except in some multiple-use production forestry areas, the use of prescribed, low intensity fires for fuel reduction is undertaken on a small scale (de Mar & Cheney 2005).

Without a strategic landscape approach to fuel reduction such as large-scale mosaic burns, small-scale burns are unlikely to be effective (Tolhurst 2007). The lack of a strategic landscape approach reflects the fragmentation of forest landscapes with multiple land tenures and agencies that often have conflicting objectives, such as managing for water supply, sustainable production forestry or conservation management. Other common impediments to fuel reduction activities have included:

- inadequate funding, skills and equipment
- community concerns over smoke and air quality
- narrow window of weather days for achieving low intensity burns
- liability issues from fire escape beyond the prescribed burn
- a decline in forestry trained fire managers and firefighting infrastructure from the transfer of sustainable production forestry areas to national parks and reserves.

Since 1990, over 13 million hectares of public forest have been added to formal conservation reserves. Over time, this has resulted in a decline in firefighting capacity and personnel formerly provided by industry for the protection of commercial wood resources and other forest values. A management imperative of production forestry is to protect the commercial resource from damage through fire prevention (ie reduce

likelihood of fire), detection and response. In contrast, the increase in conservation reserves has been associated with a more passive approach to fuel reduction, with numerous government inquiries and reviews highlighting the inadequacy of prescribed burning activities and other planning impediments (Parliament of New South Wales Legislative Assembly 2002; House of Representatives Select Committee on the Recent Australian Bushfires 2003; Environment and Natural Resources Committee 2008). There remains community debate over management priorities and the appropriate balance between the use of fire for healthy ecosystems and the protection of assets such as people and property.

However, there is common ground emerging on the importance of a landscape approach to the use of fire for ecological and other objectives. In 1994 conservation biologists recognised the need to facilitate ecological burns more integrated with fire protection burns and to provide a diversity of fire regimes to help maximise habitat biodiversity (Department of the Environment, Sport and Territories 1996). The Ecological Society of Australia recognises that fire management must be planned in a more strategic and integrated way to minimise conflict between conservation and other goals. The key policy challenge is to develop complementary land management practices that reduce the risk of large-scale high intensity fires for protection of life and property while managing for multiple objectives such as biodiversity conservation, production forestry and water supply.

Climate Policy

The prominence of climate change as a global environmental issue has brought about sweeping policy changes affecting energy use and renewable energy in the Australian economy, as well as land use policies aimed at enhancing carbon sequestration in forestry. These climate policy drivers may lead to expanded forestry development in rural and regional areas, where the intersection of climate policies with fire management is an important consideration in broader land use management.

Climate predictions

Given the significance of weather to fire incidence and severity, climate modelling tells us that fire risk is increasing in southern Australia. Land use management will have to deal with the fact that Australia is projected to have a warmer climate, reductions in rainfall across southern Australia and more extreme natural disturbances (Hennessy et al. 2007). In particular, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) concluded that:

> An increase in fire danger in Australia is likely to be associated with a reduced interval between fires, increased fire intensity, a decrease in fire extinguishments and faster fire spread. In south-east Australia, the frequency of very high and extreme fire danger days is likely to rise 4–25% by 2020 and 15–70% by 2050.

The fire season is expected to be extended as a result of a changing climate, with the window of opportunity for controlled burning shifting toward winter. These factors will only exacerbate fire management strategies for the protection of lives and property, and other forest values such as timber production and biodiversity. Australia's forests, and endemic flora and fauna are particularly vulnerable to projected change in future climate due to the fact that many species have a high degree of endemism and are restricted in geographical and climatic range. The impact of large-scale high intensity fires can consequently have significant impacts on a range of taxa.

Afforestation and carbon sequestration

There are 2 million hectares of softwood and hardwood plantation forest in Australia, largely established in southern Australia for wood and fibre production. The *Plantations for Australia 2020 Vision* aims to establish 3 million hectares by 2020. The Vision is a national policy to promote wealth and employment from plantations and help offset the economic and social impacts from the previous withdrawal of native forest areas from timber production. Infrastructure, removal of planning impediments and a taxation environment that addresses the long-term nature of forest investment have all contributed to the

growth in plantations, accounting for 70 per cent of domestic log supply.

More recently, climate change policy has provided an additional potential driver for expansion of planted forests. International climate policy, through the United Nations Convention on Climate Change and related bodies such as the Food and Agriculture Organization, has recognised the climate mitigation benefits from forestry activities, including:

- the carbon stored in growing forests
- the carbon stored in durable wood products and substitution for more emissions intensive materials such as steel and concrete
- the renewable energy produced from forestry biomass to replace emissions from fossil fuels.

These principles are yet to be developed into a comprehensive set of carbon accounting design rules and policies for forestry activities, including the treatment of harvested wood products and natural disturbances such as fire. However, tree biomass carbon from afforestation since 1990 on previously cleared land is recognised under the Kyoto Protocol and the Australian Government's proposed emissions trading scheme – the Carbon Pollution Reduction Scheme (CPRS). The CPRS recognises carbon that is sequestered in not for harvest (ie carbon sink) forests and harvest forests such as commercial plantations where timber harvesting is undertaken. In addition, carbon sink tax legislation provides deductions for the costs of acquiring and planting trees or seeds used exclusively for carbon sequestration. These tax provisions encourage the use of trees in the rural landscape for carbon sequestration and other environmental purposes that typically involve revegetation of marginal or degraded farm areas.

The long-term potential for carbon driven afforestation will depend on the availability of suitable land, including biophysical and economic land suitability. This depends upon land productivity, land use opportunity costs and the price of traded carbon or other financial incentives. Several studies suggest that substantial areas of land may be commercially suitable for afforestation over the medium term, with estimates ranging from five to 25 million hectares (or one to six per cent of farmland) depending on carbon prices (Lawson et al. 2008; Polglase et al. 2008). While these estimates are based on modelling assumptions, it is clear that Australia has a very large land base and afforestation is likely to be commercially attractive for many areas at the projected range of carbon prices.

The wide ranging potential for afforestation for carbon storage will require careful management in light of the increased climatic risks of drought and fire. This involves, amongst other factors, selection of suitable tree species and genotypes and fire management. The management of plantations and native forests is governed by a suite of state and local planning and Natural Resource Management (NRM) laws and regulations, including codes of practice for forestry operations on private and public forest land. These regulations provide an adaptive system of policies and standards for safety, environmental planning and fire management. In addition, planted forest owners have a management imperative to protect assets from fire due to their commercial value as a timber or carbon resource. Plantation forestry companies typically have trained personnel, equipment and resources such as industry fire brigades for suppressing and managing fires, including the maintenance of access roads, trails and fire breaks. It is for these reasons that the proposed CPRS does not impose additional fire management obligations on reforestation projects, as these obligations are met elsewhere through targeted NRM policies (Commonwealth of Australia 2008). Such an approach avoids duplication and promotes regulatory efficiency. However, changes have occurred in fire management capacity through the privatisation of state owned plantations and transfer of responsibilities to local rural fire organisations in conjunction with industry fire brigades. The infrastructure of most rural volunteer bushfire brigades has largely been developed around grass-fire suppression; and changes in equipment, training and fire suppression tactics are required to cope with the expanding plantation estate (McCaw et al. 2002). For some absentee or small forest owners, there

Figure 3: The bushfire cycle.

Source: Council of Australian Governments (2004).

may also be issues with respect to inadequate resources and expertise for fire management such as prescribed burning activities (Victorian Association of Forest Industries 2008). These impediments could be addressed as part of a strategic approach to fire management, such as provision of resources to ensure that private land is included in prescribed burning and other programs.

While on-site fire risks for private forests may be adequately dealt with through prudent commercial practice and the broader NRM regulatory environment, a key policy issue concerns landscape scale risks. Fires do not recognise administrative boundaries, and management policies and practices in one jurisdiction will impact on another. Australia has 149 million hectares of native forest and woodland, with over 70 per cent of native forests under public ownership in New South Wales, Victoria and Tasmania combined. Given the large extent of the public forest estate and historically passive approach to fuel management in many parks, reserves and peri-urban areas, the landscape scale risks of high fuel loads and large-scale bushfires continue to present a problem for the protection of assets and environmental values.

Long-Term Policy Solutions

The failure to develop a long-term solution to the issue of bushfire management appears to be a problem of social and political commitment to preventative land management rather than a case of scientific complexity. Over the course of the past century we have witnessed a familiar pattern of what has been termed the 'bushfire cycle'. This cycle describes the initial short-term policy response to a major bushfire event that is eventually followed by complacency the longer the timeframe since the last major event (Figure 3).

The underlying reasons for the 'bushfire cycle' are complex but include multiple land management agencies and responsibilities, the long-time frame between major fire events relative to policy cycles (eg beyond the typical three to four year election cycle), a focus on fire suppression rather than long-term prevention and competing social demands for limited resources.

Given the magnitude of fire risks and complexities of multiple jurisdictions and land management responsibilities, fire management should be supported through a national process such as the Council of Australian Governments

(COAG), in a similar way as to the treatment of water policy. The National Water Initiative, being a partnership between the federal and state and territory governments, may provide a model for the development of a 'National Fire Initiative'.

A national strategy or blueprint could be developed and implemented to assist with the reform of public land management for effective fire management. Such a process could build on the following recommendations from the review by COAG (2004) after the severe 2003 fire season in southern Australia:

- develop national principles to promote shared goals
- use a risk management framework across all activities
- adopt an adaptive management approach that takes on new information
- undertake more research into the characterisation of fuel loads and landscape scale studies into fire behaviour and responses to management
- develop 'burning guides' and a zoning approach to the classification of fuel management areas.

Within this context, research into landscape fire modelling and fire ignition and severity in forests subject to different management regimes is an important priority. The range of measures available to reduce the severity and impacts of bushfires include land use zoning and planning, use of fire breaks and access trails, grazing, ecological burning, fuel reduction burning and vegetation clearing and thinning. Prescribed burning is generally recognised as the most cost-effective means for achieving fuel reduction at a landscape scale. However, given climate policy considerations there may be a range of new and innovative options for managing fuels with multiple benefits, such as the mechanical removal of highly flammable biomass for green energy. Such options would depend on commercial, technological and ecological considerations.

Rather than hide from this complexity, what is needed is political and community commitment to a landscape approach to fire risk management that looks at the risks and options across all land tenures and is supported by scientific evidence. A well coordinated land management strategy could help reduce the risk of extensive high intensity fires, complement climate change policy and provide a range of economic, environmental and public safety benefits.

References

Commonwealth of Australia 2008, 'Carbon Pollution Reduction Scheme: Australia's Low Pollution Future', White Paper, December.

Council of Australian Governments 2004, 'National Inquiry on Bushfire Mitigation and Management', Canberra.

de Mar, P & Cheney, P 2005, 'Native forests under fire', in *The living forest: an exploration of Australia's forest community*, J Keenan (ed), ETN Communications, pp. 34–5.

Department of the Environment, Sport and Territories 1996, 'Introduction', *Proceedings of the Biodiversity and Fire: the Effects and Effectiveness of Fire Management Conference*, 8–9 October 1994, Melbourne, viewed 2 December 2009, http://www.environment.gov.au/biodiversity/publications/series/paper8/intro.html

Devine, M 2003, 'Bushfires: the solution is clear', *The Sydney Morning Herald*, 8 May, p. 15.

Environment and Natural Resources Committee 2008, *Inquiry into the Impact of Public Land Management Practices on Bushfires in Victoria*, Parliament of Victoria.

Good, R 1996, 'Fuel dynamics, preplan and future research needs', *Proceedings of the Biodiversity and Fire: the Effects and Effectiveness of Fire Management Conference*, Department of the Environment, Sport and Territories, 8–9 October 1994, Melbourne, viewed 2 December 2009, http://www.environment.gov.au/biodiversity/publications/series/paper8/paper23.html

Gould, JS, McCaw, WL, Cheney, NP, Ellis, PF, Knight, IK & Sullivan, AL 2007, 'Project Vesta – fire in dry eucalypt forest: fuel structure, fuel dynamics and fire behaviour', Ensis-CSIRO, Canberra ACT, and Department of Environment and Conservation, Perth WA, November.

Hennessy, K, Fitzharris, B, Bates, BC, Harvey, N, Howden, SM, Hughes, L, Salinger, J & Warrick, R 2007, 'Australia and New Zealand', in ML Parry , OF Canziani, JP Palutikof, PJ van der Linden, & CE Hanson (eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, pp. 507–40.

House of Representatives Select Committee on the Recent Australian Bushfires 2003, *A Nation Charred: Inquiry into the Recent Australian Bushfires*, Canberra.

Lawson, K, Burns, K, Low, K, Heyhoe, E & Ahammad, H 2008, *Analysing the economic potential of forestry for carbon sequestration under alternative carbon price paths*, ABARE, Canberra, November.

Luke, R & McArthur, A 1978, *Bushfires in Australia*, Australian Government Publishing Service, Canberra.

McCaw, L, Gould, JS & Cheney NP 2002, 'Bluegum plantations – are we underestimating the fire hazards?', Proceedings of the Australian Forest Growers Biennial Conference, Albany, Western Australia.

Montreal Process Implementation Group for Australia 2008, *Australia's State of the Forest Report 2008*, Bureau of Rural Sciences, Canberra.

Parliament of New South Wales Legislative Assembly 2002, *Report on the Inquiry into the 2001/2002 Bushfires*, Joint Select Committee on Bushfires, Sydney, June.

Polglase, P, Paul, K, Hawkins, C, Siggins, A, Turner, J, Booth, T, Crawford, D, Jovanovic, T, Hobbs, T, Opie, K, Almeida, A & Carter, J 2008, *Regional Opportunities for Agroforestry Systems in Australia*, RIRDC Publication 08/176, October.

Tolhurst, K 2007, 'Lessons we cannot fail to learn from landscape-scale fires', *Australian Forest Grower*, Vol. 30, pp. 23–5.

Victorian Association of Forest Industries 2009, 'Submission to the 2009 Victorian Bushfires Royal Commission', May.

Williams, J 2007, 'The megafire reality: redirecting protection strategies in fire-prone ecosystems', in *Are big fires inevitable*, Bushfire CRC Forum, Canberra, February.

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