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## **Landscape Management: Is it the Future?**

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## Landscape Management: Is it the Future?

### Abstract

As a Keynote Address at the 2004 Nature Conservation Council Conference, Bushfire in a Changing Environment - New Directions in Management, this paper argues that the landscape is a template with biodiversity assets, and human assets and bushfires overlaid. Two case studies, the Greater Glider and Eastern Bristlebird, are used to illustrate how the impact of bushfire on a species is contingent on it is distributed in the landscape, relative to the locations of its remnant habitat. Mitigation of bushfire effects, using fuel-reduction programs, is a process that also needs to be considered at a landscape scale, and has the potential to threaten biodiversity assets if not considered carefully.

### Keywords

bushfire, landscape, management, biodiversity

### Disciplines

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# **Landscape Management: Is it the Future?**

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## **Introduction**

I was asked to address the following question in relation to bushfire and bushfire management: Landscape Management: Is it the Future? In a sense, this question is out of date. Bushfire management should always have been designed to be at the landscape scale, because bushfires are a landscape-level process, they burn across an ever-changing, complex patchwork of land tenures within that landscape, and the various assets that are threatened by bushfires are therefore interspersed in various ways across the landscape. Nevertheless, there are still press reports and commentaries that treat fire management as if it were the responsibility of a single organisation or a particular land-owner, and imply that the responsibility for reducing the risks associated with bushfires lies with some agency. In this paper, I explore the theme of bushfire management at a landscape scale by combining some observations on conservation biology, on the behaviour of big bushfires superimposed on the complexity of modern, human-affected landscapes, and on bushfire risk-management programs. One of the consistent messages conveyed to the recent COAG Bushfire Inquiry (Ellis *et al.* 2004) is that a thorough understanding of these issues is needed if we are to achieve effective bushfire management for multiple land uses.

### **Conserving biodiversity – a landscape-level challenge**

Australia's *National Strategy for Ecologically Sustainable Development* (Council of Australian Governments 1992) identifies the importance of maintaining ecological processes as a fundamental basis for sustainable development. Ecologically Sustainable Development is defined as: “using, conserving and enhancing the

community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.”

One part of the overall strategy for achieving Ecologically Sustainable Development is a reserve system, which includes a range of categories of reserves at all levels of government. A significant amount of the landscape in each state and territory is in the national park estate. In 2002, this was about 10 percent of the total area of the continent ([Department of Environment and Heritage 2003](#)). However, it is widely acknowledged that effective biodiversity conservation cannot be achieved solely through a reserve system, but needs to be applied, in appropriate ways, across all land tenures. The *National Strategy for the Conservation of Australia's Biological Diversity* recognises this fact, and states: ‘Australia's biological diversity and the threats to it extend across tenure and administrative boundaries. At present more than two-thirds of Australia (some 500 million hectares) are managed by private landholders, while about 40 million hectares are within the terrestrial reserve system. The conservation of biological diversity is best achieved *in situ* and requires integrated and consistent approaches across freehold and leasehold and other Crown lands.’

In engaging in a risk assessment process in relation to bushfire, it is critical that we include all the assets in the landscape that might be threatened. I emphasise here that biodiversity is an asset, just as plantation forests are assets, houses and property are assets, and clean water coming from a catchment is an asset. Biodiversity is an asset that is valued by many sections of the community: so much so, for some individuals, that they design their houses and lives to be able to live in amongst it – despite the risks.

Fire can be a threatening process for many elements of biodiversity, so protecting this asset needs to be considered as an integral part of fire management. Much has been written on the impacts of fires on flora and fauna in Australia (e.g. Gill *et al.* 1981, Whelan 1995, Bradstock *et al.* 2001, Cary *et al.* 2003), and we know a considerable amount about the fire responses of a very limited range of plant and animal species. Very little of what we know is based on studies that have been conducted at a landscape scale. To illustrate how important such studies will be in the current human-affected landscape, I will focus on the case of the Greater Glider (*Petauroides volans*) at Royal National Park.

The greater glider is not listed as an endangered species, but it is an iconic one in south-east forest ecosystems (e.g. Kerle 2001, Lindenmayer 2002). As an arboreal folivore which spends most of its time in eucalypt canopies and nests in tree hollows, it would be expected to be susceptible to high-intensity canopy fires. Recovery of populations in areas of forest that are burned in a canopy fire would depend on recolonisation from unburned refugia, or at least from sites that were burned less intensely.

The 1994 bushfires in the Sydney region burned through most of Royal National Park, and were particularly intense in tall forest along Lady Carrington Drive. This has long been known as a good Greater Glider site, and there are many museum records from Royal National Park. The 1994 fire eliminated the Greater Glider from this area. Andrew (2001) reported that a Greater Glider was seen soon after this fire, but it was not recorded in systematic surveys nor in recent spotlighting searches (S. Maloney pers. comm.). The canopies appear to have recovered well in this area and there are tree hollows, so the site is potential Greater Glider habitat

again. Why have they not recolonised?

That is a landscape-level question. There are three potential recolonisation routes (see Fig. 1) (i) They could come from Heathcote National Park, quite close to the west. However, this area is separated from Royal National park by the F6 freeway and the South-Coast rail line. This transport corridor represents a significant barrier. In any case, Heathcote National Park was burned in the Christmas 2001 fires, potentially reducing the size of any Greater Glider population that may have been there. (ii) They could come from the Sydney Catchment Authority land, but these are separated from Royal National Park by the same freeway and rail barrier, and the potential link is further fragmented by the suburban urban area of Helensburgh. (iii) They could come from the Illawarra escarpment area, although again there is fragmentation of the potential link by suburban development in Stanwell Park and Helensburgh. Over two decades ago, Norm Robinson argued that the native vegetation in this area would be critical in connecting faunal populations in reserves (Robinson 1981).

This analysis is hampered by the fact that we know very little about the detailed distribution of Greater Gliders in Heathcote National Park, the Sydney Catchment Authority lands or the Illawarra escarpment (see Andrew 2001). In any event, the context for any attempts to conserving Greater Glider populations in this area, in the face of periodic bushfires, is a fragmented landscape that includes Royal National Park, other areas of natural vegetation, major transport routes, and patches of suburban development. I argue that this fragmentation will makes recolonisation of Greater Gliders virtually impossible, at least without assistance by translocation.

The plight of the Greater Glider in Royal National Park is a single case study



but it is not an isolated example of effective conservation of biodiversity needing a landscape approach. Conservation of Greater Gliders is a challenge elsewhere (e.g. Toohey Forest on the Brisbane River – <http://www.vnc.qld.edu.au/enviro/toohey/tfs-067m.htm>, accessed May 20th 2004; in habitat fragments within native forest logging areas – Lindenmayer 2002) and many other species are threatened by their isolation in fragments of their former habitat.

### **Bushfires in a human-affected landscape**

Bushfires are obviously a landscape-level phenomenon. Many bushfire inquiries, since the Streeton Royal Commission after the 1939 fires (Streeton 1939), have made this observation. The serious fire seasons of 2001/02 and 2002/03 in south-eastern Australia illustrated it very clearly. The convoluted nature of the urban-bushland interface is obvious in any aerial photograph or satellite image. The length of the urban perimeter is increasing as major towns and cities expand. In the Ku-ring-gai council area, for example, there are 8,000 properties on the urban-bushland interface, spread over an 89 km perimeter. Many of these properties back on to Ku-ring-gai Chase National Park, forming a convoluted pattern of mostly ridgetop subdivision. A satellite image of the Sydney and south coast region, taken at the time of the 2002 fires (Fig. 2), illustrates this reticulated boundary between urban fringe areas and bushland and the proximity of the fires to urban areas. It is not easy to see the enormous interspersed land uses and tenures within the perimeters of the various fires. In the Shoalhaven fires, the following land tenures were burned or threatened: pine plantation, native production forest, ecotourism businesses, national park and nature reserve, houses and other private property, infrastructure (e.g. power poles and lines, substations, mobile phone towers), horse, beef cattle and dairy

grazing lands, hobby farms.

Just as our attempts at conserving biodiversity assets in reserves are challenged by dissection of the landscape with other land uses, so is the threat of damage by fire to human structures exacerbated by the fragmented landscape. We have good reason to be concerned about the interspersed nature of these various land uses, many of which are flammable under severe bushfire weather. There are now many web sites displaying photographs of destruction caused by bushfires – mostly focussing on houses but some illustrating damage to pastures, fences, and even landcare revegetation sites. There is no argument that we need to reduce the risks to assets; there is considerable argument as to the best way to achieve it!

### **Mitigation of the bushfire risk**

Taking a risk management approach to bushfire mitigation allows us to distinguish a range of possible responses: (i) ensuring that built assets are not placed in the most fire-prone areas; (ii) requiring structures to meet standards of construction that reduce their vulnerability; (iii) reducing the frequency of ignitions that result from arson; (iv) managing the amount and distribution of fuels in the landscape, (v) enabling rapid response to a bushfire (e.g. with effective reporting and spotting, effective access via fire trails, and perhaps aerial response). Although the first three of these are critically important, and have been recognised as such in many fire inquiries (including Streeton 1939), I focus here on the issue of fuel management, because this is a landscape-level management strategy.

The principle of reducing the risk posed by bushfires by reducing the amount of fuel available to be burned is well founded and empirical studies demonstrate the

relationship between fuel load and both fire intensity and other features of fire behaviour (e.g. [Cheney et al. 1998](#), [Gould et al. 2001](#)). Fuel reduction activities in the landscape can have two slightly different, though related, objectives: (i) modify fire behaviour so as to make unplanned bushfire more amenable to suppression, because prior fuel reduction can reduce rate of spread, intensity, and the likelihood of a forest fire becoming a crown fire; (ii) enable safer and more effective protection of assets when an unplanned fire in the landscape reaches them.

Fuel-reduction burning is the most common and practicable method of fuel reduction for larger areas of the landscape, although it is not a trivial exercise. The expense and difficulty of safely conducting an annual fuel-reduction burning program are such that the responsible agency needs to be convinced that it is actually effective in achieving its objective, namely reducing the risks to assets. This is difficult to assess. In the *Report of the Inquiry into the 2002-2003 Victorian Bushfires*, [Esplin et al. \(2003\)](#) pointed out that it is really difficult to answer the question: “Did that reduction in fuel load and consequent alteration in fire behaviour actually reduce the damage to assets?” As a result, attempts to assess effectiveness have taken the less direct approaches of assessing whether a fuel-reduction prescription actually reduced the fuel load to the desired level or whether the reduction in fuel load actually altered fire behaviour, as predicted, under the weather conditions at the time of the fire.

There have been few empirical studies even of these less direct ways of assessing effectiveness in risk reduction. The information that does exist suggests that fuel-reduction burns sometimes do not achieve the desired objective. For example, post burn assessments of prescribed burns conducted in the Blue Mountains from

1990 to 1997 found that fine fuels actually increased in 30 percent of the burns and only 30 percent could be rated as effective (James 1999).

Although there have been attempts to quantify the way in which fuel-reduction burning can modify bushfire behaviour (e.g. Underwood *et al.* 1985, Tolhurst 1996, McCarthy and Tolhurst 1998), this is clearly a difficult task and there are remarkably few published studies. Debates about the effectiveness of fuel-reduction burning therefore degrade into trading anecdotes. For every anecdote of fuel-reduction burning aiding control of a bushfire, there is an anecdote of a bushfires burning through a recent fuel-reduction area. For example, the extreme weather conditions in Victorian in the 2002-03 summer drove fires through areas of recent fuel-reduction burning (p. 114 of Esplin *et al.* 2003) the Tomerong-Huskisson fire in the Shoalhaven region (shown in Fig. 2) burned through areas of State Forest and National Park that were only three years since a fuel-reduction burn (see Fig. 3). Fire intensity and rate of spread were almost certainly reduced as the bushfire burned through these areas, but anecdotes such as these show that fuel-reduction is no guarantee that a bushfire will stop or be readily contained, at least in some terrains and vegetation types. Moreover, we could not possibly achieve fuel-reduction over enough of the landscape sufficiently frequently to ensure modification of bushfire behaviour to ensure risk-reduction at times of extreme weather conditions, even if this were to be acceptable in lands where biodiversity conservation is a management objective.

The response to this problem in New South Wales has been to adopt a zoning approach, in which land closely adjacent to properties is zoned for ‘asset protection’ and therefore has severe fuel reduction, and land nearby (within several hundred metres of property), termed a ‘strategic fire advantage zone’, is managed to keep fuel

loads below a certain level. Such an approach can give land managers the flexibility to achieve other management objective in areas more remote from properties and other human assets (referred to as 'land management zones'). This zoning approach clearly makes bushfire management a landscape-level process and the development and implementation of bushfire risk management plans, based on these zonings, is potentially an effective mechanism for bushfire mitigation across the landscape. To capture local knowledge, gain commitment to protection of all assets in a complex landscape, and apply mitigation at a local scale within this context, plans should be developed with community input and cover all private and public land. Even with the best commitment to this process, there can be significant conflicts between biodiversity conservation objectives and the protection of human assets, as the following case study illustrates.

### **Managing biodiversity and mitigating bushfire risk – a case study**

The case study of the Eastern Bristlebird (*Dasyornis brachypterus*) illustrates the complex challenge that the fire-prone, human-modified landscape poses for us, especially where suburban and rural development is interspersed with the habitat of threatened species. At the last NCC conference, [Baker \(2004\)](#) described the conservation status of the Eastern Bristlebird and the ways in which it may be threatened by bushfires (see also [Baker 1997](#) and [Baker 2000](#)). The Eastern Bristlebird is listed as endangered in NSW, under the *Threatened Species Conservation Act 1995* and nationally, under the *Environmental Protection and Biodiversity Conservation Act 1999*. It has attributes expected of a fire-sensitive species: ground-dwelling, cover-dependent, a poor flier, poor disperser, and low fecundity. In Victoria, for example, 11 out of 12 populations have gone locally extinct

and fire was considered to be the cause in five cases (Bramwell 1997, Clarke and Bramwell 1998), while 12 out of 23 populations in northern NSW/southern Queensland are now extinct; fire is considered to be at least partly to blame in seven of these cases (Holmes 1989, 1997). Baker (2000) recommended that, to manage habitat for the species, fire should be excluded, at least until site-specific monitoring demonstrates that this is detrimental.

One of the two largest populations occurs in the Jervis Bay area within the Shoalhaven region of central NSW (Baker 2004). Bushfires burned through substantial parts of Eastern Bristlebird habitat in the Jervis Bay area in 2001-02 and at Booderee National Park in January 2004 (Fig. 4). Clearly, this biodiversity asset needs to be a significant part of bushfire risk management planning in the Shoalhaven landscape. Figure 5 shows how Eastern Bristlebirds records are scattered through bushland in the Jervis Bay area (D. Bain and R. Loemker pers. comm.). Urban development is also scattered through these bushland areas. Asset protection zones (APZs) adjacent to houses will clear habitat in which bristlebirds have been recorded (see Fig. 6) and maintaining low fuel loads in strategic fire advantage zones (SFAZs) of several hundred metres beyond these APZs would make a significant area of current Eastern Bristlebird habitat unsuitable for them. A current research project at the University of Wollongong, supported by Shoalhaven City Council, is attempting to quantify the proportion of the Eastern Bristlebird habitat in the Jervis Bay region that is contained within APZs and SFAZs (R. Loemker, pers. comm.).

### **Concluding comments**

As urban and other development continues in Australia, conservation of one of our major assets, biodiversity, is becoming increasingly difficult. It is obvious that

National Parks, although they are a key component of the nation's conservation strategy, cannot by themselves achieve effective conservation. They occur in a complex and highly modified landscape, and this landscape must become an integral part of the biodiversity conservation effort. Bushfires potentially threaten many of the assets in the landscape, including some elements of biodiversity (and fire, in some form, is necessary for the conservation of many organisms). I conclude that there will increasingly be conflict, in our changing landscape, between two important objectives: conservation of the elements of biodiversity that are threatened by the sort of habitat change that occurs when fuel-loads are reduced, and effective protection of human lives, structures, infrastructure.

Meeting the challenge of designing effective bushfire mitigation and management with the sort of mix of land uses illustrated above is hindered by differing attitudes and values of the various stakeholders – including local communities (urban and rural), graziers, land managers, and environmentalists – and consequent arguments about the adequacy and impacts of fuel reduction. This issue has been debated for many years (especially after each major fire event), but has usually been more about the appropriateness of the land uses than the best way of managing fire to achieve the management objectives of each area.

This strategy of wide consultation to capture local knowledge and create a shared valuing of all assets, applying a zoning approach to the landscape, identifying trade-offs, and devising creative solutions is clearly a good approach, though challenging – it is now up to us to seize the challenge and make it work.

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## **Figure Captions**

**Figure 1:** Satellite image of Royal National Park, illustrating barriers between it and the adjacent bushland areas of Heathcote National Park, Sydney Water Catchments and the Illawarra escarpment. (Base image from NSW National Parks and Wildlife Service 1999 – see Figure 1 of Andrew 2001)

**Figure 2:** Satellite image of the south eastern Australian bushfires over the 2001-02 Christmas period, illustrating the large bushland areas in the southern Sydney and Shoalhaven regions, and the interspersed urban development. (Image from Geoscience Australia: <http://www.ga.gov.au/acres/>. Accessed 12 July 2002)

**Figure 3:** Map of the Shoalhaven showing the results of the fuel-reduction burning program 1994-98. This represents 4 years of planning and hard work by paid staff and volunteers. It is nowhere near even 10% of the landscape. The outline of the 2001-02 fire is superimposed on the fuel-reduction burning map. (Images from Shoalhaven Council Web site: [www.shoalhaven.nsw.gov.au/council/pubdocs/soe](http://www.shoalhaven.nsw.gov.au/council/pubdocs/soe))

**Figure 4:** Photograph of Eastern Bristlebird habitat affected by the January 2004 fire in Booderee National Park.

**Figure 5:** Distribution of sightings of Eastern Bristlebirds accumulated over several surveys in the Jervis Bay area. (Data from NPWS Wildlife Atlas, D. Bain pers. comm., Rylan Loemle pers. comm.)

**Figure 6:** Before-and-after photographs of effect of clearing for an Asset Protection Zone in habitat suitable for Eastern Bristlebirds in the Jervis Bay area. Photographs by Rylan Loemker.



















