Sub 157

Submission to the House of Representatives Select Committee Inquiry into the recent Australian bushfires

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Summary

1. Australian ecosystems—the bush—have evolved with fire and are in many ways dependent on fire for regeneration and for the rejuvenation of ecological processes.
2. The nature of fire in Australia has changed over the millennia. Large-scale, lightning-caused fires were followed by fine-scale mosaic burning with Aboriginal settlement. Following European settlement, larger and more intense fires ('feral fires', because of increased fuel loads and shifts in seasonal timing and frequency) have obliterated the pre-existing habitat mosaic created by Aboriginal landscape burning.
3. This change in conjunction with the introduction of megaherbivores, has caused the decline and in some cases the extinction of many mammal and bird species.
4. Given the right conditions, the Australian bush is highly flammable. Under extreme conditions, bushfire can be so intense that no fire-fighting capabilities of any nation could stop them.
5. We will not be able to eliminate bushfires, whether in State forest, national parks or wilderness; given that we have forests, then we will have forest fires, and this stark reality is true, not only for our forests in Australia, but for forests over much of the world.
6. The occurrence of wide-spread, high-intensity fires will not reduce unless we recognize the need for intensive fuel reduction programs.
7. The evidence for the requirement for planned management of fire (including prescribed burning and lightning strikes) is overwhelming, not just in Australia but worldwide.
8. The technology is now available to manage fire in a way that maintains biodiversity and markedly reduces the hazard to human life and property. The only barriers to the implementation of this technology is the provision of sufficient funding for fire management and the removal of the ideological barriers to prescribed burning.
9. We must now develop programs of prescribed burning over all tenures (national parks, reserves, wilderness areas, State forests and so forth) that are aimed not just at reducing fire magnitudes and intensities, but aim at fire regimes that include the combination of prescribed burns and natural fires so that ecological diversity is maintained, if not enhanced, while the accumulation of fuels is decreased.

Introduction

Fire is a major force in almost all of Australia's ecological communities. This is the theme of a recently published book (*'Flammable Australia: The Fire Regimes and Biodiversity of a Continent'*; Bradstock *et al.* 2002) and is a recurring theme throughout the new text on Australian ecology (*'Ecology: An Australian Perspective'*; Attiwill and Wilson 2003). The flora and fauna of Australia's grasslands, heathlands, woodlands, open-forests, tall open-forests and rainforests all have been profoundly influenced, both in adaptation to fire throughout their evolution and in their past and present distribution.

In this submission, we summarize changing regimes of fire from the time that Australia separated from Gondwana and became increasingly hotter and drier, and eventually became settled first by Aboriginals and then by Europeans. This provides the basis for comment on the recent bushfires in south-eastern Australia and on the pressing need for management to define and implement fire regimes that include prescribed burning.

Changing Regimes of Fire in Australia

Attiwill and Wilson (2003) provide an introduction to the early evolution of Australia's biota. Australia, Antarctica, India, Africa, South America, New Guinea, and New Zealand formed the super-continent of Gondwanaland 150 million years ago. As Australia drifted northward following separation from Gondwanaland, the original Gondwanan stock differentiated, and the distribution of vegetation became increasingly discontinuous and isolated, and evolution proceeded by differentiation and speciation.

As Australia moved northward into hotter and drier climates (the widest part of Australia today lies at the Tropic of Capricorn, the driest part of the world), the frequency of fires increased. The major cause of fire over geologic time was lightning. Sclerophyllous eucalypt forests were well-established by the Pliocene (5–1.7 million years ago); for example, the major groups of flowering plants were existing in Victoria five million years ago. The Australian flora has therefore evolved with fire. The frequency of fire increased significantly with the colonisation of Australia by Aboriginal people some 40 000 or more years ago, and increased significantly again with the arrival of Europeans 200 years ago. Through this long history of evolution with fires caused both by lightning and by humans, the sclerophyllous flora developed many adaptive characteristics.

All of this is natural; in the words of Taylor (1990): 'the present equilibrium vegetation (in Australia) has not been "isolated in time" from the pre-Aboriginal native vegetation of the late Pleistocene. It has descended from this late Pleistocene native vegetation through an unbroken sequence of autogenic and allogenic successional responses to human-generated disturbance and other natural agents of landscape change.'

This unbroken sequence of disturbances includes fire over tens of millennia due to lightning and to Aboriginal land-use. The American environmental historian, Stephen Pyne (1992) writes that 'lightning was a highly seasonal, episodic ignition source; the Aboriginal firestick was an eternal flame.' Records from the first voyages noted smoke covering much of eastern Australia, and the early explorers and surveyors wrote of a well-developed grass layer in a number of forests, rather than the thick, shrubby understorey that we have today (Ryan, undated). It seems most probable

that European settlement has changed the fire regime in most parts of Australia and as a result the balance between many species has altered.

Bowman (in preparation) provides a valuable conceptual theory of the changing fire regimes in Australia (Figure 1). The transition is one from large-scale, lightning-caused fires to fine-scale mosaic burning by Aborigines to larger and more intense fires ('feral fires', because of increased fuel loads and shifts in seasonal timing and frequency) under European settlement.

Figure 1. 'Graphical representation of (Bowman's) theory concerning changes in the spatial scale and frequency of landscape fires in a hypothetical tract of tropical *Eucalyptus* savanna. In the pre-human period, lightning started fires infrequently and burnt large areas, creating a broad-scale habitat mosaic to which various species of birds and mammals had become became adapted. Aboriginal fire management was characterised by a high frequency of fires that burnt much smaller areas, producing a fine-scale habitat mosaic that supported most of the pre-human wildlife assemblage, with the notable exception of the Pleistocene megafauna. Under European fire management, fires, that had a similar frequency as the Aboriginal period, burnt large areas thereby obliterating the pre-existing habitat mosaic created by Aboriginal landscape burning. This change in conjunction with the introduction of megaherbivores, has caused the decline and in some cases the extinction of many mammal and bird species. (This description of the figure is a quote from Bowman [in preparation]).

The Current Position: Planned Fire Regimes are Essential for Ecosystem Management

1. Recognizing fire as a fundamental part of Australia's ecology

The themes we have developed above are that the Australian flora - the bush - has evolved with fire and is in many ways dependent on fire for its regeneration and for the rejuvenation of ecological processes. Given the right conditions, the Australian bush is highly flammable. Under extreme conditions, bushfire can be so intense that no fire-fighting capabilities of any nation could stop them.

Thus we must accept that we will not be able to eliminate bushfires, whether in State forest, national parks or wilderness; given that we have forests, then we will have forest fires, and this stark reality is true, not only for our forests in Australia, but for forests over much of the world.

Our immediate and innate feeling following a fire of the ferocity of Ash Wednesday (16 February, 1983) or the January, 1994 bushfires in New South Wales or the 2003 fires in the Australian Capital Territory, New South Wales and Victoria is that fire is bad, and so it is from a human and social perception, a perception that rightly has a primary focus on the value of life

and property. According to this perception of fire as always bad, fire must at least be suppressed, if not eliminated.

However, such a view does not encompass fire as a natural disturbance to Australian ecosystems, a disturbance which has, more than any other, moulded our biota.

Disturbance is common to all ecosystems; diversity is maximum at some intermediate level of disturbance. The role of fire is not restricted to Australian ecosystems; Spurr and Barnes (1980). They wrote in a global sense that 'fire is the dominant fact of forest history'. The American ecologist Loucks (1970) wrote that the elimination of disturbance by modern humans 'will be the greatest upset of the ecosystem of all time. . . . It is an upset which is moving us unalterably toward decreased diversity and decreased productivity at a time when we can least afford it, and least expect it'.

In direct contrast with Loucks' view is a very popular view of forests which we see so often expressed. This view sees forests as eternal, perpetual, tranquil, and changeless, and the concepts of 'wilderness forest', 'virgin forest' and 'old-age forest' all have connotations of perpetuity, of the attainment of a perfect and ordered equilibrium, of some pre-ordained state.

Three themes of ecology we now develop are:

- there is no equilibrium, no pre-ordained state of diversity;
- it is a general ecological truth that maximum diversity depends on a regime of disturbance
- as managers of the land, we are in charge of determining this regime of disturbance.

The first two themes are inextricably linked. Our ecosystems are diverse because patterns of disturbance are diverse. In Australia, bushfire is a natural disturbance which has its own regime of diversity. Bushfires are unpredictable. They occur at irregular intervals and at various times of the year, and they burn at various intensities and over a range of areas. All of this gives diversity to our forests, so that each patch of bush is different, however subtly, from every other patch of bush. What is certain is that the diversity of ecosystems, from coral reefs to forests, depends on natural disturbance. If this were not so, diversity and patchiness would decrease. It is due to natural disturbance that an equilibrium is never reached.

The large and intense bushfires of 2003 remind us that natural disturbances will always be with us and that bushfires can be so devastating that there are few human disturbances for which a counterpart cannot be found in nature.

2. An example from the United States: The 1988 fires in Yellowstone National Park, (taken from Attiwill 1994)

Before we comment on the Australian fires of 2003, it is worth summarizing some of the responses to the major fires in Yellowstone National Park in 1988 to remind us that the problems we now face are neither new nor uniquely Australian.

The evidence for the role of fire in maintaining the diversity of sub-alpine communities of Yellowstone National Park over thousands of years has been clearly recognized. For example, numbers of species of plants, birds and small mammals, and number of individuals of birds and

small mammals, is maximum in the first 25 years after fires and decreases thereafter. Taylor (1973) concluded that:

'It is necessary that fire be accepted as one of the natural and important environmental factors of the Park (Yellowstone National Park). Older lodgepole pine forests must be periodically burned to perpetuate natural plant and animal community life cycles and to promote greater biotic diversity. This could be done by allowing certain lightning-caused fires to burn and by controlling only those that endanger Park facilities and human lives. A system of zoning that would allow quick decisions on which fires to control and which to allow to undergo natural development'.

A policy of halting fire suppression and allowing natural fires to run their course in selected areas of Yellowstone National Park was made in 1972 and there is now intensive work on formulating strategies to manage fire as a natural ecosystem process. This is a difficult task since both fuel loadings to support fire and regeneration strategies after fire vary greatly in the steep mountainous region and are therefore to a large extent unpredictable. Barrett *et al.* (1991) conclude that: 'managers have tried to extinguish most fires to protect park visitors and facilities, evidently with varying degrees of success. Fire history reveals the inherent irony and futility of this approach, and consequently the need for new management strategies'.

Similarly, Romme (1982) concluded that: 'The current fire management plan probably will be effective in maintaining natural landscape patterns in the subalpine zone if most lightning-caused fires are allowed to burn naturally, including the very large fires . . . Managers should expect, and allow, an occasional fire covering many square kilometres; these are the fires that will exert a predominant influence on landscape composition and diversity for many decades to follow. Such large fires should not be viewed as unusual events occurring because of unusually high fuel accumulations.'

These views were put fiercely to the test in the Yellowstone fires of 1988 when an area within Yellowstone National Park of almost 400 000 ha was burned. Since the reconstructed fire history shows fires of similar magnitude in the early 1700s, the 1988 fires should not be viewed as an abnormal event. But the views of the American people in general and ecologists and foresters in particular vary - Americans think of parks as static curiosities rather than as dynamic ecosystems, and concludes that people see the role of national parks as 'preserving pretty places' rather than 'protecting remnants of functioning natural systems' (Elfring 1989; the underlining is ours. The whole issue of *BioScience*, Volume 39, 1989, in which Elfring's paper appears is devoted to the fires of Yellowstone National Park; it should be priority reading for all those associated with the management of fires in forests, managers, users and politicians).

On this theme, the use of prescribed fires to reduce the hazards of wildfire, for regeneration, for enhancement of wildlife habitat, for insect and disease control and for conservation of diversity of forested ecosystems in Canada has been recently reviewed (Weber and Taylor, 1992). They concluded that prescribed burning is both ecologically compatible and cost effective; it requires a 'vigorous public awareness campaign', particularly where it is to be used in parks and reserves, so that people are more aware of the dynamic nature of ecology and of the ecological goals of management.

3. **Fires in south-east Australia, 2003**

We have shown above that fire is a natural element of Australia's ecology, and that 'the transition from traditional Aboriginal to European fire management is a major ecological and evolutionary event that, while being different in character, is of the same significance as the Pleistocene colonisation of Australia by the ancestors of Aboriginal people' (from Bowman, undated).

The return to a regime of fire management based on Aboriginal traditions, knowledge and practice seems an impossibility for much of Australia. However, it is of great interest to note that burning in northern Australia is widely practiced, including National Parks and World Heritage Areas such as Kakadu.

The problems for the manager of our forested lands are many. In addition to the many ecological concerns and the problems of containing prescribed fires, there are many other questions. Should we let fires caused by lightning run their course? If we do, how will adjoining land-owners react? How can we protect adjoining landowners? How can we protect managers from excessive litigation? How can we convince asthma sufferers (and others with breathing difficulties) in the capital cities of the ecological necessity for burning? How can we alter the emotional view of a burned forest as an ugly thing?

To discuss these and other issues, the Institute of Public Affairs held a conference in Melbourne on 11 March 2003 entitled *Bush fire prevention: Are we doing enough?* The first three papers of this conference provided outcomes that we use in this submission. These papers are attached to this submission, and were given by:

- Dr Phil Cheney, CSIRO Forestry and Forest Products – *Effectiveness of prescribed burning on reducing fire behaviour*;
- Professor Syd Shea, Environmental Management, University of Notre Dame Australia – *The ecological basis for the use of prescribed fire in Australian ecosystems*; and
- Dr Kevin Tolhurst, Forest Science Centre, The University of Melbourne – *Prescribed burning in Victoria: policy and practice.*

Summarized outputs from the IPA Conference 'Bush fire prevention: Are we doing enough?'

Dr Phil Cheney introduced the topic of the fires of 2003, and presented a compelling case for prescribed burning for both ecological diversity and for hazard reduction. He stressed the need for definition of prescribed burning in the following terms:

- A prescribed burn is a fire that is intentionally lit, under specified environmental conditions and within a pre-determined area, to achieve some pre-determined objective. A fire to achieve the objective of fuel reduction has a:
    - fire intensity < 500 kW/m;
    - rate of spread < 100m/h; and
    - flame height < 1.0 m.

A prescribed burn aims to reduce fuel loads in surface litter, in the shrub layer and in elevated fuels, and in bark. Regular prescribed burns reduce:

- the complexity of wildfire behaviour;
- speed of fire growth;
- flame height / rate of spread;
- spotting; and
- total heat output (intensity).

The regular use of prescribed burns make fire suppression more efficient. Furthermore, regular burns are essential to the composition of our flora and fauna; prescribed fire is an ecological process The effects of prescribed burns are many, and include:

- Reduction of fuel loads;
- Some biota are killed;
- Stimulation of flowering;
- Stimulation of germination;
- Exposure of mineral soil, increases availability of nutrients, and enhances survival of germinants and allowing seedlings to grow; and
- Creates habitats and food.
- Patchwork mosaic following fire increases diversity.

In terms of the bahaviour of bushfires, prescribed fire:

- makes suppression of bushfires more efficient;
- reduces fuel loads and simplifies fuel structure;
- reduces flame heights, intensity and rate of spread; and
- reduces density of firebrands and the distance they are thrown.

In conclusion, Dr Chency stated that the extensive fires of high intensity such as we have experienced in 2003 are unacceptable in ecological terms (causing loss of diversity) and social terms (loss of life and property). The occurrence of wide-spread, high-intensity fires will not reduce unless we recognize the need for intensive fuel reduction programs.

Professor Syd Shea outlined the effectiveness of prescribed burning, resulting in a very large decrease in major fires in the jarrah and karri forests of Western Australia since the early 1970s. Experience in Western Australia has demonstrated that, provided that fire managers ensure that the frequency, intensity periodicity of fire is varied it is highly improbable that prescribed burning will endanger species or have an adverse impact on ecological processes.

Professor Shea outlined the growth of the environmental movement and the ideology that has led increasingly to protection – the locking up of forests in reserves, a view that all bushfires must be suppressed (but what is more natural than a lightning strike?) and the total opposition to the use of fire in forest management. Again, we submit that, as managers of the land, we must come to grips with fire regimes and their application in management; the fires in Australia of 2003 (just as with the Yellowstone fires of 1988 that we have discussed) show the total futility of a policy of total fire suppression. Professor Shea conclude that 'the technology is now available to

manage fire in a way that maintains biodiversity and markedly reduces the hazard to human life and property. The only barriers to the implementation of this technology is the provision of sufficient funding for fire management and the removal of the ideological barriers to prescribed burning.'

Dr Kevin Tolhurst presented a detailed analysis of the frequency of fire in Victoria. He showed that there has been a significant improvement in fire management over the past 60 years with respect to the protection of human life and property from bushfires. However Dr Tolhurst's analysis shows that, if ecologically sustainable fire regimes are applied across the whole of Victoria, we would expect to see a range of age classes, within a landscape-scaled area, stretching from recently burnt to very long-unburnt. It is disturbing that a systematic study across the State found that fire frequency was near an ecologically sustainable level in only one vegetation type out of 19. Therefore, compliance with the Code of Fire Management Practice in meeting the objective that 'environmental values including the vigour and diversity of the State's indigenous flora and fauna are protected, as far as is practicable, from the deleterious effects of wildfire and inappropriate fire regimes' is not currently being met.

Dr Tolhurst and colleagues are working on ecological fire cycle for different plant communities that depend in large part on the life history attributes of the fauna and flora species in each vegetation type (Tolhurst & Friend 2001). An analysis of the life history attributes of individual species enables those species which are more susceptible to too frequent fires and conversely too infrequent fire, to be identified. By identifying the upper and lower fire frequency limits, 'Key Fire Response' species can be identified and ecologically sustainable fire cycles determined.

Dr Tolhurst concluded that the recent Victorian fires reinforce the need to implement the use of broad-scale prescribed burning to complement the more intensive and strategic fire protection prescribed burning. The State must increase the priority given to providing well trained, well educated and well resourced fire managers and fire operations staff. In the long-term, more prescribed burning, primarily aimed at achieving ecological objectives, will help reduce the occurrence and impact of large and intense bushfires. This will simultaneously reduce the cost of emergency operations and disaster relief and achieve better land management outcomes.

4. Planned fire regimes are essential for ecosystem management

While the human consequences of fire are often catastrophic, we must dispel the myth that fire is ecologically bad, and we must ensure that management of our native ecosystems for ecologic and economic sustainability is based on the best knowledge of the ecology of natural disturbance. We 'must "unsell" the false impression that all fires are bad and be prepared to use both prescribed fires and natural lightning fires in landscape management' (Rowe and Scotter 1973). The emphasis on fire suppression aims primarily at protection of life and property. We must now develop programs of prescribed burning over all tenures (national parks, reserves, wilderness areas, State forests and so forth) that are aimed not just at reducing fire magnitudes and intensities, but aim at fire regimes that include the combination of prescribed burns and natural fires so that ecological diversity is maintained if not enhanced, while the accumulation of fuels is decreased. The effectiveness of prescribed burning is clearly demonstrated in the attached papers, and the work by Dr Kevin Tolhurst and his colleagues on aligning fire regimes with life histories of the biota provides a clear way forward.

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Attachments

1. **Dr Phil Cheney, CSIRO Forestry and Forest Products – *Effectiveness of prescribed burning on reducing fire behaviour.* PowerPoint presentation.**
2. **Professor Syd Shea, Environmental Management, University of Notre Dame Australia – *The ecological basis for the use of prescribed fire in Australian ecosystems.* Abstract only.**
3. **Dr Kevin Tolhurst, Forest Science Centre, The University of Melbourne – *Prescribed burning in Victoria: policy and practice.***