ACB Submission to Teague Commission on Victoria's 2009 Bushfires

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The Australian Centre for Biodiversity (ACB) at Monash University is a multi-disciplinary collection of scientists devoted to developing the tools, capacity, and understanding required to make sound environmental policy decisions to maintain and restore Australian ecosystems now and in the future. Our submission addresses a fundamental question that has emerged in the wake of the 2009 Victorian bushfires: Can fire and land management practices and policies be modified to minimise the future risk of similarly catastrophic bushfires without compromising Victoria's native ecosystems and the biodiversity that they support? To address this question, we first provide some of the broad ecological context necessary to understand the role of fire (and humans) in Australian landscapes. We then address specific management practices, such as prescribed burning, and their potential impacts on local and regional biodiversity in southeastern Australia. We conclude with some suggestions for modifying fire and land management practices that address the potentially conflicting issues of fire risk and biodiversity conservation.

Fire and the Australian landscape

Broad-scale fire is a natural part of Australia's landscapes. Much of Australia's native biota has evolved with fire. A wide range of physiological, structural, and behavioural adaptations have arisen in the plants and animals to ensure the persistence of individual species within these landscapes. However, natural fire is a complex physical process that affects organisms, communities, and landscapes in various ways. The spatial and temporal variability of these impacts depends on the intensity and frequency of fires in an area, that is, the fire regime. Fire regimes are driven by climate and weather conditions, and the availability of fuels and ignition sources. In topographically varied landscapes with mosaics of different vegetation types and quickly changing local weather conditions, the severity of any given fire – that is, its impact on the existing flora and fauna and the natural processes associated with the area – will be highly variable.

Humans have lived in these fire-prone landscapes for the past 45,000 years. We depend on these landscapes for many things – water, food, timber and recreation – and so have, in one form or another, managed them to ensure that fires do not compromise the long-term availability of these resources. Over most of those 45,000 years, aboriginal communities used frequent, low-intensity fires to improve hunting grounds, clear vegetation, communicate, and modify their surroundings, particularly in the arid regions of Australia that support savannah vegetation. In the wetter and cooler regions of Australia, fire was less commonly used as a management tool. In these regions, fires were less frequent but more intense when they occurred, and had more severe impacts.

The past 200 years of European settlement and economic development has caused dramatic changes to Australia's landscapes, particularly along the eastern and southwestern regions of the continent. For the first 140 years, these changes were primarily associated with land clearance for intensive agriculture and livestock production. The past 60 years have seen the near-exponential growth of urban populations around the major cities of the country and the associated growth of suburban and exurban housing, resource use and waste production. In southeastern Australia, the growing populations of European settlers put new fire management systems into place in the early 1900s. These systems, with fire-breaks, watchtowers, and fire patrols, were largely based on European experiences that focused on suppressing and containing fires. But fire is inextricably a part of these landscapes and on several occasions, notably 1851, 1939, 1983 and now 2009, large, extensive fires ranged across Victoria.

Fire management by humans – whether Aboriginal, European, or Australian – is about managing and controlling variability in natural systems. Where humans depend on nature as a resource, unpredictablity is potentially a threat. Management attempts to dampen this variability to ensure a relatively constant flow of resources, be they timber, water, habitation or recreational opportunities. However, management inevitably changes the underlying processes and dynamics of natural systems and their component parts – the plants, animals, and other living organisms that form natural communities. This biodiversity is a natural capital that cannot be replenished. In southeastern Australia, 200 years of land clearance and fragmentation have led to the current environment in which many individual organisms and specific habitat types are threatened and endangered. Moreover, natural ecosystems exist as mosaics and the capacity of plants and animals to persist depended on large, continuous swathes of habitat. European settlement has fragmented these swathes so our native biodiversity is unduly constrained into small, isolated parcels of native vegetation within which mosaics are difficult to maintain. Changes to fire management practices, such as the widespread adoption of high-frequency prescribed burning, have the potential to further endanger them. However, biodiversity and other ecological values represent only one component of a broader suite of values that drive management of native ecosystems. Mitigating the risk of bushfires similar to those of early February 2009 and the potential for future loss of life and property must also be a priority. So, how can these potentially conflicting objectives be managed without increasing the threats to biodiversity or the risk of deadly bushfires?

Fire management practices and biodiversity

A bushfire requires three things: fuels, certain climatic conditions and an ignition source. Among fire ecology and wildfire management specialists, these are known as the 'fire triangle'. If any one is removed, a fire cannot occur. Because weather and climate conditions cannot be controlled, and ignition sources are nearly impossible to eliminate, fire management practices have focused on the one point of the fire triangle that can be controlled: fuels. In Victoria, the Department of Sustainability and Environment and Parks Victoria conduct fuel-reduction burns during periods of low fire threat to reduce fuel build-up on public lands. Fuel-reduction burns reduce the fuel loads on the forest floor and, in principle, reduce the risk of fires moving into the forest canopy by lowering potential intensity of ground fires. By setting low-intensity fires on a relatively frequent rotation in a large proportion of fire-prone areas, the risk of catastrophic fires should be significantly reduced.

Inevitably, after a major bushfire, there are calls to increase the amount and frequency of fuel-reduction burns. However, increasing the rate of fuel-reduction burns is, in effect, changing the fire regime in an ecosystem and may have substantial ecological implications. The application of fuel-reduction burning to mitigate fire risk, therefore, needs to be critically questioned on two fronts. First, will increasing the frequency and amount of prescribed burning reduce fire risks at the landscape scale? Second, how will changing the fire regime through increased fuel-reduction burning impact on native ecosystems?

Will increasing fuel-reduction burning lower fire risks?

Several decades of research by fire scientists in Australia and elsewhere have demonstrated the effectiveness of fuel-reduction burning in reducing fire risk at the scale of individual parcels of forest. Theoretical studies have also shown that fuel-reduction burning at the landscape scale can reduce the risk of large, catastrophic fires. However, these studies make important assumptions about the other point of the fire triangle: climate. Under most reasonable climatic conditions, fuel-reduction burns done sufficiently frequently may reduce the risk of large fires. However, under extreme climatic conditions, such as those that preceded Black Saturday, this may not hold. As of Friday, 6 February 2009, approximately one-third of Victoria’s public lands had been subjected to fuel-reduction burns since 2003; that is, ~5% of public lands were subjected to fuel-reduction burns each year. This was the target set in an earlier Parliamentary Enquiry and clearly did not prevent the Black Saturday fires. Modeling studies suggest that the amount of fuel reduction burns would need to be doubled, at least, to have any potential for avoiding similarly catastrophic fires if conditions of such extreme fire danger re-occur in the future.

A critical dynamic in the development of large fires is the shift from ground fires to crown fires. Once a fire has shifted into the forest canopy, which has large volumes of fuels, the size and intensity of the fire increases dramatically. The fuel-reduction approach to reducing fire risk assumes that ignition starts at ground level—which is the case in most years. However, once an ignition source reaches the forest canopy (for example, by airborne embers), the spread of fire is no longer controlled by fuel loads on the ground, but rather by fuel loads in the canopy and their interaction with the prevailing weather conditions. Under extreme fire conditions of high temperatures and strong, gusting winds, airborne embers from fires may ignite forest canopies many kilometers downwind, creating the rapidly surging waves of flames witnessed in the Black Saturday fires. Under these conditions, fuel-reduction burns probably have little or no effect on fire spread. Indeed, areas recently burned to reduce fuel levels near Kinglake were consumed by the fire front because ember attacks from the advancing fire front directly ignited the forest canopy.

The effectiveness of fuel-reduction burning is also dependent on the type of forest that is being burned. Forests on dry sites typically have more open canopies, shorter trees, and understorey vegetation composed of grasses and heath species, which are adapted to relatively frequent, low-intensity fires. On moister sites, forests are typically taller, closed canopies, and a dense layer of shrubs and small- to medium-sized trees in the lower part of the vertical profile of the forest. These forests are also considerably more productive than those on dry sites. Forest productivity is important in considering the potential impact of fuel-reduction burns because more productive forests produce more fuels. In the case of the mountain ash forests, 4-7 tonnes per hectare of leaves and twigs fall onto the forest floor every year. This is roughly the amount of fuel that is consumed by a fuel-reduction burn. Thus, maintaining low fuel loads in these highly productive forests would require fuel-reduction burning every 3-5 years. Because the Victorian landscape is a complex mosaic of different forest types with different tenure and diverse histories of management, applying a single prescribed burning policy to the public lands is unlikely to have any impact on preventing future fires of similar magnitude, given similar predisposing weather conditions to those experience in early 2009.

How will increasing fuel-reduction burning influence Victorian biodiversity?

The flora and fauna of southeastern Australia are adapted to survive or endure fires. These adaptations vary greatly and may be structural, phenological, or behavioural. Much of this variation is associated with the prevailing fire regime in the ecosystem in which the organisms live. For example, many plant species in heathy vegetation, which is subject to relatively frequent fires of varying intensity, resprout new buds from the root collar after a fire. In contrast, in tall mountain ash forests, which experience infrequent, high-intensity fires, most of the trees are completely killed but release millions of seeds within days of the fire passing. The fauna associated with different vegetation types also vary in how they survive the fires. For example, in mountain ash forests and temperate rainforests, arboreal marsupials and birds seek refuge in large standing trees with hollows, while many ground-dwelling insects hide in large rotting logs on the forest floor. In contrast, koalas, which live in open, dry forests, just climb higher up the tree their in. Because the fires in these forests are typically low intensity, the heat from the fires does not reach into the upper parts of the forest canopy, allowing the koalas to survive.

Increasing the extent and frequency of prescribed burning in Victoria would have the effect of shifting many ecosystems towards a similar fire regime (frequent, low-intensity fires). This would have two major implications for biodiversity in Victoria. First, increasing fuel-reduction burning would directly benefit those plants and animals that are adapted to frequent, low-intensity fires by providing more available habitat. However, it would greatly disadvantage those species that were not well-suited to such a fire regime, by reducing the area of available habitat. Mosaics of different-aged sites are known to be important for maintaining regional biodiversity. For example, in mallee habitats mallee fowl only occupy long-unburned areas, whistlers only use areas burned between 15-20 years and emu-wrens only occur in recently burned locations. Second, increasing fuel-reduction burning to proposed levels (10-15% of public lands per year) would reduce habitat diversity by homogenizing the regional fire regime. The diversity of habitats and their mosaic distribution across the Victorian landscape is a critical component in maintaining local and regional biodiversity. The interdigitation of sites differing in their susceptibility to fire provides temporary refuges for animals that can move away from fires and later recolonise their original sites. More frequent fuel-reduction burning will change the structure and composition of the understorey vegetation. While many animals may be better able to survive the low-intensity fuel-reduction, the resultant vegetation may be poor-quality habitat.

Applying a single prescribed burning policy to Victoria’s public lands will disadvantage a large proportion of the native biodiversity and reduce local and regional habitat diversity. Shifting toward more homogeneous landscapes through increased prescribed burning will be detrimental to the long-term conservation of biodiversity in Victoria.

Reconciling the conflicting issues of reducing fire risk and maintaining biodiversity.

In the wake of the 2009 Victorian bushfires, there have been many calls for the State and Federal governments to reconsider their fire- and land-management policies to avoid similar catastrophes in the future. Increasing the extent and frequency of fuel-reduction burns has been widely promoted as a potential solution to reducing the risk of such intense and destructive fires. The current state of knowledge suggests that increased prescribed burning may reduce fire risks in some years, but is unlikely to have any effect in those years with extreme climatic conditions similar to those of 2009. Further, a uniform and widespread increase in fuel-reduction burning across Victoria's public lands will likely have negative long-term impacts on the native flora and fauna.

We recommend that the State government consider a more nuanced policy that acknowledges the spatial complexity of Victoria's landscapes and the values associated with them. We recommend that increased prescribed burning be focused in high-risk areas directly surrounding towns to minimize threats to people and property. However, for more remote, unpopulated areas, where the primary values are biodiversity and timber, we believe that fire management plans should be based on the best available science, that they should be consistent with the appropriate historical fire regimes, and that they provide an integrated, long-term vision for Victoria's natural heritage.