Planning to Reduce Risk: The Wildfire Management Overlay in Victoria, Australia

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Abstract
In a world where climate change is a 'given', the concepts of vulnerability, resilience and risk are now pivotal in public policy debates in many countries. Within this context, planning controls are designed to facilitate safe, sustainable and prosperous communities. In line with March's (2007, 11) observation that 'one important "reason to plan" is the reduction of risk', Victoria's Wildfire Management Overlay (WMO) was developed with the aim of mitigating wildfire risk through the identification of high risk areas and ensuring that minimum fire protection measures are implemented. The need for such an Overlay is becoming increasingly apparent as climate change contributes to the growing frequency and intensity of bushfires in Australia. Empirical research has found that, by following WMO prescriptions, the risk of a dwelling igniting from direct flame or radiant heat generated in a one in 50-year fire event can be greatly minimised. Yet not all local Councils in Victoria have built the WMO into their land use planning processes and schemes. Barriers to adoption include: lack of political will, a distrust of 'over-regulation', lack of training and mentoring of planning staff, and potential conflicts with vegetation conservation objectives.

KEY WORDS *risk; bushfire; planning; Wildfire Management Overlay; Victoria*

ACRONYMS

CFA	Country Fire Authority
CSIRO	(Australian) Commonwealth Scientific and Industrial Research Organisation
DSE	Department of Sustainability and Environment (Victoria)
FFDI	Forest Fire Danger Index
VCAT	Victorian Civil and Administrative Tribunal
WMO	Wildfire Management Overlay

Introduction

As global warming gathers pace, climate-related disasters worldwide are rapidly on the rise. Oxfam International's (2007) recent briefing paper, *Climate Alarm*, highlighted a fourfold increase in such catastrophic events as fires, floods and cyclones since the early 1980s. At that time disasters struck on average 120 times a year; the comparable figure is now 500. The number of people affected by weather-related disasters has also risen by almost 70% to an average of 254 million a year in the decade up to 2004. Moreover, there is growing recognition that disasters do not just occur in the poorer nations of Africa or Asia but increasingly are also a feature of more affluent – and often woefully unprepared – countries like the United States and the UK (Giorgi, 2006; *Planet Ark*,

2008). Devastating fires in Greece and California in 2007, as well as more recently in South Australia, serve as a reminder of what can be expected as regular occurrences around the world as climate change continues to impact on all countries (Running, 2006; Westerling *et al*., 2006). Only four years earlier, *New Scientist* (2003) magazine proclaimed 2003 the 'year of the bushfire' after fires scorched 20 different nations including Portugal, Russia and South Africa.

As one of the most fire-prone areas on earth, southern Australia is a region of especially high risk (Pyne, 1998; 2006); and, as we spell out in greater detail below, the climate change projections for this century appear nothing less than alarming (Flannery, 2007; Hogarth, 2007). Indigenous Australians adapted their lifestyles and land management practices to fire regimes over thousands of years. Contemporary society must also learn to embrace fire as a natural phenomenon and accept that nothing can be done to completely eliminate it, while at the same time recognising that much can be achieved to mitigate some of fire's most destructive impacts. This was given high level recognition in Australia by the Council of Australian Governments when, at its April, 2007 meeting, it endorsed the aspirational, *National Climate Change Adaptation Framework*. Bushfires cause loss of life, income and property, as well as human suffering, damage and disruption to the normal functioning of governments and communities, and adversely affect individuals and families. They clearly warrant strategies to mitigate their risk (Godschalk *et al*., 1999).

The bushfires that swept across Victoria in the summer of 2006–2007 for 69 days were among the worst on record in terms of the time that it took to control them. Approximately 1.2 million hectares were burned in the sparsely-populated north-east of the State, but no lives were lost as a direct result and only 51 homes were destroyed, far fewer than the 1500 consumed by the 2007 Californian fires. By comparison, the bushfires of 1939 covered approximately the same area of Victoria as the 2006–2007 event but resulted in 71 fatalities and 650 lost homes. The 1983 fires in the same State caused 75 human deaths, 27 000 stock deaths and the loss of over 2500 dwellings, many of them in heavily forested settings on the outskirts of metropolitan Melbourne.

The growing financial expense of wildfire management is shared by the whole community. Management responses in Australia – both pre- and post-bushfire events – remain largely the responsibility of State government and the costs can be substantial. These include both direct and indirect costs, the latter including, for example, long and expensive official inquiries to evaluate causes and apportion responsibility; legal and compensation claims; subsequent flood events caused by the decline of vegetation cover; and financial losses incurred in the tourism and other sectors. There can also be large scale, temporary relocation during evacuation phases. Thirty thousand people, for example, were forced to leave their homes during the unprecedented fires in British Columbia in August, 2003. The comparable figure for the 2007 Californian fires was around a million. The direct economic cost of the 2002–2003 fires in Victoria exceeded A$200 million, but this does not include the funding of an exhaustive, six-month long government inquiry into the disaster (Esplin, *et al*., 2003; Whittaker and Mercer, 2004). At a time when disaster relief is reaching 'catastrophic proportions' in many countries (Godschalk *et al*., 1999, 5), effective mitigation can substantially reduce the cost of disaster response and recovery (Burby, 1998). In Victoria, the average annual budget allocated by the State government for fire prevention is currently A$3 million. But in December, 2007, in the build-up to the summer fire danger period, the Victorian State Minister for Water announced an additional A$27 million boost to this budget to protect Melbourne's water catchments (*The Age*, Melbourne, 3 December, 2007).

Vulnerability, resilience and risk

The concepts of vulnerability, resilience and risk are now pivotal in public policy debates in many countries (Buckle *et al*., 2001; Green and McFadden, 2007; Milne *et al*., 2008). As March (2007, 11) has argued, 'one important "reason to plan" is the *reduction of risk*'. And in a recent discussion of flood risk in the UK, White and Richards (2007, 513) concluded that

> . . . the planning system may actually be the most sustainable method to manage flood risk, in that not only can it provide for risk management, it can also avoid or even reduce risk, due to its ability to influence factors such as the location, type, design, and function of development.

In similar vein, the most obvious 'solution' to the danger posed to individuals and households by bushfires is to restrict development in areas that are deemed to be at high risk (Schwab, 2005). In practice, however, because of the

historically entrenched legal protection accorded private property rights in Australia, this has proven difficult to implement thus far. As we shall see, many of the areas at greatest risk are prime amenity and high population growth districts either immediately adjacent to major metropolitan or regional centres or within the wider peri-urban field (Gurran, 2005; Buxton *et al*., 2006). The Dandenong and Macedon Ranges in Victoria, the Mornington Peninsula, the Adelaide Hills in South Australia, and the Blue Mountains west of Sydney, are all obvious examples. Commonly, these areas have inherited a complex patchwork of inappropriate subdivisions.

When a sudden natural hazard hits unpopulated areas, no disaster occurs. Disasters happen when nature's extreme events strike exposed people and property (Godschalk *et al*., 1999). Without the impact on population, wildfires are simply a natural hazard. Lucas *et al*. (2007) emphasise that Australia's south-east is particularly threatened by wildfires. When compared with the majority of fires in Australia's north, fires in the south-east of the country are more likely to threaten life and property. Development and population growth in the urban-rural fringe areas increase the risk of wildfire threat due to the alteration to the natural landscape and increased number of people and property exposed (Williams, 2007). As noted, one of the most hazardous areas, in terms of both human and economic loss from bushfires, is Melbourne's urban-forest interface (Boura, 1994). Outer suburbs, or the peri-urban areas, can be densely populated, have high property values and can be exposed to fires of extreme intensity from pockets of burning vegetation. The reality is that in such locations even comparatively small fires can become disasters by claiming lives and destroying homes. Wildfire management strategies are having to take into account higher population densities adjacent to bushland and smaller lots limiting the possibility of buffer areas on private land between bushland and buildings (Brown and Tohver, 2000). Current land use patterns see development expanding into bushland areas which further increases the risk of bushfire (Bosomworth, undated).

Melbourne is experiencing a significant increase in the number of dwellings in the urban fringe. Population growth in the peri-urban region is in part due to pressure from the rapid growth of Melbourne's overall population and in part due to housing affordability (Millar, 2007). Associated with this are growing numbers of people seeking a lifestyle change, opting for settings that incorporate both the benefits of bush and city. Little (2003) suggests that as many as 30% of new dwellings are built on the urban fringe in New South Wales; and in Victoria, according to the 2006 Census, the household growth rate in urban fringe local government areas was 34% between 1996 and 2006 compared with an overall growth across Victoria of 14.6% and 15.6% in Melbourne. Table 1 shows the number of occupied private dwellings in urban-rural fringe local government areas. It perhaps comes as no surprise to learn that for the period 1999–2004, the densely-settled Melbourne region (excluding metropolitan Melbourne) experienced the highest number (4699) of vegetation fires attended by the Country Fire Authority of any of the State's regions (Bryant, 2008).

Land use change in peri-urban areas invariably has additional problems associated with development adjacent to national parks. Private residential development within or adjacent to national parks inevitably results in problems between conflicting land uses. Planning for these properties is particularly complex as each area is subject to different administrative and legislative processes and levels of governance (Gurran, 2005). Without planning processes to specifically target the interface between national parks and surrounding areas, the ecological, historical and cultural significance of national parks is jeopardised. The vegetation modification

Table 1 Victoria: Households in urban-rural fringe municipalities (1996–2006).

	1996	2001	2006	%Change 1996–2006
Yarra Ranges	43 437	46 706	47 982	10.46%
Macedon Ranges	10 750	12 012	13 093	21.8%
Nillumbik	16 584	18 137	18 612	12.23%
Whittlesea	30 657	34 908	39 509	28.87%
Cardinia	13 561	15 168	18 982	39.97%
Casey	45 888	56 078	68 904	50.16%
Mornington Peninsula	40 900	47 133	49 871	21.93%
Hume	35 008	39 858	45 677	30.48%
Wyndham	22 946	27 058	36 704	59.96%
Melton	12 221	16 404	25 190	106.12%
TOTAL	271 952	313 462	364 524	34.04%
Victoria	1 554 456	1 667 687	1 781 666	14.62%
Melbourne	1 110 297	1 196 144	1 283 299	15.58%

Source: Australian Bureau of Statistics (ABS), 2007.

requirements for wildfire management, for example, are often in direct conflict with the management of national parks. The urban-forest interface presents some of the toughest challenges confronting the conflicting demands of environmental conservation and wildfire management.

Despite the risk of bushfires, many peri-urban areas continue to be highly desirable for housing. There are many reasons why assets continue to be located in wildfire-prone areas. Little (2003) suggested the following:

1. that many people are unaware that such areas are prone to wildfires;
2. that values are placed on aesthetics above any perceived threat, and
3. that there is an expectation from land owners that government will protect them by way of safety regulations and emergency services.

There is strong evidence that the risk posed by wildfires to Victorian communities is heightening and will continue to worsen. There is general agreement among scientists that climate change is occurring, even though the extent of this change remains uncertain. There is an increasing accumulation of fuels alongside development and population growth in wildfire-prone areas, which exacerbates the problem and increases the impact of climate change upon fire regimes. Despite growing appreciation in policymaking circles, at all levels of governance, about the implications of climate change, the development and implementation of policy to counter increased fires remain problematic (Lyth, 2006). Indeed, as Australia moves progressively towards the adoption of an emission trading regime there is an urgent need for clarity around the issue of 'landscape carbon accounting' and native forest management. How are fires to be factored into this accounting framework (Bowman *et al*., 2008)? There is some understanding that every summer will continue to bring a return of big, dangerous fires. The questions of where and when these will occur make wildfire management a 'risk' rather than a certainty. This is a hindrance to adaptation strategies. Cary *et al*. (2003) suggest society's poor understanding of fire behaviour and the role of fire has contributed further to the weak response. Few people are willing to go beyond the apparent inevitability of natural hazards to consider that pre-emptive land use planning can significantly reduce the impacts of such natural hazards.

However, as the legal liability consequences of climate change and sea level rise become increasingly likely, local and State governments, in particular, are beginning to look much more closely at the potential use of planning controls and instruments to mitigate the risks (March and Henry, 2007; McDonald, 2007a; b). This is a trend that is also apparent in relation to other potential hazards such as landslip, subsidence and coastal erosion (Brennan, 2007). This paper focuses in some detail on one such instrument in Victoria, the Wildfire Management Overlay (WMO). We look in particular at the intent of the WMO, its uptake and efficacy.

There are three key phases in the fight against wildfires. The Country Fire Authority (CFA) has classified these as: *prevention and preparedness, response* and *recovery*. Prevention and preparedness techniques have been developed on the basis that buildings burn as a result of three different methods: direct flame contact, radiant heat and burning embers. The WMO and planning controls form part of the prevention and preparedness component of wildfire management, with a focus on mitigation against radiant heat and flame contact in new residential developments to provide a safe haven while the fire front passes through. The Australian Standards 3959–1999, implemented through the building regulations alone, do not provide adequate protection from radiant heat and flame contact but instead focus on maximising the performance of buildings subject to bushfire attack through construction and design requirements for buildings. Direct flame contact and radiant heat are best managed through site layout and vegetation management which, in turn, is best achieved through the WMO and education programs like 'Community Fireguard' and 'Bushfire Blitz' (Maughan and Krusel, 2004).

Australian fire authorities advise residents to 'stay and defend or leave early' (Tibbits *et al*., 2008). There is strong evidence that well-prepared houses can be successfully defended and that late evacuation is a dangerous strategy (Tibbits and Whittaker, 2007). Australian strategies to respond to wildfires are unlike those of other countries, where mass evacuation is the norm. Proactive mitigation and preparedness form an important component of the 'stay and defend or leave early' policy.

Our focus on Victoria is deliberate. Even though the State represents only 3% cent of Australia's land mass it is relatively densely settled, has been extensively cleared for agriculture and, over the last 150 years, has suffered a disproportionate 50% of the nationwide economic

losses from bushfire events (McGee and Russell, 2003). Some 300 people have lost their lives over the years in Victorian bushfires, far in excess of the total in other States (Bryant, 2008). As such, Victoria has taken a lead in terms of developing planning instruments to mitigate fire risk (Handmer and Haynes, 2008). With their identification of 'Bushfire-prone Areas', 'Bushfire Protection Areas', and the formulation of Bush Fire Risk Management Plans at the local government level, other States, for example New South Wales and South Australia, respectively, have subsequently followed Victoria's innovatory policy path (Laidlaw *et al.*, 2008).

Interstate comparisons

There have been calls for a national policy to strengthen the focus on bushfires (Bushfire Cooperative Research Centre, 2007). It is important to remember that the Victorian policy forms part of a broader national approach to wildfire management. Tables 2 and 3 place the WMO in the context of other Australian States. Victoria, New South Wales and South Australia all now have solid, legislated policies to mitigate wildfire risk through local government planning schemes. Other Australian States, such as Tasmania, have statewide guidelines for dealing with new use and development in bushfire prone areas. Problems arise when wildfire management

Table 2 A comparison of South Australian, Victorian and New South Wales legislated wildfire protection land-use planning policies.

State	South Australia	Victoria	New South Wales
Name *Date*	Bushfire Prone Areas' 1987 – South Australia introduced planning controls over bushfire prone areas in the Mount Lofty municipality (Schauble 2004).	Wildfire Management Overlay' 1997 – The inclusion of the Wildfire Management Overlay into Victoria Planning Provisions.	Bush Fire Prone Area' 2006 – Prior to 2006 there was a number of informal guidelines 'Planning for Bushfire Protection 2001', 'Planning for Bushfire Protection 1991' and 'Planning in Fire Prone Areas 1989'.
Trigger	Mapping	Mapping	Mapping
Description	After the 1983 Ash Wednesday bushfires, the State Government declared a large part of the Mount Lofty Ranges as a 'Bushfire Prone Area'. Two levels of risk were distinguished: 'CFS[1] Referral Areas' and 'Non-Referral Areas'.	Standard State-wide provision that must be adopted into individual municipal planning schemes. The Country Fire Authority (CFA) has devised a set of guidelines to accompany the policy: Building in a Wildfire Management Overlay Applicant's Kit. Applications are referred to the CFA.	A series of booklets has been produced to assist applicants eg. 'Building in a bushfire prone area: single dwellings'. Applications referred to the NSW Rural Fire Services (RFS). Has identified areas of high risk, labelled 'flame zone'. Includes processes for standard and non-standard options for processing applications.
Objective	In general terms, the policy seeks to ensure dwellings are built using planning principles that assist in protecting them from bushfires by providing the occupant or CFS with the means to fight a bushfire if a dwelling is threatened.	To identify areas where controlling a fire of high intensity is very difficult and to ensure that development includes specific fire protection measures to ensure that development does not significantly increase the threat to life and property from wildfire.	To reduce the impact of bushfire on proposed development by requiring construction standards necessary to enhance a buildings' survivability.
Requirements	'Bushfire Service Plan' that includes siting dwellings so as to minimize the risk from bushfires, adequate access, water supply and vegetation modifications.	Commonly requires a static water supply, access requirements and vegetation management.	Applicants must match FDI rating, vegetation type, separation distance and effective slope to determine level of construction applicable to site and prepare a Fire Assessment Report. Also specify water supply and restrictions on siting portable gas bottles.

[1] CFS refers to Country Fire Service.

Table 3 A comparison of Tasmanian, Queensland and Western Australian legislated wildfire protection land-use planning policies.

State	Tasmania	Queensland	Western Australia
Name	Bushfire Prone Areas	Potential Bushfire Hazard Area	Natural Hazards and Disasters
Date	c1998 – It is believed that as early as 1980s fire hazard guidelines were included into Tasmanian planning schemes. However this date was unable to be verified.	2003 – QLD government has legislated a 'State Planning Policy 1/03: Mitigating the adverse impacts of floods, bushfires and landslides'. However, QLD has had informal guidelines as early as 1980s.	2006 – WA has no legislated State planning policies for bushfire prone areas[4]. However, the State Planning Policy No.3.4 Natural Hazards and Disasters provides some general guidance.
Trigger	Land within 100 m of standing vegetation[1].	Local area mapping conducted by local governments or by QRFS[2].	Some schemes trigger fire protection policies through rural zoning.
Description	State-wide guidelines that do not contain any legislated requirements. Some individual local governments have developed further regulatory controls and requirements. Applications referred to the Tasmanian Fire Service (TFS).	State Planning Policy provides guidelines but does not include any legislated standard policy requirements. State policy encourages local planning schemes to adopt their own interpretation of the policy.	The State guidelines declare that bushfire threat analysis should be used to determine those areas that are most vulnerable to bushfire. No provisions in the planning scheme for the referral of applications to external fire-fighting authorities.
Objective	To minimise losses of life and property from bushfires by making living and working environments defendable from bushfires.	To ensure that the natural hazards of flood, bushfire, and landslide are adequately considered when making decisions about development.	The State guidelines include planning for natural disasters as a fundamental element in the preparation of all planning documents and thorough use of these planning instruments aims to minimise the adverse impacts of natural disasters on communities, the economy and environment.
Requirements	A defendable space between buildings and bush, roads and fire trails available for emergency use, water supplies, good siting and design options as well as a fire management plan.	The Gold Coast City Council 'Bushfire Management Code'[3] states development should not occur in areas of high or medium bushfire risk or the risk must be mitigated through allotment design and siting of buildings, setback from vegetation, provision of access, and adequate water supply.	The Mundaring Planning Scheme requires an assessment of fire risk to take into account the road and public access-way network, terrain characteristics, and water supply arrangements for fire control purposes[5].

[1] Tasmanian Fire Services refer to standing vegetation as all forms of vegetation that grows to a height of 2 metres or more.
[2] QRFS refers to Queensland Rural Fire Services.
[3] For information refer to The Gold Coast City Council Bushfire Management Code. Retrieved 12 August 2007 from http://www.goldcoastcity.com.au/gcplanningscheme_new/Support_files/scheme/07_CODES_03.pdf
[4] For information refer to the Western Australian Planning Commission. Retrieved 13 August 2007 from http://www.wapc.wa.gov.au/Publications/878.aspx
[5] For more information refer to the Mundaring Planning Scheme. Retrieved 14 August 2007 from http://www.mundaring.wa.gov.au/residents/pdf/TownPlanningScheme.pdf

is reliant upon the strength of local policies or guidelines. Traditionally, the weakness of local planning policies can be attributed to a lack of a solid and comprehensive base for planning and the lack of consideration of strategic direction.

The Western Australian system poses an alternative option for wildfire management. Western Australia has a State Planning Policy that only provides general guidance regarding the management of land and protection from natural hazards. However, in Western Australia, the Fire and Emergency Services Authority provides assistance directly to the public on how to build in wildfire prone areas. This system relies upon residents coordinating advice, some of which is mandatory and some of which is discretionary. The process presumes that the direction of both the Fire Authority and planning

officers can be combined with little complication and complexity, and most importantly, without conflict. Further to this, Western Australia does not have the density of population and development in steep, heavily forested terrain that Victoria has, which increases the difficulties associated with managing wildfires.

As noted, in the context of Australia the WMO is a relatively new and innovative policy. Nelson's (1985) analysis of innovation in the Australian States suggests that when one State develops a policy similar policies soon emerge in other States. She suggests that no State has struck out on a legislative path that others have not followed, and there is striking uniformity in the range of policy areas deemed appropriate for State legislation. Nelson's study concluded that Australia has 'leading' and 'lagging' States in term of policy innovation. The leading States were identified as Victoria, South Australia and New South Wales. As shown in Table 2, the States which have legislated similar policies to Victoria are New South Wales and South Australia. These three States are also the leaders in State-legislated planning policies that mitigate wildfire risk. It is likely that other States will follow in the creation of similar policies to the WMO. The WMO has been formulated on the basis of robust scientific and technical evidence. It is consistent with contemporary political philosophies which envisage the State as being proactive in regulation and public education to minimise future harm and expense to individuals and communities. As we shall see, some Councils have been slow to implement the WMO. While first impressions are that this is due to inadequate resources, the CFA in Victoria has provided considerable support to local governments to formulate and adopt the WMO, making Victoria a leader in wildfire management strategies compared with other Australian States.

Climate change

One of the main reasons why this is such an important topic to address is that the climate change projections for Australia raise the spectre of far more frequent and severe bushfire events in the future. As an indication of what can be expected in the future, in March 2008 Adelaide experienced 15 consecutive days of temperatures in excess of 35 degrees Celsius, a record for any capital city. The 'best guess' temperature changes across Australia for 2070 point to an average rise of 1°–5°C over 1990 figures and decreases in rainfall of 10% across southern Australia over the same time frame. Regional variations are anticipated, with south-western Australia, in particular, expected to receive up to 40% less spring and winter rainfall by 2070, and experience an 80% increase in months subject to drought, compared with a 40% increase in the eastern States (CSIRO and Bureau of Meteorology, 2007).

There is a direct connection between predicted future climatic conditions and more extreme wildfires. Nicholls (2007) contends that in the past there has been a strong relationship between area affected and climate variations, in particular reductions in rainfall and increases in maximum temperatures. Mackey *et al.* (2002) reaffirm that their findings revealed a strong correlation between precipitation and area burned. This relationship was further explored by the CSIRO in 'Climate change impacts on fire-weather in South-East Australia' (Hennessy *et al.*, 2005). This report assessed the potential changes to fire risk associated with climate change. Fire risk was gauged using two measures, the Forest Fire Danger Index (FFDI) and the Grassland Fire Danger Index. Both measures are based on weather variables including daily temperatures, precipitation, relative humidity and wind speed. Researchers generated scenarios using climate change models for 2020 and 2050, and found that an increase in fire risk is likely. The frequency of days rated 'extreme' or 'very high' on the FFDI or the Grassland Fire Danger Index is likely to increase between 4% and 25% by 2020, and between 15% and 70% by 2070.

In September 2007, a new report was released by the Bushfire Cooperative Research Centre to update the findings of the Hennessy *et al.* (2005) study (Lucas *et al.*, 2007). The projections for increases in wildfire risk were recalculated using updated global warming projections from the Intergovernmental Panel on Climate Change, and the method was slightly altered to incorporate annual and individual seasonal changes to fire danger. Two new fire danger categories were defined as 'very extreme' and 'catastrophic'.

As a general rule the most significant changes are expected to occur inland (Lucas *et al.*, 2007). The latest study concluded that the number of 'very high' fire danger days is expected to increase by between 2% and 30% by 2020, and by 5% to 100% by 2050. Projections for the number of 'extreme' days are increases between 5% and 65% by 2020, and 10% to 300% by 2050. The occurrence of 'very extreme' rated days is expected every two to 11 years. In

particular locations the 'catastrophic' days will occur every three years or less.

The Wildfire Management Overlay (WMO)

There are two distinct components to Victoria's planning policy development process. The first is the formulation of the policy, including the background research and writing of the strategies, and their inclusion in the Victoria Planning Provisions. The first phase of the formulation of the WMO as a planning policy was completed over a decade ago, in 1997. The second phase, which is ongoing, involves the adoption of the policy into municipal planning schemes across the State. This section of the paper concentrates on the formulation of the WMO in the context of planning in Victoria, with a particular focus on the rationale and research behind the policy.

The WMO, as a legislated State-wide planning policy, emerged with the introduction of the Victoria Planning Provisions. In 1996 the Kennett Coalition government passed legislation that required local governments to incorporate a standard format into their municipal planning schemes (Buxton *et al*., 2005). This format, labelled the Victoria Planning Provisions, encompassed common State Planning Policies, general and particular provisions, definitions and an array of zones and overlays. To complete the new format schemes Councils formulated local 'visions' and goals into a Local Planning Policy Framework and then selected zones and overlays that would assist in achieving the local vision. Around twenty different overlays are now in existence in Victoria, including those relating to such things as environmental significance, flooding and neighbourhood character. Generally, they 'impose the requirement for a permit for building and works over and above any permit requirement imposed by the zoning which applies to land . . .' (Eccles and Bryant, 2006: 58).

The WMO was developed by, and in the interests of, the Country Fire Authority (CFA). With almost 60 000 volunteer firefighters and responsibility for some 150 000 km^2 of land and almost a million dwellings in Victoria, the CFA is one of the biggest volunteer-based disaster response organisations in the world. In an average year, CFA volunteers attend around 5000 fires (Bryant, 2008). Much of the writing of the policy was undertaken by a planning consultant commissioned by the CFA. The policy seeks to ensure the survival of houses to provide a place for people to shelter while the fire front passes through (Maughan and Krusel, 2005). More specifically, the aim of the Overlay is to protect houses from radiant heat or direct flame by creating a 'defendable space' and ensuring the provision of appropriate resources and equipment. The CFA intended several outcomes from the Overlay; in particular, to

1. minimise the intensity of fire near a dwelling;
2. minimise the risk of a dwelling igniting from radiant heat or direct flame contact through the management of vegetation; and to
3. ensure the establishment of an area which the owner, or fire fighting personnel, could safely and actively defend.

The formulation of the WMO initially was triggered and remains motivated by the interests of the CFA. The Overlay assists in achieving the objectives of the CFA, namely preventing and suppressing fires for the protection of life and property (Country Fire Authority, 2006a). Hall (1993) has identified three different types of policy change. *First order change* comprises a change of setting in the light of experience and new knowledge, while the overall goals and instruments of the 'old' policy remain in place. *Second order change* constitutes a change to the basic techniques or instruments used by the policy to attain its goals, usually as a result of past dissatisfaction; and *third order change* represents a paradigm shift in which the setting, the instruments and the goals of the policy change.

The initiation of the WMO in the Victorian Planning Provisions may be considered to constitute a third order change. There were two major political shifts that initiated the WMO's development. The first was the expectation that government needs to be proactive in relation to wildfire management rather than re-active for the good of the community, as well as to reduce the financial burden of bushfires on State and local governments. This political philosophy, articulated in Giddens' (1998) *The Third Way*, maintains that good governance means taking responsibility for the citizenry while allowing some freedom for individuals to make the right choices. The second component of politically-motivated change was the realisation that governments cannot provide all the resources necessary to fight major bushfires, and that individuals must take some responsibility for their own properties. This shift in expectations was accompanied by the realisation that able individuals are often safest in their own homes in the event of a major fire. The philosophical

changes to the government's and individuals' roles in wildfire management were accompanied by the following changes in the three variables of the policy making process – *goals*, *techniques* and *settings* (Hall, 1993).

The changes to the *goals* of wildfire management encompassed in the WMO are to ensure that owners of new developments in wildfire-prone areas are fully aware of the risk posed to life and property, and accordingly they implement minimum wildfire protection measures that allow individuals and fire-fighting personnel to more readily defend their homes. Changes to the *instruments* included the development of the WMO, a planning policy instrument to regulate new developments in bushfire prone areas; and the *setting* or context of wildfire management was shifted to the Victorian Planning Provisions (VPPs), and more explicitly in the use of proactive mitigation techniques through individual municipal planning schemes.

In part, non-political circumstances also influenced the development of the WMO. The Overlay formulation was in large measure a response to the devastating fire events in Victoria at the end of the twentieth century. Since the 1983 fires, Victoria and South Australia have learned a great deal about the mechanisms involved in the ignition and destruction of buildings by bushfires (Brown and Tohver, 2000). Initially, the 1983 Ash Wednesday fires provided a source for primary research into how and why houses burn. In particular, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) conducted studies into the causes of house loss during bushfires which resulted in a good understanding of the mechanisms of how houses are ignited (Maughan and Bosomworth, undated). A detailed study of the 1983 Mount Macedon fires by Wilson and Ferguson (1984) found that a person's chance of surviving a bushfire in their own home is excellent. All able-bodied residents, aged under 50, who stayed in or near their home survived and about 90% saved their homes as well. This information was used to form the theoretical basis for the WMO.

Evidence

The evidence underpinning the WMO concept is probably the most technical and precise of any other Victorian Planning Provision. The overlay developed from the enhanced understanding of fire behaviour and the way houses ignite. Fire is dependent upon the interplay of three elements – fuel, heat and oxygen. Thus, the management of vegetation around a dwelling effectively controls the fuel supply (Cohen, 1999). A crucial component of the research behind the WMO is a calculation of the distance required between unmanaged vegetation and a building, so as to avoid ignition from direct flame or radiant heat. To determine the standards used in the *Building in a Wildfire Management Overlay Applicant's Kit*, a worst case scenario was devised (Maughan and Krusel, 2004). Since 2004, this kit has formed the primary basis for implementing the requirements of the WMO in practice. The model used to form the basis of the practical measures contained in the kit is dependent on the following variables:

Fire Intensity

The fire intensity is determined using the weather conditions compared with those experienced at Melbourne Airport on Ash Wednesday, 1983, which generated a Forest Fire Danger Index (FFDI) of greater than 100. The fire intensity also depends on the type of vegetation, categorised as tall forest, open forest, low forest, woodland or shrub and heath, and the topography or the slope of the site. Fire Intensity has been defined by Alexander (1982) and is calculated as:

$$I = HwR/600 \quad (1)$$

where I = intensity; H = Heat of combustion; w = available fuel; R = forward rate of spread (which is determined using the FFDI for each vegetation type).

Flame length

The flame length is then calculated using Alexander's (1982)

$$L = 0.0775(I)^{(0.46)} \quad (2)$$

where L = flame length and I = fire intensity.

Radiant Heat

The distance calculated at which a threshold of radiant heat is reached and wood ignites spontaneously. It is calculated using the Leicester (1987) equation:

$$Q = 60(1 - e(-I/3000*D)) \quad (3)$$

where Q = radiant heat intensity; I = Fire Intensity; and D = distance of observed flame front. Finally, the flame length and distance required to reach the threshold radiant heat are added to calculate the setback distance required between unmanaged vegetation and the building. These

equations form the determinants for the standards of vegetation management zones around a house specified in the *Building in a Wildfire Management Overlay Applicant's Kit*.

Adoption of the policy into municipal planning schemes

The second stage, and the most serious weakness of the formulation of the WMO, has been in its adoption (or lack of adoption) into municipal planning schemes. The WMO is yet to be adopted into several schemes, apart from those municipalities where control is not applicable, either because the area is built-up and does not experience wildfires, or the municipality does not have the vegetation coverage and density required to generate high intensity wildfires (Table 4). For example, local government areas such as Mildura, Swan Hill, Gannawarra, Buloke and Yarriambiack do not have the continuous tall forests and under-storey vegetation coverage that generates the fire intensity at which the WMO is applicable. Approximately 21 Victorian Councils adopted the Overlay at the same time that they introduced the new format planning schemes. Figures 1, 2 and 3 display when the WMO was adopted into local governments, in 2000, 2005 and August 2007. These maps highlight how slow has been the process of rolling out the WMO across Victoria.

Table 4 Victorian local governments that have adopted the Wildfire Management Overlay into municipal planning schemes.

Nature of Municipality	*Number of Municipalities*
Rural that have the WMO	22
Metropolitan that have the WMO	7
Where the WMO is not applicable	30
Should implement but have not as of August 2007	19
Total	78

Source: Victorian municipal planning schemes.

The risk posed by bigger wildfires increases the need and urgency for local governments to adopt the Overlay. There are five possible

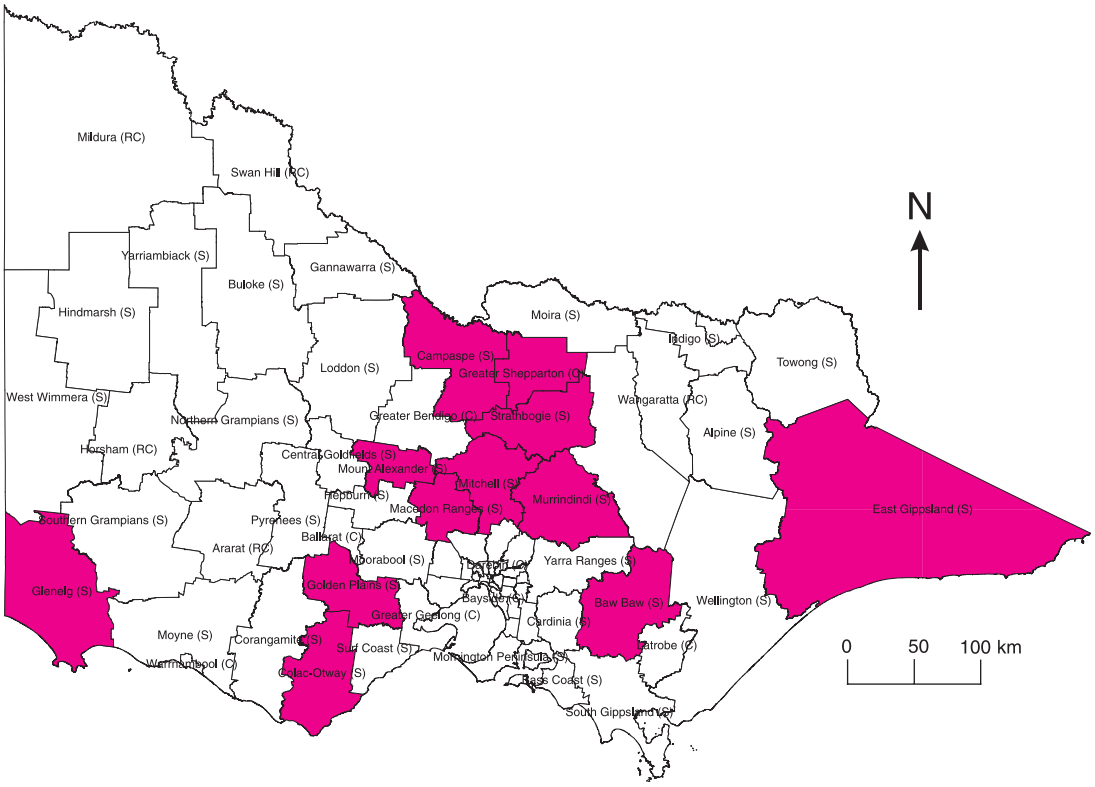

Figure 1 Local government areas that had the Wildfire Management Overlay prior to 2000.

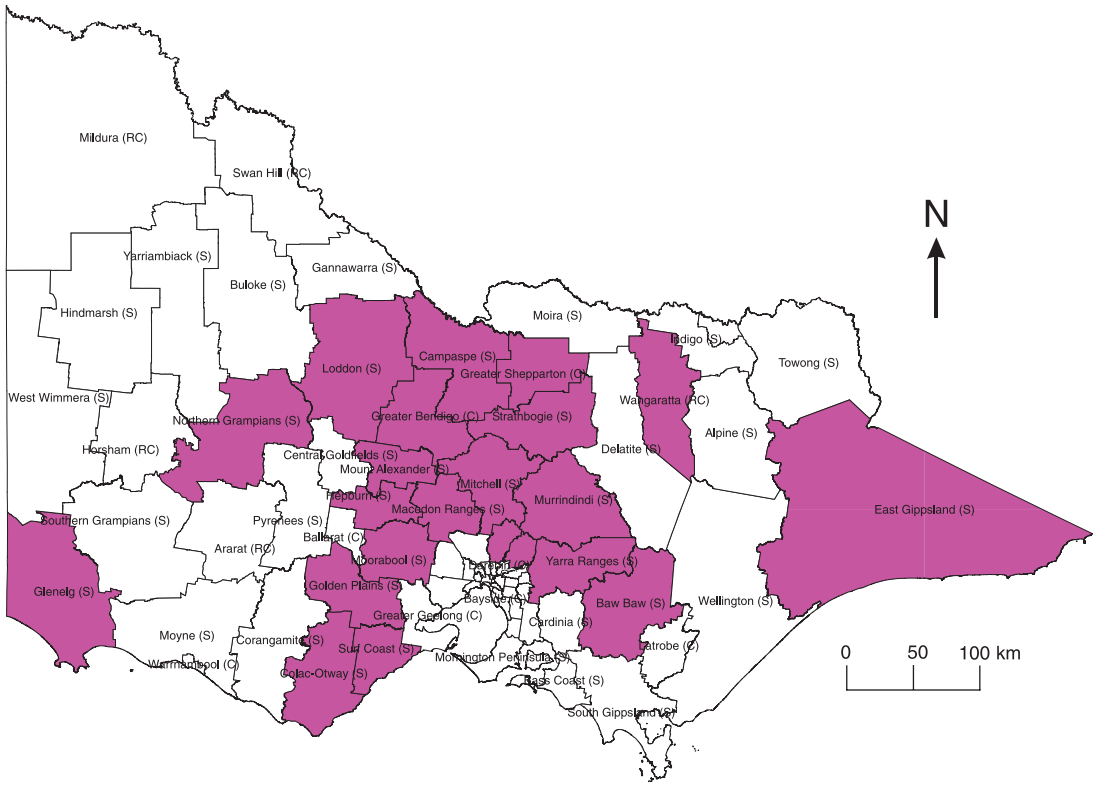

Figure 2 Local government areas that had the Wildfire Management Overlay prior to 2005.

explanations as to why Councils have been slow to implement this policy:

1. doubt over the need for, or capacity of, the policy to mitigate wildfire risk;
2. the belief that further regulation on development is excessive and stifles growth and development;
3. lack of resources, knowledge or support from State government for local government to undertake strategic planning;
4. lack of political will to support the policy, and
5. the belief that wildfire risk should not be addressed through the planning system.

Most arguments against the inclusion of the WMO have been based on a lack of understanding and comprehension of wildfire management and the planning system. The level of commitment and the capacity of local governments can strengthen policies of hazard mitigation. Burby (1998) acknowledges that the general public and locally elected politicians tend to downplay the importance of hazard mitigation policy. Wild River (2003) summarises the main factors inhibiting natural resource management in rural Councils across Australia as a shortage of essential resources including money, time, expertise, statutory powers and lack of political will, data and knowledge, and poor consultation with stakeholders. Some of these factors are directly applicable to the WMO. Various other studies referred to by Burby (1998) point to a reluctance in local governments to adopt, or adequately enforce, strong measures for managing development in hazardous areas for four main reasons. First, unless local governments have had direct experience they tend to discount the risks involved (for an earlier study emphasising this finding in relation to flooding, see Hansson *et al.*, 1982). Second, other problems or concerns are usually higher on the agenda than managing wildfire risk. Third, high risk areas often have high economic value due in part to their aesthetic characteristics. Finally, wildfire-prone areas like the Dandenong Ranges have already been densely settled, and remedial action is costly and politically sensitive as additional regulation is often seen as an undesirable imposition on residents.

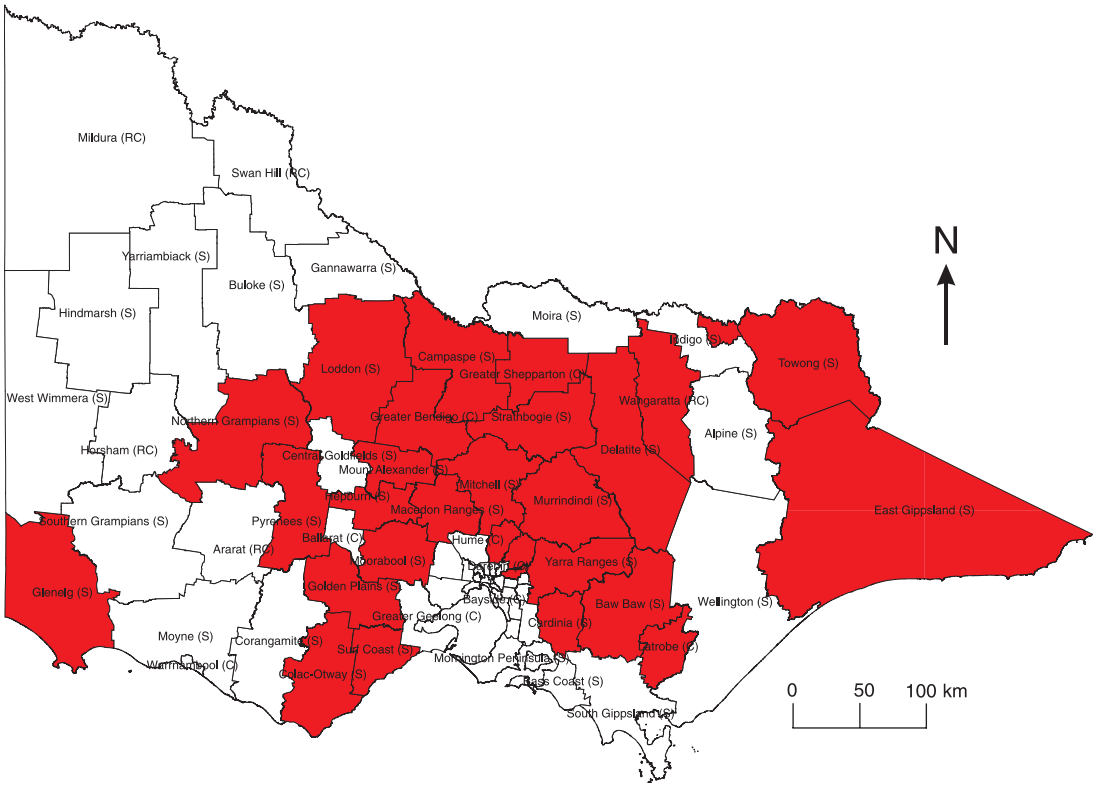

Figure 3 Local government areas that have the Wildfire Management Overlay as at August, 2007.

The vast majority of the work involved in adopting the Overlay and processing the amendment is undertaken by the CFA. Depending on the desire of the local Council, the CFA can take over responsibility for writing the reports and undertaking the mapping. It is therefore illegitimate to claim that a barrier to the acquisition of the WMO is the lack of resources within local governments.

The most significant remaining impediment to the development of the WMO is the lack of political will. There is some reluctance, particularly by planning practitioners, to fully endorse the inclusion of wildfire management through planning controls. Part of the explanation for the lack of commitment is that practitioners object to the inclusion of wildfire management requirements as part of the ever-expanding planning system. Sceptics question the ability and role of planners in taking up responsibilities associated with wildfire management, especially when this is primarily the responsibility of another agency, the CFA. The reality is that many planners are not trained in the science of wildfire behaviour, the implementation of risk management requirements, design and construction details, or vegetation modification. The CFA may be best positioned to implement wildfire management requirements. However, the requirements have implications beyond those considered by fire safety officers. The CFA does not have the expertise or capacity, for example, to consider the implications of WMO requirements for native vegetation.

Vegetation issues

The most contentious issue in the implementation of the WMO is that its objectives conflict with vegetation conservation efforts. Vegetation management is a significant component of a suite of factors that influence the survival of a house during a wildfire. However, the clearing of native vegetation is a major cause of both the loss of biodiversity and land degradation (Farrier *et al.*, 2007; Stoianoff and Kelly, 2007). The Victorian Planning Provisions contain numerous policies regarding the importance of native vegetation, including specific overlays:

the Vegetation Protection Overlay, Environmental Significance Overlay, and Significant Landscape Overlay; and Clause 52.12 which is a particular provision regarding native vegetation. Wildfire management for properties prone to wildfire may conflict with native vegetation management issues. Bosomworth (undated) reminds us that conflicts can frustrate those involved in fire safety and native vegetation management, which can result in reduced community safety or lead to unnecessary environmental impacts.

A dwelling in the midst of a forest poses a significant fire hazard. The objective of vegetation management around a dwelling in a wildfire-prone area is to reduce fuel load. Reducing the fuel load, through vegetation management, can decrease the probability of direct flame contact and the effect of radiant heat on a dwelling, by reducing fire intensity. In order to achieve the objectives and outcomes specified in the WMO, '... [t]o ensure that fuel (ground fuel and shrubs) is managed to reduce potential fire intensity in the vicinity of buildings', and to establish '... [a] building protection zone, landscaped to reduce fuel load, distribution and continuity, [which] must be established to inhibit the spread of fire and minimise the fire risk to life and property' (Department of Sustainability and Environment, 2006, 1), vegetation management is required. Strategies to achieve this have been detailed in the *Building in a Wildfire Management Overlay Applicant's Kit* (CFA, 2007). These strategies require the following:

1. grass must be no more than 100 mm in height;
2. leaf litter must be less than 10 mm deep;
3. elevated fuel must be removed from at least 50% of the predetermined management zone;
4. dry shrubs must be isolated in small clumps more than 10 m away from the dwelling, and
5. trees must not overhang the roofline of the dwelling.

These requirements have implications for the ecological composition and value of the area, in particular for the biodiversity of the understorey. The ecological consequences of wildfire management are not the priority of the CFA, and therefore will not be highlighted as a priority in the Applicant's Kit. The extent to which fuel modification imposes on the environment varies on a case by case basis. More sensitive vegetation modification usually requires greater expertise than that of a statutory planner or resident. Although the WMO does not have permit exemptions for vegetation removal, Clause 52.12 cites several exemptions for requiring a planning permit for vegetation removal associated with wildfire management. These exemptions were expanded in November 2006.

Although it is obviously preferable for fire specialists and ecologists to provide residents with mutually acceptable plans at the local level, it is not easy or always possible. The basis for effective planning is a thorough knowledge of the issues, including: an accurate assessment of the fire danger; realistic assessment of the effectiveness of fire protection works; recognition of environmental values, and the effect of fire protection works on these plans (Boura, 1994).

Effective implementation of the WMO relies upon planners giving consideration to both wildfire risk and vegetation conservation, as both referral authorities, the CFA and Department of Sustainability and Environment (DSE), have vested interests. There is a tendency for Council planners to apply wildfire management requirements with little consideration for their impact on native vegetation. Special consideration must be given if the WMO conditions require the removal of endangered or excessive vegetation. Planners must be of the opinion that conditions placed on a planning permit are in the overall interests of the application.

Victorian Civil and Administrative Tribunal (VCAT) case studies

The complexity of issues and the possible conflict of wildfire management and environmental conservation are illustrated by the following two case studies that came before the Victorian Civil Administrative Tribunal (VCAT) in 2002 and 2005. The extent and impact of vegetation modification required to meet wildfire requirements can and have formed the basis for refusal of applications. This has contributed to the discontent behind the WMO and its implementation.

Buchanan v Mornington Peninsula SC [2002] VCAT 1752 P1552/2002

An application was lodged under Section 79 of the *Planning and Environment Act 1987*, brought by Buchanan to review the failure of the Mornington Peninsula Shire Council to grant a permit (Austlii, 2002). A VCAT hearing was held on 16 October, 2002. The application was for the construction of a dwelling and the removal of 90% of the existing vegetation on the site. The site is part of land that was subdivided during the 1960s. Most of the land no longer

remains in private hands as it has been bought by the State to form the Mornington Peninsula National Park. An Environmental Significance Overlay and a Significant Landscape Overlay control development of the site. There has been little development of surrounding land. Council declared that it intended to refuse the application principally on the basis that it was inconsistent with fire protection objectives of the planning scheme, as the proposed dwelling would intensify the risk to persons from wildfire unless there was significant clearing in the National Park, to which the Department of Natural Resources and Environment and Parks Victoria were opposed. The presiding VCAT member, Rachel Naylor, found that the proposed removal of 90% of the vegetation from the subject site was contrary to many of the objectives of the various Overlays that applied to the site and its surrounds. On behalf of the CFA, Dr N. Krusel, Acting Director Community Safety at the CFA, presented a case that the site was not large enough to manage the vegetation effectively. The proposed dwelling was to have a setback of two metres from the National Park boundary. A wildfire in the vegetation type surrounding the proposed development would create radiant heat levels in excess of the maximum temperature that could be mitigated through construction methods. Compounding this issue was the claim that during the passage of a fire front, it was inevitable that the proposed dwelling would also be subject to direct flame contact. Given the inappropriateness of clearing native vegetation and the need to do so for fire management, and the proximity of the National Park to the subject site, Naylor concluded that the subject site could not satisfy both the objectives of fire protection and vegetation conservation and therefore the proposal should be refused.

Cock v Nillumbik SC [2005] VCAT 2156 (17 October 2005) P43/2005

An application was lodged under Section 79 of the *Planning and Environment Act 1987*, brought by Cock to review the failure of Nillumbik Shire Council to grant a permit in the prescribed time. Planning approval was sought for the re-subdivision of the land, the use of a dwelling on each lot, the construction of dwellings on three of the lots, and native vegetation removal (Austlii, 2005). The subject site was a rural property approximately 50 km north-east of Melbourne. The property has been zoned for Rural Conservation, and was also controlled by the WMO, an Environmental Significance Overlay and, partly, by a Land Subject to Inundation Overlay. The proposal required the clearing of vulnerable, very high conservation significance vegetation to meet the wildfire management conditions, which the Department of Sustainability and Environment (DSE) had recently declared should be prohibited except in exceptional circumstances. Mr Costello from DSE stated his department did not believe this proposal was an exceptional circumstance, and therefore the vegetation should not be removed. It was argued that the proximity of the dwelling to vegetated land that was in separate ownership created a fire risk. The slope of the land and the topographical features of the site would make it difficult to sustain the vegetation management requirements. The panel member, Rachel Naylor, found that there were environmental and wildfire constraints associated with the subdivision and development of lots for residential use which could not be adequately addressed. She stated that wildfire management was an important characteristic of this area as recognised in the Planning Scheme. The environmental values of this site and its wildfire risk and development implications led her to decide that the proposal should be refused.

It is interesting to note that both applications lodged at VCAT were for the failure of the Responsible Authority to determine an application. Both cases illustrate the complexities when trying to deal with both vegetation conservation and wildfire risk. The complexity of the Cock v Nillumbik SC case is illustrated by the length of the decision, which amounted to 19 pages, and the number of expert witnesses who presented at the hearing. Both applications were refused due to the unreasonable risk posed by wildfire which cannot or should not be mitigated through the removal of vegetation. The wildfire risk alone is not often grounds for refusal of an application. However, the implications of wildfire management requirements that accompany the use of land and development of land need to be considered by planning practitioners.

Discussion and conclusion

The CFA has subsequently initiated a project that seeks to develop solutions between property bushfire preparedness and native vegetation management. In August 2006, a workshop conducted at the headquarters of the CFA in Burwood discussed the matters of bushfire preparedness and native vegetation management

(Country Fire Authority (CFA), 2006b). Those in attendance were local government planning officers, as well as representatives from the CFA and the Department of Sustainability and Environment (DSE). A summary of the problems identified included:

1. direct conflicts between values of bushfire preparedness and native vegetation management;
2. difficulties among all practitioners (CFA, DSE, local government planners) due to a lack of understanding, skills and resources to implement the system effectively and consistently, and
3. lack of awareness, understanding and information about the system among residents.

These problems arise out of a lack of shared understanding among all those involved. The miscomprehension and misunderstanding are further exacerbated by a lack of training and mentoring among staff. The high turnover of staff in local government planning departments is a phenomenon that has serious repercussions, especially when dealing with complex issues which are applicable only in certain areas. Not only do Council staff implement processes incorrectly, but their lack of understanding is then passed on to residents. The lack of attention the WMO receives from planning practitioners can be commonly attributed to the misconception that WMO is the CFA's responsibility and a planning officer's role is simply to refer the application to the CFA. According to the Executive Officer for the Emergency and Safety Planning Department at the Shire of Yarra Ranges, the lack of consideration of WMO requirements has become evident during auditing by fire safety officers (Hunt, personal communication, 30/08/2007). The CFA has acknowledged that policies and strategies are more effective when they are well understood by the affected community, who then have a sense of ownership and control, and support their implementation (CFA, 2003).

Progressive local governments have begun to adopt local planning policies in an attempt to provide greater guidance to assist in resolving conflicts between vegetation conservation and fuel management. Many Councils share the view that sensitive fuel modification is possible, in most circumstances, with greater understanding and direction. Manningham City Council has taken a further step to re-emphasise their commitment to the environment through encouraging higher construction standards or alternative options in preference to vegetation removal. The Council discourages the extent of vegetation management specified in the standard options vegetation requirements in the *Building in a Wildfire Management Overlay Applicant's Kit*. It encourages residents to adopt Option 3, where standard vegetation modification is not specified. This strategy highlights what can be achieved when proper consideration is given to WMO requirements. There is real potential to improve planning outcomes by trading off the amount of vegetation modification required through increasing standards of construction which will maintain the same level of protection from wildfires.

To further improve the WMO, a phase of second order change must occur. This is defined by Hall (1993) as one which sees a change to the basic techniques or instruments used by the policy to attain its goals, as a result of dissatisfaction in the past. The Overlay must seek to further incorporate construction standards to minimise the impact on native vegetation to more effectively mitigate wildfire management with regard to other objectives of the planning scheme. By using sound design principles, homes can be constructed to respond to their environment and minimise the threat of being lost in a bushfire. Archicentre, the housing advisory service of the Royal Australian Institute of Architects, has prepared an advisory note on bushfire design (Archicentre, 2003). They identify three fundamental principles to minimise bushfire attack as: a simple roofline; minimum angles, and fire-resistant construction materials. Specific construction requirements are outlined in *Australian Standard 3959 – 1999 Construction of Buildings in Bushfire-prone Areas*. Thus, one way to minimise the amount of vegetation modification to be undertaken by an applicant is to commit to a higher level of construction standard.

A central barrier to the development of wildfire preparedness through the adoption of higher levels of construction is the level and diversity of expertise required. Few individuals can claim to be experts in planning, wildfire science, the environment and the relevant building practices. Yet all of these areas of expertise are required to produce and implement policy, which further requires collaborative decision-making processes. The implementation and formulation of the WMO requires a diversity of specialist skills to achieve good outcomes. In implementation, bridges need to be built

between the residents, fire scientists, building surveyors, environmentalists and various government officials. This is not always easy when all sectors of society use various discourses, a variety of problem-solving techniques, and contrasting values to produce different outcomes (Brown, 2004). The implementation is often difficult when the knowledge required to address a problem is fragmented and divided into categories among different individuals. Traditionally, difficulties have always occurred in collaborative decision-making among community, experts and government decision-making systems, let alone among various specialists. To better resolve disputes between wildfire management and vegetation conservation, further collaboration is needed with builders, architects and building surveyors as well as planners, environmentalists and fire scientists.

According to the CFA's Yarra Area Fire Safety Officer, the CFA receives in the order of 650 WMO referrals annually from local governments (Sacco, personal communication 20/09/2007). The Shire of Yarra Ranges documented fears at the beginning that the mechanisms by which the policy works would generate considerable administrative work for the Council and the CFA (Rooke *et al*., 1999). In particular, the Council questioned the ability of the newly established referral authority, the CFA, to cope with the influx of applications. The Council recognised that in some cases there is no need to refer applications, such as subdivision applications. Overall, the CFA has coped well with its new responsibilities as a planning referral authority. However, as with all planning system processes, there are always opportunities for improvement of the administrative operations. The Department of Sustainability and Environment (DSE) advised that, from 2002, it was not necessary for all applications to be referred to the CFA, as stated in the scheme, if an agreement had been set up between the Council and the CFA. By not referring applications that had complied with standard conditions this would drastically reduce administrative work for both the Council and CFA. However, initiatives like this are not possible until Council planning officers are sufficiently familiar with the requirements to enforce wildfire management conditions.

Implementation involves weighing up a variety of diverse factors, some of which may be found to conflict with one another. For example, the desire for people to live in a forest setting in close proximity to trees and bushes, must be balanced by the need to keep fuel levels low close to buildings. The removal of native vegetation close to buildings must be balanced against the desirability of maintaining native vegetation and ensuring the maintenance of its diversity. Achieving the appropriate balance is difficult when experts offer conflicting advice. The complexity is increased when there are several ways of achieving the same objectives such as changing construction materials and decreasing the extent to which vegetation must be cleared. Such issues have meant that successful implementation of the WMO is inherently difficult, when attempting to give consideration to all aspects of an application. However, change to improve the process is urgent, given the future threat of worsening bushfires. Most Australians would like to believe that fire protection and community safety are beyond politics. The story of the WMO illustrates that this is clearly not the case; political opposition and confusion have compromised the planning processes.

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