THE UNIVERSITY OF MELBOURNE
SCHOOL OF FOREST AND ECOSYSTEM SCIENCE

Hon. John Pandazopoulos, M.P.
Chair, Environment and Natural Resources Committee
Parliament of Victoria
Level 8, 35 Spring St.
Melbourne, 3000

25 May 2007

Subject: Inquiry into the Impact of Public Land Management Practices on Bushfires in Victoria

Dear Mr Pandazopoulos,

Thank you for your letter to me dated 3 April 2007, inviting me to make a submission to your committee. As I think you are aware, public land management and in particular, fire management is a major concern of mine. I welcome the opportunity to contribute to your deliberations.

Please find attached my submission. I have not gone into great detail, but I would welcome the opportunity to meet with your committee to discuss any of the issues in my submission or those of your inquiry, in more depth at a mutually convenient time.

Yours sincerely,

K. Tolhurst

Dr Kevin Tolhurst

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"Look after the land and she will look after you" Ted Lovett, 2004

Short Biography

Dr Kevin Tolhurst
School of Forest and Ecosystem Science, University of Melbourne

Kevin Tolhurst is Senior Lecturer in Fire Ecology and Management at the School of Forest and Ecosystem Science, University of Melbourne and a member of the Bushfire Cooperative Research Centre.

His initial training was a Diploma of Forestry, Creswick completed in 1976. He then went on to complete a B.For.Sc.(Hons) at the University of Melbourne, graduating in 1980. In 1996, he completed his doctoral thesis on the management and ecology of bracken in south-eastern Australian forests.

Kevin has undertaken a wide range of forest and fire management activities during his career. These have ranged from timber harvesting, forest recreation planning and management, flora surveys and for the past 20 years in bushfire research and training.

Kevin provides expert advise on fire behaviour and fire suppression strategies at major bushfires. Some recent examples include the Great Divide Fires in 2007, the Grampians and Moondara Fires in 2006, Alpine fires of 2003, Sydney bushfire in 2001, Grampians Mt Difficult Fire 1999, Linton Fire 1998, Caledonia Fire, Alpine National Park 1998 and the Blue Mountains Fire 1994. He has also been involved in developing a national Fire Danger Rating System in South Africa and developing prescribed burning techniques in Malaysia. Kevin has been involved in several inquiries and court cases involving fires including: Linton Coronial Inquiry, Canberra Coronial Inquiry, House of Representative 2003 Inquiry, 2005 Wangary Coronial Inquiry S.A. and court cases in Tasmania, Western Australia, Queensland, New South Wales and Victoria.

Kevin's current research activities are centred around developing a bushfire risk management decision support system to be used nationally. This work has been a core activity in the Bushfire Cooperative Research Centre since 2003.

His research and consulting interests include:

- Wildfire behaviour prediction
- Development of prescribed burning techniques and guidelines
- Landscape scale fire ecology management
- Fire risk management
- Ecological impacts of repeated fires

Submission to the "Inquiry into the Impact of Public Land Management Practices on Bushfires in Victoria" conducted by the Environment and Natural Resources Committee of the Victorian Parliament.

Submission by:
Dr Kevin Tolhurst
Senior Lecturer, Fire Ecology and Management
School of Forest and Ecosystem Science
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25 May 2007

Main Issues Arising from the 2007 Fires in Victoria

It is my opinion that the extent and severity of the 2003 and 2007 fires is a result of poor public land management over the past 30 or so years exacerbated by the effects of a decade of drought, almost certainly made worse by Climate Change brought about by the enhanced Greenhouse Effect.

Response to Climate Change
We need to acknowledge that the effects of Climate Change are with us. Climate Change is predicted to increase the frequency of extreme weather conditions including thunderstorms and droughts. In combination, these two factors will continue to lead to an increase in the number of fires on public land and the potential for more severe wildfires because more of the forest biomass is available to burn during droughts.

Maintain Vibrant not Sedentary Ecosystems
Our best response to maintaining biodiversity on public land is to maintain the range of ecosystems in a vibrant state. This means that the essential biological processes of energy exchange, nutrient cycling and genetic exchange need to be kept active and in a state able to respond to changing climate and other environmental conditions. At the same time, the threat to viable populations of some species from competition from pest plants or animals needs to be minimized by targeted control and monitoring programs. Fire is an essential element in maintaining these fundamental processes. This does not mean that we need to keep burning everything, but that we need to be maintaining viable fire regimes.

Viable Fire Regimes not Fire Protection
Viable fire regimes are not about "burning the bush" to control the buildup of fuels. That might be the objective if protection of human life and property were the only priority. Viable fire regimes are about maintaining ecosystem processes which will lead to fuel reduction over the public land estate as a desirable "spinoff". In a landscape were viable fire regimes are practiced, there will be a range of developmental stages of each of our ecosystem types, ranging from young seral stages through to "old growth". Trying to maximize the amount of "old growth" in natural ecosystems is as desirable as wanting to run an economy where all the population is

over 60 years of age – lots of wisdom and wealth, but not much future or ability to explore new environments or adapt to change.

Where is the Political Support for Good Management?
From a political perspective, there is considerable pressure on land management agencies when fire operations do not achieve their intended aim. This is clearly demonstrated by the response to escaped prescribed burns such as occurred following the Wilson Promontory fire in 2005. However, there is little evidence of public support for good fire management outcomes. This makes land management agencies such as DSE risk adverse and the tendency is therefore to shy away from doing the amount of prescribed burning that is needed to maintain our forests and parks in a vibrant state.

Wrong Skill Mix at Present
Apart from the need for strong political will and support, there is also a need to have a highly skilled and educated workforce. In the past 20 years or so, there has been a tendency for public agencies to recruit generalist staff who have generalist degrees or diplomas. This has meant that while they are competent in writing easy to digest policies and plans, there is very little traction in moving the professional management of public land forward. Maintaining viable fire regimes in the landscape requires the combination of a high level of scientific understanding, good communication skills, and good "bush" skills. These skills do not necessarily need to reside in each individual, but needs to be knitted together in a coherent whole in the operations of a land management organization like DSE. That is not currently the case. DSE is strong on the bureaucratic "process" side, but very weak on the technical / science side. There is a dire need to demand University graduates be well educated in the science behind land management. DSE must then recruit people who are highly skilled, not just equipped with some generalist science, resource management or environmental science degree. These degrees might be quite adequate for a policy writer or planner, but not for the complex task of land management. You don't get a Physicist to build a bridge, you employ an Engineer, you don't get a Haematologist or Pathologist to perform heart surgery, you get a specialist Surgeon, so why do we get Botanists, Zoologists or Ecologists to manage land when what we need is Forest Scientists, Landscape Ecologists or Conservation Biologists.

More fire behaviour specialists are needed within DSE and Parks Victoria. Their input needs to be made in the development of fire management plans, in developing individual burn prescriptions, in developing fire suppression strategy options, and increasing fire fighter and community safety. There is currently some planning to make this happen, but it needs to be reinforced and pushed until it materializes.

Firefighting Skills
Firefighting skills in Victoria have traditionally been supported by those working in the timber industry. The network of roads, the bushcraft skills, machine and vehicle operational skills and just bush familiarity have largely been gained through work associated with timber harvesting. Timber harvesting in native forest is now largely a thing of the past, but the need for the skills and knowledge are just as great and no real mechanism has been put in place to replace what is being lost. The consequence of this is a less effective fire management workforce with an increased level of risk. The response to the reducing workforce in the bush has been to employ "seasonal

firefighters". Since the 2003 fires, it has been recognized that these seasonal employees need to be involved more in prescribed burning operations as part of their fire familiarization and development of bush skills. This has been a good move. Seasonal firefighters do not fully replace the year-round bush workers. Increased training has been used to try and compensate for the lack of experience, but again this can only go so far. There are issues of safety and effectiveness that need to be addressed in a broad context to see what is really the most cost-effective employment strategy for firefighters.

Greater Integration with Volunteer Firefighters

A reduction in the capacity of land management agencies to deal with fires on their land has meant a greater reliance on CFA volunteer firefighters. Volunteer firefighters are very effective at increasing firefighting capacity very quickly, but they are not very effective in difficult terrain or in protracted firefighting works. Volunteers are very happy to be involved during the initial emergency, especially where human life and property are being threatened directly, but they are not very effective or enthusiastic in firefighting in remote or rugged forested areas where much of the work is laborious, "boring" and protracted.

The increased interaction between the volunteer firefighters and the paid firefighters of the land management agencies has not been altogether productive. Many paid firefighters have taken on firefighting practices favoured by the volunteers who are more familiar with open grassy environments. This has seen a dramatic reduction in effective blacking-out and mop-up operations and the inappropriate use of backburning. There needs to be a clear distinction made between paid firefighters working for land management agencies and community volunteers working for the CFA, in the tasks they perform and the level of professionalism. It is not acceptable to be using CFA volunteers to fill the gap made by inadequate recruitment of paid firefighters. Paid firefighters must get due public recognition for the work they perform. At the moment the majority of the public thanks and recognition goes to the CFA volunteers so there is little incentive for paid firefighters to perform well.

Mis-use of Backburning

Direct attack of fires is becoming a much less preferred fire suppression strategy even though it is fundamentally safer and can potentially significantly reduce the area burnt. Backburning has become the strategy of first choice in many cases, partly because you can get out of the smoke, keep away from the heat, stay on your vehicle, and feel a sense of "doing something" as you watch the new fire you have just lit burn off into the bush. There are many instances where backburning has made the fire much worse than it needed to be. In just one instance in 2007, an additional area of about 90,000 ha and an additional cost of probably many hundreds of thousands of dollars was incurred due to a poor backburn strategy. Backburning is a major strategic operation that needs careful consideration of the options, risks and potential consequences. Instead it is often undertaken in a state of almost panic by those on the fireline.

I believe there is a need to redefine backburning and burning-out, revise training around the use of backburning compared with direct attack methods and those undertaking backburns need to be held to account for their actions afterwards. It is

not good enough to dismiss all backburn decisions as being done in "good faith" when it may have been done in "complete ignorance" of the bigger picture.

Backburns should only be undertaken once all viable options have been considered, a risk analysis has been completed, the Incident Controller has approved it, and there are sufficient resources to control the backburn and black it out to sufficient depth to prevent its escape in coming days given the forecast and expected weather. If all these conditions are met, there will be fewer backburns undertaken, but fewer instances of situations were a wildfire has been made worse and more cases where backburns have aided in fire control.

I propose that Backburning be redefined as:

An indirect fire control strategy where a controllable fire is set along the inner edge of a planned control line, when the wildfire is not yet fully visible nor having any direct impact on the planned control line, with the aim of consuming fuel in the path of the wildfire to prevent flames or spotfires crossing the control line.

I also propose that Burning-out be redefined with two aspects:

Burning-out (Strategic)
An indirect fire control strategy where areas of unburnt fuel (tens of hectares or more) within a defined control line, not likely to be burnt by the main fire within a few hours, are burnt to minimize the potential for the fire or spotfires crossing the control line.

Burning-out (Tactical)
A direct fire control strategy where areas of unburnt fuel (individually less than a hectare) within a defined control line, and currently being affected by the main fire, are deliberately burnt to minimize the potential for the fire and spotfires crossing the control line, and to expedite blacking-out operations.

Assessing Fire Management Effectiveness
At the moment, the primary method of quantifying fire management effectiveness is to tally the number of hectares burnt in prescribed burning programs or the area burnt by wildfires. These are easily measured parameters but do not give much indication of how effective management is being.

At the very least, fire protection programs should be assessed in terms of the level of compliance in meeting the level of desired fuel hazards levels in each of the Fire Management Zones.

Work should be undertaken to be able to assess the level of risk to various values and assets either on public land (e.g. species viability, water quality, cultural values) or in neighbouring land (e.g. house, human life, infrastructure). In this way, the level of fire management could be assessed and compared from year to year in a way this has some meaning and aligns with regulatory requirements and stated management objectives. The Risk Management Project in the Bushfire CRC is helping address this issue.

Community Involvement

There are many ways the community could be engaged in fire management issues, but I believe the current approach is flawed. Currently, too much emphasis is placed on engaging the community in crossing t's and dotting i's of operational plans whereas I would maintain that the community ought be engaged to develop agreed land management objectives within the confines of statutory requirements. The implementation of fire management plans should be left largely to skilled and responsible staff with the necessary technical skills and expertise to achieve the specified objectives. Too much community engagement time is wasted dealing with the minutia of operations without necessarily addressing the key issues.

At the same time, it is necessary to always have the ability to hear what local communities have to say as often they have knowledge that can be harnessed in the management process. This is different from "taking direction" from the locals and requires a strong professional approach.

Access and Fuel Breaks

One of the main advantages of an existing network of tracks is rapid access during a fire and the ability to place and maintain these tracks or roads is the most environmentally desirable manner.

Access roads and tracks and fuel breaks provide a very useful location from which to conduct prescribed burning or backburning operations. Often at wildfires, it may take several days to build and establish fire lines during which time fires have expanded significantly. Research needs to be undertaken to understand the best configuration of tracks and fuel breaks to achieve fire management objectives. The negative effects of these tracks and breaks also need to be comprehensively studied so that the effects can be countered by better design and maintenance.

I have a number of real concerns with the proposed 600 km of permanent fuel breaks in and around Melbourne's water catchments:

- Some fuel breaks have too much overstorey removed and this will lead to drier, more fire prone conditions in the breaks.
- If too much of the overstorey is removed from the breaks, wind turbulence will make fire operations very dangerous in these breaks.
- The cost of maintaining these breaks will reduce the resources (people, priority and dollars) available for the broadacre fire management needed in the catchments and elsewhere.
- There does not seem to be any long-term strategy in place to allow for recruitment and succession in these breaks. The trees left behind will need an opportunity to be replace progressively over time as they age and die.
- Some of these breaks will be significant barriers to fauna movements. Some variations in the management of the breaks will need to be implemented to minimize these impacts.
- Further monitoring and research is need to quantify their effectiveness and impact.

Some Background Information

Level of Fuel Reduction Burning and Wildfires

The area of prescribed burning on public land in Victoria reported by DSE and its predecessors is shown in Figure 1. The areas reported are generally the gross area treated rather than the net area actually burnt. From the mid-1970's through to the late 1980's, approximately 150,000 to 200,000 ha were burnt on average, but seasonal conditions meant that the annual figures during this period varied from about 50,000 ha to about 450,000 ha, an order of magnitude variation. Currently, there is about 100,000 to 150,000 ha burnt annually.

There is about 7.8 million hectares of public land in Victoria. The current level of prescribed burning represents between 1 and 2% of the public land being burnt by prescribe fires. In the period from the mid-1970's to the late-1980's, the average area prescribed burnt was 2 to 3%, with up to 6% being burnt in 1981.

The average annual area burnt by wildfire since 1920 is about 120,000 ha, this is up from the average of 80,000 ha per annum for the 80 years from 1920 to 2000 (Fig. 2). This therefore represents about 1 to 1.5% of public land being burnt by wildfire per annum, with this ranging from 17% in 1939 and 2003 to less than 0.1% in several years.

Therefore, the current total area of public land being burnt annually in Victoria is 3 to 4%.

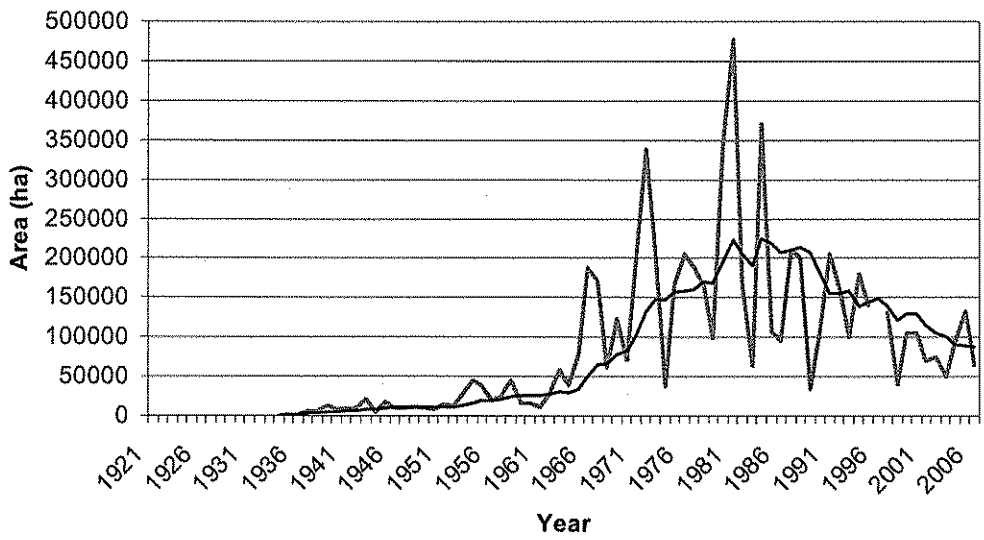

Figure 1. **Area prescribed burnt on Public Land in Victoria since 1920. (Source: Forests Commission Victoria to DSE annual reports). The fine black line represents the 10 year rolling average.**

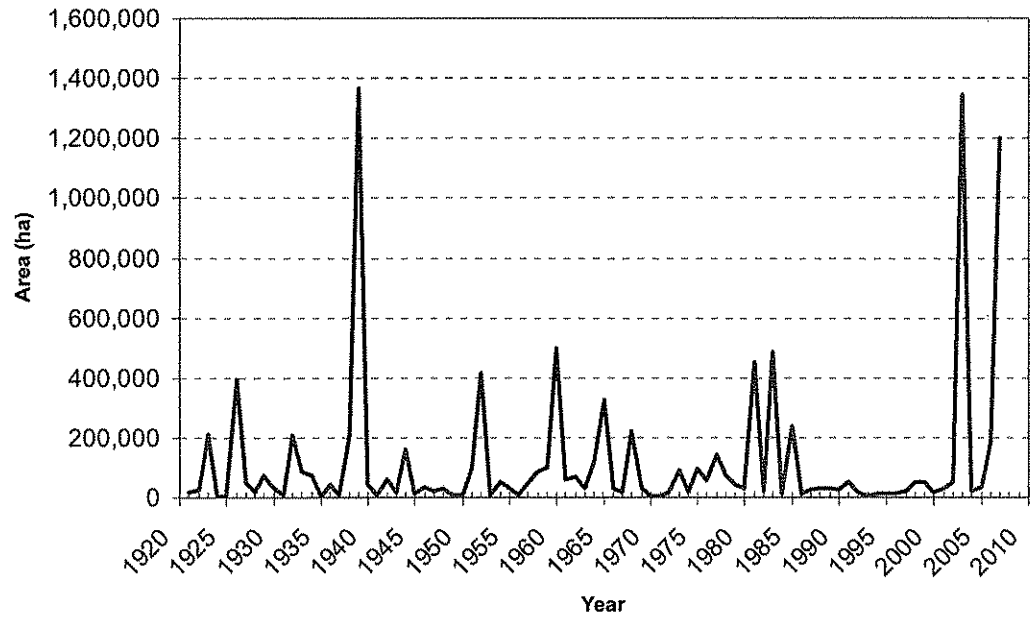

Figure 2. **Area burnt by wildfires on Public Land in Victoria since 1920. (Source: Forests Commission Victoria to DSE annual reports).**

What Effect Do Previous Fires Have on the Size and Severity of Wildfires?

Following the 2003 fires, a study of the effect of previous fires on fire severity was undertaken (Tolhurst & McCarthy 2004, unpublished report). This research showed that there was a lot of variation in the severity of fire in previously burnt areas, but the two main factors affecting fire severity were the time since last fire and the Forest Fire Danger Index.

Figure 3 shows how the severity of the 2003 fire was significantly less in recently burnt areas. It also shows that the measurable reduction in fire severity could be seen in areas up to 10 years post fire.

More importantly from a water catchment and ecological perspective, this study also showed that there was about 40% greater level of patchiness in areas burnt in 2003, but also burnt in the previous 10 years as well (Fig. 4). These unburnt patches provide important refuge for fauna and flora to survive the fire and then act as launch sites for recolonization of the burnt area as it recovers. These unburnt patches also provide areas where there is remnant soil protection so that water quality and soil erosion is not as adversely affected.

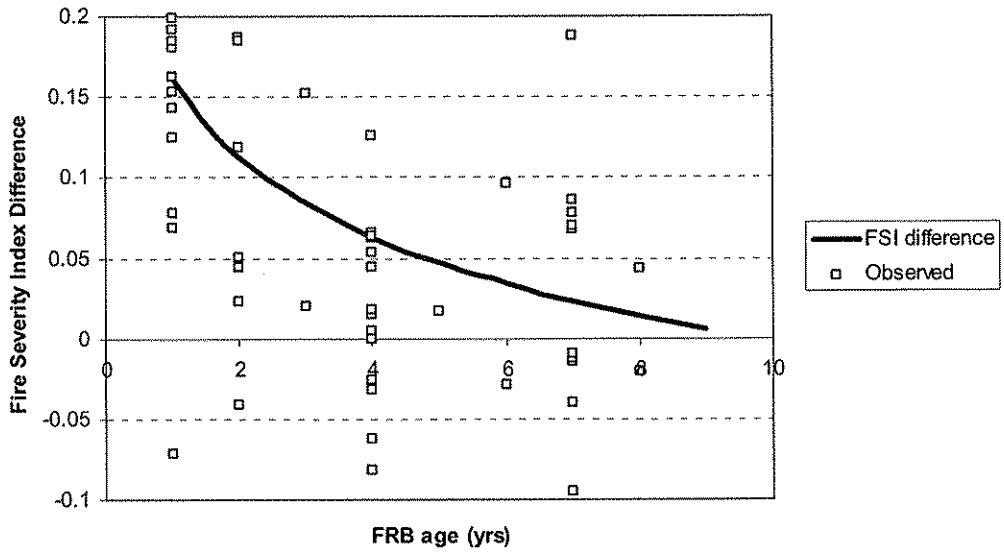

Figure 3. **Trend in the difference in the Fire Severity Index between the paired recently burnt and longer unburnt areas. Nine out of 65 paired observations outside the range of the y-axis are not plotted on the graph to make the graph more legible.**

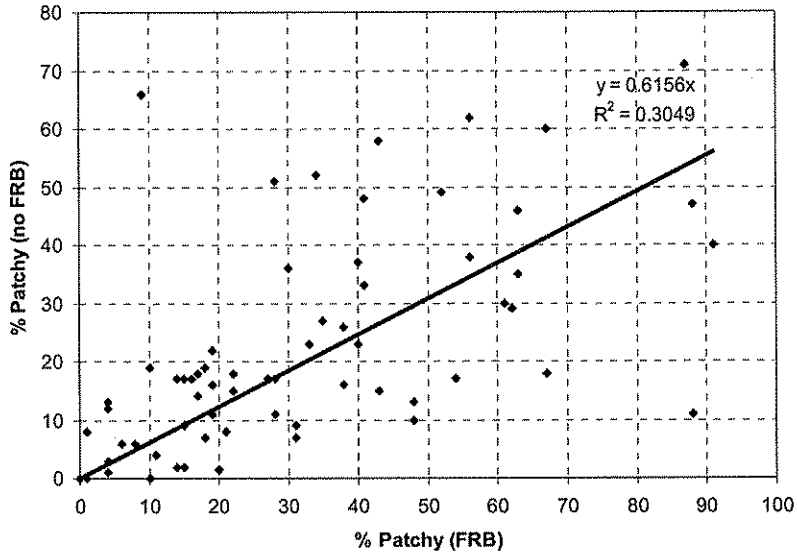

Figure 4. **Comparison in the percentage of area with patchily burnt between the areas burnt in the 10 years before 2003 (FRB) and those areas longer unburnt (no FRB).**

Again, from a fauna habitat and water catchment protection perspective, the amount of total overstorey canopy removal was significantly greater in areas that were long unburnt (Fig. 5). Figure 5 shows that there was not much distinction between previously burnt areas and long-unburnt areas when the fire intensity was extreme, but under milder conditions, there is a significant difference between areas with the contrasting fire history. Areas long-unburnt were suffering 27% canopy loss when there was no canopy loss in the recently burnt areas burning in 2003 under the weather, slope and aspect conditions.

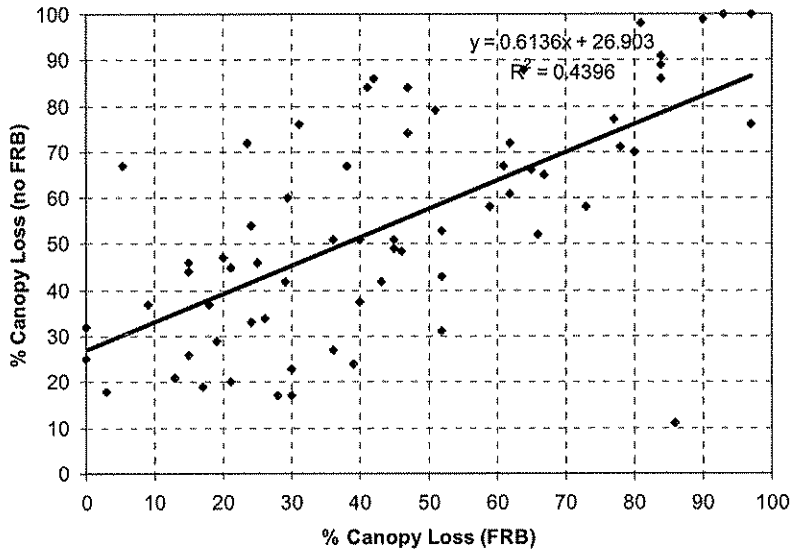

Figure 5. **Comparison in the percentage of area with complete canopy loss between the areas burnt in the 10 years before 2003 (FRB) and those areas longer unburnt (no FRB).**

The data presented in Figures 3, 4 and 5 do not tell the whole story however. In Figure 6, it can be seen how the effect of recent burning can extend well beyond the area treated. Recently burnt areas near "A" and "B" in Fig. 6 show how these areas have created low intensity "shadows" downwind of their position. The "shadow" formed by area "A" is over 30 km long and about 10 km wide and the "shadow" cast by area "B" is about 15 km long. The recent burns near area "C" have not formed "shadows" but they have produced lower intensity areas in their vicinity on the edge of a major fire run. The recent burn near area "D" has had little impact on the fire behaviour except perhaps for some local effects. Area "D" is in the path of major fire run.

Figure 7 shows the fire severity patterns of the whole burnt area of 2003. Burn severity has been a combination of the effects of recent fire history, fire size and fire weather, and to a much lesser extent to fuels and topography.

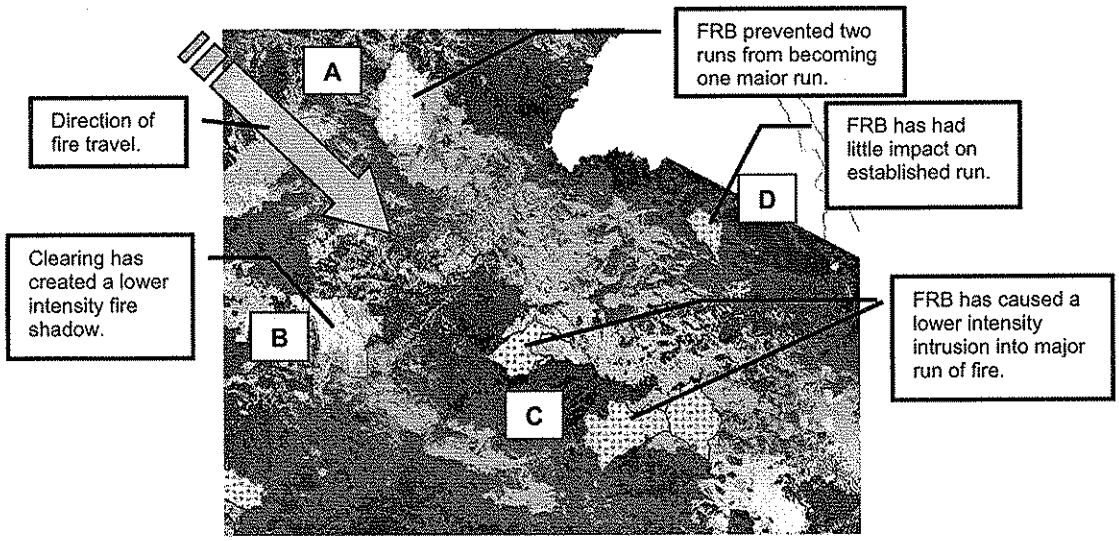

Figure 6. An example of how recent fuel reduction burns have impacted on the path and intensity of the fire. This image is about 40 km wide and 35 km high. Brown areas are crown burnt, red are severe crown scorch, orange are partial crown scorch and cream is patchily burnt.

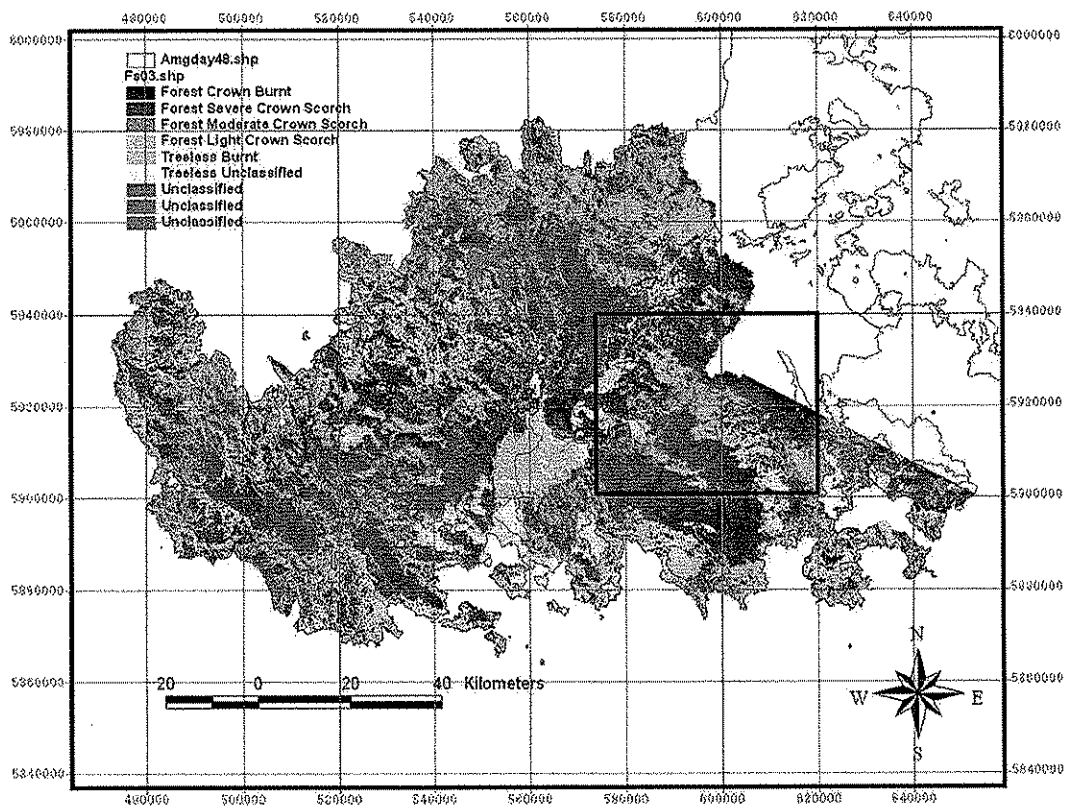

Figure 7. Fire severity map with the more severely burnt areas shown in the darker colours and the less severely burnt and unburnt areas in the paler colours.

In an attempt to summarise the interactions of the main factors affecting fire behaviour and hence fire severity, I have produced a conceptual diagram shown in Fig. 8. What Fig. 8 shows is that under Extreme fire danger, weather will dominate fire behaviour. With Low to Very High fire danger, fuel levels are particularly important to fire behaviour. Topography and fire size can be important at intermediate fire dangers.

The importance of this model is that fuel modification brought about by previous fire or other forms of fuel modification will be most effective under Low to Very High fire danger conditions (McCarthy & Tolhurst 1996). This is usually about 95% of the time. However, there are some Extreme fire danger conditions where fuel modifications well have little effect. This is not to say that we will necessarily have fires like we saw in 2003 and 2007 regardless of the previous fire history because this is not so. In 2003, during the 59 days that the Alpine fire burned uncontrolled, there was only a total of 25 hours of Extreme fire danger weather spread over 3 days. The implication of this is that with the more regular use of fire across the landscape, there may still be days when fires are able to make significant runs, but the chance of them remaining uncontrolled and joining up to form a "megafire" is much less likely.

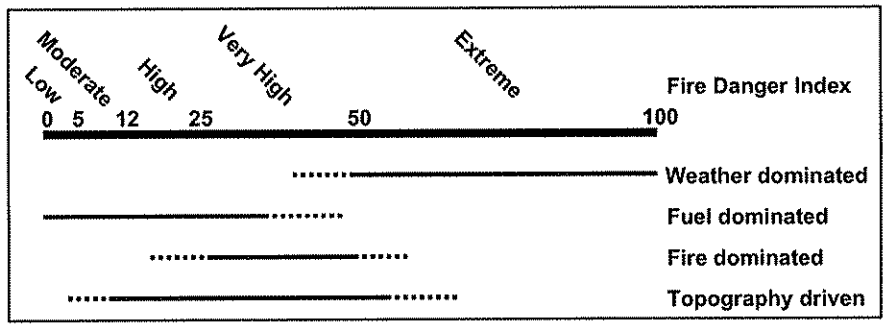

Figure 8. **Fire weather conditions (McArthur 1967) in which different factors may dominate fire behaviour (Tolhurst 2004).**

Figure 9 shows the output from a fire characterization model (PHOENIX) being developed as part of the Bushfire CRC. The actual extent of the Deans Marsh fire on Ash Wednesday is shown by the pink lines depicting the progression of the fire in time. Before Ash Wednesday, less than 1% of the area had been burnt since 1939, 44 years previously. Therefore most of the area was covered in long-unburnt fuel.

Three fire management scenarios have been explored here. The first is where area ranging in size from about 100 to 600 ha have been burnt across the area on about a 10 year cycle. The second is where areas of the same size have been burnt on a 20 year cycle and thirdly, burnt on a 40 year cycle.

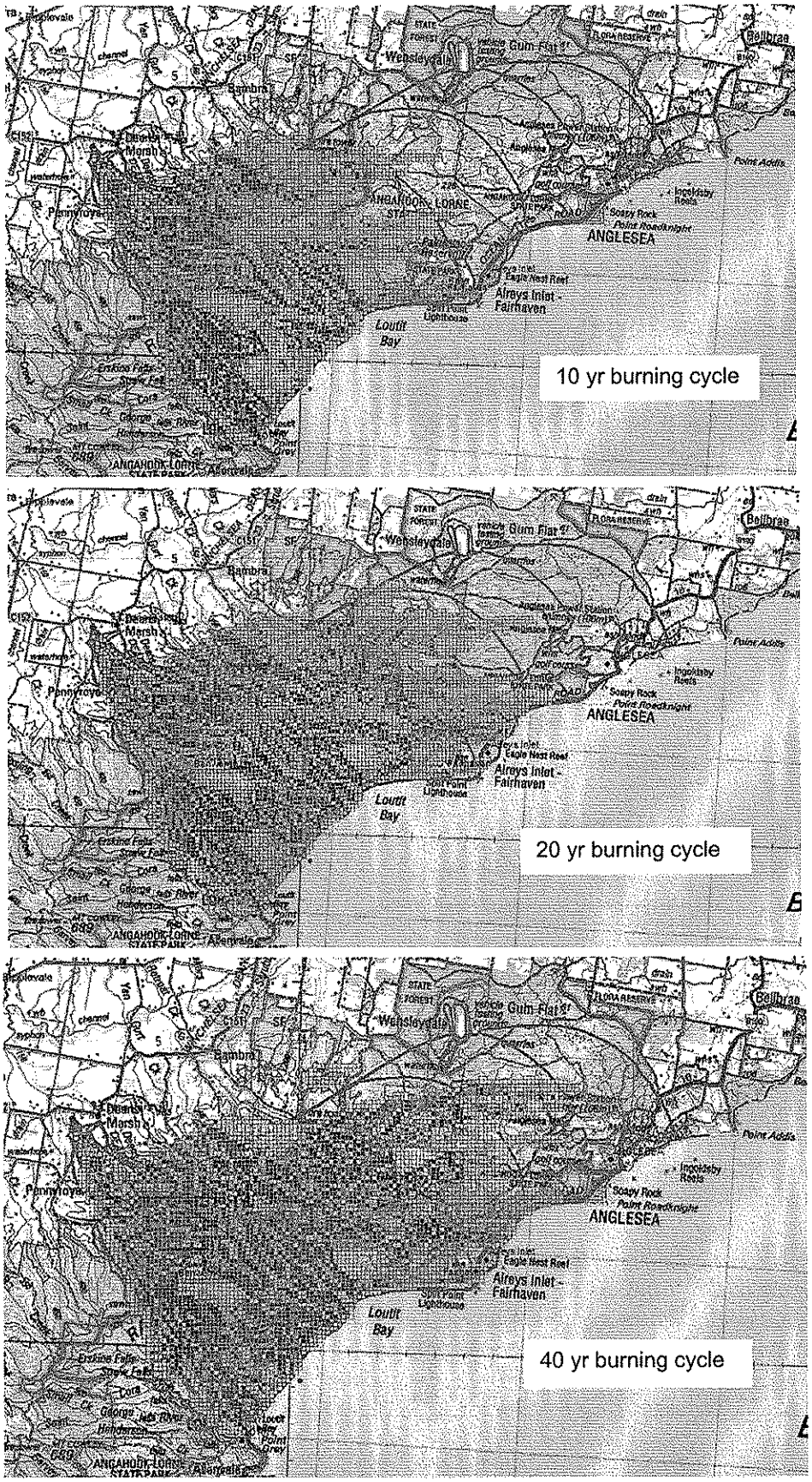

Figure 9. **Simulation results from PHOENIX for Deans Marsh Fire, Ash Wednesday 1983.**

On "Ash Wednesday" 1983, the fire was driven by north-westerly winds from the farming area around Deans Marsh to the coast at Lorne. A south-westerly wind change then drove the fire along the coast to Anglesea, wreaking havoc along the way, particularly at Fairhaven and Aireys Inlet. This was the result of the fire where fire had been largely excluded for the previous 40 years.

If, as depicted in the first scenario, 10% of the area was burnt annually, the fire would have only been half as extensive and barely got to the outskirts of Aireys Inlet. Of the area that did burn, the relative intensity of the fire would have been significantly less. The colouring in the images in Fig. 9 indicate fire intensity. Brown areas are most intense and yellow areas are the least intense. Most, if not all fauna and flora species would be able to survive in this type of fire regime, but the location of successive fires may need more consideration than the random placement used here (e.g. McCarthy & Tolhurst 2001).

In the second scenario where 5% of the area is burnt annually, the extent of the fire is still significantly reduced. The fire still impacts on Aireys Inlet, but it does not reach Anglesea. The final fire area is about two thirds what was burnt in 1983 and the extent of less severely burnt areas is much greater. A 20 year fire cycle could easily be implemented without threatening any fauna or flora species. In fact, such a regime would maintain the level of biodiversity in the area.

In the third scenario, 2.5% of the area is burnt annually. The extent of the fire is still reduced (about 80%) compared to what actually occurred with the greatest benefit being to those living in Anglesea. One of the main benefits of this fire cycle is that even though a significant area still got burnt, there are some significant blocks of forest within the burnt area which have only been burnt by low intensity, patchy fires, much the same as was found in the 2003 Alpine Fire study mentioned previously.

Where to from here?

If we compare the outcomes of these three scenarios with what has happened in Victoria in recent years then we need to ask why the 3-4% of the public land burnt annually has not had a bigger impact.

Inspite of the overall fire extent figures for the State, in the area burnt in the Alpine Fire in 2003, only about 2% of the 1.1 million hectare burnt had had a previous fire in the preceding 10 years, that is a fire cycle of about 50 years. The apparent discrepancy between the extent of fire activity in the Alpine Fire area and the State average is brought about by the fact that prescribed burning tends to be restricted to areas that are more easily burnt. A 50 years fire cycle is too long for many of the ecosystems in our Parks and Forests. A statewide study undertaken by the Fire Ecology Working Group in DSE (NRE/PV 2002) found that there had been insufficient burning in all bioregions of the State. There is a great potential here to improve the biodiversity status of the State and at the same time increase the level of protection to the human population from large intense wildfires.

The solution rests in good land and hence fire management. If we can get our land management right, then many of the fire protection issues will disappear.

It is my opinion that if the issues I raised in the beginning of this document are adequately addressed, we will be able to face climate change and increasing community expectations of safety together. Public safety and biodiversity security are different sides of the same coin.

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