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2009 VICTORIAN BUSHFIRES ROYAL COMMISSION

MELBOURNE

MONDAY 22 FEBRUARY 2010

(109th day of hearing)

BEFORE:

THE HONOURABLE B. TEAGUE AO - Chairman

MR R. MCLEOD AM - Commissioner

MS S. PASCOE AM - Commissioner
CHAIRMAN: Yes, Mr Rush.

MR RUSH: Commissioners, can I firstly welcome and thank our panel who participated in a discussion on Saturday, but firstly I think it would be appropriate if each was individually sworn in, Commissioners, and then we will develop the morning from there.

NOEL PHILIP CHENEY, sworn and examined: 

ROSS BRADSTOCK, recalled: 

MARK ANDREW ADAMS, sworn and examined: 

MICHAEL FRASER CLARKE, sworn and examined: 

JERRY THOMAS WILLIAMS, sworn and examined: 

KEVIN TOLHURST, recalled: 

ARTHUR MALCOLM GILL, sworn and examined: 

MR RUSH: It may be best to do this, Commissioners, in alphabetical order. Professor Adams, you are professor and dean of the Faculty of Agriculture, Food and Natural Resources at the University of Sydney and co-director of the Western Australian Biochemistry Centre. Perhaps rather than me running through matters, if you would like to in broad terms inform us of your areas of expertise and your previous areas of research.

PROFESSOR ADAMS: Thank you. Yes. I have worked in forests in Victoria, New South Wales, South Australia and Western Australia for the past 25 to 30 years. I'm a forest ecologist. I focus mostly on cycles of water and carbon and nutrients and I have a long experience of bushfires in Victoria, including having research sites burnt out at Mount Disappointment in 1982 and in the Dandenong Ranges in 1983 and we have conducted much follow-up research as a result of those bushfires.

MR RUSH: Professor Adams, in addition to that, you hold
editorial responsibilities in a number of national and international journals dealing in those various fields.

PROFESSOR ADAMS: Yes, I do.

MR RUSH: You have also researched in fire and fire matters concerning your expertise internationally in USA, Germany and France.

PROFESSOR ADAMS: Yes, we have conducted a number of research collaborations with people from other countries and much of that is ongoing.

MR RUSH: Dr Bradstock, you are the director of the Centre for Environmental Risk Management of Bushfires at the University of Wollongong and visiting fellow at the FENA school at the Australian National University and a fire ecologist. You have worked on your own but also I notice with other members of the panel today. Perhaps if you could give us something of your background.

DR BRADSTOCK: Yes. Thanks. I can confirm all that and I have worked with a number of people here, particularly Malcolm Gill over the last 20 years on aspects of fire ecology and fire management in Australia and I have wider collaborations elsewhere in Australia at the moment and overseas in countries such as the USA, Africa and Europe.

MR RUSH: The Centre for Environmental Risk Management, the basis of the work undertaken there?

DR BRADSTOCK: The mission of the centre is to get to a quantitative understanding of bushfire risk in its widest possible sense to a broad range of values, people and property, as well as environmental assets, we might call them; to quantify risk, to understand the levels to which risk can be altered through management actions and how we can resolve potential conflicts in that portfolio of
MR RUSH: Mr Cheney, from 1981 to 2005 you held leadership responsibilities with CSIRO, Forestry and forest products, Fire Research Group and since 2005 you have been an honorary research fellow with the CSIRO and your concentration and expertise, as we understand it, has been in relation to wildfire behaviour in Australia.

MR CHENEY: Yes, that's correct. I have been working in bushfire research since 1964, before the organisation I was with joined CSIRO. I have investigated quite a number of wildfires, including the 1967 Tasmanian fires, the Ash Wednesday fires of 1985 and more recently the Canberra fires in 2003. I have carried out a number of large scale field experiments on how fires behave and spread. I have also undertaken research into suppression systems of large aircraft and the physiology of firefighters and I have supervised the operation of long-term fire ecology plots in the Northern Territory and in the ACT.

MR RUSH: You also had a role or an involvement with Project Vesta in Western Australia.

MR CHENEY: Yes, that was a project I created initially in 1993 and it was concluded in 2003 and written up.

MR RUSH: I note you co-authored the synopsis of the knowledge used in prescribed burning in Victoria in 1999 with Dr Tolhurst.

MR CHENEY: That's correct.

MR RUSH: Perhaps if the microphone could go to Dr Clarke.

Dr Clarke, you are on associate professor and head of the Department of Zoology in La Trobe University with expertise in ecology, conservation biology and the

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management of threatened species and threatening processes.

DR CLARKE: That's correct.

MR RUSH: Perhaps, Dr Clarke, if you could tell us of your experience which we understand has a concentration in relation to the Mallee more recently and biodiversity projects there.

DR CLARKE: Yes. I co-lead a large project in the Mallee regions of Victoria, New South Wales and South Australia where we are studying the impact of large scale fire on a range of different plants and animals, vertebrates and invertebrates. I also carry out research at Wilsons Promontory on the response of fauna to fire.

MR RUSH: You hold a position chairing the scientific advisory committee established under Victorian legislation, the Flora and Fauna Guarantee Act.

DR CLARKE: That's not correct. I did formally hold that position from 2002 until I think 2007, during which time we had to consider the listing of inappropriate fire regimes as a threatening process in the state of Victoria and we made that recommendation to the minister.

MR RUSH: Thank you. Dr Gill, you hold the position at the moment of a visiting fellow at the FENA school at the Australian National University, but your work has been, as we understand it, basically as a scientist with the CSIRO centre of plant diversity and research in Canberra with a number of visiting positions and an expertise in research in relation specifically to biodiversity and the impact of fire.

DR GILL: Yes. I started in CSIRO as a full-time fire ecologist in 1971. I retired from there in the year 2000,
but subsequent to that I had an honorary appointment with
them and with Australian National University. Presently
I'm full-time at Australian National University looking
after graduate students and doing research. It may be of
interest that I was personally, socially and
professionally involved in the 2003 fires in Canberra, and
it may also be relevant that I have published many
scientific papers, some books and some major research
reports, and that I have been involved in collaborations
with researchers in Australia, North America, Europe and
South Africa.

MR RUSH: You were also appointed as one of two expert
independent persons to assist Mr Esplin in relation to his

DR GILL: That is correct.

MR RUSH: Dr Tolhurst, you have given evidence in the Royal
Commission before, but you are a senior lecturer in the
Department of Forest and Ecosystem Science, University of
Melbourne, and particularly you have studied the impact of
fire and prescribed burning on ecology in Victoria and
also undertaken research as to the nature of prescribed
burning and its impacts and regimes.

DR TOLHURST: That's correct. My original involvement in fire
I guess was as a forest scientist where my original
training was and I started doing fire ecology and fire
behaviour research in 1984. Since, I have been involved
in a number of fire inquiries and in I guess the
development of a risk management model over the last five
years as part of the Bushfire CRC, which tries to bring
together the understanding of fire behaviour and its
impacts on various parts of the environment. I guess as a
lecturer I have also been involved in the training of undergraduate and postgraduate students.

MR RUSH: Finally, Mr Williams, you are the former director of the USDA Forest Service, Fire and Aviation Management, in the United States with a long history commencing in the Forest Service in the United States in 1969. Perhaps you might give us a brief overview of what has happened since then.

MR WILLIAMS: I retired in 2005 from the federal government's senior executive service as the director. I spent my career in fire management with the Forest Service at the operational, the management and the administrative levels. I hold a masters degree in fire science. I have had the privilege of visiting Australia on professional exchanges and part of the review team for the mid-year Bushfire CRC. We started studying the megafire phenomenon in the US in the early 2000s following a series of disastrous fires. We are a long ways from solving it, but we are trying to work collaboratively with other levels of government and other governments around the world. We see this as a global issue.

MR RUSH: In that work it has involved you with countries in South America and Europe.

MR WILLIAMS: Well, not so much Europe. I take that back, I'm sorry. Portugal, Spain, Mexico, Canada and of course Australia.

MR RUSH: Commissioners, each of the experts has been asked to provide a report answering questions posed at a comparatively early stage of counsel assisting's knowledge concerning fire and bushfire and fuel reduction burning, prescribed burning. I will go through with each witness
and ask them to attest to their reports, but it should be
said that there are matters in the reports that answer the
questions but we will be ranging further afield than the
reports during the course of the next two days.

Perhaps if I could start again with Professor
Adams. Professor Adams, you have provided a report,
Commissioners, which is at (EXP.018.001.0001), 13 January
2010, in response to those questions.

PROFESSOR ADAMS: Yes, I did.

MR RUSH: And the contents of the report are true and correct?

PROFESSOR ADAMS: Yes, they are.

MR RUSH: I tender the report.

#EXHIBIT 732 - Expert report of Mark Adams dated 13 January
2010 (EXP.018.001.0001) to (EXP.018.001.0007).

MR RUSH: Dr Bradstock, you undertook the same task as
requested by the Commission. The report is at
(EXP.012.001.0001). I ask you, Dr Bradstock, are the
contents of the report true and correct?

DR BRADSTOCK: Yes, they are.

MR RUSH: I tender the report.

#EXHIBIT 733 - Expert report of Ross Bradstock
(EXP.012.001.0001) to (EXP.012.001.0059).

MR RUSH: Mr Cheney, you undertook the same task when requested
by the Commission and provided a report to the Royal
Commission answering those questions.

MR CHENEY: Yes, I did.

MR RUSH: And the contents of that report or statement are true
and correct?

MR CHENEY: Yes, they are.

MR RUSH: I tender the report of Mr Cheney.

#EXHIBIT 734 - Expert report of Philip Cheney dated 1 January
MR RUSH: Dr Clarke, you undertook the same task for the Royal Commission at (EXP.016.001.0001). Are the contents of the report that you prepared true and correct?

DR CLARKE: They are.

#EXHIBIT 735 - Prescribed burning - expert opinion of Michael Clarke (EXP.016.001.0001) to (EXP.016.001.0035).

MR RUSH: Dr Gill, you also followed the same routine and provided a report to the Royal Commission at (EXP.015.001.0001). Are the contents of your report true and correct?

DR GILL: Yes.

#EXHIBIT 736 - Expert report of Malcolm Gill dated 1 January 2010 (EXP.015.001.0001) to (EXP.015.001.0062).

MR RUSH: Dr Tolhurst, you provided a report at (EXP.013.001.0001). Dr Tolhurst, are the contents of the report that you provided to the Royal Commission true and correct?

DR TOLHURST: They are.

#EXHIBIT 737 - Expert report of Kevin Tolhurst dated 10 January 2010 (EXP.013.001.0001) to (EXP.013.001.0054).

MR RUSH: Finally, Mr Williams, you undertook a similar task and provided a report at (EXP.014.001.0001) and are the contents of that report true and correct?

MR WILLIAMS: Yes.

#EXHIBIT 738 - Expert report of Jerry Williams dated 20 January 2010 (EXP.014.001.0001) to (EXP.014.001.0036).

MR RUSH: Commissioners, I thought a starting point this morning might be something that's not been raised in the reports or really in any evidence and initially I would like to direct the topic to you, Dr Gill. It has been
said that the land, particularly the land in south-eastern Australia, has always been the subject of burning prior to European settlement, both as a consequence of Aboriginal burning, lightning strikes and the like, and thus the flora and fauna has developed in the context of burning of that nature. I wonder if you could give us a comment or a bit of background about that?

DR GILL: Yes. If you don't mind, I will expand it a little bit to wider than Victoria.

MR RUSH: Yes.

DR GILL: I think the main evidence comes from explorers' records, from current procedures in different parts of the country where Aboriginal people are still burning their landscapes and from sedimentary records of pollen and charcoal in the soil and in peat bogs and so on. They show that the practices of burning of landscapes by Aboriginal people has not been the same everywhere over the entire country and I understand that in some places Aboriginal people tried to protect some of the areas, perhaps sacred areas, from being burnt in order to protect what they saw as assets in those particular places.

So, it seems that the practices from contemporary peoples have varied from place to place, but there is an important element of time as well. Australia 20,000 years ago, for example, was an entirely different place, much more arid. One person I think expressed it as a country of sand dunes, which no doubt has some hyperbole involved, but nonetheless it gives the impression that the landscapes were vastly different in terms of fuels and ignition potential and so on. So burning could not have been the same across Australia for all time, or the
50,000 years everywhere.

Just one more thing I would like to add is that there is an absence of what actually was the historical practice, particularly in Victoria, over time.

MR RUSH: I'm sorry, you might enlarge for us on that.

DR GILL: We don't have good records of what tribunal Aboriginal people did in Victoria in relation to the frequency, intensity, seasons of burning.

MR RUSH: Is there anyone else who would like to comment in relation to this initial aspect?

DR BRADSTOCK: If I may. I will just augment Malcolm's comments by saying the history of fire in Australia goes back possibly 50 million years to the early tertiary. The flora at least of Australia has evolved in concert with forces such as fire and aridity, so there is a broad perspective, as Malcolm said, of continual change, fire working in with that change and more recently, even since humans have been on the continent, the climate has changed, people have changed, fire has changed and all the interactions between all those forces has changed.

The subject is one of great debate amongst palaeo scholars. However, there is a consensus emerging from analysis of indicators of fire over the last 20,000 or 30,000 years that the principal control on fire activity is probably the climate, and people obviously influence things within the climatic parameters of the time and the complex interactions between climate and vegetation. So, it is useful for us to understand that because we seem to be in an era of fairly rapid climate change at the moment.

MR RUSH: Is there anyone else who would like to put a perspective on it?
MR CHENEY: I would just like to say that sort of in recent
times, and I don't go back much more than 2,000 years or
so in my thinking about it, is that the Aborigines were
very familiar with fire, they understood it, and if we
take the evidence where there are good records of their
practice, and that is mostly in central and northern
Australia, it is quite clear the Aborigines burned
primarily to protect themselves. I believe that they
fully understood the nature of the potential for the
extreme fires that we have seen in the last 10 years in
Victoria and I believe that it is most likely that they
carried out burning in the southern states for the same
reasons as they did in central Australia, and that's
primarily to protect themselves.

DR CLARKE: If I could make one observation. To my knowledge,
the largest or most extensive fire in Victoria's written
history was in 1861, which interestingly is closest to
when Aboriginal burning was still being continued in the
state.

MR RUSH: Certainly from the papers, and I'm referring to the
report of our parliament in Victoria, in 2008 it made
comments that there was no uniformity in relation to that
fire and cited an author, Rowles, to the effect that it
was impossible to exaggerate the amount of burning in
Aboriginal Australia. I'm just wondering if anyone wants
to comment on that or whether that may be an exaggeration
in itself?

DR GILL: I can comment. It seems to me that, looking at it
extremely critically, we just don't know and we don't
really know the motivations of the people who were
carrying it out. We think we know, but maybe we don't.
MR RUSH: Moving away from that topic, gentlemen, and looking more directly at prescribed burning, the reports that have been provided would suggest that prescribed burning will not prevent bushfire in Victoria and that's a comment, Professor Adams, that is taken up in effect in your report. Not preventing bushfire in Victoria is one thing; what do you see is the role of prescribed burning?

PROFESSOR ADAMS: It is important, I think, that people understand that we won't be able to prevent bushfires. In discussions amongst the panel we discussed the issue of what might be called the residual risk just as a concept, so it is important that people recognise that. That's the first thing. After that, then I think we need to understand that prescribed burning, fuel reduction burning, ecological burning, all of them reduce the amount of fuel and thus reduce fire intensity and importantly allow suppression efforts, particularly early suppression efforts, to be more effective.

Just if I may return for a moment to the weather issues and the consensus that Dr Bradstock spoke about. Agreed, the weather has been important, or climate in particular rather than weather per se. Climate has been a very important part over geological time scales and the frequency of fire. A critical part of it is lightning, the major source of ignition, and we mustn't forget that that will continue to be associated with the climate of this part of the world. So, when we come back to the effectiveness of prescribed burning, it is most effective at reducing the fuel load and thus reducing the nature of fire intensity and from that a number of things follow. But, to start the ball rolling, I'm sure this will be a
long discussion.

MR RUSH: Is it too much to say - perhaps I will ask Dr Tolhurst this - that prescribed burning will reduce the probability of bushfire ignition or spread?

DR TOLHURST: No. I think when Dr Adams mentioned "won't prevent fires", that's quite true, but there is evidence to suggest it will reduce the number of fires in the landscape. For example, we know in very recently burnt areas the numbers of ignitions, whether it be from lightning or from burning embers blowing into those areas, the take rate is extremely low or perhaps zero in some recently burnt areas, so it will reduce the number of fires in the landscape. It might not prevent them, but it certainly reduces their intensity, their rate of spread. I guess the question is does that reduce it below a threshold that will be either suppressible or a threshold intensity that will cause damage. There you have to look at other factors other than just the fuel to work out how much energy the damaging power of the fire might be, which includes things like the weather, the topography and the amount of moisture in the landscape.

MR RUSH: I think we will deal with intensity more closely in a minute. Dr Clarke, you have referred to local factors being important in relation to prescribed burning and the impact or effect of prescribed burning. I'm just wondering whether you want to enlarge on that as to where you see in a general sense prescribed burning, local factors and anything else you wish to add at this stage.

DR CLARKE: For clarification, are we talking about the effectiveness of that prescribed burning?

MR RUSH: Correct.
DR CLARKE: There was general agreement on the panel of factors like topography and microclimate on the day and the preceding climatic conditions. So, the effectiveness of a particular prescribed burn will be very dependent on the conditions under which that prescribed burn area is challenged.

MR RUSH: Prescribed burning may mean different things in different parts of the state, the way in which it may impact in a forest as opposed to another area of the state. Is there anything we should be looking at in relation to that?

DR CLARKE: I'm uncomfortable with generalisations across habitat types as an ecologist to say "prescribed burning will have this effect throughout the state". Clearly habitats differ profoundly in the distribution and structure of fuels and so a prescribed burn in a grassland is going to have a different effectiveness to one that is carried out in the forest, which is fairly obvious. But it is the generalisations that disturb me because I'm interested in the ecological detail and the ecological consequences of prescribed burning, both in protecting habitat or in modifying habitat and causing regeneration to take place. The devil is in the detail.

MR RUSH: Dr Cheney, "intensity" has been used. The word "intensity" has been used in relation to the nature of prescribed burning that might be undertaken. But I want to direct this to the bushfire that may impact on the area where prescribed burning has been properly undertaken for the purposes of the question. What's the issue with intensity of the bushfire?

MR CHENEY: Well, simply the intensity is the rate of heat
release at any part of the fire perimeter and it is dependent on how much fuel is consumed and how fast the fire spreads through that point. If prescribed burning removes the fuel, then it will immediately reduce the intensity at that point. If it also slows the fire down, then that decrease in intensity is increased. So there are two factors coming into play here about the effectiveness of prescribed burning. The summing up is the heat release, but then the individual factors run through other issues such as the speed that the fire spreads, the height of the flames, the capacity to produce firebrands from the bark of the trees principally and create spotfires further downwind.

So, in any consideration of effectiveness per se, one has to be quite careful over what timeframe we are talking about; is it immediately after the burn or is it some time further down the track. I think this is where a lot of confusion comes in, so when we are talking about how long will a prescribed burn be effective, then one has to stipulate what you mean by "effectiveness".

Now, we came to a conclusion that by and large a prescribed burn or a good prescribed burn will stop a fire, if it is large enough, in the first one and perhaps two years after burning. At three years it still has a profound effect in decreasing the rate of spread. This rate of spread in certain forest fuel types may persist for - sorry, the reduction in rate of spread may persist for five to eight years. The effect on flame height, which is important, determined by the regrowth of the understorey, might be reduced for considerably longer and so might the effect on firebrand production and in some
cases this may extend out to 20 years.

MR RUSH: Appreciating something that you said there about the size of the prescribed burning that might have taken place, but just looking at it on a general basis at the moment and perhaps, Mr Williams, you may come in here. In relation to the impact of prescribed burning on a day where the forest fire danger index is extremely high and the fire is intense, is it still going to matter?

MR WILLIAMS: We find in the US and elsewhere that prescribed burning has a positive effect, even under extreme burning conditions. As my colleagues have said, it is dependent on scale, both temporal and spatial. How big these prescribed burns are, how often they are conducted or repeated across a landscape and their placement in the landscape has a lot to do with influencing wildfire outcomes.

MR RUSH: I was wondering whether anyone would like to comment on that in relation to those days of very high intensity bushfire and the impact of prescribed burning properly carried out when we get the very bad days. Dr Bradstock.

DR BRADSTOCK: I will just briefly refer back to the report that was presented last week where we have at least tried to examine the relationship between change and intensity as a function of fuel age and the weather conditions which shows even under extreme or the most dire weather conditions you do get some change in intensity at relatively young fuel ages. The question is whether that's a change that is strong enough to facilitate suppression or not and it would appear that under those dire conditions the change is insufficient, in some forest types at least, at very small ages, though it may alter
things like spotting and it could alter rate of spread.

As Phil Cheney said, you have to reference these
effects back to meaningful measures of effectiveness and
you do have to take into account the weather; in other
words, things will change according to the weather
conditions.

MR RUSH: Has there been sufficient research to provide an
answer to that question of just what measurement there is
in relation to prescribed burning and high intensity
fires? Professor Adams or Dr Tolhurst?

PROFESSOR ADAMS: As researchers, we will never say there is
too little research, but there has been good work done and
Phil Cheney has already referred to - his comments are
based on extensive research over many, many years. One of
the great difficulties in after the fact analysis is that
it is very difficult to determine what was the
effectiveness of the prescribed burn at the time. In
other words, did that prescribed fire take out half the
fuel? Sometimes it might have only taken a small fraction
of the fuel.

So, when you do a point-by-point analysis it
becomes very difficult. We really need to be able to
assess on the basis of large areas of prescribed burn
where there has been large areas that have been burnt and
we know approximately how effective they were in reducing
the fuel load. When you look at those sorts of areas,
then again the evidence is pretty strong that they remain
effective even under extreme fire conditions. It is much
more difficult when the areas that were burnt previously,
the prescribed burning was very small or where the areas
were only very lightly burnt, for whatever the reasons
were on the day when they were trying to do the prescribed fire.

So I just make the point that it is not an easy after the fact analysis, but where there is evidence, particularly where there has been large prescribed fires, that they remain effective and where those large prescribed fires in both aerial extent and the amount of fuel they reduced were well conducted and effective as judged by those measures, then they remain effective in protecting and in reducing the bushfire.

MR RUSH: Dr Tolhurst?

DR TOLHURST: I think in relation to the issue of whether we have done enough research in some areas, I think one of the things, and I think Mr Williams here has really pointed it out in his discussion of megafires, that one of the things that research has not really addressed very well is the impact of very large fires on the landscape and how so many things change by necessity and because of the resources and logistics of carrying out landscape scale fires.

From an experimental point of view, most of our experimental work and measurements have been conducted on relatively small fires and I have tried to describe, I guess, in one of my earlier reports the nature of how the fires on Black Saturday, we should be considering an area of fire rather than necessarily just the firefront. In that case we start to consider fuels other than what are classically assessed as being fuels, the fine fuels, but some of the coarser fuels like the woody material in the forest and some of the material that burns out after the main firefront has passed are still contributing to
the convection column affecting the spotting behaviour and
the indraft winds and so on of the fire. We have done
very little research in that area and it is an area that
we really need to address if we are going to be able to
understand what these megafires really are like and how
they interact with the climatic conditions. But I think
we have enough evidence, even from the research that we
have, that they are important.

So, as Professor Adams is just saying, it is not
just about looking at any one or two points in the
landscape. You really need to be looking at the whole
landscape to be able to evaluate how effective these fires
are. So there needs to be a bit of a shift in the way in
which our research is undertaken to look at that
landscape, that broader view of fire, which is really not
very convenient from a research point of view because it
doesn't fit so well into a three year time span on a 100
hectare block, but Dr Clarke has been doing some work in
the Mallee, for example, on a slightly larger scale for
from an ecological point of view, which is a step in the
right direction.

MR RUSH: Perhaps to take that up, you might tell us about that
work, Dr Clarke, but also in the context of what we are
discussing, the difficulties or the research that needs to
be done to look at the effectiveness of prescribed burning
in fire.

DR CLARKE: To my knowledge, from reading the literature,
I wouldn't share Dr Adams' optimism of how broad our
understanding is. I think it has been constrained in
particular habitats that are of concern to human beings,
typically forest and timber related habitats. To my
knowledge there are two very good studies, one in
Western Australia and one Dr Bradstock has done that has
systematically and quantitatively attempted to analyse the
effectiveness of prescribed burning.

I think the small number of those quantitative
studies that are available reflects the difficulty of the
task. You need large areas that have been subjected for a
long period to prescribed burning that have also been
tested by wildfire to make conclusions about the
effectiveness of that prescribed burning and there are
small numbers of studies and, as I said earlier, I think
we are getting an improved understanding of some of those
forest habitats but we have so far to go in other
habitats. So, to come to the Mallee, we don't have a
similar degree of understanding of that yet and these fire
landscapes behave differently, so I think we have a long
way to go.

MR RUSH: Mr Cheney, you mentioned the first two years of it
being important in the context - first two to three years,
I think, after effective prescribed burning and then it
being of impact up until 20 years. Can you just - I know
you did - but perhaps delve into the first two or three
years. Why is that so important and, one might ask, if
the impact is only so great for two or three years, where
do we stand in relation to doing something that may have a
more limited impact later on over a much longer scale?

MR CHENEY: I'm going to confine my comments to forests,
eucalypt forests and I think it is important that we
appreciate what we are talking about is eucalypt forest,
or I'm talking about eucalypt forest. When I first
started research in the very early 1960s there was a
concern that under these extreme or catastrophic conditions, that the eucalypt fire would travel through the crowns of the eucalypt forest independently of anything that happened on the ground.

Over my career in inspecting large fires being overrun by crown fires I wouldn't be here if that was true because the capacity for a eucalypt forest to carry a fire through its crown for any significant distance beyond an edge where there is heavy fuel is dependent on the intensity of the surface fire. This is not true of some other forest types such as pine plantations which have branches right down to the ground. Now, a burn that removes the surface litter would have very little or no effect in stopping a crown fire through that plantation under extreme weather, so it is important to appreciate the structure of the forest that you are talking about and the conditions. But, for the first part of your question, and you are going to have to remind me about the second part --

MR RUSH: The two or three years and the alleged long-term benefit of prescribed burning. Really the question was if we are to get such a measurable impact, as I understood what you have said to the Commission this morning, over two or three years, that might be thought to be a relatively short period of time for something that is so significant on the landscape.

MR CHENEY: For many forest types, at three years there's not enough fuel built up on the ground to support a fire travelling into the crowns of that forest. At three years it will still carry a fire and that fire would be sufficiently intense to kill someone who was unprotected.
in it, but it will be travelling slower and have lower
flame heights, much lower flame heights, than a fire in an
unburnt forest.

In subsequent years the fuel load and the
structure builds up as the plants regenerate and litter
and bark and material falls to the ground. So in
practical terms for many dry eucalypt forests, after five
years you have the capacity to support a crown fire again
and you have a capacity to support a fairly fast moving
fire. I hope that answers your question.

MR RUSH: And in that sense, if after five or six years or
thereabouts you have the capacity to support a crown fire,
where does the benefit of prescribed burning lie at that
period of time, after five, six, seven or eight years?

MR CHENEY: I would say, in my opinion, up to about seven or
eight years there is a possibility of - well, in some
forests it will slow the fire and so the benefit is just
that if you have a fire burning under these conditions, if
it doesn't get to an asset under threat while the extreme
weathers persist, then you have a considerable benefit to
that asset, but that's about it. After that period you
have to consider repeating the burning program so you are
reducing the fuels again.

The key to a burning program for wide scale
protection is to have the blocks strategically located
across the landscape in a pattern that, when repeated,
large fires are going to sooner or later run into one of
these low fuels and be checked and in the lighter fuels
suppression of the fire in subsequent hours or days after
the extreme weather will be made much easier and can be
done more efficiently.
MR RUSH: Perhaps, Dr Tolhurst, you wanted to make a comment, and I think some of the work you did in the Wombat State Forest some time ago may be relevant to this discussion.

DR TOLHURST: Yes. In addition to what Mr Cheney has just said, which I believe is all true and supported by the research, but there is another element which is terribly important here, which is there is consistent research around the world that basically indicates that house loss in particular is a result of burning embers blowing through the air and setting fire to houses, and from work I have done in the Wombat Forest we know it is very difficult to get fire to run up a stringy-bark tree, one of the sources of a significant number of embers, until about 14 or 15 years after it's burnt and it takes about 20 to 25 years to actually get the amount of bark back on those trees that was there before the fires.

So, in addition to the reduction in the speed and the intensity of the fire, the radiation from the flame height that Mr Cheney mentioned earlier, a really important aspect, something that as we saw on Black Saturday could reach out 30 kilometres or more from the main firefront, is the extent and density of embers that land which makes it really simpler or more difficult for people to defend their properties or for firefighters to help suppress the fire well ahead of the main firefront.

Again, one of the phenomena that we saw on Black Saturday was this mass ignition effect which is induced by these firebrands being blown forward and one of the things prescribed burning does that it has the longest enduring effect on is the effect on the production of these embers...
which can produce this mass ignition or firestorm-type effect. So, in addition to what Mr Cheney was saying, I would say one of the most enduring benefits of prescribed burning is a reduction in bark hazard in the forest.

MR RUSH: Dr Gill?

DR GILL: I would like to comment just perhaps to reinforce some of the comments that have been made and perhaps put it in a wider context. It seems to me we need to consider benefits in relation to a range of assets or else define which assets we are concerned about as, various people have on the panel, whether they are social, environmental or economic, for example, and, secondly, that you might expect variation in benefits depending on the vegetation type and the tenure of the land in which these fuel reduction treatments are taking place.

For example, just to add to what my colleagues have said, grassy forest may be treated differently in terms of times and seasons for prescribed burning and the lengths of time the benefits last, grassy versus litter for example. So in a grassy forest it might be seasonal effects are particularly important rather than just the year-to-year variation we have been discussing. Kevin brought up the question of bark type, so we are simplifying in our discussion our responses to a complex set of issues. If you have stringy-bark it may be different than if you have particular sorts of smooth-barked eucalypts.

MR RUSH: Thank you. Mr Williams, or would anyone else like to comment in this area?

COMMISSIONER McLEOD: Could I throw in another thought which is
relevant to what the discussion has been dealing with, the
value over a timeframe of controlled burning. There has
been reference to controlled burning over time being able
to lessen the velocity or the intensity of a fire and
reduce the rate of spread. Would I be right in believing
that, if that's a significant factor, it is very important
in terms of the lead times that might be created for
firefighters to be able to deal with a fast emerging
situation a little easier but, more importantly, to be
able to issue warnings to communities that are in the path
of a fire which may give greater lead times to those
people to prepare themselves for an oncoming fire?
Is that a significant advantage of controlled
burning of whatever age if, overall, the combination of
previous efforts can give rise to a slowing down of the
fire to give more time, especially from a warning point of
view? I think our evidence has shown us that sometimes
minutes are extremely important in a fast-moving fire
event and lives can be saved if only a small amount of
additional time sometimes is available for people to make
a quick decision in an emergency to do something that may
need some time to prepare for.

DR CLARKE: I would agree. I would add a qualification: if the
public perception was that they were made profoundly safer
on such days and it lured them into a false sense of
security. I totally agree with you saying that the
slowing could aid - - -

COMMISSIONER McLEOD: That is a public education issue and how
you would deal with that.

DR CLARKE: How you convey what we have actually achieved in
effectiveness I think needs to qualify that.
COMMISSIONER McLEOD: Certainly. That's an important point.

DR TOLHURST: I would like to say what you are saying is correct, that with less dead fuel and less fuel altogether, that the rate at which the fire will develop will tend to be longer, so one of the things that we know is that prescribed burning shouldn't be really considered as a passive treatment on its own. It is really there, and I think Mr Cheney mentioned it earlier, but it really needs to be there in conjunction with suppression activity and then building design and all sorts of other things; it is just part of the mix. But it certainly gives you some advantage, both whether it is warning, whether it is getting detection and early suppression going on, and I would add again, going back to the spotfire situation, it adds to the chain of events, so even new fires that are starting from spotfires will start more slowly as well so the effect continues to magnify further down as well, so it is an important factor.

But you have to be conscious still that on conditions like Black Saturday you may have had 10 minutes to respond to some of those fires. Often you wouldn't even be able to detect it in much less time than that, so it was already uncontrollable by the time it was detected. You might be able to stretch that out to 20 minutes, 30, minutes, 40 minutes. The question then is are you able to take advantage of that reduced rate of spread and so on. That's a different question to whether or not you have done your prescribed burning.

I think we will come back to one of the issues, but an indirect benefit of prescribed burning is the fact that people involved in firefighting and fire management...
are more switched on to fire, if you want to put it in
those sort of terms, and are able to deal with fire
better. We need to come back to that at some stage, but
prescribed burning also has some benefit to firefighters.

CHAIRMAN: Can I clarify one further matter that relates to
vegetation types, in a sense. There is reference in the
summary that has been prepared to "foothill forests",
which means something to me and I don't regard the Mallee
or the Wilsons Promontory or the high alps as foothill
forests, and again there is reference made to aspects that
vary. Grassy forests are included in foothill forests or
are they a species of foothill forests? There was a
mention made of grassy forests which doesn't quite fit the
same idea.

Can I just clarify that and then wonder, perhaps
a second question, whether in most of the discussion that
is following we are tending to put to one side the Mallee
and Wilsons Prom and so on? We are looking at the
foothill forests because that's where it seems that most
of the human deaths have arisen in the past, so we are
tending hereafter to be aware of the fact that we are
focusing, that there are other differences that are very
important, but we really are tending to come back to the
foothill forests?

MR RUSH: Is there agreement on that proposition that that is
really what we are concentrating on? Yes.

DR TOLHURST: If I could help, I guess probably the foothill
forest in its narrower classification is probably about 20
to 30 per cent of the forests in Victoria. However,
prescribed burning can probably be carried out in about
80 per cent of the forests or natural vegetation of
Victoria. What we discussed on Saturday in the conference was that, as you rightly pointed out, the majority of the interface between high population areas and the forest happened to be in this foothill forest. The grassy forests may be part of those foothill forests or they may be part of grassy woodlands.

PROFESSOR ADAMS: Just to follow on from Dr Tolhurst, yes, the ground layer might be shrubby, it might be grassy in some of these foothill forests, and indeed fire might have something to do with whether it is a grassy or a shrubby understorey.

MR RUSH: Which in one way raises the question about intensity. I might ask you about this, Dr Bradstock. Is the intensity of the fire governed by the fuel in the litter of the forest or is it governed by the weather?

DR BRADSTOCK: It is governed by both. We know that from fundamental principles. I think Kevin Tolhurst in his report has rather elegantly summarised how those factors can interact and how there can be almost steps in the way intensity changes according to combinations of those factors.

If I could just go back a little bit to the fundamental question that you sort of started this session off with, which was really defining a window of effectiveness. It is first important to say that there is no single study that is definitive. Also, as we have pinpointed, there are places which are well studied and places which aren't. It is very important to point out that you can study the problem in all sorts of different levels of scale, so there has been a lot of discussion about studies which are essentially located at a point on
the ground. Size, the question of size of treatment
blocks and stuff has been hinted at, and that's certainly
obviously important. There are studies that deal with
points and patches and blocks and now there are emerging
studies which deal with regions.

The most important thing probably is to put all
those things together and look for the congruence among
those studies; the pattern, the overall pattern. At least
for eucalypt forests, when we look across the different
levels of scale of studies, we can start to see a picture
emerge and it really tells us that five years matters.
The inherent outcome of that, as Phil Cheney I think has
hinted, is you have to treat at very high rates of
treatment to really have major effects on unplanned fire
activity. So, that's the fundamental point. As we have
noted, we know less about the Mallee and some of these
other systems, but we have some coalescence or congruence
of results for eucalypt-dominated systems.

MR RUSH: I guess from a community perspective it might be
asked, because we have heard evidence there is still much
to be done, much to be looked at, and the matters you have
raised, does that mean we defer what the panel in the
summary have suggested, there needs to be more burning?
Do we defer it pending further resolution of some of the
issues or do we act?

DR BRADSTOCK: Other people perhaps might disagree with me, but
I think, no, we don't defer. We push ahead, in particular
in those high priority areas such as the foothill forests.
I think that was our consensus on the weekend because we
probably know more about those systems. There is perhaps
less potential for collateral damage, if I can use that
term, that might occur out of a much more vigorous
treatment program. We go ahead; we can't keep waiting.
But some of these other systems, obviously, we may need to
find out more before we decide upon future levels of
treatment.

CHAIRMAN: Mr Rush, can I suggest we have two shorter breaks
and take one now, with a view then to having a 10 minute
rather than a 20 minute overall break, so we are going to
come back close to 10 to 11 with a view then to having a
break around about midday.

MR RUSH: Thank you.

(Short adjournment.)

MR RUSH: I invite any comment on what we raised just before
the break as to whether we should be putting things off
pending further research or whether it is necessary to
commence as soon as we can raise the resources for it.

PROFESSOR ADAMS: Yes, absolutely we must commence now. There
is no reason to wait. There is good evidence, as I say,
for the foothill forests to which you referred. The work
by Dr Tolhurst in particular has established a very sound
basis and delay is just an invitation for further trouble.

MR RUSH: Dr Gill?

DR GILL: Would you mind if I returned to the questions from
the Commissioners?

MR RUSH: Certainly.

DR GILL: I would just like to add another contextual point, if
I might, following on from what Mr McLeod asked and
Mr Teague's comment. I respect that the main focus of the
Commission is on Victoria's forested landscapes, but
I note that fires can start outside the forested landscape
as well as start inside and this can affect assets either
in or outside the forest area. So, to me, having that element of context including tenure is quite important to solving the problem in the wider sense anyway.

COMMISSIONER PASCOE: Can I ask, in relation to that broadening of the discussion, the impact of fire on water catchments and the capacity to undertake prescribed burning in water catchments. It is probably an extension of Mr Rush's question, so the degree for caution or movement in terms of protecting those areas.

MR RUSH: Professor Adams, I think your report raised as one of the pluses, if you like, in relation to fuel reduction burning the potential impact on the protection of water catchment areas. You might like to take up the question initially.

PROFESSOR ADAMS: Thank you. Again, without complicating the issue, in the foothill forest type such as they are represented within water catchments, my earlier comments absolutely stand that we can begin now with very little concern that the impact of prescribed burning would be deleterious and certainly not when you consider what the impact of bushfires is in water catchments. So I think in relation to the foothill forest types as they are represented in catchments we are quite clear on that.

Other forest types are represented in the catchments, and we have already touched on the fact that some vegetation types are difficult and what we need to do there is to work in the foothill forest types to protect those forest types where we can't do prescribed burning.

MR RUSH: You I think have indicated that the security of the water yield and the quality of water can be assisted in essence by prescribed burning.
PROFESSOR ADAMS: Yes. The two things to separate here is water quality and water yield. We know that bushfires pose tremendous problems for water quality immediately after fire, with contamination with nutrients and ash and it is an extremely expensive operation to maintain water quality after bushfires. Water yield, too, is tremendously affected by bushfires. We know in the Melbourne water catchments that the years following bushfires there are initial increases in yield, but long-term reductions in yield.

Using prescribed fire we can help to smooth out water yield in the long-term. It is one of those issues that, for water managers, the security, that is the year-on-year certainty of water yield, is very, very important to how they manage. If we go to boom and bust-style water yield management, it is incredibly expensive. Using prescribed fire helps us to smooth out and to make more sure of water yield in the long-term. Now, again earlier comments about prescribed fire not being a panacea of course apply, but we are talking now about increases in the certainty of water yield.

The other factor that is seldom appreciated is that the water balance of a forest is a simple affair, how much rainfall comes in and how much water goes back to the atmosphere via the vegetation, and that's all down to the leaf area. If you have reduced the leaf area by removing some of the understorey, you are allowing more water to go through to become water yield, so prescribed fire helps again in managing the security of water yield.

MR RUSH: Is there anyone else who would wish to comment in that area?
DR TOLHURST: I think in addition to what Professor Adams as 
sort of brought up, I think there are two other important 
issues to be considered. One is that the benefit of 
prescribed burning isn't restricted to the extent of the 
catchment itself, but the probability of fire getting into 
the catchment from outside, for example. Prescribed 
burning can be very effective in protecting, for example, 
rainforest gullies and other areas of high value. We 
spoke before about some of the Aboriginal use of burning. 
That was one of the things they did, was actually used 
fire to burn one area to keep it out of another, for 
example, so there is a landscape perspective needed here. 

The second thing is that even in these mixed 
species eucalypt forests that we find in the foothills, 
putting aside for the moment the wet eucalypt forests that 
we get in many of Melbourne's water catchments, these 
drier mixed species eucalypt forests, they also after high 
intensity fire can have significant structural change so 
that we end up effectively increasing the number of trees 
in the basal area of trees in the landscape, which affects 
the water use of that site. It is something that has not 
been well studied or documented because most concentration 
has been on the wetter forests because of their 
importance. But just simply because of the sheer extent 
of these drier forests in our catchments, and it is not 
just Melbourne water catchments that we should be 
considering, that is terrible important. 

We have examples now in our landscape from fires 
back in the 1950s and 60s which were high intensity fires 
where the stand structure, the structure of the forest, is 
very different now to what it was before those fires
occurred in the 1950s and 60s and we are going to have the same result after the most recent fires in the last decade.

It is something that is a major issue for any land management agency, is the consequence of an action today may not necessarily be seen for several decades. So, the political will and resources that need to be applied now may be seen to be, "Well, we can put that off" and research is seen often in the same way, but that has severe consequences two, three, four decades down the track. Water catchment issues are a classic example, I think, of where this long-term view needs to be taken.

So, one of the areas of research, coming back to an earlier question we had, that I think is sadly missing is really looking at the impact of these large scale, high intensity fires across the landscape. From a research point of view that's not so easy to actually study because of the logistics of getting around them and taking enough measurements to make sure you have captured all the variability. It is something we desperately need to do but it doesn't usually fit very well into a three-year PhD research program. It needs long-term commitment.

So, I think we need to come back to how do we actually set up some of those research programs and I hope at some stage we will also come back to the importance of monitoring where that fits into, marries in with research, so we can actually ask the right questions and help answer the question what long-term changes are occurring and how they might be impacting on the various values and assets in the landscape. So, I think water is a really important issue that helps capture and answer some of those
questions, but we need to be looking beyond what is happening just within the catchments.

MR RUSH: If we can perhaps try and bring together the effectiveness in relation to prescribed burning. There are a number of matters raised in the summary but, to tick off as I understand it, it is the view that it will reduce intensity, flame height, heat output, propagation of firebrands, potentially a slower rate of spread that would assist potentially with suppression of the fire. One matter before we leave this topic is there is a positive potential impact on the environment and ecosystems, but I guess there's also the potential of a negative impact. Perhaps this is something that's taken up in your report, Dr Clarke, where you see the balance in relation to those matters. I know we are talking about effectiveness of prescribed burning, and we will come back perhaps to that dichotomy between the two in more detail, but just in general terms?

DR CLARKE: In general terms I think we are struggling to define effectiveness ecologically. I think our goals are vague. They are at a very broad level. My understanding at present, they are at the crudest level: have we lost species from landscapes? Have we caused extinctions from what we have done or failed to do? There is a lack of long-term data on those kinds of questions because we have not done prescribed burning long enough or large enough and we have not monitored adequately enough.

So, in terms of advocating increases in prescribed burning, it needs to be accompanied by a commitment to monitor the ecological consequences because the data are typically of a very short duration and we are
trying to capture the impact on very long-term processes. So we might study it for three years, but is actually a successional process that might run for a century. So the consequences of what we have done will not become evident in a three-year study.

MR RUSH: So your position is that, whilst, as I understand it, we get on with it, it is very, very important that we set up the systems to monitor the effectiveness and the impact of it?

DR CLARKE: Absolutely. Inactive is not an option. It is a decision, if we don't move forward. But, if we are going to be active, we need to be learning from it.

MR RUSH: Is there anyone else who would like to comment?

MR CHENEY: Just before you sort of finish off on the effectiveness, I would like to go back to the question that Commissioner Teague asked about fire growth. I think it is important to appreciate that not all disaster fires start under extreme conditions; they start under a wide range of weather conditions. In considering a fire that starts from a point such as a single ignition by arson or lightning or whatever the fire takes time to reach its potential rate of spread where it is in balance with the weather conditions and the fuel. This is a function of the width of the fire.

One of the really important things of reducing the fuels and reducing the spotting potential is that that also slows the rate that the fire grows because the spotfires which can be just thrown out short distances to the side of the fire have a dramatic effect in increasing the width.

When the fire is kept narrow, and there have been
examples that I have measured, where a single ignition
fire can burn all day and still only be a third of its
potential rate of spread for when it is wide, this has an
everseous effect on the capacity of people to arrive at it
and to put it out.

MR RUSH: Dr Bradstock?

DR BRADSTOCK: I just wanted to expand slightly on Michael
Clarke's point by saying we don't know everything. We
need to act and monitor in order to find out. But we do
know enough, particularly in terms of ecological effects,
possibly even questions of things like catchment yield, to
know that different systems behave differently. That
needs to be taken into account, even if we are going to
press ahead and try and change things. There are logical
generalisations which we can use and which are already
embedded in management systems. They are not perfect.
They need to be built upon through the types of monitoring
that Michael has suggested. So it is well worth noting
that.

MR RUSH: Mr Williams, do you have any comment in relation to
these matters?

MR WILLIAMS: I think it is true that we don't always know the
long-term effects of prescribed burning, and certainly in
the US we don't know the long-term cumulative impacts of
wildfire impacts either. There are species decline and
other concerns in our country as well and deal with the
whole realm of fire weather, prescribed fire or wildfire.
In our country it does need attention.

MR RUSH: Commissioners, there is one topic I thought we could
go to and then perhaps we could have some questioning from
the parties. I guess it is summed up in the question of
how often and how much. I know, Dr Bradstock, you have
I think made the point that it needs to be a high level of
treatment to have impact. Perhaps you could give us the
reasoning behind that.

DR BRADSTOCK: The reasoning goes back to the whole question
about quantifying the time period for which effectiveness
is registered in the system. As I said before the break,
the numbers start to coalesce down on something like that
five-year period. So that means if you really want to put
the lid on the activity of unplanned fires, the incidence
and area burned, you want to try to wind that back to
absolute minimum levels, you have to treat very large
amounts of country, a high rate of treatment. That's
inexorable out of those simple numbers.

MR RUSH: When you say "high rates of treatment", what are we
talking about?

DR BRADSTOCK: There is enough evidence perhaps now
crystallising to say that in forested systems you might
have to treat well in excess of 10 per cent of the
landscape on average per annum, maybe up to 15 per cent to
drive unplanned fire activity down to quite low levels.
Some of that evidence suggests there is a linear
relationship or possibly a slightly curved relationship
across the scale of rate of treatment in relation to the
response of the system. But most of that evidence
suggests you have to get well up over that 10 per cent
mark to really minimise unplanned fire activity,
10 per cent treatment of the landscape on average per
annum.

MR RUSH: Would people like to take it up from there?

Dr Clarke, have you a view about 10 per cent or more per
annum?

DR CLARKE: I'm not a fire behaviourists and I concur with Dr Bradstock in regard to the effectiveness in controlling fire. The ecological consequences of such a figure are unknown. In foothill forests, some of the places where we have the best evidence, it looks as though that may not be damaging. But there is an absence of evidence. So I think I'm right in saying Ross is saying this is what would be required to have an appreciable effect on the residual risk, and it is not saying anything about the ecological consequences of that to the places you are applying it. So it is a value judgment about how much you value the assets in that place to achieve an appreciable reduction in risk.

MR RUSH: In the context of that amount of burning there is also discussion about each parcel of burning, if you like. We have had comment in the Royal Commission last week of small parcels of burning being done. But I take it, and we will start with you again, perhaps, Dr Bradstock, you are not looking at small parcels and I think the 500, the 1,000-hectare prescribed burning parcels are what you are directing your attention at.

DR BRADSTOCK: Yes. I think we have noted this morning that bigger is better and if you are going to push ahead with a more vigorous approach to prescribed burning it is inexorable that you are going to have to achieve that by treating larger slabs of country. So the two are connected. Even if you wanted to consider hypothetically very high rates of treatment, and I would emphasise hypothetical, it couldn't be achieved through doing little bits and pieces. So the two are connected.
PROFESSOR ADAMS: I think the comments from both Michael and Ross are right. I think we have to consider larger areas. There is a relationship. This is not a step and then nothing or nothing and then a step. There is a relationship, and Phil Cheney expounded on that earlier in the day. So increases in the areas burnt will improve the effectiveness of prescribed burning. It is right to suggest that the greatest effectiveness will be with the greatest area burnt. That's obvious.

So I think it does come back to an issue of how much and where, as you have said. I think the panel gave you a summary of our discussions on that point and indicated a figure between 5 and 10 per cent. Beyond 10 per cent I think we are probably, as Michael said, in the realm of unknown ecological consequences, but only insofar as there is a lot of other vegetation types that haven't really been considered. We do have, though, good evidence for burning at that order of the 5 to 10 per cent in the foothill forest and we can move ahead with that.

MR RUSH: I will come back later to the codifying or the setting out of objectives. Dr Gill, and I will then come to Dr Tolhurst, have you got a view about those sort of figures of 5 or 10 per cent and the need for a broader scale in relation to prescribed burning?

DR GILL: Yes, the way I would like to couch my remarks, if it is okay with you, is in relation to the discussion the panel had on Saturday. We suggested a way forward was to conduct a trial - not us conduct a trial, someone conduct a trial, perhaps in the Wombat State Forest - and this would involve burning an average of 5 per cent per year in parcels of about 1,000 hectares perhaps. These details
could be worked out. The operational costs could be
worked out in some detail as a result of that trial;
I stress trial rather than experiment. The actual
patterns of burning could be detailed, and we have
discussed monitoring to some extent already, and that
would be part of that process.

We would look at both the mapping of prescribed
fires and unplanned fires. It would look at environmental
effects on flora and fauna. One thing we haven't talked
about is the effects of smoke, which can be quite
important from a community point of view, affecting
potentially the health of some people, affecting tourism
in some areas, affecting viticulture and maybe other
agricultural industries, but certainly affecting some
businesses in some ways.

Then the effects of that on people and property
of course is extremely difficult to measure. So indirect
measures have to be used to assess that. The one we have
just been talking about is the trade-off relationships
between the area prescribed burned and the area burned by
unplanned fires. One of the figures discussed at the
weekend was you may have to burn four units of landscape
to reduce the unplanned fire area by one unit. Those
figures are arguable, but that gives an example of how
that discussion can take place.

COMMISSIONER PASCOE: I'm just wondering before we leave that,
given that we have Project Vesta which has in effect been
close to the kind of trial that you are describing, and
you may want to nuance that, what would be the added
benefit of the kind of trial that you are discussing in
the Wombat State Forest?
DR GILL: I think there are a couple of points here. The Project Vesta experiments which Phil Cheney ran in association with others dealt with 200-metre by 200-metre plots. Kevin is saying four hectares. It is not burning parcels of 1,000 hectares at a time, for example. The costings would be quite different from an operational trial rather than an experiment. While I believe, and I don't know this for sure, that there have been some attempts to examine the effects on flora, I'm not sure to what extent that has taken place, and perhaps especially with respect to animals.

MR RUSH: I will perhaps come to Mr Cheney in a minute.

Dr Tolhurst, the issues of 5 to 10 per cent and the necessity as described of larger parcels of land for impact?

DR TOLHURST: I guess adding to what's already been said, I think it also needs to be said that the proportion of the landscape burnt also depends on how it is applied across the landscape in terms of its strategic location. So, for example, there was a study done by Dr Karen King that sort of basically saw strategically located prescribed burning on 5 per cent of the landscape achieved similar to what 10 or 15 per cent achieved where it was randomly located.

The other point to make perhaps is when we are talking about perhaps a 1,000-hectare area being burnt, that wasn't just a random number. That size is the sort of size we are thinking of would be needed to capture the majority of embers falling within three kilometres of a wildfire. So it is in relation to that spotting and those spotfires starting. It is not just to achieve a target of
so many hectares. So that's important because that's one of the objectives that needs to be set.

I guess the other thing to say is that how these prescribed burns are carried out is also important. One of the things that we agreed on Saturday I think as a group was that they ought to be burning at least 70 per cent to be effective in reducing the impact of the fire, but probably no more than 90 per cent to maintain a certain amount of unburnt area within it so that there is a quicker recovery of the fauna and flora within that area afterwards. So it is not a matter of just being burnt. It has to be burnt in a particular way which will require certain skills and resources to do that. So I think it is important that it is not just about a percentage figure. It is where it is in the landscape and how it is actually conducted, and it is important to keep that in mind.

MR RUSH: We will come back to the 70 per cent issue that was raised by the panel. Mr Cheney, in the context of Project Vesta and the nature of the experimentation that was done in that project, are there lessons there in your opinion that can be transferred over to Victoria in the sense of the issues we are looking at, the 5 to 10 per cent and the nature or what has been described as a need for a broader scale of burning?

MR CHENEY: No, Project Vesta was set up to quantify the impact of reduced fuels of different ages on the subsequent fire behaviour, and that's what's allowed us to make certain statements about how long the effect of prescribed burning will last; some quantification of the reduction of ember production at fuels of different ages. So we carried out the experiment because there was dispute about just what
reducing fuel ages would do in terms of altering fire behaviour.

Kevin has indicated that the size of the block is important to absorb spotfires and a certain fraction. Now, on large blocks you can afford to have a slightly higher fraction unburnt within that because if spotfires do happen to chance they are not going to get out. So in an overall ecological effect, if you are dealing with large blocks, you are going to have more variety of fuel age within that block than if you were just burning small areas where there is a tendency to make sure you burn everything.

COMMISSIONER McLEOD: Could I just ask the panel, with the suggestion that was made as a possible trial, was it envisaged that that would, if it was to be adopted, replace the existing planned burning program of the state or in addition to? Obviously that would be a decision for the decision makers. But, in terms of your own thinking, one approach means you are putting off doing anything else until you have got the results of a trial, albeit that you will get some benefit from the trial site; the other way is that you are continuing what you believe to be a reasonable policy that's been in place for some time but that you are ramping up the need to put a bit more research into some of these intangibles such that future planning may be improved.

PROFESSOR ADAMS: I think it is the latter. I think everyone has been quite clear that this is not meant to be a reason for inaction on increasing. We see this. If I may mention, the West Australian experience again is they have a monitoring system in place that they call forest check,
it is a well-established system, it works well, it covers many of the ecological attributes that have been raised. So certainly I see it as the latter and that there are well-established precedents and frameworks to implement such a monitoring program.

DR TOLHURST: I guess I would just add to that that one of the reasons for picking a relatively small area like the Wombat State Forest, which is about 50,000 hectares, is that we see that there would be a need for extra resources and skills to do that and, rather than put it off until there was a recruitment and training process, we could start that immediately so that resources could be concentrated in an area. It doesn't have to be the Wombat Forest, but a relatively small area that could be achieved in the immediate short-term.

MR CHENEY: I have a great deal of problems with this because one of the problems with looking at the effect of prescribed burning on the landscape is that there is no adequate control. It has to be applied across the landscape. If you compare it with other areas significantly far away then there are differences in vegetation, there are differences in climate. So, strictly speaking, there is not a control on it.

Now, if you like, as a landscape environment for prescribed burning or a landscape demonstration we have had Western Australia which has been operating very successfully for the last 50 years. In that timeframe they have established a pattern of burning, information on the size of the blocks which should give us a lead here in Victoria to say, "Well, if we are going to apply prescribed burning to a similar dry forest here in
Victoria, we probably have to go along very similar patterns of burning that they do in Western Australia."

MR RUSH: The summary of discussion on Saturday indicated that we should be looking at achieving prescribed burning treatments of the order of 5 to 10 per cent which, in a sense, raises the issue of targets. Dr Bradstock, as I understand it, you are in favour of a target because of, one, the community needing to know that there is something being done and that there is an advantage in a target in putting that forward.

DR BRADSTOCK: Yes, I think there are a number of issues attached to targets, as you have alluded to. First of all, targets are bandied around both in the past and in the present without really a clear quantitative definition of both the cost and benefit. I think the state of the science now is that we can probably start to put some numbers on the benefit.

So if we take something like 5 per cent, particularly at a large scale such as a regional scale or whatever, we can now say that it is going to put a fair dent in risk to people and property in and around that region, possibly won't eliminate half of the risk posed by the condition of the landscape, but it will significantly reduce risk. There will be a lot of risk left over, as has already been alluded to. The community therefore needs to understand what they are getting in terms of the costs of doing that.

The big unknown of course is to really cost this out properly in the long-term. I would emphasise that something like that means it is an extra cost. You still need your suppression system. It means more people, more
workers, more equipment and a bigger budget.

It seems that there is just no clear idea about defining that cost properly. So, if we are going to go for any target, we really have to define both the cost and the benefit. The community must have a fair idea of what it is getting in terms of risk reduction for any particular target.

I suspect that in the long-term the targets will equilibrate at a level that the community deems it can afford. Ultimately that will become part of the political process. Governments and potential governments have to cost this out, put that out for debate and the community decides the level of protection it can afford via this mechanism.

MR RUSH: The costing issue in Victoria is something that would be a little bit difficult at the moment. But, putting that to one side, I think what you were driving at, Mr Cheney, in your previous answer is that you can't apply a target across the state. I think that's what I got from your statement. But nevertheless, as I understand it, you are of the view that a target is a worthwhile procedure to have in place to focus attention on the need for burning.

MR CHENEY: I think the target is essential in the planning and initial set-up of the structure that has to do it. It is a considerable increase on what we have now. As Dr Tolhurst said, there is a lot of work that will have to be done to provide the infrastructure to do the burning in terms of money and manpower and skill. I would also add that that will go also into suppression, and it comes down to the issue of who does the burning and who does the suppression.
I am absolutely convinced that prescribed burning will not work in Victoria unless the land management agencies are charged with the responsibility of doing it, and they are also charged with the responsibility of carrying out suppression on their own land. The suppression cannot be left to a second individual emergency service which cannot do the prescribed burning operation because they don't have the authority and they don't have the capacity to integrate the burning with the ecological and other effects that a land manager has to consider when he is carrying out the operation.

MR RUSH: Dr Clarke, what is your position in relation to targets? I think you have made the observation that you can do some pretty cheap burns, in the colloquial sense, to achieve a target that aren't of much purpose.

DR CLARKE: Indeed. I think there are two issues that need to be considered prior to contemplating targets. Dr Bradstock has touched on them. What is the reduction in risk that is the objective we are attempting to achieve? If that is not absolutely clear, then a target becomes meaningless. So, unless we have a clear specific objective of the reduction in risk we are after, we will not know how much to burn and how much we are willing to pay for. So that is, to me, a primary question we have to wrestle with as a community before we pluck a number out of the air.

Assume we have plucked a number out of the air and we have said 130,000 hectares or whatever. My concern is how much have we reduced the risk by burning that area of the landscape or that percentage of the landscape. One hectare in the Mallee has not appreciably reduced the risk
to the same extent that one hectare in the Dandenongs may
have reduced, yet when the reporting comes they are often
bundled together and we report state wide that we have
burnt X hectares this year. That is my concern with
targets; it is how they are used and that they are
uninformative in many cases.

MR RUSH: Accepting those qualifications, do you accept the
validity of a target in the sense of focusing government
to resources and the necessity for the organisational
capacity?

DR CLARKE: I absolutely endorse targets if they are based on
smart objectives. If there is not a measurable outcome at
the end, then our objectives are vague and we are unlikely
to achieve them.

MR RUSH: Mr Williams, on targets?

MR WILLIAMS: We have a lot of examples in the US where targets
have become an opportunity to pick off the low-hanging
fruit, so to speak. I think they become valuable when
they are lent context. I believe our discussions on
Saturday reflected a high degree of confidence among this
group that prescribed burning at about 5 to 10 per cent
per annum across the burnable estate was a good place to
start; that targeting the foothills, eucalypt and
high-risk fire regimes at larger sizes, strategically
placed across the landscape and treated at adequate
intervals across both public and private lands,
nevertheless across all ownerships, were important places
to start.

In our country we are coming to recognise that no
option, including prescribed burning, is without some kind
of risk. Our real objective here in beginning this
discussion has to do with finding solutions that recognise there's always risk, but that we are after trying to minimise overall long-term impacts that socially at the human level, economically and ecologically have become largely intolerable.

I think in my experience, watching areas that take this problem on programmatically, using a program approach where budgets and personnel skills and monitoring and evaluation are ongoing are essential elements. In places where we have done a little more burning and attempted to treat the problem on a year-to-year basis, on a catch as catch can basis, we have failed.

MR RUSH: Professor Adams, on targets, do you see them in the context of the overall prescribed burning program as having an impact or an importance?

PROFESSOR ADAMS: I think Jerry has very well captured what the panel discussed and certainly my own beliefs that this has to be as part of an overall program of forest management. Indeed when we come to costs we have to include the alternative costs of fighting campaign fires that are not the annual cost of maintaining the suppression workforce. They are extraordinary costs. That has to be put on the other side of the ledger when we look at the costs of prescribed burning.

So I think Jerry has hit the nail squarely on the head. We do need targets. As Ross said, we absolutely must take into account the costs. But, on the other side of the ledger, there are some very large costs. I, for one, would be hesitant about putting a cost on some of the losses, if you like, in bushfires.

MR RUSH: Dr Tolhurst?
DR TOLHURST: I guess I would agree with the others that we need outcome based targets, not just simply hectares targets. You may end up with hectares, but it needs to be outcome based targets. I think that is really quite important.

I think the other thing that is important that is sort of coming out in some of the discussion that has gone on is that we need to be refocusing, I suppose, the whole equation so that we see that we can actually reduce the effort that goes into suppression by putting more effort into the prescribed burning program. It has to be, as Jerry said, a program where you actually build up the skills so that the people doing the suppression are more efficient and effective, but the overall impact to the environment is reduced. So, whether that's through more vigorous and viable populations of plants and animals or whether it is by protecting human life and property, it all ought to be part of the same package. It is not one at the cost of the other.

That is not a simple thing to achieve, as the divergent views around the country sort of all attest to. But that's what we ought to be aiming for. It is a land management issue. It is not a fire suppression issue. So that requires stronger support, I guess. We need to be looking at outcomes, not necessarily just simply area targets.

MR RUSH: Dr Gill?

DR GILL: Yes, I think that's right. Part of that sense of purpose or objectives in identifying particular assets at risk is the zoning system in Victoria and in other places as well. So if you burn zone 1, which is set aside mainly
for protection of lives and property, it is a different proposition as to what per cent you might burn at a particular time and how often you might do that compared with zone 3, which I think is an ecological zone where the primary assets may be considered to be the flora and fauna. So that's one way of looking at the allocation of any particular target.

If I can just add one more thing. I think we may move on to eventually discuss the Western Australian proposition that Phil raised?

MR RUSH: Yes, we will. Commissioners, if that is a convenient point to ask for questions.

CHAIRMAN: Focusing on those matters that have already been addressed, and coming back as is appropriate to other areas.

MR RUSH: As I think we have appreciated, it crosses the borders, but focusing on the matters we have discussed. If there is anything that is missed, we will have the opportunity through the panel and questions to gather it all up at the end. I invite the Commissioners, if the Commissioners have any questions, and then the parties.

CHAIRMAN: Not at this stage, no.

MS JUDD: If the Commissioners please, I do have a number of questions but the questions do overlap with other issues. I do need to get some instructions. So I just want to indicate that I may be coming back to some of these topics, but I don't wish to embark on the cross-examination at this point in time.

CHAIRMAN: Thank you, Ms Judd.

MR RUSH: I think the Victorian Association of Forest Industries desires to explore one issue at the moment.
MR NEWTON-BROWN: Commissioners, I act on behalf of the Victorian Association of Forest Industries and the National Association of Forest Industries.

CHAIRMAN: Yes.

<CROSS-EXAMINED BY MR NEWTON-BROWN:

MR NEWTON-BROWN: This question relates to a topic that hasn't been directly discussed, but it is in relation to access to perform the prescribed burns. Specifically, Dr Gill, if I can refer to your evidence at page 0044. Just to paraphrase your view on that page, roads and tracks impact on biodiversity, water quality and increase the potential for weed infestation, and also that roads and tracks can be used to provide easy access for arsonists. Would you agree that, despite these concerns, roads and tracks are essential for fire suppression and also for providing access to perform the prescribed burns?

DR GILL: Yes, I would. It is a matter of the extent, nature, location of tracks that might be at issue there and the specific objectives for that parcel of land. So if it is forest for wood production, for example, it may be quite different than forest for some other purpose.

MR NEWTON-BROWN: But roads and tracks are commonly used to delimit the areas for the prescribed burning. So would you say that it is essential to have roads and tracks so that the areas of prescribed burning aren't too large?

DR GILL: I think there are two questions there. One is size and one is the delimitation of prescribed burning areas. I think in relation to size it depends on the size of the parcel that's being managed. In relation to the size of the area that is set aside for prescribed burning, I think delimitation by tracks is important. The locations of
those tracks can be strategically placed. So, for example, partly in relation to Commissioner Pascoe's comment about water catchments, you try to avoid having tracks running straight down into streams, for example.

So it is a complex question. There is a lot of literature on the topic around the world dealing with a wide variety of circumstances, plants and animals, fire context and purposes. So it is a very difficult question just to answer with a very simple response.

MR NEWTON-BROWN: You would agree with the proposition that if a fire breaks out that roads and tracks provide quick access for firefighting crews that can suppress the fire before it becomes out of control?

DR GILL: Access is particularly important. I don't think there is any dispute about that. It is a matter, again, of how much access is necessary to achieve your purpose which you have stated and it will vary according to the fuel type, the terrain, just what is possible, which equipment is needed, the slopes, for example, just how rugged the situation is, and what you can do with aircraft as well.

MR NEWTON-BROWN: You make the comment on page 0044 that roads also provide access to arsonists. Now, would you agree that an arsonist, somebody who is predisposed or minded to light a fire, they don't require a road to light a fire, do they? If they are going to do it, it will happen anyway, won't it?

DR GILL: Human nature is that people follow the easiest route. There is the potential for arsonists to use tracks to gain access in some form or another.

MR NEWTON-BROWN: If an arsonist has used a track, then that
track will also be available for firefighters to get to the source of ignition?

DR GILL: It's not all one way; that's right.

MR NEWTON-BROWN: So would you agree then that, taking into account your concerns about tracks in terms of biodiversity and potential use by arsonists, on balance a good system of tracks and roads is essential to fire suppression and also to facilitate prescribed burning?

DR GILL: I think I would go even further than that and say you have a system of roads and tracks that suits the particular assets of concern in your particular area, and what the density of those tracks is and the nature of those tracks depends on that. It also depends on historical factors such as roads being present beforehand, access corridors for power and so on. So I think there are many considerations involved in what you have and what you might like to have.

MR NEWTON-BROWN: And the maintenance of the tracks would be important?

DR GILL: Yes. If you are going to have good - you use the word "good". If you are going to have a good system for whatever your purpose is, maintenance is essential. The costs of that need to be considered in various forms as well.

MR NEWTON-BROWN: Would it be a reasonable comment that, if the timber industry were maintaining the tracks and roads, there would be more state resources available for other measures such as actually performing prescribed burns?

DR GILL: I don't know the answer to that question.

MR RUSH: I have no re-examination, Commissioners. Is it timely to take that 10-minute break?
CHAIRMAN: Yes, it is appropriate.

(Short adjournment.)

MR RUSH: Commissioners, one thing I neglected to do this morning was tender the summary of discussion by the panel.

CHAIRMAN: Yes. That will be exhibit 739.

EXHIBIT 739 - Fuel management topic facilitated experts' conference, 20 February 2010, summary of discussions by panel (TEN.227.001.0001) to (TEN.227.001.0004).

MR RUSH: Perhaps if I could put forward that one of the matters raised in the discussion paper related to a consideration of the 100,000 to 130,000 hectares, now 130,000 hectares, which is the target or the amount of prescribed burning aimed for by DSE in Victoria. It is said that this is doing too little prescribed burning to reduce the risk posed by large unplanned fires below an acceptable level and has equated to a low level of risk reduction.

I guess it brings together matters that we have already discussed this morning, but just looking at that, perhaps we will start at this end of the panel and go along. How does that relate to risk reduction in your view, Mr Cheney, to aim at that, and it's 130 or 140 depending on the year that you look at it. In the context of where we have been this morning, where does that put risk reduction through prescribed burning?

MR CHENEY: I think at that level of burning that the risk reduction is going to be rather small and narrowly focused, which may be useful for sort of the lower intensity fires, but when you are dealing with fires with the potential to spread over large areas it is going to be overwhelmed by the scale of the fire. So that's why
I think the panel had gone to a considerably higher level in terms of being able to distribute the burning across the landscape as well as some areas which may be strategically focused. But, unless we get to a certain fraction of blocks of considerable size, then the impact on reducing the spread and scale of large fires is going to be minimal.

DR BRADSTOCK: I will try and summarise it on a fairly simple quantitative scale, which I think is based on the available scientific evidence, as I have indicated in my report. That level of burning is probably better than nothing and you could say on a scale of 1 to 10, where 10 equals doing nothing, in other words maximum amount of risk, the current level of burning might be getting you down into the 9s.

MR RUSH: Do you have anything to add to that, Professor Adams?

PROFESSOR ADAMS: No.

MR RUSH: Dr Clarke?

DR CLARKE: I would just like to highlight that that total is a statewide total and in my opinion we should be talking about foothill forests and where our risks lie. I haven't seen figures of what has been achieved as a total in those habitats of profound concern for human welfare or human assets.

COMMISSIONER McLEOD: Could I just suggest I think those figures related to the proportion of public land, with public land being perhaps essentially forested, as a generalisation; is that correct?

DR CLARKE: Correct, but it will include large tracts of remote country like the Mallee are in that 130,000 total which may not have appreciably reduced the risk for people.
MR RUSH: I will come back to just what we mean about five or
10 per cent in a minute, but I see you have passed the
microphone to Dr Tolhurst, Mr Williams. Have you any
comment or anything additional to say to what's been said,
Dr Tolhurst?

DR TOLHURST: I think the evidence is that the majority of the
damage is done by a few fires which are under those really
extreme conditions, so it is one of the reasons why we
focus so much on those extreme conditions. Under those
conditions, as Mr Cheney has already said,
100,000 hectares will only have sort of relatively little
local - a great benefit in a relatively small percentage
of the area.

I think we can probably achieve a reduction level
of perhaps two-thirds of what we currently expose.
I don't think we can ever take it to 100 per cent safety.
To do that with 100,000 or 130,000 hectares, we might be
achieving one or two per cent risk reduction. I think we
could increase that quite considerably with more and
broader-scaled prescribed burning and that's based on,
I guess, observations from past fires as well as some
modelling work that I have been exploring.

MR RUSH: And Dr Gill?

DR GILL: I will just add one small thing, if I may. It seems
to me that prescribed burning effectiveness takes place
within a context of suppression capacity. People have
talked about prescribed burning allowing suppression to
have a greater chance of success, so that relates to the
context of suppression forces available.

MR RUSH: The other issue on this point that was raised in
discussion is whether we set off areas that are burned
through unplanned fire against that and, with everything that's been said about target, whether that should be set off. As I understand it, it is the position adopted that it should not be set off. Perhaps someone would like to explain just why it shouldn't be set off. Can we start with you, Professor Adams?

PROFESSOR ADAMS: I will just start. I think what we said was that, on the assumption that there is a local/regional level of fire planning, that if you've had a thumping great bushfire that has just burnt all of your district, then you do take it into account, but at the statewide level we believe that the targets should remain.

MR RUSH: Taken into account in the sense of looking at what is done in that particular area or region, taking into account obviously what's occurred.

PROFESSOR ADAMS: That's right. You may have nothing left to burn.

MR RUSH: Yes. I'm not sure there is anything to add to that. When we talk about five and 10 per cent, are we talking about area of burnable land in Victoria or are we talking about the public estate?

MS JUDD: Perhaps if we could have "burnable" defined a little bit more. Mr Fogarty used the expression "treatable" public land and if "treatable" and "burnable" are being used in the same sense, I would like that clarified.

MR RUSH: I think that's fairly apparent, but are "treatable" and "burnable" being used in the same sense? Yes. When we talk about five or 10 per cent, are we talking about the whole public estate or are we talking about the treatable or burnable part of that estate? Dr Tolhurst.

DR TOLHURST: My understanding is we are talking about the
whole public estate. Some analysis I did looking at some
of the vegetation types saw that about 83 per cent of the
state's public land could potentially be treated with
prescribed fire, based on my analysis, so the five to
10 per cent is of the whole estate.

MR RUSH: Including that not capable of being treated.

DR TOLHURST: That would be my understanding, because what we
are talking about are landscape scale fires here which
incorporate all vegetation types, all topographies.

That's my understanding.

MR RUSH: Is there anyone with a different view to that?

COMMISSIONER McLEOD: It is a little academic, the discussion.

I guess with this group it will have to be academic. But
when the panel is saying between five and 10 per cent and
we are talking about a current program that is around
about 130,000 hectares, which I suspect is only probably
about two per cent or three per cent of the public land,
it's a bit esoteric, this discussion about refining the
measure we are talking about, because the range between
five and 10 per cent is so great in relation to public
land, and it seems from what's being put that the amount
of untreated land is a minor proportion of the public
estate, is that correct, a relatively minor proportion of
the public estate?

DR TOLHURST: I would say that's true, but the frequency with
which different parts of that treatable area are treated
is quite important.

COMMISSIONER McLEOD: Sure. So, if you are talking about the
treatable part of the public estate, you are really
talking about the bulk of the public estate and you are
talking about a figure of within the band of five to
10 per cent. Now, that's a pretty broad estimate of magnitude that is at least sufficient for my purpose to understand what you are saying.

MR RUSH: Just dealing with benefits during the course of the morning, Dr Tolhurst, you mentioned prescribed burning and firefighter safety. Perhaps if we could just quickly explore that issue. What were you referring to there?

DR TOLHURST: There are a number of issues. One is I guess being able to get close to the fire edge and the amount of radiation that they are going to be exposed to, but it is also how quickly a fire can change its characteristics because of rapid variation in fuels or because of spotfires starting in or around them. Those factors can be significantly modified by fuel modification, so whether it is through mechanical means or whether it is through the use of fire, where the firefighters are actually working, makes a big difference to firefighter safety.

MR RUSH: It has been said in at least one of the reports that was provided that 3,500 kilowatts per metre is the threshold at which people can really try and suppress fire. Is that agreed to, and then after that the impact of prescribed burning is really, as a consequence of various matters we have discussed today, going to fuel intensity.

MR CHENEY: Seeing that it might have been one of my figures, 3,500 kilowatts per metre is a pretty intense fire. From the evidence we have, that was about the intensity where the spotfires produced from that fire would overcome any break that was formed in front of it, be it from an air tanker or a bulldozer or any short firebreak system. That figure was for the foothill mixed stringy-bark type.
As work by Dr Tolhurst has shown, in other forests with a lower spotting potential you can have greater success at perhaps a higher intensity than that. For example, if you are in grassland, then you are up around 10,000 kilowatts per metre and can still be effective in being able to directly suppress the fire. But in our mixed stringy-bark forests which we are concerned about, suppression breaks down because spotting overcomes the particular firefighting technique that you are using. With hand tools that's about 1,000 and for any other system we sort of settled a figure of about 3,500.

MR RUSH: It may be appropriate to raise this now. In relation to the increasing funds that are being spent on suppression regimes, DC10s and the like, does the panel have a view as to whether there is a view as to prescribed burning and the matters we are talking about now against the ever-increasing funding of fire suppression?

MR CHENEY: I will start off by saying that our current system has failed; that expansion to bigger and better suppression systems is going to fail; that it has failed in the United States, and I think Jerry will back me with that; and if the biggest and most powerful country in the world can't devise a physical suppression system to suppress a fire without prescribed burning, then we should really take some notice about that.

MR RUSH: Perhaps it might be an idea to flick over to you, Mr Williams. Do you agree with that and the thrust of that comment?

MR WILLIAMS: Generally I do. In the US we have places where we have been successful with prescribed burning programs at landscape scales, but we are deeply invested in a
suppression-centric approach to dealing with fires. While those may work for the majority of fires that we deal with, a defining feature of the megafire phenomenon is that it exceeds all efforts at control. More specifically, it challenges our doctrines. We have a notion that, as wildfire threats increase, we can match those with increasing suppression force and we have found clear limits of that. Bringing the bigger hammer, so to speak, doesn't show much promise, in my mind.

MR RUSH: Yet all fires are not the megafires that you have described.

MR WILLIAMS: That's correct.

MR RUSH: From the US perspective, is there a balance between the suppression resources and what we are discussing here, the prescribed burning resources, that may balance out depending on the nature of the fire that's being fought?

MR WILLIAMS: Yes. My comments don't mean to suggest that there is not a place for suppression forces. There are, and in fact it should not be viewed as mutually competing strategies. They can complement one another and in fact should complement one another. Our best firefighters are often weaned on prescribed burning experience. It is an iterative relationship. Earlier Mr Cheney's comments about seeing this as a land management challenge I think are enormously important. Moving strategies to all risk or a fire department model may over time actually defeat the strategic objective of dealing with the causal factors here which trace back to how we are managing fire dependent ecosystems. In that respect prescribed burning is an essential element of that management regime.

MR RUSH: Is there anyone else who would like to comment on
this particular aspect? Then, just dealing with what you
have now raised, Mr Cheney, before the break, of the land
management agency being responsible for fire of the nature
that we are talking about, is it the view of the panel
that that is a particular expertise that needs to be
embodied in the one area or the one department, if we look
at it in governmental terms? Would you like to kick that
off, Professor Adams?

PROFESSOR ADAMS: Sure. I do believe that the panel and the
evidence is that this must be viewed as part of the
overall forest management, which by definition in Victoria
on public land is the responsibility of a government
department. So, to divorce firefighting from the land
management would be a mistake, in my view. It's got to be
embedded within the government's agency.

MR RUSH: Is there any differing view to that?

DR GILL: It seems to me that I'm wary as a scientist in
going into this area of whether one department is
appropriate for both suppression and land management.
I just don't know the answer to that. I believe it is
very complex, especially if you consider the point made
earlier that fires can start outside in private land and
move into government land, public land, as well as move
from government land into private land. So it raises the
question of how you treat those different tenures and
whether that's the best model. As I say, as a scientist
I just don't know.

MR RUSH: That dichotomy between private land and public land,
what we are talking about is devoted to public land. Is
there a problem there in relation to effectiveness of
prescribed burning in Victoria, having regard to that
difference, Dr Tolhurst?

DR TOLHURST: I think the issue between the public and the private is that every year we are going to potentially have the possibility for large fires on private land where it is basically, if you like, grassland or cropland. It is difficult to get away from that, so the work that's done on private land is more of a local nature. So I would see that the public land manager, whether it be a parks organisation or a forest organisation or a water catchment authority, their interest really is in the broader scale strategic management of fire in the landscape, with the expectation that there will always be the potential for fires to burn into those areas from the private land and statistically it is more likely that fires burn into public land from private land than the other way around.

So, I think the work that's done on private land is much more of a local nature rather than a landscape level, but it also needs to be done strategically because there is a lot that can be done on private land to prevent the widespread movement of fire across the landscape, too, whether it is through firebreaks on cropland or grazing land or whether it is through the management of roadside vegetation. So I think there is a difference between the management of public land and private land in that sense, so I think they would need to be treated differently, but obviously communication between the two management systems needs to be good.

MR RUSH: If we can come back to the effectiveness and measuring the effectiveness of prescribed burning.

Dr Clarke, you have indicated, as I understand, that there
needs to be a transparency in setting objectives and that we need objectives to be able to measure the effectiveness of prescribed burning. That's probably one of the most difficult questions. How do we go about that?

DR CLARKE: Obviously the first distinction we would make would be between assets and human life and property and ecological consequences, so I would start off with my measures of effectiveness in setting objectives and being clear why are we burning this, what are we hoping to achieve. That distinction has been blurred in the past under the usual phraseology of something along the lines, "We are burning for multiple objectives here," and it becomes unclear whether we are achieving those objectives because of the vagueness around them.

So, the first suggestion I would make is a clearer and more transparent prioritisation that is location specific, so, "We are burning in this area primarily to protect this timber asset and it may have secondary ecological benefits," but we must be clear about those things so that, when we come to burn vast tracts of remote country, which I'm more familiar with, and we justify this for ecological benefits, we need to be saying what are the ecological benefits? What would we gain or lose if we did not do this fire? It is that lack of specificity that I think then translates into vague objectives that agencies are not held accountable for.

MR RUSH: Dr Bradstock, you I think have referred to a need for a tenure blind fuel management plan, and perhaps you can tell us what you mean by that and where you would see that leading.

DR BRADSTOCK: Yes. I think there is experience in other
jurisdictions maybe where those types of approaches have been developed and I ---

MR RUSH: What are we talking about?

DR BRADSTOCK: In terms of looking at a broader scale across tenure and developing strategies at that level of scale, like a regional scale or something similar. I think that builds upon what Kevin Tolhurst said. There are certain restrictions on what you can do on private property, just as there is different scope for actions on public land.

So somehow or other you need a planning process that can integrate those two, those differing perspectives in some coherent way and in a cooperative way, so that all people have some input into the process and there can be some consensus at the broad landscape scale among the players.

If I may, if I could just build upon Michael's comment about measuring effectiveness. We manage for many different things, and they are all things that we value, whether it is lives and property, water, or plants and animals. Not all of those things can be reduced to dollar values. We can examine trade-offs in management strategies in terms of some of those things on the basis of dollars. However, some of them we can't. I can't value a species, but I can value a person's property et cetera. I can't really value a person's life.

However, there is a way through this because, as Michael has indicated, this can lead you into a terrible problem of definitions and blurry objectives. I think there is a way through this and it does involve an understanding of risk in terms of the probability of adverse outcomes to the things that we value.

Conceptually you can; if we can quantify risk, in other
words the probability of those adverse outcomes to the respective entities of value, we then have a common currency to compare which we can use to compare strategies, alternative strategies. We can ask how much does risk change under this particular strategy to the suite or portfolio of things that we are interested in.

Inexorably, management in our landscapes is going to be about some sort of set of trade-offs and I think if we proceed on that basis we can make progress. There is a nexus there also with an overview that is across tenures as well. The two do fit together.

MR RUSH: In setting out the objectives, are we capable at the moment of giving an indication of the sort of - we spoke about it this morning - the sort of percentage reduction in risk as a consequence of adopting a prescribed burning regime of somewhere between five and 10 per cent?

DR BRADSTOCK: I will agree with you, yes, and I have actually given some indicative ranges of response in my report to different treatment options. It is my understanding, from the way I can see the science and my own interpretation of imperfect knowledge that, for example, a level of five per cent is a pretty satisfactory compromise. It will certainly decrease risk to people and property. I don't see, if it is handled carefully, that you will elevate risks to a lot of other things, environmental assets. It will almost certainly reduce risk to some aspects of biodiversity and ecosystem processes.

As you slide along the scale, the relativity of those changes alters, but in that range I think we could say, we could have a go at moving into that range provided we keep monitoring and learning more about the system.
MR RUSH: Would anyone else like to take up that point of being able to establish in the objectives some form of risk reduction or benefit to explain where we are heading in increasing prescribed burning? Professor Adams?

PROFESSOR ADAMS: Just one point. We have been speaking mostly about the likelihood of risk without assessing the other axis that is usually used in risk management. The other axis is what are the consequences, so will it be catastrophic or will it be relatively minor. I don't believe we should just address one axis, the likelihood of an unplanned fire, but the other axis, which is what is the likelihood of the outcomes of that or, indeed, if we are thinking about prescribed fire, when we are saying, "Okay, we move along the scale," as Ross says, "but there is another scale up there as well that we really need to be just clear about."

If I could just use an example here. The unspoken issue at the moment is a particular species; if we put in place a five per cent or a 10 per cent, what will be the consequences of that for a given species. Now, it might be very, very small that there is a probability that something will change in the environment. Are we to not use prescribed burning because of a small probability of a change to a single species, or are we, as I think also the international literature and the international consensus around species management is heading, to put our greatest effort where we have the greatest possible return? That is, it is impossible to manage for every species; we must manage for the bulk of species. So this is, as I say, the other axis of the risk management that's used widely around the world.
DR CLARKE: I have worked on threatened species for a long time now and I have never known any threatened species program I have been involved in to look at a species in isolation from its ecosystem, so I think the distinction between single species approach and community is actually a false dichotomy. You can only maintain a species in a landscape if all it needs is still in that landscape, so by doing one I believe you are doing the other. So I don't accept that dichotomy.

I think there is a profound lack of knowledge of the consequences for a vast majority of species. I have studied some for a very long time and know very little about them now. We can't wait until we know everything. We clearly have to manage now. So I concur with the sentiment that we can't manage for single species, but we need to do this in a sensitive manner that considers the consequences of these actions in an adaptive monitoring framework.

MR RUSH: Mr Williams, this must have been an issue that's been raised in the United States over the course of your time in this area. How has it been managed or has it been managed?

MR WILLIAMS: I think there are two dimensions, if you will, of the megafire phenomenon. We have talked a little bit about the land management importance of this and seeing it as something much deeper and much more complex than a simple fire operations or fire management or fire policy failure.

The other dimension of this, though, is clearly
risk and how we perceive risk. If there is a lesson that we might draw from the megafire phenomenon it is that it is extraordinarily low risk. Less than maybe 1/10th or 1/100th per cent of all fires that we deal with become a megafire, but they result in enormous consequence: ecologically, socially, human, economic consequence.

I'm interested in some of the decision models that we might adopt in better defining risk. If we stay settled on what I might term maximisation models where we might be attempting to maximise single concern outputs rather than optimise decision making in the context of a whole functioning ecosystem I think we will arrive at very different levels or very different perceptions of what risk means.

The same applies to the time or temporal scales involved. We have lots of examples where we have avoided short-term risk and found that it carries enormous long-term consequence.

Finally, I think much of the science is starting to bring us to a place where we better understand the importance of tailoring land management objectives to the dynamics of these fire dependent or fire-prone ecosystems rather than trying to push a rope, and by that I mean trying to develop resource objectives that are at cross-purposes with ecological dynamics of those systems. These are all areas that in my mind have a lot to do with how we define risk, how we perceive risk and where we wind up in dealing with the whole matter of risk.

MR RUSH: Allowing for the difficulty in that, how do we come to work it out in the sense of looking at the impact that fire potentially might have on particular ecosystems?
MR WILLIAMS: We have some examples across the world where we have gotten better at understanding the importance as an example of couching resource objectives in the context of fire regime dynamics. That's had a positive long-term outcome in terms of biodiversity and water quality and protection of human life and so forth. Having adopted those practices, the short-term challenges are very difficult; smoke impacts to local communities that may be short-term or short-term sedimentation in watersheds following prescribed burning. But, when contrasted over the long-term in the broader context of sustaining a functioning, resilient, healthy whole, those viewpoints become good models for us to begin looking at. That's what I mean and I think that's what many of us mean when we talk about trying to optimise management strategies and optimise objectives rather than the more conventional maximisation models we have typically employed.

MR RUSH: So that's a particular role for the land management agency in the use of prescribed burning, to optimise it in terms of both types of risk that Professor Adams is speaking about?

MR WILLIAMS: I think so. I think that's one of the reasons we are as a panel drawn to this notion of trying to bring in-house research and natural resource specialists and fire managers all together working on this common notion of managing a whole ecosystem rather than the discrete parts of an ecosystem where just by nature we begin to compete with one another.

MR RUSH: Dr Tolhurst?.

DR TOLHURST: I think there is a lot being said here which is really good. One of the most difficult things, though, is
actually how we come up with these objectives in a community agreed form. I think Victoria is particularly well served by the code of fire management practice that it has in place. We spoke about it to some extent on Saturday. The code actually provides a mechanism by which we can basically come to some community agreed objectives, because it shouldn't be necessarily something that is set by a department or a political interest. So it needs to be a community agreed set of objectives and then as a technical issue in a sense how we optimise those. So I think we need to separate what the community's role is here as distinct from what the technical role is.

Now, I guess of course there is the context of legislative requirements that we have to fulfil. There are international agreements. There are national policies that have to be aligned as well. But that is part of what the code of fire management practice is actually good at, is reconciling all of those requirements, but then requires that community input.

So I think I'm in full agreement with what's really been going on here in the discussion, not maximising but optimising, but the process by which we do that has to be a community process. I think that needs to be clearly defined in the code of fire management practice so that we can actually come up with that. That's dealing with all land, not just public land; it needs to be private and public land. So local governments are going to have to take a very key role in this as well, I would see.

MR RUSH: In relation to the optimisation model, Mr Williams, where do we prioritise life and property against the
threat or the risk to species and ecosystems?

MR WILLIAMS: Nobody would sit in front of you and say life and property is something less than the first order objective. One of the problems that we struggle with, though, is how do we couch that over the long-term. We have built communities and reinforced a notion of safety with larger and larger fire departments, as an example. Over time we have found that in adopting that line of thinking we have actually placed communities at risk.

The whole challenge of optimisation models is trying to see things in context, I believe, trying to look at the long-term. I heartily agree with Dr Tolhurst that this isn't something that government can do in isolation. It involves the whole community looking as best we can to the long-term trade-offs involved, because ultimately I think this really is about those trade-offs.

MR RUSH: Dr Gill, do you have anything to say in relation to this aspect and the nature of risk and trade-off?

DR GILL: No, I'm just thinking that the trade-off might be a better term than optimisation in any one place. So to achieve optimum outcomes there may be a zonation in space.

MR RUSH: I'm sorry?

DR GILL: There may be a zonation of what is considered to be the primary asset in space; so zones 1, 2, 3 and 4, for example.

MR RUSH: We will speak about that in a little bit more detail this afternoon. When one looks at the summary of discussion by the panel and the statement "achieving prescribed burning treatments of the order of 5 to 10 per cent will be costly, contentious and not without residual risk", I take it that one needs the skilled
organisational structure to back up that increase on where Victoria is at the moment. Are those particular needs part and parcel of the increase that is spoken about there?

MR CHENEY: I would say very much so and totally essential. Government in its departments can do so much. They can do a lot in reducing the risk. History tells us there tends to be a reliance on the public, on the government and the agencies to do this job for them to the extent where the government agencies find it's very difficult to do a prescribed burn around a certain centre or certain asset because of the fuels that have accumulated within that asset, to the point where if they get escape under even mild prescribed burning conditions they will do substantial damage.

So our big challenge in the overall management is persuading all levels of government to take the appropriate action and to reduce the fuels appropriately not only in the public lands but across other areas, including towns and private forests, so that the risk is brought down to an acceptable level.

MR RUSH: Professor Adams, if I can ask you in relation to training and education, the universities and the colleges of Australia, what's happened in relation to the sort of forestry skills and matters that give that form of expertise over the last 10 or 20 years?

PROFESSOR ADAMS: That's a sad subject. There is no doubt that we as a community have not been served well by the decline in the number of graduates from professional courses that used to come out of our forestry schools, particularly at Melbourne and ANU. That declined, because that was the
place where the greatest level of skills both in firefighting and in prescribed burning were created. The collapse of student enrolment and student interest in the area has been, in my view, quite disastrous for the broader community.

But you are right to point out that this is a 10 to 20-year phenomenon. It takes time for that to happen, for the decline in student interest to happen, and it is a very good question as to why it has happened. Now, in part and in my view it's because there has been very little for them to see as a career. The public perception of careers as professional foresters has been badly affected by the way it has been portrayed in the media - I'm not here to bash the media - and it has also been badly affected by the way it has been portrayed by other interest groups. Where once it was viewed as a noble profession, no longer in many people's eyes.

It is important, I think, that as a community we now go back and say we desperately need people to be well trained. We desperately need the government agencies to be employers of people and to discriminate between people who have had strong and rigorous training from those who have had - and I have to be careful of my words here - mickey mouse degrees that provide no real substance of the day to day needs for managing forests.

So I think this is a sad story. It is important now that we start to fix it in Australia. It needs governments as the major employers - and we keep coming back to this point. As Phil said, governments can do a lot. Most people who were trained in this area were employed by government. So it will have to be again in
the future. We need to ensure then that the employment is there, that the due accord is given to those people who have been trained and who have then gone out and done the job.

MR RUSH: Dr Tolhurst, are your graduates coming out with the skills of what might have been thought to be appropriate 20 or 30 years ago, and is there a career path for graduates from the forestry course that's offered by Melbourne University?

DR TOLHURST: I would say I guess that the students that are graduating these days haven't had the same degree of practical experience and actually time in the field as well as supplemented by the science that supports it that students 20 years ago would have had. The contact time, the time to actually spend one on one has reduced.

The emphasis has become more on, I guess, being able to collect existing knowledge from published scientific papers and the like and put it together into a plan or a policy document. That's where the emphasis has really been. That's an important element in itself, but it needs to go hand in hand with the practical experience.

One of the issues that I see, I guess, is that in conducting a prescribed burn you really need to have a good understanding of what the plants and the animals, the soils, the environment that you are actually working in, what it is and therefore what impact fire might have on it and how you may change your burning activity to make sure you actually achieve the outcomes that you want. So we have some training that helps people conduct a burn in a safe manner, but it doesn't necessarily provide us with the outcomes that we are saying that we need to have well
defined.

I would make the analogy, I guess, to some extent that a physicist may be able to tell you how materials and so on in a bridge might work and what stresses might be there and so on, but you actually use an engineer to design it and build it; it is not a physicist. Likewise, you don't use a botanist or a zoologist to manage public land, but they have an important role in actually informing the management process. You use someone like a forest scientist or you use a conservation biologist to actually provide that broader view of how things fit together. So you are using your science but you are also using your practical background.

I think the pressures have been on universities to actually reduce the contact time, and the practical element is missing. Within land management agencies themselves they have, I guess, reduced the time that they have to actually allow people to develop that skill in conjunction with people who are more experienced and have been through the process themselves. So the development of people is less than it used to be.

I think that's been reflected in more variable and sometimes undesirable outcomes from a prescribed burning program which has put the prescribed burning program under pressure, if you like, for the wrong reasons; not because fire is inappropriate or because fire is a bad thing, it is because it has been perhaps not applied as well as it should have been or could have been.

If we can learn something from the indigenous people in a sense, they were often very thoughtful about how they actually applied fire. It was a practical
knowledge, but they also knew when and how to light.

Going back to what Dr Gill was mentioning first thing this morning, we can't put in place - we don't even know what those systems of work were, how they used fire. But we can learn from some of the patterns and some of the processes they had in place. We need to relearn that both at a tertiary institution level but also as an employer and a land management agency.

MR RUSH: Mr Cheney, as someone who has been the supporter of the land management agencies this morning, I put this generally to you: there was evidence last week of a great reduction, it might be said, in relation to full-time staff in the land management agency in Victoria and what might be seen as a heavy reliance on part-time persons over the summer months or the bushfire season.

If the type of increase in prescribed burning is to be undertaken that is set out in the paper and the discussion we have had this morning, what do you see as being necessary to ensure that that is done properly and having regard to the sort of issues that have been raised, particularly if you accept what I have put to you as to being the present position of Victoria's land management agency?

MR CHENEY: I do accept that and, as Professor Adams said, that's been a decline that has followed the reduction of the forest industry throughout our native forests. When it comes to fire there is a technical knowledge about how fires burn, but there is also a very important experience component that helps individuals interpret that technical knowledge. Without both of those, the operation of prescribed burning can very easily go astray.
I believe that in areas where there have been a workforce that has become familiar with the problems in the burning of the area that has enabled the fire management agencies to achieve a much better result than one in where we are just applying a technical or application of a technical prescription without that full understanding of what happens in the field. In places the whole of the staff of the organisation - the whole of the staff of the organisation - is assessed for both their technical expertise in fire and their practical experience at different levels, and both of those factors are absolutely essential.

I think it is absolutely outrageous that our governments have relied on the volunteer firefighters to do so much work on the public estate that they are being asked to do. I think that the volunteers do a fantastic job. But they cannot do prescribed burning at the level of technical expertise and time that is required to do it. Most of them have other jobs.

Prescribed burning is a rolling process of planning and application that requires a professional organisation to take it on and apply it. That organisation must also be responsible for what happens after that, and that's the suppression. Unless the land agencies take on this in some way which is across the board of all the agencies managing public land in Victoria, there has to be some overall coordination because the fires don't take any notice of the tenure, and the prescribed burning has to be applied on the basis of the vegetation type and its position in the landscape rather than the tenure, and so we have a situation where
it will not go ahead unless it is professionally managed,
staffed and funded.

MR RUSH: That may be a convenient spot to conclude.
CHAIRMAN: Yes. We will resume at 2.

LUNCHEON ADJOURNMENT
UPON RESUMING AT 2.00 PM:

MR RUSH: Before lunch I asked Professor Adams directly about the career path in forestry and the like. I perhaps didn't go to Dr Bradstock. Have you got a comment in relation to that and the nature of training and what's being offered?

DR BRADSTOCK: Yes, just a brief comment, and I accept and understand and endorse a lot of what was said. I think we have to look to the future. I suspect that education and training needs in the future will obviously be driven by the fundamental point that people said, which is job demand, so it is all about creating that. But I also think the education and training solutions in the future will probably be different than the past because the educational institutions per se are changing. So, what happens in the future will have to be within that context of different types of institutions and different courses and stuff. That's going to be the nature of the beast, so the challenge will be to up the ante, but within that context.

MR RUSH: Dr Bradstock, another matter in relation to increasing the amount of burning concerns modelling and the research that we have spoken about. Would the idea behind that be to develop the treatment options and the range of treatments available within that generic term?

DR BRADSTOCK: Yes. I think one of the issues that's been touched upon here is we can enter into trials and monitoring of the real world, but it takes a hell of a long time to really understand how systems like this change. We are talking about long-term changes over vast areas of land, so you need to collect information and look
at that. But we also have the increasing capacity to try
to model systems and if we do that carefully and we do
that in conjunction with working out how the real world is
changing, it gives us another string to our bow.

I wouldn't advocate being dependent on models,
but we do have models of increasing sophistication.
Technological changes will up the ante in that regard.
There is an interplay between the real world and modelling
which always has to be sustained and kept in mind, so it
is one of these things. All problems of this magnitude
need multiple lines of evidence to understand, so
appropriate models can provide insight and a line of
evidence that can be compared with other pieces of
evidence. So, keeping that going and resourcing it is
important.

MR RUSH: Does anyone want to say anything in relation to that
particular aspect? Dr Tolhurst?

DR TOLHURST: I guess Dr Bradstock has been working on this for
quite a while and with the risk management modelling that
we have been doing as part of the Bushfire CRC, I think,
as Ross has alluded to, we have been able to incorporate
some aspects of road network, of suppression difficulty,
as well as some other sort of elements of realism,
I guess, that weren't previously possible in some of the
older models, but they really provide some useful insights
to some of these longer term potential impacts that are
otherwise difficult to determine just through monitoring
or through research. It actually helps to put the thing
together.

I would have to say the models are also a very
good communication tool as well to be able to demonstrate
particular issues when you are putting options to a
community forum or even to decision makers, land managers,
for example. So I think models aren't reality but they
can capture a lot of the complexity and at least they have
a consistent, even if not 100 per cent correct, they have
a consistent output. I think that has to be part of the
way in which we come to our decision making and our
communication in the future, so I fully support what Ross
has said there.

DR BRADSTOCK: If I can just very briefly add a point to what
Kevin said. It is a subtle difference, but where we are
with these types of models is not so much about
forecasting but they actually give us an understanding of
how the system works and which bits are sensitive to
change and perhaps management inputs. If they are used in
that philosophy as a way of exploring the way the system
responds, then they are very powerful. Where they might
fall down is if you try and over-rely on them as
forecasting tools. We are not quite there yet, perhaps,
in that regard.

MR RUSH: If I can briefly turn to two subjects that we have
spoken about. One is the topic of mosaic burning. It has
been mentioned before or it has been said I think this
morning that mosaic burning in a way is carried out in a
normal prescribed burn. Dr Bradstock, you have mentioned
this, I think. What does "mosaic" mean? Has it got a
meaning?

DR BRADSTOCK: At a very simple level it simply means
variability in the pattern and intensity of fire in space.
We expect from one point to another there may be some
variation according to all sorts of factors; fuel, weather
variation and perhaps topography. However, there are other meanings which are attached to the term "mosaic" and there is, I guess, a lot of inference that mosaic has a certain specific connotation meaning high levels of fine scale variation in fire and so in common usage mosaic is often intended to convey high levels of variability at relatively small scales.

It is worth saying a number of things. All fires create mosaics; all fires are variable; the scale of variability varies tremendously according to circumstances and measurement of this thing called "mosaic burning" is almost non-existent. So, it is something that people believe is true and believe to be important, people believe that it is important, but strict definition and strict measurement of variability is lacking. In particular, the connection of that variation with the response of the system, particularly plants and animals, is also lacking.

So we tend to use it and we think it's good, but we don't really know what it is and so the whole thing needs a great deal of work to define it more carefully and measure it more carefully.

MR RUSH: Mr Cheney, from the, if you like, practitioner's point of view, in the foothills of Victoria is it possible to burn with the sophistication to create that mosaic?

MR CHENEY: Well, not initially. Again, as Ross said, what is important is to understand the scale. Some people would call 2,000 hectare blocks scattered across the landscape a mosaic. Other people will want to understand it as a 50 per cent burnt coverage over every block, where we have an unburnt block here and a burnt block there in very
small scale. Practically that can't be attained unless you are burning extremely young fuels, which probably are two years old, when there's already separation between those fuels so the fire won't spread.

Once you have continuous fuel, the only thing that is going to stop the spread of that fire is a change in the moisture content, either because of its position in the topography or because of the change in weather conditions, usually that night.

In terms of doing an operational prescribed burn where you get what experience has said to be effective is something better than 70 per cent burnt, the mosaic is going to mean that your burnt areas are mostly your dry ridges and the unburnt areas are the moister creek lines because that's the natural spot that the fire will stop. So this is one of the reasons why I tend to favour going for the bigger blocks because you then have in any one operation a variation in moisture levels within the fuels that will give you some separation of burnt and unburnt areas and will give you some edge effect which is useful for both habitat and different plants and animals.

But, again, I think it is a term which has been badly used and really for most of the operational people their mosaic is the distribution of burning blocks across the landscape, rather than the variation of the unburnt areas within that individual block.

MR RUSH: Does anyone else want to make a contribution to this particular aspect?

DR TOLHURST: I guess I would just like to come back and reinforce one of the aspects that Dr Bradstock came up with, which was that a lot of our past research has really
looked at averages and things that are more easily measured, whereas in fact, particularly from an ecological point of view, we need to be looking at the degree of variability, both if you like the spread as well as the — yes, the spread in time and place across the landscape.

Our research hasn't really dealt with that very well and that's partly a technological thing, it's hard to analyse that, but there are statistics now which are helping do that and we have computer programs that will help do that, but it is an area of research which is very young, I would say, it has probably only been around 15 or so years, but its management is not really using those concepts.

I guess the other thing that I would say is that, in addition to what Mr Cheney just mentioned, ignition pattern is a really important aspect of achieving burn outcome and how a fire is lit in both time and space. The spacing between ignition points, what time of the day and so on, will significantly affect the percentage of the area burnt and how much of the fuel is available when the fire reaches it. That is a very skilful task because often the ignition pattern needs to change every few metres, perhaps, across the landscape. It not a matter of putting in a 500 metre ignition grid across the landscape; it may need to change depending on the topography, the time of day and so on. It is actually a highly skilled operation to achieve the outcome you want, but ignition pattern should be seen as one of the key factors that plays into the fuel moisture and fuel distribution that Mr Cheney mentioned.
MR RUSH: Moving perhaps to a different topic for the fire experts, during the course of the Royal Commission from time to time the word "unprecedented" has been used in relation to the fires of 7 February, the Victorian fires of 7 February. I just wonder, perhaps, going across the panel, whether that terminology or whether the fires in themselves were an event that we had never seen before. Do you have a view on that, Mr Cheney?

MR CHENEY: I certainly don't think they are unprecedented in even our recent history over the last 50 years. What we are doing better is making more measurements and making more observations, so in some ways it is more of a guess to say was the damage from these fires better or worse than damage from fires previously. Certainly to the built environment it was probably unprecedented, although we had Hobart in 1967 and during those fires the township of Snug, which was almost the size of Marysville, was completely razed to the ground. So, the fact that you lost a whole town is not unprecedented.

In looking at the photographs of damage from the 1939 fires, it was my opinion that the physical damage to the trees as illustrated in those photographs, where whole large ash trees were snapped off and smashed, seemed to be higher than anything that I have seen from the recent fires, although I haven't been right through the areas. I think one thing that is quite important to appreciate is the difference between the way we measure our fire danger rating and our fire danger index and the way we measure rate of spread and it is to do with the influence of wind. I hope this doesn't get too technical, but I will try to be as simple as possible.
The relationship between wind and fire danger index is a power function that's somewhere between 1.7 and 2, which means that if you double the wind speed, then you have got something like a four times increase in the index. The relationship between wind and rate of spread is a linear relationship, so if you double the wind speed you only get an equivalent increase in rate of spread.

Now, a lot has been made of the fact that we had some remote weather stations that recorded very high wind speeds on a 10 minute observation. In the past we didn't have those. In 1939 the only weather observation was down here in Lonsdale Street at the Weather Bureau surrounded by buildings and we can't compare the record there in any way with the record from an AWS on an exposed hill at Kilmore.

So, I think there is very little evidence to say these were unprecedented. I think when people talk of, you know, a fire danger index hitting 160 as being quite bad, that's not quite as serious in terms of the fire and the fire intensity.

Just a little bit more, if I may. The fire danger index is supposed to represent suppression difficulty and how hard it is to put out a fire. In the past it has been directly related to rate of spread and fire behaviour, but that's incorrect because of the difference in this function between wind speed and rate of spread, wind speed and what's perceived to be, by McArthur when he created it, suppression difficulty.

If you think about the problems that we have under extreme conditions with high wind speeds, the major effect of the high wind speed is to promote prolonged
glowing combustion. So, when the flames have passed and they last a relatively short time, tall flames about 10 to 12 seconds and continuous flames around about a minute or so, we then have following that combustion which is accelerated by the strong winds and so quite large pieces of wood, which under mild wind conditions wouldn't catch alight and burn very strongly, now catch alight and burn. Little sparks that lodge in the frame or wooden parts of houses are burning because they are kept alight by the strong wind. That is why the wind function is so important in suppression difficulty.

MR RUSH: Dr Bradstock?

DR BRADSTOCK: Phil Cheney has summed up many of the points very well. I don't think these fires are unprecedented, at least in historical time, in terms of size and intensity and pattern in the landscape. I guess the thing you could add to that, though, is we must appreciate that land use and people and property are very different now than they were in 1939 or even 1983 and so you have to take that into account in understanding consequence of this event.

MR RUSH: Professor Adams?

PROFESSOR ADAMS: No, I again agree with Phil Cheney's assessment. The word "unprecedented" is a little absolute for me. I don't believe it is unprecedented. What I will say is that we have, as Phil said, one of those remote weather stations that we have maintained in the ash estate not far from Warburton. That was operating all the way through that period and we have compared long-term climatic records for the seven stations that we can find that cover the mountain ash estate. What they show us is
that, since about 1927, that summer of last year was
certainly one of the driest on record and certainly the
month of January was an extremely hot month. If you look
at the relationships between dry and hot summers and the
incidence of major bushfires in the mountain ash region,
there is a very strong relation. No surprises in any of
that, but it only serves to reinforce the point that this
is not unprecedented, particularly for that forest type.

MR RUSH: Dr Clarke?

DR CLARKE: I have nothing further to add.

MR RUSH: Thank you. Dr Tolhurst.

DR TOLHURST: I'm agreeing with the others, really, that
I don't consider it unprecedented. The two things that
you could perhaps consider as being unprecedented, as
Professor Adams just said, the severity of the drought was
the driest on our recorded record. So, over 100 years of
rainfall records, it was the driest period.

I think the other thing that makes it a bit
different was, I guess, the extent of the hot dry windy
conditions across the state as well. Not related to those
things is the impact of the fire on life and property was
unprecedented. But the fire itself wasn't. The
400,000 hectares or so that was burnt in 2009 was typical
of a bad fire season year. So the million hectares that
we saw burnt in 2003 and again in 2007 I would say are in
quite a different category in a sense to what we saw in
2009. So the fire behaviour I wouldn't say is
unprecedented, but some of the background conditions are.

MR RUSH: Dr Gill?

DR GILL: Seeing I'm on the end, perhaps that calls for a
little summary. Using "unprecedented" depends on what
criteria you are using. So the weather may have been a record level in certain aspects, and that in those terms is unprecedented. The area, as Kevin is saying, was not unprecedented, and I think Phil was saying about the sort of damage. The other point I would add to that is the longer the time period the greater the chance you have of getting a record. I hesitate to this: you may or may not want to go into climate change.

COMMISSIONER McLEOD: Could I ask a question just on that point that you have raised, Mr Rush. Dryness of the fuel is obviously a very important factor in terms of its ignitability. Is there a point at which the fuels have reached their maximum level of dryness such that another week of drought or another two weeks of drought is not going to make any difference? So the measure of the length of the drought may not be significant. It may be that the drought has lasted for so long that the fuel has reached its optimum level of dryness. I think there is certainly a tendency to look at the length of the drought as a measure of the magnitude of the risk. My question is: is that reasonable or not?

DR TOLHURST: I think you need to look at the various components of fuel; what we would call the fine fuels, basically the fuels that change their moisture content within one or two hours of the ambient conditions changing, so that's a very rapid rate. The Americans have I think quite a useful system in -- --

COMMISSIONER McLEOD: Which, if I can interrupt, I think we have been told earlier in our hearings that the fine fuel is the most critical in terms of ignitability?

DR TOLHURST: That's true, and it will have considerable effect
on flame height. The American system where they talk about one hour, 10-hour, 100-hour 1,000-hour and I think 10,000-hour fuel indicates how long it takes to come into equilibrium. I guess at the other end of the spectrum you have live fuels, which would normally maintain a moisture content because of their normal growth processes, physiological activity. Under severe drought and the conditions we had on Black Saturday, some of those live fuels were significantly drying out more than they would have otherwise. So that week-long heatwave that we had actually killed some of that live fuel and actually dried it out.

COMMISSIONER McLEOD: That's really adding to the fuel load.

DR TOLHURST: It is, but it is part of the fuel mix that it is much easier then for that to combust if it has already been partially desiccated. The large woody material is very slow to respond to weather conditions. So there would be continuing drying out of partially rotten logs and large logs on the ground and so on which would be potentially consumed more the longer the drought goes on. So I think it would take a very long time to actually reach the equilibrium where the whole environment is dry. But Mr Cheney might like to add something to that.

MR CHENEY: I think it is important to appreciate that, regardless of the drought, a change in atmospheric moisture will mean that your fuels won't ignite. But, as Dr Tolhurst has said, as you continue to progress more and more material slowly becomes available until in the end, I guess, the whole of the living vegetation dies. Then that would solve your problem a bit anyway because once it has burnt there is nothing else there. Sorry to be
facetious on that.

COMMISSIONER McLEOD: I think you are really saying there is no research that you are aware of that has been able to put a dimension on the extent to which the length of a drought does in fact, as you put it, create more fuel. Is it slow or is it rapid? That's really the sense I'm trying to understand.

MR CHENEY: There are some guidelines. There are a couple of indices. The Mount's soil dryness index is one of them. The Keetch-Byram drought index. These are indices which are correlated with the degree of dryness of large material. In very rough terms for our forests in Victoria or let's say the foothill forests of Victoria, when the index exceeds 100 then generally you have the capacity that all the fine fuels in the fuel bed on different aspects come down to about the same moisture. So you don't get a change of fire behaviour dependent on fuel moisture when a fire moves from one aspect to another.

The other thing is that, again in pretty general terms, when you exceed 100 the large log material tends to stay alight overnight. So in that case, where firefighters under lower drought indices may be able to take a break overnight and then come back the next day and just mop up, at over 100 you know your fire is going to stay alight overnight and is going to have the potential to keep burning.

COMMISSIONER McLEOD: I guess our interest has been to focus on the first four or five hours, because that's where the vast bulk of the damage was done in that particular fire. The fact that logs are burning overnight, in a sense, is interesting, but it didn't really add to the destruction.
that occurred in the first four or five hours after most of the fires ignited.

DR BRADSTOCK: There is some international research which relates particularly through remote sensing the live fuel moisture content, in other words the moisture content of the canopy, to fire activity particularly in shrublands in Europe and some emerging research in America. You can look at the correspondence of drought indices with those measures. There is relationships between area burned and that sort of thing. We have actually been extending that to our own local research backyard.

The evidence, even though it is research in train, seems to suggest around my region that if we have a month without rain in summer then it is ready; it is ready for a substantial fire. That needs further clarification, but I think that's a reasonable yardstick. We can see it in our remote sensing data for that particular region.

MR RUSH: Mr Williams?

MR WILLIAMS: It might bear repeating, but I think one of the more important features of drought is how moisture differential tends to disappear across a landscape. In our situation, as an example, we might normally expect our north slopes, your south slopes, to hold moisture much longer as we would river bottoms and that sort of thing. But in a drought those parts of the landscape also dry out. In terms of overall contribution of heat to an environment, they can add significantly.

That's one of the things that we see in this megafire phenomenon, is how these fires build up a head of steam, if you will, across a large landscape and no longer is the fire behaviour mitigated by a little more moisture
on one aspect or at a lower elevation, in a creek bottom for instance. I think that is a defining feature of prolonged, persistent drought.

MR RUSH: Commissioners, that probably neatly finishes one area.

CHAIRMAN: Yes.

<CROSS-EXAMINED BY MS JUDD:>

MS JUDD: I wish to just get some clarification about a couple of aspects of the consensus document. Given that you are sitting in the middle, Dr Clarke, perhaps I could start with you. If you could turn to paragraph 11 of the consensus document, you will see there there is reference to a figure of at least 5 per cent of the available public land estate being subjected to prescribed burning. What did the panel mean when they were talking about available public land estate? Perhaps if I could ask an even more specific question. Does that mean treatable public land?

DR CLARKE: My understanding was that was to mean treatable public land.

MS JUDD: Dr Tolhurst, I see you nodding. But, for the transcript, is that an agreement with that proposition?

DR TOLHURST: It is my understanding that was the intention in that paragraph. Then there is the 5 to 10 per cent as well.

MS JUDD: Certainly. At the moment I'm just asking about what was meant by that expression "available public land estate". We can take that as treatable public land. Then if you go to paragraph 20(b), in determining the figure of 5 per cent in the foothill forests in that particular paragraph is that a figure or a percentage more akin with treatable public land?
DR CLARKE: Again, I would say yes.

MS JUDD: So you are not taking into account in that paragraph untreated public land such as rainforest?

DR CLARKE: I'm going to seek clarification from the rest of the panel here.

MS JUDD: Dr Tolhurst, maybe you could comment on that?

DR TOLHURST: I wasn't the only one there. My understanding of what we were talking about there is, if you like, almost a trial sort of use of prescribed burning and we were talking about particularly of progressing this in the foothill forest areas where there would be less contention in terms of the impact of the fire and we knew it was an area of high priority in terms of protection of life and property. So our discussion there was revolving around the first implementation, if you like, of a trial.

MS JUDD: In terms of a first implementation or a trial, if we are looking at an initial percentage, is what you are saying mean that there needs to be flexibility in terms of being very prescriptive about a target in Victoria for the future?

DR TOLHURST: We discussed as a group, as I understand it, that we considered at least 5 per cent of the landscape needed to be treated before we would see a distinctly measurable benefit from the prescribed burning on large and intense fires. So this was really meant to provide that starting point. We are saying that really you are not going to see the benefit of that until the program has been in place for 10 years at least.

MS JUDD: Am I correct in understanding that that 5 per cent, when you look at 20(b) and you look at paragraph 11, you are looking at a possible target of about 5 per cent of
the treatable public land that might start to have some
impact on protecting the community a bit more?

DR TOLHURST: That's correct.

MS JUDD: In terms of looking at those figures can I just ask
- and I'm not saying that there should have been; I'm just
trying to clarify where you are coming from - was there
any consideration, in terms of fixing on that trial target
or that trial percentage, of the ecological requirements
and tolerances? Did that come into the measure in terms
of coming up to that 5 per cent?

DR BRADSTOCK: I think what we said was if you went for
something around 5 per cent in foothill forests that it
was our consensus that at least that would be okay in
terms of vegetation responses, though we noted that there
is very little information about animals. So that was
part of the deal. We reckoned the vegetation could cope
with that; plenty of evidence to suggest that it could.
We don't know much about animals. We need to monitor it
if you are going to do it. But that's not a reason not to
do it.

MS JUDD: So what you are saying is perhaps let's start off
with this figure, but in terms of long-term objectives you
would need to take into account future research, future
science, future monitoring; is that what you are saying?

DR CLARKE: Absolutely. I endorse Dr Bradstock's comment,
particularly in relation to fauna and our ignorance of the
impact on fauna. But the evidence to date suggests that
that doesn't look like a dangerous level in that habitat.

I guess the other thing we were emphasising in
20(b) was we think this is a habitat that's important for
human life and values and assets, and one in which a trial
could take place without major risk to ecological values,
but that we would want to monitor that.

MS JUDD: In terms of the monitoring, the research and the
science, are you looking at both fire behaviour and the
ecological considerations?

DR CLARKE: Indeed.

COMMISSIONER McLEOD: Although, I think to be fair, you did
indicate earlier that the level of scientific
understanding from an ecological point of view of mammals
is very, very scant at the moment.

DR CLARKE: Yes, and I wouldn't just single out mammals.

I would go beyond that.

COMMISSIONER McLEOD: So what is the implication of that? All
of that science needs to be done; is that the implication
of the question; you need to get your science up to
scratch before you can combine it with bushfire science
such that you are giving equal weight or similar weight to
both considerations?

DR CLARKE: No, I think the panel was of the opinion in this
particular habitat type of foothill forest the risk was
worth taking, provided there is a commitment to learning
as we do it, and that couldn't be said for other habitats
about which we know less.

COMMISSIONER McLEOD: So your judgment was at the conservative
end of the spectrum that you talked about, 5 to
10 per cent, where you felt more confident that with the
current, though limited, state of knowledge of ecological
impacts in your judgment it was a relatively safe figure
to fix on for a trial?
DR CLARKE: Yes, for a trial, because we also need to learn
about the effectiveness of preserving ecological values by
this very action as well and, without doing it, you won't
know whether it was worth doing.

COMMISSIONER McLEOD: I understand that.

DR TOLHURST: I would just like to add there I think it would
be fair to say I don't think we should leave the
impression that it is vacuum of knowledge in terms of the
effect on fauna, including mammals, invertebrates, bats
and so on. There has been considerable work done on the
ecological effects of fire in this type of forest, both in
Victoria and in other states. So it is not as though we
are starting from scratch. It is probably one of the best
understood vegetation types. That was part of the
consideration that was being made. We are probably surer
about the vegetation, but the fauna is certainly not an
unknown quantity and we have enough research to at least
make a start here.

DR CLARKE: Can I make one distinction here. Our understanding
of the implementation of the prescribed burning practice
is reasonable in this habitat. The long-term consequences
when challenged by fire is less well understood for fauna.

DR BRADSTOCK: Could I add one more thing too. On the other
side of the ledger there could be ecological benefits from
doing 5 per cent. We have heard, for example, water yield
might be something to consider in that regard. There is
knowledge to suggest that. So we must note that as well.

CHAIRMAN: Could I just raise a query in relation to the
5 per cent linked to the evidence that we had last week
from Mr Sneeuwjagt that basically said, and I am probably
oversimplifying it, that if he had to pick a figure, his
centre of the road figure, if you like, was 8 per cent, but that's based upon, if you like, the 40 or 50 years of very close dealing with a relatively limited - not so much limited - manageable area of much the same terrain with much the same comparable eucalypt species to some parts of Victoria, and I take it that, viewed in that light, his eight per cent, the five per cent is conservative.

MR CHENEY: I would agree with that. We said five to 10 per cent. If you ask me personally, I would say eight per cent. I would also like to say that the panel agreed that this should be a program, not a trial. The word "trial" has come up, which is tending to say we should confine this only to some relatively small area. No, the panel said that we should apply this as a program across the dry foothill forests of Victoria as an area basis, not in one specific area.

MS JUDD: But in terms of a more permanent target, you are saying that there needs to be more research and more monitoring; is that right? Appreciating what you say about trial or program, you start with a trial or program for the five per cent of treatable public land or in the foothills, but in terms of a definitive target there ought be more research; is that what's being said here?

PROFESSOR ADAMS: No, I don't think it is. I think we say, as Phil just pointed out, five to 10 per cent. We discussed at length the difficulty of achieving targets and we say in the preamble or in the context statement that it will be difficult to achieve and we fully expect that if you even aimed at five to 10 per cent, you might end up with a figure of eight per cent. It is not going to be easy.

But I also think that we were quite clear that, as a
program, we say that it would take at least 10 years to implement it and that it should be monitored, but it is a program of the five to 10 per cent in the foothill forests, with monitoring, yes, but in the sense of a "trial" we end up on a semantic point. A program that might take us a minimum of 10 years to implement, is that a trial or is that prescribed burning?

MS JUDD: I think you called it a "regime" in 20(b), a regime with a five per cent target in the foothill forests of Victoria, so we now have another expression in the mix.

MR CHENEY: Could I just say that I believe the research has to be ongoing, I agree with you there, and it has to be in both the ecological side, the hydrological side, the actual burning guides need to be refined and developed and that will require research. So, yes, research is an ongoing process, but until we start applying this at this level we won't be able to do the research, so it follows, it has to follow. You have to start implementing it at a landscape level and then, if that raises problems, of course then you will do research into it.

CHAIRMAN: Could I again clarify. As I understand it, in the mid to late 1980s, perhaps before the cost cutting became more significant in a lot of other areas as well, we were having five per cent or more actually being burned, although we don't know where and what value, but if that had been continued we would have had a lot more presumably of the information that would enable a more informed assessment to be made as to what the ongoing process should be, or are we just speculating?

DR TOLHURST: I think that's all true. I don't know that we spoke about it in these terms, but we sort of recognised
that it wasn't going to be possible tomorrow to suddenly start a program of five to 10 per cent of the landscape. We were I think looking for ways in which we could start the implementation more or less immediately and we considered it was worthwhile actually applying it, our current resources, until we have the skills and the resources built up, at at least one location where we can have a fair dinkum look at what the value of doing this is.

So, I don't think there was any intention that we'd wait until the end of, say, 10 years before we went any further. It is a matter of, "How are we going to start this program off?" The suggestion was, "Let's concentrate on a few areas in this foothill forest and get the program up and running," but we recognise the resources and the skills weren't necessarily going to be there at day one.

MS JUDD: Thank you.

COMMISSIONER McLEOD: Could I just clarify that a little. I think the word you used in the middle of that explanation implied that you were assuming that existing resources being applied would be the level that would be maintained; is that correct?

DR TOLHURST: I'm assuming there is not some hidden pool of resources that is currently under-utilised that will suddenly be able to be applied to this. It is not just about people, it is also about people with adequate knowledge and skills that need to be applied in implementing such a program, so I don't think it is something we can kick off as a running program within 12 months. I think we can start it in some locations and
we need to be a bit strategic about how we actually start to implement the program.

MS JUDD: Even if resources were significantly increased, there is still going to be a period of time for the regime to get up to that kind of level. Would that be correct?

DR TOLHURST: That's the intention of the 10 year span there. We figured we are not going to be able to really measure any effectiveness for at least a period of 10 years.

MS JUDD: But again, even if resources were increased, it takes time for, say, new people coming on to perform these operational activities and, in terms of carrying out the monitoring and research and so forth, there has to be training and skill levels I suppose across the board to be able to be carrying out the planned burns at this greater percentage. Is that correct?

DR TOLHURST: I'll say yes. I'm not sure if anyone else ---

DR BRADSTOCK: I would agree. But can I also add that, you know, ramping up in that manner you will need increased resources or learn more about the costs and the implications of costs over much wider scales, so that's implicit in implementing the regime. It is not just what's going on in terms of the fire activity on the ground, but it is also that resource and cost part of the deal.

MS JUDD: And the other part of this equation is the broader community acceptance and acceptance by rural industries and so forth. Does that have to go into the equation?

DR TOLHURST: We deliberately acknowledged that there needed to be a program put in place and part of that was engagement with the community and setting up what the objectives ought to be, so it is not only about the operational side
of things. It is also making sure the rest of the social
and political framework is in place.

MS JUDD: If I could move on to a different topic.

Dr Tolhurst, perhaps if you could start by answering this,
but I'm happy for anyone else to add to your answer.

Commissioner McLeod asked a question about planned burns
giving more time for warnings. There was a bit more to
it, but if I can just ask about, in the context of
warnings, do you agree that if planned burns are strategic
rather than random, the early reduction of fire behaviour
gives a much greater opportunity to warn the community?

DR TOLHURST: Yes, I thought that was the purpose of the
question in the first place. If the fire is moving more
slowly and taking longer to build up, then it will take
longer to reach a particular point in the landscape.

MS JUDD: When we are talking about "strategic" here, are we
talking about the planned burns creating opportunities to
help prevent the fire starting, as one example?

DR TOLHURST: "Strategic" I would consider to be talking about
the placement of these prescribed burns both in time and
space in the landscape and that might be in areas where
there is a high ignition probability or it may be in areas
where you know you are going to get severe impact from the
intensity or embers from a particular location in the
landscape. So, it is about modifying the fire behaviour
as well as modifying the initiation of the fire in the
first place.

MS JUDD: So we've got the fire initiation. Does it
incorporate assisting in initial and ongoing attack?

DR TOLHURST: Yes.

MS JUDD: And reducing the intensity of fires as they approach
DR TOLHURST: Yes. Anything to do with "strategic" means it is a selection of one site or location or time of implementing a burn that will give you a greater benefit than if you selected another place or time.

MS JUDD: So the use of "strategic" in relation to planned burns is in fact quite a broad concept.

DR TOLHURST: I believe so.

COMMISSIONER McLEOD: Could I have from learned council a definition of "random"? I don't quite understand what you mean by "random" in this context.

MS JUDD: Sir, I was really just concentrating on being a lot more strategic about the planned burns. Obviously we have talked about having planned burns across the landscape and I think there has been consensus that there needs to be more planned burns generally across the landscape, but at the moment I'm really highlighting being very specific and strategic in relation to where those planned burns would be.

COMMISSIONER McLEOD: I understand that part. I was just puzzling what you meant by "random", which suggests to me the process is just lighting fires anywhere, which is what "random" really means.

MS JUDD: It does to some extent.

COMMISSIONER McLEOD: I don't quite understand the relevance of that to the discussion we have been having.

MS JUDD: As one extreme there is random ---

COMMISSIONER McLEOD: Like an example of ---

MS JUDD: Well, years and years and years ago there would be more randomness than where the planned burns are implemented today.
COMMISSIONER McLEOD: In relation to prescribed burning we are talking about?

MS JUDD: Yes, sir.

COMMISSIONER McLEOD: Maybe the panel can assist me with better understanding of the past, but it seems to me to be a bit unclear just what "random planned burning" is meant to describe.

DR TOLHURST: My understanding of "random" in the context of this discussion is the probability of an area in the landscape being burnt is more or less equal across the landscape. So, rather than necessarily just lighting fires willy-nilly, if you like, it is a matter of, if you have 1,000 potential burning units, each one of those 1,000 would have an equal probability that you would choose that burning unit to achieve your five per cent in any particular year.

COMMISSIONER McLEOD: I understand that, but is there evidence to suggest that that was the way it happened in the past?

DR TOLHURST: I don't know if anyone studied that.

COMMISSIONER McLEOD: It didn't really matter where the fire was lit?

DR CLARKE: Some modellers have chosen to contrast that. I think I'm right in thinking the study by King in south-west Tasmania contrasted random placement of blocks versus strategic placement of blocks to demonstrate the value of strategic placement of burn blocks. I think that is possibly how it has entered into the discussion. I think it potentially becomes relevant if we're talking about unbounded large scale burning, do we care where it burns, and I think the scientific evidence suggests, yes, we should care where it burns because we can get more bang
for our buck out of certain places rather than areas.

PROFESSOR ADAMS: I know of no evidence to suggest that it was
willy-nilly, as it was put. I know of plenty of evidence
that for long periods of time it has always been fairly
carefully thought through.

MS JUDD: Dr Tolhurst, in terms of being able to ensure that
the planned burns are as strategic as possible, will the
Phoenix tool assist in that regard?

DR TOLHURST: That's one of the possibilities for evaluating
the benefit, having different parts of the landscape burnt
on a particular regime compared with others. It is one of
the design purposes of that tool, so Phoenix Rapid Fire
would certainly give you some metric to allow you to
compare one set of options with another in terms of what
the final outcome might be in terms of things like
potential house loss, for example. So there would be
other experience and analysis of past fires that could be
used as well, but a simulation model like Phoenix Rapid
Fire would certainly allow you to explore some of those
options that might not have occurred in the past and
evaluate those.

MR CHENEY: Could I just add one comment. An operational
burning program is far from random, it has to be planned.
All sorts of things are taken into consideration. The
planning period eventually will be something like five to
seven years that you are working up to examine blocks.
Has the block been, for example, affected by a fire
recently; what is the fuel accumulation rate on this block
compared with other blocks; how does the placement of
burnt blocks fit within the landscape in order to break up
large fire spread. All of these things need to be
considered. It is certainly not a random procedure.

MS JUDD: Sir, I didn't ever mean to suggest that there ought
be a random procedure or that there was a random
procedure; quite the reverse.

COMMISSIONER McLEOD: It is not the first time the term has
been used and it hasn't been clarified, so I felt it
important while we had a group of people with substantial
background to clarify what was really meant.

MS JUDD: I'm glad we did that, and can I just indicate that
the State's position is that, the more strategic the
planned burns can be, the better, and that the State does
embrace the concept of having as much strategy as possible
and as much research and science as possible in terms of
determining where these burns should be so that they are
very strategic in their nature.

<CROSS-EXAMINED BY MR NEWTON-BROWN:

MR NEWTON-BROWN: Just prior to the adjournment for lunch,
various members of the panel noted the decline in skilled
labour coming out of the universities. I think Professor
Adams referred to the need for government agencies to
employ more graduates. What does the panel think of the
role of the forestry industry in employing graduates and
the benefits for the sector as a whole?

PROFESSOR ADAMS: Firstly, just let me clarify that I don't
really care what the title of the degree is that a person
holds; it is the skills and experience with respect to
what we are talking about here that are part of that
training.

To the substance of your question, the forest
industry has, as I'm sure you know, also gone through a
significant reduction in large part in southern Australia,
certainly in south-eastern Australia, so again it is axiomatic, there are less opportunities. However, the industry has the opportunity equally to make a contribution through the employment of students going through universities in practical roles, so if that's what you are asking, I'm happy to endorse that.

MR NEWTON-BROWN: If there was a further reduction in forestry activity, what impact would that have on the skills base?

PROFESSOR ADAMS: This has been covered by a number of authors, and I'd just refer to some work by John Dargavel from the Australian National University who has pointed out that the reduction in forest industry activity has many corollaries, including reduced equipment that is suitable for firefighting as just one, and further reduction in the industry. Again it is axiomatic that there will be some further reductions in the availability of people and equipment for firefighting, but also some reduction in the skills base in terms of people experienced in working in forests and under forest conditions. So, yes, I would agree with that.

MR NEWTON-BROWN: Putting aside those who have tertiary experience, what about those who simply have the practical experience working in forests? Is there value in what they can contribute?

PROFESSOR ADAMS: Are the other members of the panel happy to -

DR TOLHURST: I will give one practical example. A colleague and I undertook an analysis of the effectiveness of different means of constructing and controlling fire line. One of the factors we looked at was the degree of experience of actually working in a forest environment,
which included dozer operators, for example, who had been involved in timber harvesting activities. We found that there was a measurable benefit, if you like, from people who had worked in the forest in terms of their construction and control rate on fire line, compared with, for example, earthmoving contractors who may have been more normally engaged in road building or dam building. So there was a measurable difference, in our terms, of perhaps somewhere between 10 and 20 per cent benefit.

The thing that is hidden there a little bit is the safety issues, the fact that people who are working in the forest are more familiar with the environment, they are more attune to changes that are going on in the fire environment and actually get early warning, if you like, of an impending danger. That's something that hasn't been quantified, but I don't think should be underestimated.

I don't know whether Mr Cheney wants to comment on some of the work he has done sort of following some of the investigations of accidents and so on, but people who are familiar with working in the forest actually, I think, have a significant safety benefit over those who are less familiar working in the forest on a day-to-day basis.

MR RUSH: I have one matter and then if we took a break, Commissioners. You were asked about flexibility in approach, regime, program, trial. I just want to go to the first page of the summary under "Project level objectives" and the final dot point on page 1 where it is the recommendation that the code provide an outcome orientated approach rather than consisting of statements of vague principle or being a means of measuring activity. By "outcome orientated approach" what was meant? Perhaps
Mr Williams?

MR WILLIAMS: I think the panel was looking at measures that would be reducing overall risk on a sustained basis.

MR RUSH: And the code placing those matters to the forefront?

MR WILLIAMS: Correct.

MR RUSH: Thank you. They are the matters, Commissioners. Is it convenient to take a break and then Ms Doyle will conclude the matters I think that arise going to zones and the like.

CHAIRMAN: Yes.

(Short adjournment.)

MR RUSH: Commissioners, one matter. Professor Adams, you wanted to clarify the position in relation to regime, program and trial.

PROFESSOR ADAMS: Thank you, Mr Rush. I think the discussion immediately before the break became a little tangled up in semantics. I just wanted to clarify at least what my understanding of the agreed position was as summarised.

It was that five to 10 per cent of the public land in Victoria would be a reasonable target, in the full acknowledgment that some land is not treatable with prescribed burning, and mention was made of rainforest and there are other types, of course, but you have to start somewhere. So, we spoke at length about the sense of using the foothill forests as where such a program could start and that it would take time to implement.

It wasn't our intention, and this is my understanding, it wasn't our intention to identify it as a trial or an experiment or as research that should be done beforehand; it was that you needed to get under way with a program of that scale and then conduct your research and
monitoring as you go along. I hope that clarifies. As I say, that's my understanding.

DR GILL: My understanding was a little bit different, and perhaps similar to what Kevin Tolhurst said before, that while that is an overall direction, that there are benefits in choosing what we could call a pilot area in which a program could be conducted which could begin soon and which could be reviewed formally in 10 years' time, not to pre-empt other areas, but to provide a focus and a starting point and one in which perhaps knowledge was most advanced so that we weren't as concerned with ecological effects on plants, for example, although we would have a concern for some animals and we should monitor it all very carefully. Hence the discussion that we did have that mentioned at least Wombat State Forest, as I said earlier in the day.

MR RUSH: Dr Tolhurst, we heard evidence last week of Project Phoenix and it looking at the Otways, but reading this document one might think that what it is directed to is really what Professor Adams said, that it is to undertake, accepting the understanding Dr Gill put forward, but to undertake something that is different in that sense to what is being undertaken as a pilot in the Otways, but indeed to put in place a regime in the area that is designated in the document and to get that under way in Victoria and "ramp up", as the word has been given, our organisational structure to ensure that is put in place.

DR TOLHURST: That's correct. The work that's being done in the Otways is largely about exploring the use of the modelling process rather than the operation that's happening is to some extent independent of the exploration
in the modelling sense. So the modelling process is being used to inform the management to some extent, but it is not part of the same program, necessarily. I think what we have been talking about for the last couple of days is really something that's quite in addition to what's being explored in the Otways. We are really talking about something that would be rolled out on a broader scale across the state, which is more than just the modelling process that we have started in the Otways. The intention would be to do that work elsewhere as well. There is no reason why you wouldn't do it in central Victoria, around the Wombat Forest, Mount Macedon area.

MR CHENEY: My understanding was certainly that this program was to be a statewide program, it was to go across the dry forest or foothill forests of the state, that in fact the large areas that were burnt in 2003 are now seven years old and they have accumulated enough fuel that prescribed burning must be started in those areas if we are to establish a sensible structure and distribution of age classes in there. There is a lot of work to be done and there is a lot of forest to cover, so I really don't like the idea, while research of course is an ongoing process, this research will not be possible really in the overall scheme of things until the State establishes this overall fire prescribed burning program.

MR RUSH: Do you have anything to add, Dr Bradstock?

DR BRADSTOCK: No, I think Malcolm and Kevin have summarised my understanding of the situation quite well. I don't think we are poles apart here.

MR WILLIAMS: I guess I just want to emphasise that, having had experience administering programs, the key here is the
programmatic approach that we are talking about in this consensus document and emphasising that a change of magnitude of this should not happen by chance, it needs to happen by design. Planning and organising and staffing and funding have all got to be thought out in order to sustain a program. I think it was the consensus of the group that if left to a year-to-year approach or a catch-as-catch-can approach, this will ultimately fail. It needs something much, much more than that.

MR RUSH: Thank you.

MS DOYLE: Gentlemen, having spent some time today talking about the matters of the effectiveness of prescribed burning and the question of targets, I want to ask you to focus now on some elements of the issue of how we should implement a prescribed burning regime, and this is a matter that is dealt with in paragraphs 16 to 19 of the joint document. There are a couple of matters in that that I want to explore with you and, perhaps to remind you of that, if that could be brought up. Item 16 dealt with the question of the size of areas treated and we have already spent some time on that; 17 and 18 then deal with the intensity of prescribed burns and related matters.

What I want to ask you flowing from points 17 and 18 in the document is about how the State ought to then implement the regime of prescribed burning, and seek your input as experts in relation to that. We have heard just this afternoon that the State embraces a strategy of the implementation of strategic burns. Now, if we can call on your expertise to flesh out a little what strategic placement of burns might mean. I want to ask you in that context to perhaps first consider the zones that are
already established in Victoria and perhaps use them as a prism for discussion about the way we approach this task.

There have historically been five fuel management zones, now known as four fire management zones, in Victoria. They are conveniently located in the code of practice for fire management on public land. I'm just going to show those to you or remind you of them and then ask you a couple of questions about it. They appear at (DSE.HDD.0012.1286). This is an extract from the code which you refer to in the beginning of your joint document.

There is a statement set out about the rationale in terms of fire management zones. I assume each of you can see the screen sufficiently. It is noted there that zones must be determined following consideration of a number of matters. The first is indicated to be the strategic importance of fire protection to the areas and there is then reference to matters including appropriateness, practicability, the location of natural and developed assets, et cetera.

The first zone which is nominated is the asset protection zone, if we can have a closer look at that. It states here, "The asset protection zone will provide the highest level of strategic protection to human life, property and highly valued assets vulnerable to damage by wildfire through radiant heat and ember attack." You probably all do know that these zones then move through from that level of asset protection zone to strategic wildfire moderation zone, to ecological management zone, to prescribed burning exclusion zone. We will look at each of those in a moment.
First of all, is this methodology of dividing the state and its districts into zones a useful one when working out how to apply a prescribed burning regime? Would anyone care to start the discussion in relation to the use of zones?

DR TOLHURST: I will kick off. I'm sure there will be plenty of discussion. I think the zoning system is imperfect, but at the same time provides a good basis for discussion because the objective of what the zone is trying to achieve is clearly stated, and it then means that you are able to provide prescriptions and management objectives, operational objectives, that would help achieve that. For example, in the asset protection zone it gives you an idea of how large that zone ought to be, what condition the fuel needs to be maintained in and a clear idea of what the objective of carrying out those operations are, in this case the protection of human life and property.

So I think it is useful for discussions and for the thought processes. There probably needs to be some more thought about as to whether or not the zones are in the most appropriate locations and whether they are an appropriate size and so on, but the concept I think helps the discussion and the allocation of resources.

MS DOYLE: Flowing from that, Dr Tolhurst, and perhaps others might care to comment, you mentioned the zones state the objective and also they assist in implementation. If we can stick with asset protection zone, the goal stated is clearly the protection of human life and property. In the next paragraph it suggests that fuel management in these areas must be intensive.

Can we just compare that with perhaps the next
zone, if we can move down to page 1287. The strategic wildfire moderation zone, it says, "will consist of strategic areas of sufficient width and continuity to provide a substantial barrier to the spread of wildfire." The aim is stated to be reducing the speed and intensity of fires, along with the potential for spotfires. Then in terms of outcome, it nominates "fuel management in the strategic wildfire moderation zone will aim to maintain a nominated range of fuel characteristics within a defined limit."

Are these zones assisting managers in terms of understanding what the objective is in each zone and then what the level of treatment should be in each zone? Would anyone care to comment on that?

DR TOLHURST: I will kick off again. I think they certainly do help identify what each zone is supposed to be achieving and provide an undefined, a non-prescriptive way of defining what needs to happen to make those effective. What's missing from that in a sense is how you are going to determine whether or not the zone is wide enough or whether the zone is being effective in reducing the wildfire, the measure of whether or not that's being achieved.

MS DOYLE: What about the intensity of prescribed burns? Paragraph 17 of the agreed document said burning under too low an intensity may not achieve appreciable risk reduction. Bearing in mind the zones are each attempting to achieve different things, what can you tell us, what scientific guidance can you give us about the application of intensity during a planned burn? What should you be aiming for when your goal is X as opposed to Y and what
would you be wanting to see after you have treated a
particular area? Mr Cheney?

MR CHENEY: I have a little difficulty with these zones because
I don't know the scale that we are involved in here, but
to me it seems - I have lost my reference to various
zones.

MS DOYLE: We can bring the zones back up.

MR CHENEY: The strategic wildfire modification zone, it seems
to me that that would cover the bulk of the area that we
are dealing with and that the burning there has to be of
the order that we have set out in this statement, that it
has to be of blocks of 1,000 hectares or larger, it has to
have a burn coverage of greater than 70 per cent and,
provided the fuel is removed, it doesn't matter really
much what intensity you remove it with, except if your
intensity of your prescribed burn is too high you are
likely to compromise the vegetation and some of the fauna
in that area. So, as a general rule we say we will keep
it to a reasonably low level.

We have to take into consideration within that
intensity is part of our fire protection objective to
reduce the amount of bark on the trees, in which case we
would need in that forest a higher intensity than one
perhaps where the bark was not flammable, because we need
to take the fire into the upper parts of the tree to do
removal.

The asset protection zone I would see as a much
higher level of burning because the objective there is to
retain pretty much at all times the fuels within that area
at a low level. So, instead of a five year rotation, you
might be coming down to a four or a three year rotation.
That can have some severe ecological consequences, which means that in places you might shift that from a shrubby forest to a grassy forest and maintain that area. Now, that's a trade-off that you might have to consider in an asset protection zone, but because you want it to protect assets, then your fuel level at all times has to be lower than you can tolerate in parts elsewhere in the forest.

MS DOYLE: Can I just ask arising from that, Mr Cheney, do you then read the way in which asset protection zones are described as effectively stating the way in which any conflict between competing objectives or principles ought to be resolved; namely, it effectively dictates that in the asset protection zone there may be levels of planned burning that are undertaken which compromise values other than the protection of human life, but in effect the conclusion is that is the way in which this risk management task will be approached?

MR CHENEY: Yes, I do. I think certain values will be compromised. For example, if you have an animal in the area that requires a high shrub component to survive, that animal will be severely disadvantaged and will probably move somewhere else or it will be somewhere else. So, yes, you are going to compromise some of the multiple objectives.

MS DOYLE: I think each of Dr Bradstock, Mr Williams and Dr Clarke have something to say. Dr Bradstock?

DR BRADSTOCK: Yes, I think you're right. Very frequent treatment of asset protection zones will have ecological effects. However, what you have to bear in mind is typically these very small portions of landscapes, so it is a trade-off and you may accept losses in those zones.
provided that they are adequately compensated for by an appropriate range of fire regimes elsewhere. It's really only the things that are totally confined to those zones, so in other words species which that's their only habitat just happens to coincide with those zones, are the things you have to worry about. So, there is a trade-off. However, with care, that trade-off can be planned for and worked around.

The other thing I'd just very quickly say is, look, the zones have evolved because there is limited resources and they are an inherent way of trying to prioritise and focus resources. If the resource levels change, the zones won't change generically but obviously the specifications, the size and types of fuel treatments, will probably change to fit the resource levels. We have to recognise that.

MS DOYLE: Dr Clarke? And perhaps, Dr Clarke, while you are commenting on this issue you might also comment on the value of the final zone in the continuum. The final zone is the prescribed burning exclusion zone. Perhaps you could comment on the trade-offs that might happen under asset protection zones compared with the utility of the prescribed burning exclusion zone.

DR CLARKE: Before I get on to that, can I just qualify this point 17. My interpretation of point 17 and the 70 per cent to 90 per cent - sorry, this is in the joint document - 70 to 90 per cent being required to be treated within those zones, my understanding of the panel's agreement on that was that we were talking about what would be effective in reducing risk of fire. So, therefore I would reinforce what Phil said earlier, that
this falls into asset protection zone and strategic
wildfire management zone, but I would not want that
interpreted as the desirable percentage in an ecological
management zone, which has a different function, where we
might be looking at something like 30 to 50 per cent to
ensure connectivity within that zone and survival of the
fauna and flora.

MS DOYLE: Can you perhaps explain the term "connectivity" in
the way that you mean in relation to flora and fauna?

DR CLARKE: In particular in relation to fauna, fauna do not
typically have the capacity to regenerate on site and once
a site is burnt they will need to recolonise that site,
presuming it recovers sufficiently. To get back to that
site once it has recovered requires the animal to cross or
navigate through habitat that provides the cover or the
resources it needs. If that connectivity is lost in the
landscape, the animal may never get back to that site even
if it does regenerate. So, by patchily burning a
landscape at a percentage less than 70 per cent, there
will be a good chance that there will be unburnt refuges
in that landscape by which the animal can travel through
the landscape and recolonise burnt sites.

MS DOYLE: I understand. Mr Williams, there was a comment you
wanted to make in relation to this question of zones?

MR WILLIAMS: Thank you. This is an area we struggle with a
good deal in the USA as well. We might call it a little
something different, but this area is the one that's in
closest proximity to the most immediate social values at
risk. Other social values are elsewhere across the
landscape and I think in our examples are watersheds, like
your catchments. Those can't be overlooked.
I think it becomes especially critical in this zone where this optimisation model that we discussed earlier comes to bear. This is also, in my mind, a place where, maybe more than most others, the community at risk has a real stake in understanding not only the trade-offs involved, whether it be smoke or even occasional risk of escape from a prescribed burn that does damage, but what the long-term implications are. Again, we often avoid short-term risk and then are surprised at long-term consequence. Somehow that's got to be revealed and understood and better brought in to these discussions. Much of what happens in the asset protection zone may very well depend on what complementary measures are occurring on the private lands adjacent to it.

MS DOYLE: Dr Gill or Professor Adams, was there anything you wanted to add in relation to the question of zones?

DR GILL: The only thing that I would add is that the declaration of an asset protection zone, notwithstanding the description, tends to imply that there is only one asset in the landscape.

MS DOYLE: Are you wanting to draw attention to the different types of assets, namely property as opposed to life, homes as opposed to commercial/industrial? Is that the sort of distinction you are making?

DR GILL: And environmental values which then come out under other zones.

MS DOYLE: Perhaps if I can go to another question and then, Professor Adams, if you wanted to comment in this context. Do I take it from what the panel is saying, then, that first of all one would expect to treat areas within the asset protection zone and ecological management zone, just
by way of example, treat them differently in terms of the intensity of a planned burn, but also revisit them at different cycles or intervals in terms of how often you burn them? I understood Mr Cheney to say an asset protection zone might require intense treatment on high rotation. Is there a different consideration in terms of the way you treat an ecological management zone? Perhaps you first, Professor Adams.

PROFESSOR ADAMS: I agree with most of what's been said. I think the zoning is inevitable. It is a planning tool and some form of zoning will be required. It is also an explicit way of acknowledging the sorts of trade-offs that you have mentioned and that have been addressed. I don't particularly like the titles of the zones because that immediately implies in some cases, as they are meant to, that one set of values takes precedence over another. I prefer a more anonymous zone A, B, C, D for that.

But, in coming to the issues that you raise about the timing and frequency, yes, absolutely there will be greater frequency, you would expect, in some parts of the landscape than in others. One of the great difficulties, though, and I think you raised, is the no planned burning zones, which are indeed difficult to define, I would argue, not that they shouldn't be there, there are parts of the landscape where we don't need fire or want fire, but, again, getting the lines right on the map is very difficult, as it is for all zones, might I add.

I think this is where Dr Bradstock has been quite clear in as much as trying to determine which is your strategic part of the landscape and which is your ecological parts of the landscape. These can be very
difficult boundaries to be sure about. We have imperfect
knowledge because of our lack of knowledge of the past
fire regimes.

MS DOYLE: Can I ask you all then, arising from that: assuming
that some species of zone or planning tool, to adopt
Professor Adams' terminology, some sort of tool needs to
be used at a district or regional level in order to do
things, and assume also that the panel's recommendation of
implementation of a statewide target of five to
10 per cent is introduced, if then in the districts or
regions something approaching these zones is adopted or
used, will we not end up with a mosaic, to use that term
in its broadest sense, across Victoria, by which I mean
some areas of land burnt and unburnt, burnt at different
times with fuels of different ages and, as it turns out,
having been treated for different purposes?

Would any of you care to comment on whether
continuing to use the term "mosaic" in that very general
sense is a good descriptor of what we might end up with
and whether that's the right outcome or whether there is
any other comment you would like to make about where we
should be heading?

DR BRADSTOCK: I will just point out that at the moment you
have a mosaic and if you do something differently you will
have a different mosaic. It seems trite, but it is well
worth bearing that in mind. There is just not one mosaic
and the question is which mosaic. Which mosaic gives you
the best mix of consequential risk reduction to all the
things we value. So, it is a question of understanding,
using such a zoning system and a different rate of
treatment, what that mosaic will look like.
Can I just say one other thing. We have had a
discussion of zones but we have left out probably the
crucial ingredient, cost. It costs a lot of money to
treat what we call asset protection zones. They are very,
very expensive usually and that's another factor in sort
of choosing and shaping the criteria and it needs to be
borne in mind that in some cases in some of these asset
protection zones it may be better to permanently modify
the vegetation by other means rather than prescribed
burning because of the ongoing high levels of cost. That
needs to be looked at much more carefully.

MS DOYLE: We might come back to that issue of asset protection
zones in a moment. I think Dr Clarke and Mr Williams had
something to contribute.

DR CLARKE: Just in relation to the advantage these zones give
us in reporting and accountability and how we are going on
meeting targets, simply in terms of activity I think they
are a step forward, if there was a requirement to report
region by region on how we are going in each zone, on a
long-term rolling basis, not necessarily on an annual
basis. I think annual targets can be distorting. We need
to be rolling with the seasons that we get dealt, so that
when we set up targets they possibly should be five year
or 10 year targets within each of these zones and be
reviewed on a rolling basis.

MR WILLIAMS: I think Dr Tolhurst described this zoning system
as imperfect but useful, and I would agree with that. If
we tend to look at it in absolute terms, I think we may be
heading in a difficult direction. When I look at zoning
approaches I think they become most useful when we
acknowledge that they're fluid and they're dynamic, both
in time and space. I also think that we mustn’t overlook
the wildfire imperative. That will come eventually under
each zone, no matter what we might hope for or what we
might plan. How we respond to that I think is important.
It goes back to this notion of understanding the fluid and
dynamic nature of an ecosystem, particularly a fire-prone
or fire-dependent ecosystem.

COMMISSIONER PASCOE: Before we leave that, I am interested in
take up that issue with Dr Bradstock in relation to the
potential for permanently altering the vegetation near
asset protection zones because one of the issues in fact
that we have explored with Dr Tolhurst and others is the
type of vegetation and the degree to which a careful
choice of vegetation can help mitigate bushfire risk. So
I’m interested to know if that’s the direction in which
you are heading there.

DR BRADSTOCK: Yes, I think so. I think, as Phil Cheney said,
it is very important to get fuel levels down to very low
levels near property and that really constrains what the
vegetation can look like in those places. You really
can’t have much litter on the ground and you can’t have
much near surface fuel and you want discontinuity
vertically up into trees and perhaps even trees thinned
out. So, that means you can sort of design an ideal
compromise in that regard and some of the best ways of
achieving that may not be through prescribed burning, it
may be through physical alteration. They may be long
lasting, they may be longer lasting treatments which are
ultimately more cost effective in that regard.

COMMISSIONER PASCOE: In addition to those alterations, what
about particular species, because for example there has
been a view put by some that the deciduous trees offer a
better form of protection than, say, some of the
Australian native trees.

DR BRADSTOCK: There may be some possibilities in that regard,
but I would also – this question is often asked and I'm
personally very conservative about that. I think you have
to be careful because under very bad conditions everything
burns. Also, the architecture of some exotic trees may be
very different to our local trees. They may, for example,
have more vertically continuous leaf structures and things
like that which could be conducive to conducting fire up
into crowns. There are all sorts of things. The leaf
chemistry may be important, but you can sort of say, worst
case scenario, it will all burn. Having said that, there
are some plants like saltbushes and things like that which
may be useful ground cover in some circumstances but they
are not going to grow everywhere.

There is also a negative side to doing this sort
of thing, and that's invasive species, exotic grasses and
things, which have to be factored into the equation and
around habitation they are vectors of introduction of
exotics. So, as with everything there are pros and cons.
There is not only the choice of species, but there is
actually the sort of architectural characteristics or
landscaping characteristics in terms of catching embers
and stuff, but we were probably edging into the urban
design area in this discussion.

COMMISSIONER PASCOE: Sometimes it is hard to separate the two.
For example, some of the earlier discussion that we had
about the potential for the outbreak of fire on private
land as distinct from public land, by way of example, when
we had the expert forum on planning, it did emerge as a
significant topic because of the number of so-called bush
blocks of small acreage where you do have much greater
difficulty in controlling the growth of fuel.

DR BRADSTOCK: Yes.

MS DOYLE: Perhaps just to follow on from that, Dr Bradstock or
anyone else, when you use the phrase "permanent
modification of fuel" in the asset protection zone, are
there examples of permanent modification which include
mineral earth breaks, literally wide fuel breaks? Are
those the sorts of mechanisms you were also including in
that description?

DR BRADSTOCK: Yes. I can think of examples, particularly
maybe where there has been some earth breaks and
positioning, for example, even of tracks around the edge
of urban areas so that not only does it provide access at
the back of property but also contributes to the break, so
there are all sorts of things you can do there.
Facetiously I have even heard the idea that we should be
building golf courses around major urban centres, so
that's again almost getting into this town planning level
of design. You can think about how you might plan
communities like that to maximise the potential separation
of bushland from property.

MS DOYLE: To conclude this discussion about asset protection
zones, can I perhaps clarify a matter with you, Mr Cheney.
You spoke a moment ago about intensity of treatment in the
asset protection zone and frequency of treatment. What
about size? I understood you this morning to say that
narrower than three kilometres may not provide great
utility in a treated area in terms of slowing down
spotting incidents, for example. Is there anything that
you can offer in terms of advice about the size of planned
burns in the asset protection zone when you are talking
about protecting a town?

MR CHENEY: The first comment on size was why we came to the
size of the blocks in the general area. In terms of the
asset protection zone, if that is narrow, for example, a
kilometre of hundred metres, there are plenty of examples
where the fire has gone over the top of that and into the
town zone. I don't think we are just touching on town
development in forest areas; it is an integrated program.
It has to be taken into consideration. If the town
carries more fuel than the forest, and this happens, it
happened in Canberra, that there was more fuel in the
suburbs than there was in the plantations, so it is not
surprising that the town burns. So, in terms of working
with the asset protection zone, you also have to modify
the fuel in the built environment. This, I think, is
where the introduction of deciduous hardwoods, which don't
drop a lot of leaf fall in summer, some fleshy-type
plants, green lawns, all this sort of thing, is looking at
the fuel levels where they are most important. When it
comes down in the end, the most important fuel level is
right around the house.

MS DOYLE: Dr Tolhurst?

DR TOLHURST: If I could just add another element here, I guess
particularly in relation to the asset protection zones and
perhaps the need for permanent modification of fuel
structure and perhaps species selection. Another element
here is not just the passive reduction in fire intensity,
whether it be flame height, radiation or the spotting, but
also it is basically to allow some access and egress for
the firefighters and people living in those areas so there
is a certain amount of safety issue as well. So, even
though it may not necessarily stop the fire or whatever,
it actually provides a safer zone to fight a fire from,
either during the passage of the fire or soon after the
passage of the fire. So, there is another element to the
fuel modification which needs to be considered, I think,
which is the safety of the people either living in the
area or the firefighters, too. It is not just about the
modifying the fire as a passive protection.

MS DOYLE: Can I ask two final matters about how we burn. In
paragraph 18 of the joint document there is a reference to
the fact that the treated area ought be left with an
overall fuel hazard of high or less, in accordance with
the document that obviously has meaning and a technical
meaning to those of you on the panel. Can you perhaps
provide some insight into what that means and if possible
by reference to the way a lay person might understand fuel
structure; namely, a fuel hazard of high, what does that
mean in terms of leaf litter, bark, canopy? What will the
forest look like after you have done it?

DR TOLHURST: If I could answer that. For example, if we are
in a foothill, mixed species eucalypt forest, dry forest,
eucalypt forest, we would be considering in a situation
like that there would be little or few embers that would
be produced from the bark on the trees, so the bark would
be tightly held, not capable of producing many burning
embers in the passage of a fire, even under extreme
conditions. The shrub layer would be minimal and what was
there would largely be green with a very small component
of dead material in it, so it would be easy to walk
through, if you like. The amount of litter on the ground
would be probably less than 25 millimetres deep and would
be less than eight tonne per hectare, for example.

So, there are different ways of coming up with
that combination to give you an overall fuel hazard of
high, but what I have given you is probably a typical
level. So if the fuel level starts to get more than eight
tonnes a hectare, if you start getting more bark on the
trees or you get a denser understorey layer, then you
would be exceeding that overall fuel hazard level of high.

MS DOYLE: So, despite the use of the terminology "high" which
would ordinarily connote danger, what you seem to be
telling us is that is in fact a way of reducing risk, by
leaving it at high in the technical way in which that term
is now being used.

DR TOLHURST: That's correct. It has been produced in the
sense of difficulty of suppression, so what we are saying
here is it would still be difficult to suppress a fire
here, but significantly more occasions when you would be
able to suppress a fire here than if it was very high or
extreme. So preferably I guess what we are saying on
asset protection zones is we want to keep it to moderate
or lesser, moderate level of difficulty of suppressing a
fire in that location with first attack resources, so it
has a technical definition as well which refers to the
difficulty of suppressing a fire in those fuels. So,
"high" is a reasonable description given that it would
still be difficult to suppress a fire here but it would be
possible.

MS DOYLE: Can I ask you about paragraph 19 and perhaps by
reference to something that emerges in Dr Clarke's report. In paragraph 19 you have noted that different habitats will require the application of different regimes because rates of fuel accumulation are different for different habitats. Assuming that that is addressed still to the question of reducing risk, what do you say, Dr Clarke, in terms of how we then still manage the environment and manage the application of fire for what you call in your report the most vulnerable species? How do we resolve the tension between the sorts of objectives we have just been devoting attention to and still having regard to the most vulnerable species?

DR CLARKE: Firstly, we need a better understanding of the rates of fuel accumulation in these other habitats that are more poorly studied and we don't apply blanket assumptions about how fast they are accumulating just because we have studied fuel accumulation in some other habitat. So, once we know how rapidly fuel accumulates, we can then make a rational decision in terms of asset protection of when we need to come back to those habitats if we are trying to achieve a risk reduction for assets.

In terms of minimising the risk to threatened species, the same applies. We need to know what works in terms of reducing the risk from fire. We also need to know the consequences of that action that we are taking in doing a prescribed burning action to the organisms that live on that site and the consequences of not doing that prescribed burning action in the terms of increasing the risk of a fire taking out a larger block.

Our knowledge across the state is not great on either score for many habitats in the state, nor on the
consequences for the fauna, because the fauna in particular have been studied so - not poorly, but in a limited fashion.

MS DOYLE: Having now explored some of these issues about the different zones, is there any consensus that emerges or support for Dr Tolhurst's proposition that the zones may be imperfect but remain useful? Is there anyone who dissents from that or wants to add to that as a descriptor? I will take that as consent. Dr Gill, you didn't have an opportunity during that last part of the debate. Was there anything you wanted to say in relation to either implementation or zones as a specific method of implementation?

DR GILL: No, I'm quite happy at this point, thanks.

MS DOYLE: I would now ask then that any party who wants to cross-examine in relation to those matters of implementation, how we do it and zones, take their opportunity before we close for the day.

<CROSS-EXAMINED BY MS JUDD:

MS JUDD: If I could just seek the panel's comments on what improvements could be made, how to improve the zones, given that there has been reference to the zones being imperfect but important.

DR TOLHURST: If I could kick off, I guess my comments come from some practical experience in understanding how some of the zones have been applied in the state in the past. I think when you set up a zone, and let's say a wildfire mitigation zone, wildfire modification zone, for example, it needs to be in a location where you specifically are going to either have the greatest success in reducing the amount of spotting or the amount of intensity of the fire.
to give you a chance to either suppress the fire or reduce
the fire coming out of that area.

In some locations I've seen I guess the location
of those zones being put in a location that would be most
easily maintained rather than necessarily one that would
create the greatest impact on a wildfire, for example, so
the systematic analysis of the landscape and the fire
climatology in an area should help drive that process.
I don't see that that has been systematically done in the
past. It has usually been done on people's past
experience and their expectations and so on. I think
there is a need for a greater systematic approach to that.

In doing that, there would be a much clearer
definition of what each zone is capable of achieving and
therefore what management would be required to achieve its
potential which may differ from one zone to another, so
I guess a more systematic analysis of where they go.

The asset protection zone, its location is almost
without negotiation because of the recognition of those
high value assets and in the main they tend to be human
life and property, but not exclusively, so that's not so
much at issue. I guess there we are asking the question
how big do they need to be to be effective in achieving
what they want to and, as Mr Cheney has mentioned, maybe
200 metres is not enough, but that will depend on the
topography and the nature of the vegetation.

So, a more systematic analysis needs to be
undertaken rather than necessarily just a feel from the
people with local experience. I think that needs to be
analysed and using a modelling process would be part of
the development of that.
MS JUDD: Does anyone else wish to add to that?

DR CLARKE: I would like to suggest that the zones as they are stated are helpful. They could be more explicit. My experience, a bit like Kevin's, is when I've seen those applied on different landscapes the justifications have not always been as detailed or as convincing as they could have been and it left one with the suspicion that something was called an ecological management zone but actually what it was being sold to for the public was asset protection or strategic wildlife management zone, and yet we can do it on a large scale so you got a lot of hectares up.

So it is being really, really clear about why are we doing the burn in this location; if it is for ecological reason, what is the ecological justification; what are we going to lose if we don't do it; what species is going to disappear or community is going to disappear from the landscape because of a lack of fire. So I think it is very much in the implementation of these zones that there is scope for improvement. They are new, reasonably new, and I think it is a learning process. I think we can refine that process as we go along and build on what's been done in the past.

MR WILLIAMS: I just offer that the approach has been much admired in the US. One of the things that we have struggled with is this interface between public and private lands and how a zoning effort might better reflect how those two come together. The other thing that we talked about yesterday among the panel was it is not always clear that there are prescribed burning guidelines in place that might complement the implementation of the
zone concept.

MS JUDD: Thank you.

MS DOYLE: I think that concludes proceedings for today.

CHAIRMAN: Can I just ask a further question that helps clarify in my mind the position relative to Western Australia where they talk about "the Red Book". The Red Book, as I understand it, is what Western Australia has that deals with its south-west forests and it is roughly comparable to the code. But, as I understand, in Victoria the position is very much more complex for a variety of reasons, including that we have not just a south-west forest but we have the Great Divide which is divided up into a variety of separate areas. We have even in Gippsland the Strzeleckis, apart from that. Then we have even within the Great Divide, if you like, the Yarra Ranges and the Dandenong Ranges and then moving further across we have the Macedon Ranges and the Wombat State Forest and the Central Highlands and we have the Otways, and I have probably forgotten a few other things in between.

But it seems that that, to my mind, means that to some extent the Red Book in Western Australia, while it must be very valuable, the code and the way it applies must be very much more complex in Victoria for a variety of reasons, including the geographical spread of different kinds of foothill forests, rainforests and a variety of other descriptive means that can apply to those areas.

Comments?

MR CHENEY: The Red Book is a burning guide, it doesn't have anything to do with zoning. It is a burning guide for a number of forest types; the jarrah forest, which is a dry
forest type; the karri forest, which we would probably
call a wet forest type here; plantations; wandoo forest,
which is a scattered forest. So, the Red Book is simply a
burning guide that they use to work out the specific
burning conditions that they need to use to achieve an
objective of fuel reduction, or in some places combined
with that burning guide they will do that for habitat
manipulation.

I believe that one of the things that we do need
in Victoria are better burning guides because we have a
range of different fuel types, as you have indicated, and
that is a key part of the research and development that's
needed for the implementation of this burning program.

DR GILL: I agree with what Phil says, but to take your two
comments you have made in relation to Western Australia
into account, Commissioner, I think it is important to
look at south-western Australia and Victoria in relation
to the terms you raise, the different geographies. There
are, I believe, differences in fuel types as well and
differences in roading patterns which we discussed earlier
in the day and many other things.

These issues can be examined through detailed
comparisons which take those conditions into
consideration, plus weather, plus the various assets you
are managing for and so forth, to see what the comparisons
are, what the similarities are and what you might decide
to do as a result of that work, which could involve some
simulation as described by Kevin and Ross.

So these recommendations about what you need in
Victoria is what's done in Western Australia, I have
been around for a very long time and I suggest that this
idea I just mentioned should be considered as a project to look at all the factors involved in both places to see similarities and differences and then decide which aspects are applicable in Victoria and which aspects aren't, and in this context, especially in relation to prescribed burning, including the numbers of days available per year that are possible and desirable.

DR TOLHURST: Just to add to what's been said, and I think we may have an opportunity to talk about the difference between south-west Western Australia later, because I think there are some important differences there, but one of the strengths of the Red Book that I see is that it is forest type or vegetation type specific in terms of identifying fuel moisture predictions and drying rates and it has a way of dealing with differences in vegetation structure. We probably deal with it a little differently here, but they are very site specific, whereas the generalised approach that we use I think could be improved, as Mr Cheney has alluded to. But that guide has been developed and refined over, well, nearly 50 years now, I suppose, so it is a significant help to identify the conditions for burning to make sure you get the outcome that you have prescribed.

There can be other ways other than burning guides to actually come to that, but it has served Western Australia very well and there is a lot that we could learn from the way in which that burning guide has been put together and used, the training that goes with it. But I think we also need to recognise, as you have sort of highlighted, some of the differences between south-west Western Australia and Victoria, which I think
we might have a chance to discuss a bit later.

PROFESSOR ADAMS: Yes. Just to illustrate, really, the West Australian land form and the variation in climate from north to south and the forests is much more uniform than we have here in Victoria, and the point was made earlier about rates of fuel accumulation, that these are variable and we have poor knowledge for some habitat types.

I agree. One of the areas that we can acquire better knowledge in Victoria using the current tools, and things like remote sensing has been mentioned, digital elevation models are another thing, soil maps and so on, is a much better handle on rates of fuel accumulation at the landscape scale. That will serve to greatly inform, for example, zoning and fire return intervals and so on.

MS DOYLE: Any other comments arising from those matters? In which case I will just indicate for your benefit and that of the parties that what we propose to do tomorrow is move to an exploration of both the objectives, but also the implementation of a prescribed burning regime using the device of a hypothetical. For that reason, therefore, I will asking you all to stay back after class, at which stage I will distribute your homework.

You will be given some information about a real place, it is the Ovens district. That information has been the subject of some evidence in the proceedings already about both the organisation of the Ovens district but also the Beechworth fire. You will be asked to examine the hypothetical in light of some of that information. You ought not assume that you're retracing the steps, for example, that Dr McCaw has already done in terms of his analysis. Nor ought you regard it as an
exam, although you may receive grades, depending on the outcome. But, in essence, it is a hypothetical using some real facts or the real world as a springboard.

So, I will provide you with the papers at the conclusion and we intend to tomorrow explore these matters of implementation in particular, just using that as a device.

CHAIRMAN: Yes. We will adjourn until 9.30 tomorrow morning.

ADJOURNED UNTIL TUESDAY, 23 FEBRUARY 2010 AT 9.30 AM