Conference Proceedings – Speaker Transcript

Setting the scene: climate change and the changing fire risk

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Link to slides

Good morning everybody, it's great to see such a large turnout for this conference program. I have been asked to give a brief address to put the issues of bushfires in NSW in a broader context, that is, what we might expect of our state and the world, over the next few decades, because of climate change. This talk is titled, Be Prepared, because the influence of climate change is coming down the track at us whether we like it or not. I'll begin by giving a brief overview of what's happening with the climate globally, then in Australia, and then bring it down to New South Wales, talk about some projections for changes in our environment in general, and also changes in fire risk, and then very briefly at the end talk about the implications of this for both biodiversity and emergency management.

So, this is what's been happening to the global climate (see slide 3). Each one of the bars on this graph is the difference between the average temperature for that year, and the average over the whole period, going back to the 1800s. The blue bars are all the years of below-average temperature, the average being measured over that entire period, and the red bars are the years where the temperature was above average. The trend is fairly obvious - up to about 1930, all the years were below-average temperature, compared to the whole period. Between 1930 and about the mid seventies, there was a mixture, and post that period, all of the years have been above average in temperature, and in fact, 14 of the 15 hottest years in recorded history have occurred this century.

What the next graph (slide 4) shows is two possible alternative futures for the planet. The little, black, wiggly line at the bottom of that graph represents the observed temperatures we've had so far. The blue band is our possible future if we are able to reduce greenhouse-gas emissions sufficiently to stay below what's called the two-degree guard rail, that is two degrees above pre-industrial temperatures. Whether we achieve this will depend a lot on the success or otherwise of the talks in Paris at the end of this year, and the commitments of countries to achieve their stated targets. The red band represents what is called the business-as-usual scenario, ie the temperatures experienced going forward into this century if we keep emitting greenhouse gases at the current rate. Much as we would all like to remain below that two-degree target, most of the science is pointing to at least a four-degree world, by the end of this century (slide 5).

Coming down to New South Wales then (slide 6), because there's less data in New South Wales than there is for the world, as you might expect, the picture is somewhat more variable, but nonetheless, you can see that until about the 1990s or so, there were years that had average temperatures both below and above the average over the period. Since the 1990s, no years had below-average temperatures. If you look at the most extreme right-hand side of that graph, you'll see 2013 which was the warmest year on record in Australia, where we had the hottest day, the hottest summer, the hottest month, and also

the hottest New South Wales.

This infographic from the Climate Council (slide 7) highlights some instances where longer, hotter, drier, more extensive and earlier heatwaves have been experienced all around the country. To show that I haven't been cherry-picking these numbers, what the next graph (slide 8) shows the number of days each year when Australia's daily mean temperature is extreme - above the 99th percentile. Of course it varies from year to year, but the upwards trend of the numbers of days of extreme heat is fairly clear from this graph.

Our rainfall has also been changing, but the direction of change is different in different parts of the country (slide 9). Some places have been getting wetter, and others drier - the grey-blue colours are the areas that have been getting wetter, and the red and yellow are the areas that have been getting drier. These two maps split off the temperatures from October to April and April to September. For New South Wales, we've been in a fairly long-term drying trend. These figures compare the period right back to 1900, so the southwest, the southeast and other parts of the eastern coast have been getting drier, the northwest areas and parts of the central areas have been getting wetter.

This map (slide 10) shows observed trends in the forest-fire-danger index, which you will understand is a composite measure of fire-risk weather on any particular day. They've been mapped and analysed at 38 different weather stations across Australia. The round circles indicate where there's been an increase in the fire-danger index, the purple filled-in circles are where this is statistically significant. The size of the circle indicates the magnitude of the increase, so the larger the circle the larger the increase - up to 600 times. Once again, you can see that while there's variability across the country, there is a concentration of large purple dots in the south-eastern parts of the country.

Now for the future (slide 11). These two maps show our current climatic zones and what we might expect under a fairly hot and dry scenario for later on this century. The basic message here is that the climate zones are shifting southward, so, what was generally cool is getting warmer, what was warm is getting very warm indeed.

This graphic (slide 12) from the last IPCC chapter on Australasia shows the days per year over 40°.The successive maps show estimates for 1990, 2050, and 2100, and as you see it's projected to get very, very hot in many parts of the country. The overlying graph shows the number of people exposed to those temperatures in each of the different states. My apologies to anyone in Tasmania, it's not that you've been ignored, it's just that there's fewer people in Tasmania so they don't quite make it onto the Y axis. But as you can see, the trends are fairly stark as you go through into different parts of this decade, the number of people exposed to extreme high temperatures in each state increases a great deal.

But what does climate actually mean for what we will experience in our environment? I'm going to show you a couple of maps now produced in a study by some CSIRO researchers a couple of years ago (slide 13). The yellow bits on the maps indicate the physical environment is relatively similar to that currently experienced, the green bits indicate it's getting a bit different, the purple bits indicate the physical environment is going to be really different. Firstly the 2030 map, and as you can see, under the particular climate change scenario that was used, the northwest areas of the country are changing the most, compared to what they are now. Then the map for 2070 - basically purple Australia. What this is saying is that looking forward into this century, *everything* will be different to what we are experiencing

now, and this knowledge should affect all our planning - for bushfires or health or environmental conservation - absolutely everything.

Another illustration of this is shown in the bottom couple of pictures which come from my interpretation of another CSIRO study (slide 14). This was a climate analogue study, where CSIRO took various cities from around the country and estimated for a 4° warmed world, what the climate might be like, compared to other places in Australia currently. What the bottom two pictures illustrate is some potential changes in Cairns. The wet tropics region around Cairns is a marvellous storehouse of biological diversity. In a 4° warmed world with a drying scenario, Cairns could experience the current climate of Jabiru in the Northern Territory, shown in that other picture. Jabiru's vegetation is classified as dry monsoonal savannah. While this region does contain a lot of biodiversity, it certainly does not support the species richness of the Cairns wet tropics.

Coming back now to New South Wales, this map (slide 15) shows the major bushfires and their aerial extent over the past few decades, just to illustrate that while those of us that live here tend to notice bushfires around Sydney, but, of course, bushfires occur right across the state and in other parts of the state, they can be very, very big in aerial extent.

This is infographic (slide 16) illustrates the multiple ways in which climate change can affect fire risk. It can affect all four major factors contributing to fire risk – ignitions, fuel load, fuel condition and weather. It can affect ignitions, not in terms of the number of 10-year-olds with a box of matches that go out and light fires, but in terms of lightning strikes. Lightning increases as the weather gets warmer and more humid. Climate can affect fuel load in several ways - if we get a wetter summer, for example, we get more vegetation, if we get a drier summer, we can have less vegetation. Fuel condition, however, is more dependent on the weather in the preceding few months, up and down, The one factor where climate change has a very clear, directional impact, is bushfire weather, and this comes back to that map I showed earlier of the forest-fire-danger index. As we get more extreme high temperatures, we also get more extreme bushfire weather.

The bushfire season is lengthening in New South Wales - it's starting earlier, lasting longer (not in every year, but in many years) (slide 17). Last year, we had 55 local-government areas declare their bushfire season earlier than they usually do. This map shows the Australian seasonal outlook for 2014/2015 (slide 18) put out by the bushfire CRC. As our first speaker indicated, it was thought that we would get an El Niño in 2014. It didn't eventuate, but it is just been announced for 2015. We don't know how strong it will be.

These next two maps (slides 19-20) come from a very useful resource, the New South Wales NARCLiM project which provides down-scaled climate-change projections for New South Wales (http://www.climatechange.environment.nsw.gov.au/Climate-projections-for-NSW/About-NARCliM). These are projections from that website for 2020 to 2039, and from 2060 to 2079. There are many other similar maps on the website, so it's a very useful resource for planning.

We know that bushfires have enormous impacts on our health and our economy (slide 21). We've had over 100 deaths since the 1920s in New South Wales from bushfires directly. Bushfire impacts on health via smoke, however, are probably more significant. Reduced air quality increases the number of admissions to hospitals very dramatically, especially for conditions like asthma, but also for other respiratory and cardiac conditions. Deloitte Access Economics recently published a report indicating that the economic costs to New South Wales in 2014 would be $43 million, with a tripling by mid century.

Much of this conference is going to be about ecological impacts about fire, so I'm only going to touch on this topic briefly (slide 22). We know that fires reduce water quality in catchments, and we also know that plants like obligate seeders are particularly vulnerable if fires are too frequent, because they don't have enough time to regenerate and reproduce. We also know that fauna that is of low mobility is at increased risk.

So, what are the implications overall for managers (slide 23). Hotter and more frequent fires will drive significant changes in the structure and composition of ecological communities, some of which we can only speculate about, but some of which we've got a fairly good idea about the directions. We will get, in many places, a decline in seed banks, because of more frequent fires, and potentially hotter fires, and those changed habitats will probably lead to some local extinctions.

Coupled with this increasing risk of fire weather is a growing population in New South Wales (slide 24), projected to grow from the current 7.4 million, to 12.6 million by later this century. Connected with this we have seen the increasing pressure on fire-management agencies to perform more hazard-reduction burning at the urban-bushland interface, with 2012/2013 having the largest hazard-reduction program in NSW National Parks with more than 200,000 hectares burnt in this way.

Finally, I'd just like to point out some useful resources on this topic. I've just mentioned the NARCLiM website (slide 25). It's a collaboration between New South Wales OEH and university scientists, particularly those at the University of New South Wales. Just Google NARCLiM and you'll find it. It's a very easy-to-use website with all sorts of information that I think you will find useful. The CSIRO and Bureau of Meteorology have also recently updated their Climate Changes in Australia website (slide 26). The website now contains a vast array of easy-to-use and useful tools, including climate analogue tools such as some of the examples I earlier spoke of. There is a threshold calculator, future projections downscaled for the whole country, all sorts of other exploratory tools - a very useful website.

And finally, the Climate Council (slide 27). I'm a councillor on the Climate Council and I'm sure that there are people in the room who have been financial supporters, thank you very much. One of our major themes on the Council is to emphasise to the Australian public the link between climate change and extreme events, and the very first report that we wrote was on bushfires, hence the Be Prepared title for this presentation. We have followed that report up with a number of state-based bushfire reports that essentially contain more or less the same basic information, but with state examples and state projections. If you go to the Climate Council website you will find we have about 20 different reports and a vast array of infographics and other shareable material that you are most welcome to use.

Questions from audience

Q - The implications of what you were talking about are things like increased fire frequency but also including things like asthma and health concerns. What are your thoughts on the contradictions here of using fire more frequently to manage biomass, but with potential risks to health and environmental risks?

LH - Well, I don't have any ready answers. Awareness of the latest science is all you can use to conduct any sort of deliberate burn in the most sensitive way, whether it be sensitive to the health of local people or sensitive to that particular environment at that particular time. I don't think there's any magic answer to that question. I guess my emphasis in this talk has been that everything will get more fire

prone, it will get hotter, we will get more wildfires and we will have more pressure to do hazard reduction because of that increased threat, and that simply puts the onus on fire ecologists and managers to continually be aware of both the positives and negatives of their actions, and at any one time weigh up the costs and benefits of those actions. It's just that the goal posts and the background context of everything we do is changing, and changing quite rapidly.

Q - With the statistics that you showed, are they all for the hot burns? Did you have any on the cool burns, because there is a different between the two for the bush regeneration and for our brothers and sisters, our animals and all that is out there. You were talking especially about changes to our seed banks.

LH - Once again, it's a continuum, and in a past life, during my PhD, I actually performed some fire experiments with seeds and looked to see how they came up from different depths and the role of ants in that. It's the background context, so as the climate continues to change, there will be more hot fires, and they will occur more frequently, so, certainly, the relationship between the temperature of fires and the ecological impacts is very strong, but I think the main thing to bear in mind is that all of that will ramp up.

Q - Lesley, just picking up from the first person's question on smoke, just teasing out that, you mentioned the impacts of health from smoke, just with the more extreme weather, are you able to tease out the impacts of smoke versus extreme temperatures? I know you talked about asthma and other things. With Black Saturday, more people I think died from health-related impacts from heat, than from the fires. It seems it is going to be a massive issue, and I'm just keen to hear a bit more.

LH - I'm not an epidemiologist. There certainly are studies that track hospital admissions with heat, and there are also studies that track hospital admissions with smoke, and sometimes those occur on the same days, and sometimes they occur on separate days, so it is certainly the case that, as you say, there were about twice the number of people that died in Black Saturday in the fires, died the week before that due to heat-related conditions. There are very clear epidemiological relationships between heatwaves and human health, as there are between smoke and particulates in the air. Sometimes they occur on the same days and sometimes they occur on different days and you can look at those studies, but that's all I can say.

Q - Lesley, you showed a graphic of Cairns, and how it might change to an ecosystem resembling one in Jabiru, and you also showed purple Australia, things are going to change and look very different. Is it the case that we're going to lose some ecosystems and how do we manage for that? I'm not expecting you to answer this, but it's just kind of messing with my head at the moment. Do we put the time and the effort into trying to keep what's here at the moment, or do we realise that we are going to lose species and ecosystems and where do we put our focus?

LH - Look, it's a really, really important question, and it's one that I've been pondering for more than two decades as a climate-change ecologist. I've been talking about this for a long time and saying to people, we cannot keep managing the way we've been managing as if the environment is not changing. We will lose species. There's been quite a lot of papers published trying to estimate how many species globally we will actually lose. The most recent estimate published in Science just a couple of months ago was that for about a 4° warming, we're looking at a 16% loss of species, one in six. That's actually at the lower end of some of the previous estimates, so we will lose species, it is inevitable. We will also lose whole ecosystems, the alpine zone is an obvious one. At more than 2° we may well lose the Great

Barrier Reef, or at least the Great Barrier Reef as it looks now. And I guess all I'm emphasising is that every decision about management and our resources should be in the light of the changing climate. We will never have enough resources, we know we don't have enough resources to conserve everything as all of the people in this room would like to conserve them, we know that. And so we are always making hard decisions as to where to put our resources, and some of those decisions are by default, of course, if we put our resources into one bucket, by default we are ignoring all of the other things that need help. So, I would simply emphasise that climate change needs to be the context of any management decision going ahead, that anybody makes about what to focus on, and by default, what not to focus on. We will not save everything, and we will certainly not save as much as we could save by managing things the way we did in the last two decades or the last five decades.

There's a saying that goes around climate-change ecologists that we need to *manage the transformation to minimise the loss*, and that's the best mantra I think there is. It just has to underpin all our decisions. The world is changing whether we like it or not, and it is completely futile to simply think that by throwing money or time or volunteers at a problem in a local area you're going to conserve that area as it is now forever. We won't, but we can do a lot, I think, to minimise the worst aspects. I'm sorry, that's a very pessimistic message, but I'm just trying to inject a bit of realism.

Q - From a fire-agency background, with the increased heat and the chance of more severe fires, our natural way that we would deal with that would be more hazard-reduction burns, whether they're cultural or our normal hazard reduction. Are we going to be accelerating climate change by pumping more carbon into the atmosphere?

LH - Look, it's a really good question. No, as long as there is regeneration of that carbon stock, so, it's a sort of a closed loop. When you burn something, you put the carbon that was in that tree into the atmosphere, temporarily, but as long as you regenerate that tree to the same size, that carbon will be taken out, so it's a zero-sum game. The problem with why we're getting so much climate change is that we're redistributing the carbon that was locked up in the earth's crust, as coal, for example, into the atmosphere. It's the fossil fuels going into the atmosphere that's the problem. Having said that, of course, we do know that in any one year, a reasonable percentage of Australia's emissions actually come from savannah burning in the Northern Territory, but that is picked up again if that vegetation regenerates.