

Make better decisions about bushfire risk in our changing climate

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We're very fortunate again tonight to have two experienced and noted presenters. Our first presenter is Dr. Kevin Tolhurst AM, from the University of Melbourne, a renowned Fire Scientist and a researcher in this area. And then we'll have a Q&A, and then we'll hear from Michael Vermeulen from the CFA. Kevin, over to you.

Thanks very much Malcolm. I'll just share my screen. And thanks very much for inviting me along and, I've got to say, I think the organising committee needs to be commended for actually taking this initiative. There's a lot of interest in bushfires, but the opportunity to learn more about fires is sometimes limited.

So, I guess what I've been asked to talk about is making better decisions about bushfire risk in our changing climate. And some of this is relevant, whether or not we can talk about changing climate or not. But the changing climate actually makes it more urgent and makes it actually a little more difficult.

So, I think the scope for improvement that we have includes being better informed about what might occur in our local area, and the saying, "Knowledge is power", I think is quite appropriate here. So, coming along to webinars like this are important in terms of making sure we're asking the right questions, I suppose, and understanding where the answers might lie. The next question is how do we get better informed about what decisions and actions could make a difference. So, again, the webinar series is useful there.

Better planning for bushfires. So that includes looking ahead, setting some clear objectives, and looking at what our options might be and the pros and cons of those options. So that's planning. And then being better prepared that's about what we can do to mitigate the level of risk that we're exposed to, maybe even preventing being exposed at all. What training we might need in terms of being able to undertake the actions that we want, and what resources we might need to actually undertake those preparations.

And, firstly, I guess a better response to bushfire risk. Our capacity, our capability, and our ability and resources to recover. They're all aspects of things that I think we can make some better decisions about along the way.

So, if you look at bushfire risk, there are two sides to this coin. I guess one is about the fire: the probability of ignition occurring, and about three quarters of ignitions in Victoria are caused by humans and about a quarter are caused by lightning. So as our population grows, there are more ignitions, as we have more people in the landscape doing things like slashing grass, might be burning off, might be having a campfire, might be smoking. All sorts of things lead to ignitions in the landscape associated with human activity.

Fuel is important, obviously, because fuel provides one of the stored energy sources. But fires are also good at integrating energy from the weather, as well as the terrain, the environmental moisture, and taking advantage of the atmospheric instability out there. So, fires integrate all of

those factors, and we need to know what levels of those factors exist in our environment, and how that might change day-to-day, season-to-season.

On the other side of the bushfire risk equation, we've got the hazards that come from bushfires, which include embers and how embers are responsible for about 80% of house ignitions, in conjunction perhaps with other factors, but embers are really important. The radiation exposure and convection exposure. So, heat from the fire itself, and I've put in there the Bushfire Attack Level, the BAL rating, is a measure of the likely amount of heat we might get from radiation in a fire. Some of you may have heard of that already.

There's the wind that affects the vulnerability of our property, whether it's blowing material into the house, blowing embers, or even lifting roof, or tiles, or doormats, or furnishings around our house, wind increases our level of risk around a house. The design of our house. The level of maintenance of the house. The location of the house relative to other houses, relative to the fuels, relative to the terrain. What defense and mitigation there might be at the time of fire impacts on the house. Sprinkler systems. Firefighting gear. Those sorts of things that might occur, perhaps even a fire truck in your gateway. And last one there, that's not insignificant, is tree strike. What I'm talking about there is perhaps a branch falling on your house, breaking a window, putting a hole in your roof, which then makes it a lot more vulnerable to all those other fire hazards.

So, if we're going to be better informed about what might occur, then we need to understand that in the Nillumbik Shire, it's one of the most fire prone areas in Southern Australia, and there are reasons for that that hopefully you'll understand better by the time I finish.

Historically, the fire cycle, the period of time it takes to burn an area equivalent to all of Nillumbik Shire, is about 69 years. That's the historic fire cycle. And for all of Victoria, taking into account all the private and public land in Victoria, it's about 180 years. So, it seems quite long, but that doesn't mean that you're not going to have a fire in your area, that's the chance of every point in the landscape effectively being burnt.

But the thing that we need to appreciate is the fire cycle's getting shorter. In forested areas, it's dropped from about 90 years, back in the 1930s, to about a 20 year cycle currently. The graph I've shown here, you can see the trend line going down here from about an average fire cycle of about 90 years going down. And there are a number of reasons for that. Climate change is part of that, but it's also about the number of ignition points in the landscape, as well as accumulating fuels in the landscape. So, we need to appreciate that fire is becoming more common in our landscape and Nillumbik is certainly one of the main areas where that's occurring.

If we look at a map of Victoria at the average fire cycle, I've outlined Nillumbik here in blue, what you can see is it's on the edge of an area that's quite high fire occurrence. And you'll note that I've hatched the area here of public land. So, a lot of that high fire occurrence is associated with public land, forested land in particular. But Nillumbik basically butts right up against that area. What's different is that if we actually look a bit more closely, we see what's a little unusual is the amount of private land that actually has that high fire recurrence interval, because of its proximity to forested areas, but also because of the terrain, but also just where it is in the landscape, where it sits.

If we actually look at the fire history for our area, what I've done here is overlapped the fires that have occurred since 1927 and have been recorded. And what you can see here in Nillumbik is that it sits into an area here in Central Victoria which shows that some of these areas have been burnt three, four, five times in the 90 year period from 1927 to 2020. But Nillumbik is in there with some of these forested areas where fire's been more regular. But you have to appreciate that if you live in Nillumbik, a lot of the area has a significant fire history. Out to the west it's a bit less, but

certainly to the north, the east, and southern areas, there's been a lot of fire there historically, and there's absolutely no reason why that is going to reduce, but in fact it may increase.

The bushfire risk that we're looking at is a combination of the probability of ignition occurring, and as I said that's actually increasing, the human and lightning caused fires are both increasing, probability of severe weather associated with droughts, storms, or significant events. Severe weather has also been increasing, and we've had some significant storm conditions recently. Storms both in terms of the weather they provide at the time, but also the damage and the debris they leave behind afterwards.

The same with drought. Drought actually makes a lot of the vegetation available as fuel. The probability of fire spread. So, whether or not you perhaps live in a fire corridor or a fire flume, and you'll see that a lot of Nillumbik fits into a passage in the landscape where fires more regularly occur. We'll talk about that a bit more. And the probability of impact. Once the fire spreads, whether it has the right nature in terms of its intensity, the number of embers being produced, the scale of the fire to interact with the vulnerability of your house, your property, various infrastructure, for it to cause damage. So, what the consequence then of that interaction between the fire and the values or assets being impacted might be. So, the degree of damage or disruption that might be caused, what sort of cost but sometimes there's even benefits, because we actually need fire in the landscape for a lot of environmental services. So, there are benefits of having fire, but it's what sort of fire we're talking about. So, what I'm talking about is trying to reduce the catastrophic fires, and we actually need to increase the amount of fire in the landscape for the positive benefits we get. But they tend to be lower intensity and smaller scale fires.

And then the bushfire risk also has an element of the resilience and recovery afterwards. So, it doesn't all happen while the fire is burning. Some of it depends on how quickly the recovery occurs in the medium to long term, and what sort of long term disruption there might be, and the costs and benefits. So, resilience and recovery is an important part of what the level of risk is, not only the fire itself.

Looking at some data from the area, what we can see here, this is data going back to 1921 from forested areas or public land across Victoria, we can see the number of fires has been progressively increasing over time. There's quite a spike here in the last couple of years, whether that keeps going up or not but regardless we can see that there have been more fires in the landscape. These don't include a lot of the fires that CFA go to which are smaller fires and aren't causing as much damage. They're important fires, but what I'm talking about here are the bushfires, which tend to be the ones that lead to a lot of the damage. Major fires on private land are included in this data set as well.

So, some work that was done a while ago, looking at the impact of climate change on fire conditions, basically show that for Melbourne, for example, there's going to be a reduction by 2050 in the number of days of low fire danger, but an increase in moderate, high, very high, and extreme fire danger days. And we're seeing that already. I mean, you don't have to look at the data to know that we're getting more of these very high and extreme type days.

And, just for comparison, what's happening in Sydney is much the same. The only difference is the very high and extreme sort of days are much less common than they are in Victoria. So, the pattern is similar along the East Coast, so, Southeastern Australia.

And this same study, if we just look at Melbourne, we can look at any of the other areas as well, but we can see from 9 days a year of very high or extreme fire danger. That's a fire danger index of 25 or more. Back when this study was done in 2003, there were about 9 days a year of those very

high and extreme fire danger days. That's expected to increase up to about 14 days. So, for all of these numbers, just about, there's about a 25-50% increase in the number of severe fire weather days. So, they're not great in terms of number necessarily, say, 14 days compared with nine days, but fires travel a long way in one day or even 8 hours. So, the changing climate is going to have a big impact.

Where does Nillumbik fit in all of this? Some modeling that was done by CSIRO looking at different weather patterns, this is for a climate change scenario, and what we can see here is there's basically a corridor coming from Northwest Victoria down through Melbourne out to the sea again. But there's a corridor here that actually has severe fire weather conditions on a regular basis. So, in here in Nillumbik, we would expect to see a fire danger index of about 175, there's a 1 in a 1000 chance of that occurring by 2050, a fire danger index of 175. And by comparison, Black Saturday was about 130. So, the area in this darker pink color is actually showing an area where the potential fire danger is much greater than it would be, say, in parts of South West Victoria or in Gippsland or even up in the Alps. So, whether you like it or not, Nillumbik is actually in quite a bad area for the likelihood of having that severe fire weather just because of where it is in the topography.

If we compare the climatic conditions, I guess for some different areas, and I'm using Hurstbridge as a point for Nillumbik, what we can see is that there's probably about a 1 in 10 chance of having an FDI of around 70, and about a 1 in 50 chance of the FDI being about 110. This is in any particular year, so on a summer's day, one of the days in the summer, being an FDI of 120 there's about a 1 in 50 chance of that occurring.

This is in by 2050 and it goes up the probability reduces so a 1 in 200 chance of it being up as high as an FDI of 140. But this is for that FDI persisting for a period of three hours, so it's the average over three hours. And just out of interest, the Bushfire Management Overlay is based on a calculation of fire conditions when the FDI is 120 at a peak. So, in reality that would be equivalent to about 100 here, because 120 at a peak is not the average, whereas these numbers here for this graph are three hour average FDIs.

So, what we can see is that Hurstbridge again is not that far off somewhere like Mildura, which we consider to be hot and dry, but significantly greater than somewhere, say, like Bright in the Northeast or Orbost in Gippsland.

So, across the state, we've had mapping done to define areas which are bushfire areas, potential Bushfire Prone Areas. And the hatching across the state here shows that most of Victoria is considered bushfire prone, apart from urban areas, like around Melbourne and water bodies like Lake Wellington down here. So, there's not many areas miss out of being bushfire prone in Victoria. More particularly, that's on the basis that fires can potentially get up to an intensity between 4,000 and 30,000 kilowatts under the fire danger index of 120.

BMO areas, Bushfire Management Overlay areas, are areas where you have to have special planning permission to build a house, as show shown here in yellow. That's where the potential fire intensity can exceed 30,000 kilowatts, and you're likely to have sufficient ember load to set fire to your house. And if we look at Nillumbik down here, it's solidly in a Bushfire Management Overlay area, because most of the area has the potential to be exposed to these high intensity fires and high ember loads.

Another way of looking at what's going on here is that we can look at things like convective strength. So, the potential of fires across Victoria to create effectively pyro convective fire behavior, that's where we get fire induced winds and potential for firestorms forming. We see Nillumbik is on

the edge of the area between moderate and high up here. Some of it is down in the low for convective potential, so it's an indication of the scale of the fire. Firestorm potential, again around the boundary, there's a potential for that. We saw that happening at Kinglake, and we saw it happen in Kilmore, in Narbethong, and in Marysville. So, not so bad that way.

Ruggedness, Nillumbik starts to show up as being in some of the high and moderate ruggedness. So, where fire potential can be quite high, and where we've got potential for a lot of severe fire behavior.

But, with all of that combined, we've got the house loss probability showing up Nillumbik as being high to extreme over large parts of it. And that's because of the combination of all of those factors. The embers, the flames, and the fire induced winds.

Purple is the extreme areas, and we see a lot of Nillumbik occurs up in the Strathewen and St Andrews area, falling into that, and even down here around North Warandyte, we see patches of these extreme areas mixed in with the high. Nillumbik has some real issues.

So, when we look at the potential for fires, this is a whole lot of simulation where uniform fires have been lit across the landscape, so it's a bit unrealistic from that point of view, but it gives you an idea how flammable landscape is. We can see some patterns here, where there are runs of fire through the landscape, areas here where perhaps a couple hundred of the simulations have overlapped. So, these are the fire corridors, and these fire corridors are partly because of the terrain and the fuel, but also part of the weather patterns. So, there's a secondary pattern here that's affected by the wind changes we get, that often result in a lot of the damage and life loss.

So, with Nillumbik again, what we can see is because they're in the green wedges or green coronal areas, there's not likely to be a lot of change to that bushfire level, because of the openness and the ability for bushfires to burn through there. And that's why a lot of the Bushfire Management Overlay area covers the Nillumbik area. One of the issues to Nillumbik is the majority of the area is actually private property, and there's a lot of forest mixed in there. So, that puts more onus on you for taking consideration of bushfires. You can see up here, where some of the high house loss potentials were, and some were associated with public land as well as private land, that the vast majority of Nillumbik is actually private land.

So, what can we do about it? We need to be looking at what we can do about embers, radiation, convection, flame attack levels, the fire induced winds, tree strike, and house to house ignition. They're all things that we need to be assessing on our own properties, so that we can make some changes about that. So, prepare for it, make some allowances for it.

If we bring that all back together, what decisions can we make? Well, we can be better informed about what might occur. Severe bushfires are becoming more common due to climate change and population growth. Personal fire impact is changing from once in a lifetime to perhaps an event every two or three times in a lifetime. Fires are becoming more extreme due to increased fuel and more severe weather. There's a distinct pattern of fire occurrence in Nillumbik, and Nillumbik is certainly a fire prone area.

So, being better informed about what decisions and actions could make a difference, well we need to be able to assess what my level of bushfire risk is, by looking at what my current Bushfire Attack Level is. So, even though we may not be building a house, we can still undertake the assessment. Have we got adequate insurance? What mitigation and what response are we making?

What are my trigger levels for action? So, based on my level of risk, where do I get trusted, reliable, local, relevant bushfire information from so that I can enact my plans and see whether I'm getting to my triggers, and what are my options for various bushfire scenarios so not all bushfires are the same. I need to consider all the different scenarios that may threaten either my life or my property.

We need better planning for bushfires, better prepared for bushfires, and have a better response for bushfires. Basically, understanding the fires, planning, preparing, and practising those plans is really the answer here.

I'll just leave you with an image from Marysville, which basically shows a house in the background here, which you would think has limited chance of surviving, but they were well prepared and the house was well defended. A brick house in the front, so this is a timber clad house in the back that survived. The brick house in the front here was totally destroyed. So, you need to understand it's not totally random. There are reasons why some houses survive and some don't. So, thank you for listening.