Bushfire Resilience Inc. Webinar 5 2021. Presentation

Your sheltering options

Chair: Malcolm Hackett OAM

Presenter: Dr Rahaele Blanchi

Chair

Tonight's webinar will begin with a presentation on Bushfire Sheltering by Dr Raphaele Blanchi. This will be followed by a panel discussion with Dr. Katharine Haynes from University of Wollongong, and Dr. Chloe Begg who's the senior research scientist from the CFA. We'll finish with our usual Q&A. So, over to you Raphaele.

Raphaele Blanchi

Thanks very much and thanks for the introduction as well Malcolm. That was a great introduction to this topic today. Your story and what you've been facing when trying to defend your house and trying to then exit a burning house. And that's a good introduction for this seminar where we're going to look at the challenges that we are facing when the bushfire arrives. But also some of the issues we might as well face.

This presentation is based on the research that we did in collaboration with CSIRO and the University of Wollongong and I'd like to acknowledge my co-author here Katharine Haynes. She'll be part of the panel and will be able to give you some other perspective on some of the challenges that we might face during a bushfire.

To better understand what people have done during bushfire we collected information from post-bushfire surveys, interviews that have been done after major bushfire like Ash Wednesday, Black Saturday and more recent bushfire, the 2019-2020 bushfires. We used reports from the 2009 Bushfires Royal Commission, Coroner's reports, documentaries, news articles, and journal papers. So we look at fatalities and the circumstances of the loss, but we also look at, how people survive. Where people died, the weather conditions, what were the distance to forests, what were their response and intentions, where people sheltered and how they survived the bushfire.

Some of the information we are presenting today could be distressing to some of the audience. So, please make sure you look after yourself and reach out to the helpline if needed that Malcolm mentioned early in the introduction of the seminar.

When we look at historical loss during the last 120 years we found out that most of the losses have happened during iconic bushfire such as the Black Saturday or Ash Wednesday. They have occurred in the south-eastern part of Australia. Victoria, our state, is one of the most affected with around 10,000 houses that have been lost and around 500 civilians that have lost their lives. And this is because of the concurrence of Extreme fire weather conditions, fuel accumulation, big forests, and people living in those forested area in a Bushfire Prone Area. So when we look a bit more into the loss they have occurred during fires that are driven by Catastrophic weather conditions with a forest fire danger index above a 100 which means temperature that could be above 40^{o}C, humidity under 5%, wind above 40km/hr, and very dry conditions.

If we look at the location where people died during those bushfires - losses in open air (people that have died outside), and in vehicles are rising up to Extreme weather conditions, and then it reaches thresholds under Catastrophic weather conditions, where we have more deaths that happen inside structure. The data is obviously driven by the Black Saturday fire but still interesting to consider what could happen under those extreme fire conditions, like intense fire conditions.

It's also important I think to look at it in the perspective of our current building regulations. Because it's interesting to note that the regulations are assuming a fire weather Extreme or below when we consider the exposure to build a house. And that means that they don't claim to be affective under Catastrophic weather condition. So if someone has to shelter in a house that's built to regulation under those weather conditions the house might not survive. So something to think about when we're considering our plan for sheltering. In an ideal world I have to say under those conditions people should not be there, but what we've seen in our research as well is that for different ranges of reasons, people find themselves at the house or outside when the fire arrives.

If we look at people's response during the bushfire it's quite complex. Some people would leave early, some people would stay and defend, some people began to defend and then leave, some people return to the fire, some people would shelter, and some people do many things, not only one thing. When we look at some summary to have a bit of an understanding where people are and what people have done some of the summary from the 2009 Black Saturday showed that 48% of the population stay and defend, and around 21% have left early and leave during the bushfire.

If we look at subsequent fire we find that like in the 2011 to 2014 fires the stay and defend were around 10% and 35%, and then we have 26-65 percent of people leaving. And then for more recent fires similar for the stay and defend, we still have a high percentage of people that stay, like 47% for the 2017 New South Wales fires and 43% for the 2019-2020 bushfires, the recent bushfire.

So what does it say to us? At least less than half of the population might find themselves at home or in a fire affected area when the bushfire's going to arrive. So we need to think about what happens and think about how to protect ourselves. So is there any change that we can see since Black Saturday? There is an emphasis of leaving early on Catastrophic days, but is it practical? Like it's not always possible in different regions or for people that are living remotely. Is it possible when there is fire as well in the landscape for many, many days like in the 2019-20 bushfires where people might evacuate several times and have to keep coming back and evacuating. How practical is that? What the research shows as well is that many people remain committed to stay and defend. There is also better communication on risk and preparation which is good to know because that's when people going to be able to prepare their house better. But it's still significant proportion of the population that's unaware of bushfire risk and might not take the right decision.

We also got a better warning system but some of the research shows as well that people tend to rely too much on that information and on those systems. And sometimes there is some issue there is some black spot. The mobile phone is not working, the response to warning is delayed, so what do we do in those cases? Having also past fire experience might encourage people to stay and defend but it really depends on the experience and it's difficult to understand how it might influence people's decision.

So when we think again why people shelter. In a lot of cases people believe that the house would provide safety. They also believe it was too late to leave so they have to shelter. They were unable to leave. They tried to leave but they found a blockage or their car was not working, and a lot of things could happen and they have to come back for example. They try to protect themselves from the effect of the fire, the heat, the smoke, the wind, and the flame. Or they were unable to defend or stay in the house.

So, looking at people's intention and plan and preparation because that's what I think is really important to consider having a plan and put that into practice. In the research we did and some other data we looked at there is limited evidence of prior planning and preparation for sheltering. There are people that have shelters or bunkers, and here I'm talking about homemade bunkers, because there was not an accredited bunker on the data beforehand. Some peoples also have made some preparation because of clear or fuel reduced area explicitly for sheltering, or some people have prepared their house with short term sheltering in mind. And we see some difference in intentions, with people that want to shelter as a primary strategy (not many) or shelter as a backup or last resort.

So when we think about sheltering it's really about protecting yourself from the effect of the fire and other conditions that you might experience during the day. So that means first what are the physical impacts of the fire? The things that you might experience when you stay and defend or when you're outside when the fire is going to arrive. There is potential burns from radiant heat flux and flame. There is also the fact that you might experience exhaustion and dehydration because of the heat exposure. Usually some of the bushfire always happen during those very hot days and extreme temperature. Potential car accidents and other injuries because of falling objects and falling trees. Then we have to consider also the smoke exposure with the issue with smoke inhalation but also the visibility and what's the impact that has if you were to go if you're driving or if you want to go somewhere. Noise as well is another aspect. And eventually something we need to consider is a mental health effect with high level of fear, anxiety and trauma. And I won't go into detail about mental health effects but I'd just like to go through some of the physical impacts that people might experience.

The first one is radiant heat and I'm sure that most of you have heard about it and what it is. But I'm just going to give a simple explanation, just as a reminder. So if you think about yourself in front of a campfire and you put your hands like that you can feel the warmth in front of you. And that's the heat that radiates from the fire. So, if you think about it all your front is quite warm in front of the fire, but your back is really cold. And it's because your body is acting as a barrier between you and the fire. So the front's warm but the back is cold. And that's really something I like to pass as a message it's really important when we're talking about radiant heat to think about what's the barrier between me and the source of fire.

In addition of the barrier you could think about having enough distance so the effect of the fire or the radiant heat could be reduced or diminished. If we look as well at this bushfire little scene like graphic. What we find is the bushfire produce flame, embers, and here that's just simulated with those orange line. Then we can think about objects between the source of the fire that can play a role as barrier, like trees, or for example like a fence that can protect a bit from the radiant heat, or even a house. Like if you put yourself here you will be protected from the radiant heat coming from the fire that is here.

So it's quite important also to consider that the bushfire is not the only source of flame and radiant heat other things are burning around your house like surface fire, fences, and other houses that could be burning. And they all produce flame and radiant heat that you need to consider to protect yourself as well. Second point I'd like to raise it's the exposure to heat and the high temperature in the day because this will bring your body temperature up and that can result first in cramps, muscular pain and spasms. But then you can also experience if your body is still very hot if you're working hard outside because you're trying to put out some fire or you're trying to protect your house that can evolve a loss of a lot of body fluids through heavy sweating and that can create heat exhaustion. That's when it's really important to remember to hydrate and drink a lot during the bushfire. But if you keep going and if you don't cool down it can lead to heat stroke which could be life threatening if you got some pre-medical conditions. So the best thing you can do if it's possible, is to get out of the heat and rehydrate in those cases.

The last one I'd like to talk also about is the smoke exposure. So when the visibility is really low like when the smoke is really thick that means that there are a lot of particles of carbon monoxide and other compound in the smoke. And all of those have different impact on your health. The impact on your respiratory systems like with breathing difficulty but also increase any medical condition you might have such as asthma. So that means you can have more severe asthma attack and thinking about vulnerable people that might be susceptible to those asthma attack. It's also an irritant for your eyes and your nose and your throat. Finally they can cause headache, dizziness, fatigue, confusion, and impact your decision making because they slow down your thinking and impair your judgment, so it's really much difficult to make some sound decisions. Finally they have an impact on your cardiovascular system if you have some pre-existing conditions.

How to protect from smoke is for example to use a mask. For example the P2 mask would protect you from particles and would reduce the irritations. It won't protect you against some of the other compounds. And using goggles would also reduce the irritation. Something you need to consider when you're working harder you are breathing more and breathing more pollutant in your lungs and that could increase the effect of smoke on your body. But overall all of these effects play a role together - the heat, the smoke, the exhaustion, and that's what can really impact and have some strong impact on your body.

Moving down now to sheltering and some of the data we've been looking at from the 2009 bushfire we've look at people that have shelter in different places such as houses, commercial building, different structure, like a garage, shed, spa water tank, bunker and all of that we consider as a structure and will provide a bit more protection from the radiant heat. If the house is really tight it also can provide protection from the smoke.

People have also shelterd in vehicles and open space and the number that I'm presenting here is only indicative because we know that much more people have shelter in open space and CFA sheds. So when we talk about open space that could be over paddocks but also could be a water body, pool, dam, or river. But all of those in open space provide less protection and really has to be considered as a last resort.

So I'm going to talk about more generally about three places of shelter. First the house because that's the most common place of shelter. What we've seen in the house like where people have shelter as you can see different room like bathroom, kitchen, bedroom, studies, and a house enclosure which includes cellar and workshop, for example, the entrance, the lounge, or laundry. But what's really interesting on that aspect is most of those rooms have reduced visibility to the outsides and have no direct exit as well. Like only the entrance really and the laundry have a door at a direct exit to the outside. Most of the other room don't have it. And the bathroom for example is one of the room that's got the less visibility to the outside but also no potential exit. And interestingly this was perceived as a safe place. So this might stem from the ready availability of water in the bathroom, hard surface, might also stem from information coming from cyclone protection. But what's interesting to note is that children and pets were often confined to the bathroom with and without the presence of the adults making quite dangerous for them to be in the place with a bath full of water for example.

So why it is dangerous to not having visibility to the outside is because there is a potential of a house to fail. And we've seen in the data a number of shelter failure where people were sheltering in the house and they were forced to exit or become trapped into the shelter. And mainly in the house we had many examples from survivors that describing how their house ignited and how it was difficult for them to make this decision when to get out and where to go as well. Because everything's burning outside, like strongly. And things are starting to burn inside. So when do you make those decisions that's it's not safe inside anymore and it's safer outside? So, that's this really thin balance that people need to understand when making those decisions.

And to do that you need to understand what's some of the issue with the tenability of shelter. Recognizing when the shelter is going to lose the tenability and when the shelter might catch on fire. And when you think about a house there is a lot of cavities. There are wall cavities that often have like a wooden frame. There is underfloor where people have storage. There is the roof cavity with a lot of debris. And all of those cavities if embers or if any ignition happen in those places it's very hard to recognize. And it's also very hard to extinguish. So the house can catch a fire before people can even understand that happened. And people need to have the ability to recognize when the house is close to failure. And that includes the house is rapidly filled with smoke, the floor or the ceiling might start to collapse, there is rapid flame spread through the house as one of more rooms or the building cavities in flashover. There are items in or near that's starting to catch on fire or might even be exploding. And at that time it's why it's so important that the occupants ease or locate themselves at the most viable exit location in anticipation of this occurring so they're able to get out.

So how we can do that and what we find in the research that was really important to sheltering actively which mean having a regular monitoring of the fire and the condition inside and outside the place of shelter as well as action to protect the occupants including extinguishing fire preventing entry of the smoke, caring for children, elderly, and people who may have been injured. So inactive sheltering was something that was an issue with a lack of regular monitoring and action to protect occupants.

What we find and it's good news in most of the cases, people were sheltering actively with varying degrees and engaging in monitoring and action to protect occupants. There was only in some of the households there was maybe one person who sheltered inactively and that was often children or elderly or dependent, and that's something that Kat will discuss a little bit more in the panel afterwards. While all the other ones were defending or sheltering actively. Out of the 325 cases that we studied only 22 of the households member were sheltering inactively.

So a summary what we have to remember when we shelter in a house is the importance of active sheltering, understanding the house response to the fire, when the house is no more tenable, and then thinking about safe exiting. What are the combustible elements around the house, the trees, the car, the fences, the wooden retaining wall that might be burning and that might make it very difficult for you to exit. What is my pathways, what's the deck and the stairs if they're made of combustible elements they might burn down when you open this door and you might not be able to exit. And also thinking about issue with visibility because with the thick smoke we might not be able to see where to go. So understanding where things are and where we can go.

So sheltering in the house is probably one of the safest option that you have. Then you have the option of sheltering in a vehicle that provides some protection from radiant heat and from smoke as well.

We did some experimental work to understand how people can survive in vehicle and we find out first importance of parking in an area without fuel and far away from fuel, like a burnt paddock, for example. It's important also to position the car facing the main fire direction because some of the tail lights melt easily and then let the fire in. It's nice maybe to have the air conditioning on and on recirculation at the beginning but when the fire arrives it's important to turn the engine and the air condition off to ensure also that all of the vents are closed and all the fans are off during the peak of the fire. And this is to avoid the smoke circulation in the car and fuel related engine fire as well.

What also we find out was that staying low and preferably under a blanket would provide more chance of survival because the hot smoke tend to be worse the higher in the cabin. And finally it's the same then for the house. It's balancing when to stay into the house during the peak of the fire and when to exit. And it could be very uncomfortable as well because you have to stay as long as possible inside the car to give you most chance to exit in a tenable environment where not everything is on fire outside. So again, a balance between staying protected and exit on the outside.

When we think about sheltering outside now we find out that's some of the residents refuge in open space that were close to their house such as burnt paddock, non-combustible driveway, olive growth, or further away at community sport oval or school ground. Some of the people also shelter in water bodies like swimming pool, dam, lake, and open spa. And that was often a secondary location of shelter. These are places of last resort because people mentioned how difficult it was to get there because of the poor visibility and burning of ???. But we discuss a bit more about those challenges in the panel.

In conclusion, sheltering is not an alternative to leaving early but it really needs to be considered as a contingency plan. But also we need to think about it as a plan beforehand. It requires a lot of planning and preparation by residents, understanding if you're safe in your house and outside what are the issues and the vulnerability of your garden and that you may face if you have to get outside.

Really important to actively shelter, which means continually monitor and respond to the condition inside but also outside the house. The shelter needs to be appropriately designed for the circumstances like safe and effective exits. The surrounding landscape free from combustible objects mentioned that creates a lot of risk when you're exiting. Good building design that will perform well and provide confidence to the occupants when used at a temporary shelter.

And then there are other options - Community shelter, neighbourhood safer place, last resort that we might discuss a little bit more in the panel. Thank you very much.