Bushfire Resilience Inc. Webinar 4 2023. Panel and Q&A Session

Grass fire and bushfire behaviour

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Malcolm

To start the session off I'm going to ask you Justin about some commonly held beliefs concerning fire behaviour. Some of us might think of them as fire myths. You've already answered my first one but I'm going to pose it and you can give a quick answer again. Is the facade of a house and nearby vegetation facing the wind the only location affected by a bushfire.

Justin

I covered that to some extent. What we're finding is houses actually more pre-eminently ignite and burn from the downwind side back towards the wind. It actually tends to be more dominant in entering the back of the house and burning through. That seems a little bit counterintuitive when you think about fire fronts raging towards the house. In fact it's more common for houses to ignite and burn without actually having to face that really severe fire front attack. Most houses don't actually experience that brute force frontal assault of a fire. They're burning from the more insidious ways which is why it seems to be far more common where house ignitions are observed. And their progressions observed that it's actually happening from the downwind side back.

Malcolm

This question's related. Is it true that if your property is on the downslope of a hill that you're going to be safer in a bushfire?

Justin

Meaning the fuels are above you rather than below you is the assumption there. Being on a slope simply means you've got potentially elevated fire behaviour specifically from the fuels that are below you. So a grassland fuel on a slope can be more serious. Fires can burn across slopes and the fact that you're on a slope means that the broader terrain around you has complexity to it. Like Kevin articulated there's quite a lot of dynamics - wind dynamics and unknowns that are entered simply by the fact that you're in that terrain. Therefore I think you have to broaden your thinking about all the other aspects of what that broader terrain context is going to bring.

Kevin

Malcolm if I could just add to that. In the 2009 fires the most intense areas of fire were actually on the eastern slopes which was the opposite direction to where the wind was coming. There are a couple of reasons for that. Because they're sheltered slope that tend to have more vegetation and fuel because of the better growth conditions but also that's where a lot of the embers were falling and then being drawn back up into the main fire event. So it was really surprising to see that the

most intense areas weren't on the windward side but on the leeward side because of this inner draught conditions where those fuels suddenly become available and got drawn back into the main fire event. And there's no way of cooling then. Air being drawn in is hot air. So it can be quite counterintuitive. What might look good in mild conditions doesn't necessarily apply under really severe drought conditions.

Malcolm

Those wind directions you showed on Pine Ridge Road certainly bears out. Lots of people in Strathewen talked about the fire coming from every direction possible on numerous occasions working its way around depending on what the wind was and where they were located.

Justin, lots of people say if you're more than 100m from bushland then you won't have to worry about ember attack.

Justin

When you look across the broad set of loss statistics of how and where houses are burnt down there's really losses out to 600-700m from what you'd call conventional forest fuels and other conventional fuel sources. That more or less defines the maximum ember reach distances you need to think of before you're more or less immune from potential ember attacks that are of the intensity enough to ignite your house and immediate surroundings. There would be exceptions to that under really extreme weather conditions but that's just looking across the broader context.

What's achieved is approximately 80% of all the house loss falls within that first 100m. And then it's a very long taper of loss ember related impact loss way out to 600-700m range. So you have to think about it over those distances and not to become overconfident by the fact that for instance regulation notionally stops at 100m in terms of requiring house construction. It's actually just saying well 80% survival rate's acceptable in terms of setting up minimum regulation and losses beyond that are common and are often observed.

Malcolm

Kevin, you mentioned trees can slow the grass fire. This person wants to know where they can find information on designing and growing a firebreak of trees to slow grass fire.

Kevin

There's a couple of aspects to that. The CSIRO fire behaviour model for grassland for Northern Australia takes into account the effect of trees in slowing the wind. A woodland environment where you've got about 30% tree cover will slow the wind by about a factor of two. And when you're closer to fire the wind reduction is more than 30%.

The second part of that story is you probably need to be then choosing species that aren't going to contribute to your ember load when they do burn or the radiation. So for example the Corymbia Maculata (Spotted Gum) would be a tree that would be reasonably robust but not produce many embers and produce good wind reduction.

You'd need to choose the species. Deciduous trees would be fantastic because they're not going to produce embers and so on. If you want a woodland environment they would be ideal - sort of

10-30% tree cover. And try to choose species that have low flammability in terms of both their bark and also structurally sound in the sense of branches and so on that might break off in strong winds.

Malcolm

Is there a preferred tree height?

Kevin

Some rules of thumbs I suppose which are that the trees will have an impact for up to about 10 times the tree height. So if you had trees that were say 30- 50m away from the house but were about 20-30m tall they'd be having a significant benefit in terms of reducing the wind. So what I'm thinking here is more like a shelter belt rather than necessarily a continuous area. But you could have a continuous area but you'd want to be very careful about the species selection you made.

Malcolm

Now here's one for you Kevin. Central Victoria has large areas of heavy gorse infestation on the fringes of the grasslands and forest. How might these affect fire behaviour and spread?

Kevin

In the area where I live there's plenty of gorse in the landscape. It won't affect the rate of spread of the fire particularly. But what it does do is prevent access to areas and will make fire suppression a lot more difficult. If you had an extensive area of gorse that was burning it would actually act as a bit of an in draught area to draw in the wind. So there may be some localized reduction in the rate of spread of the grassfire but it would be quite localized, less than 100m. So really it's just an impediment to access and suppression because they burn very hot because of high oil content. A lot of dead material is suspended in it. It's a terrible fuel and we're just lucky we don't have as much as New Zealand.

Malcolm

Justin, would having small mounded gardens breaking up grass either slow down or accelerate a grass fire?

Justin

Any discontinuity or change in the terrain in terms of breaking up will help. Fires will move at different speeds in the grass compared to a mulch bed or a mound. So that helps break up the intensity only because it has slightly different rates of spread through those different mediums. Any degree of discontinuity will help but what does it mean in the end? You have to think about the house as more of an onion ring of consideration. So if you've got low level dry grass right up against your house that's going to burn at some point and it might burn in a number of small erratic fronts. Or it might burn as a nice big clean even line. Kevin definitely showed how that build up in continuity and consistency means more intensity because it works together. So in a sense breaking it up so you're getting lots of smaller rivals is slightly better than having the broad front turn up.

Malcolm

This is a very topical one. Could the urban destruction from the fires in Maui, in Paradise California, occur in Australia? In particular new urban developments located in rural towns such as Romsey and Lancefield.

Justin

Thankfully the way various US states approach their building construction and town planning differs from Australia in a few ways. They tend to build even lighter weight construction buildings than we do and they make a bit of an extra effort to stack them even closer together in quite a uniform consistent way almost like a volume build them all the same type layout. I'm watching our approaches and the economics of how high density building estates are put together in Australia are becoming more and more like the US. I'd say our legacy building stock is not as bad as these parts of the US that are showing these large urban fires. But I definitely am concerned about how much closer and closer we're getting to building whole estates that could burn in those similar ways.

Malcolm

Kevin?

Kevin

I would like to add to that. I was talking to a Canadian fire agency at one stage a few years ago where the same thing was happening in Canada. And they were looking at the prospect of bulldozing a number of the houses to break up the run of fire through the township. That was going to be an incredibly difficult decision to make as to where do you start to bulldoze the houses? You'll have winners and losers in that. So it's something that needs to be dealt with at the design and planning stage. It's not something that ought to be left up to fire fighters at the time. It's quite predictable and I think Justin has pointed that out. And it's not just the proximity of the houses but it's also the building materials.

Justin

If you ask those fire fighters how they can pull up - let's call it an urban conflagration fire, they would describe those fires as being so intense and generating such an acute amount of smoke that actually making a stand within that urban environment to pull it up (other than driving a very large dozer to build a fire break within it) is near impossible. For their own safety they have to actually stand back and let the fires burn out the other side of these urban environments because they can't really make an effective stand within it. That involves standing in front of the smoke and putting up with so many coincident large asset fires.

It's really important to know. Kevin made a good comparison between the relative fuel load of a grassland and a forest. Put an urban environment at a similar escalation again in terms of its overall representative fuel load. There's much more fuel in an urban environment compared to a forest. So the whole issue of intensity and process as that unfolds is on another level again. I think there was a particular Canadian or North American fire where while there was an urban conflagration where there was so much heat going up, even more so than you typically get out of a forest, that it was actually creating or interacting with the weather and creating fire induced winds

and eddy tornadoes and stuff that looked pretty damn ominous. And that was a large urban footprint fire that it had progressed into rather than a forest fire.

Malcolm

If there's a grass fire approaching is it better to try and stop it at the boundaries say 400m away and down slope, or to stay in readiness to defend at the house? In this case there's only two adults present. I went to a spot fire that was 400m away. And while I was there I saw another fire coming to threaten my home and sheds. I was exhausted by the time I got back the 400m to confront the fire that was coming. I don't think I'd ever do it again. Justin?

Justin

I'd surmise that once you put it out and made that stand and run back while you're running back all the grass between you and putting that out is probably starting to go off in various spot fires. So the question is to what outcome or effect would making a stand at a border given that you've run over a whole lot of let's say well manicured dry grass to get there? That's going to burn out at some point unless you've got a very effective wetting system that's going to keep it in a non combustible state. Because there'll be so many reasons and ways all of that fuel will eventually burn out.

Malcolm

How likely is a ground fire going to creep into the canopy of the tree? Can canopy fires start from ember attack alone?

Kevin

No not really. You can get a fire started in a canopy if an ember falls into some dead bark in a tree but that's not going to cause the canopy fire per se. There wouldn't be enough continuous heat and ignition to set fire to a eucalypt canopy as it would be too dispersed. So what would be required would be considerable more fuel as elevated fuel - shrubs and bark on the trees to basically get the heat in the canopy or a very steep slope to get that continuity. Embers alone won't start a canopy fire.

Malcolm

Is a longer well watered lawn going to stop grass fires due to preserving soil moisture?

Kevin

Soil moisture is not the critical thing here. It's the fuel moisture. So if there's no dead material in your lawn which is a little bit unlikely then the soil moisture will keep the grass moist for longer but if it dries out in a drought or whatever or on a really hot day it will still burn. So the soil moisture on its own is not going to do it. It's the condition of the grass that's important. On top of that is this thatch idea that if there's dead material in amongst it the soil moisture is not going to have that much influence on the thatch layer. So I've seen Kikuyu grass that looks totally lush and green smoulder but quite happily. It's not a flat big flaming front but it continues to burn and provides a source of ignition that could be for hours.

Malcolm

If you have limited ability to reduce all possible hazards is it more valuable to prioritize preventing ember ingress into the building than reducing the fuel sources?

Justin

Start from the house and move outwards in terms of your consideration. Creating an ember resistant house if I was to list the hierarchy of things would be step one. Very soon after would be eliminating vegetative fuel sources immediately around the structure as a very close second. But you almost have to do those two things as a box set because the embers are going to attack your house directly or they can attack the fine fuel debris around your house which then is going to attack your house. So really they're both all into the ember attack consideration camp.

Malcolm

We are having some trees removed next week in our driveway and they want to mulch them and spread mulch up our driveway

Justin

The further away from your house the better and definitely go back to making sure your house is ember proof for a whole range of reasons, mulch being an additional source. And consider the use of your driveway as a possible path that you may need to navigate in an extreme event. So think about separation from the physical driveway itself and the fuel loads along it.

Kevin

The problem of burning mulch is how long it burns for. It'll smoulder for a long period of time so it makes the duration of your fight much longer. That's a major hazard in itself.

Kevin

And considering your composting window between getting it down and how well it'll compost in before things get too dry then it'll just remain as consistent mulch on the surface in a dry state.

Malcolm

Most of us are looking to the north or the northwest for a fire threat. Is this the most likely direction?

Kevin

On a big fire day that's true but fires can come from any direction. If we're considering south eastern Australia those directions are likely to cause the biggest problems. But when it gets within say 10-20km of you then the potential of the fire to come at you from any direction is a real possibility. So the bad hot northerly wind days are already a bad sign. But in terms of the attack on your property it could come from any direction once it's within about 20km of your property.

Malcolm

Justin do you know from your research how many houses are destroyed from the north or northwest compared to on the southwest wind change?

Justin

The vast majority of houses were lost on the wind change. So as it folded from a northerly driven system to a south southwester the dynamics of how all the winds were rolling and folding meant that there was significant additional wind and that erratic nature and severity of the wind played a significant role. And you're also turning the fire from a fairly small impact footprint to a very large front which is the other reason. You've just got a lot of assets in the way on the change. But it was surprising how many houses burned actually on the change rather than in the hours once the change had kicked in and created a much larger landscape fire. So yes it's certainly after and during the change rather than prior.