

Conference Proceedings – Speaker Transcript

Using a long-term research project to investigate the immediate effect of fire on fauna

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Today I'm going to be talking about short term fire effects on fauna (Slide 1). What do I mean by that? Effectively, what I'm talking about is how animal populations respond to individual fire events. You might ask why this matters (Slide 2). It matters for several reasons. Firstly, how species respond in the short term to individual fire events will influence post fire recovery in the long term. Secondly, fire events can be significant for range restricted or threatened species. Thirdly, there are management implications about how fire influences populations. For example, species' use of refuges, patchiness of planned burns, and how this actually influences species' responses has important implications for management, and can potentially be manipulated.

But how do you actually go about determining the effects of fire on fauna populations (Slide 3)? Here on this graph, we've got a site being monitored over time. Animal abundance is on the Y axis, with a fire happening about halfway through. When you look at the animal abundance over time you might conclude that fire is affecting this animal population and resulting in a reduction in abundance.

But what if something else is changing over time as well (Slide 4)? Just as an example, rainfall. What if rainfall's declining over time? What if that's influencing this population? What you've got now is uncertainty about whether fire is actually influencing this population. So, in order to look at this, you need to monitor sites both before and after fire, but you need to monitor sites at control sites as well. Luke talked about a really good before/after control impact experiment this morning.

Before/after control impact (BACI) fire experiments basically involve monitoring burn sites before and after fire, and also monitoring unburnt controls before and after fire (Slide 5-7). These are great, but they're logistically very challenging, especially when you're dealing with fauna. In terms of wildfire, planning for a wildfire to happen is not something you want to do, obviously. In terms of planned burning, getting planned burns happening can be quite

logistically challenging, especially if you want to get replications happening. Just as an example, some work that my group has done and as part of my PhD research was the responses of small mammals to one planned burn. Looking at how they respond to the fire and also the use of unburnt patches as refuges within planned burns. I've got to say, this, I'm happy with this work, but I think it was a little bit unsatisfying in the sense that effectively what we're looking at here is one planned burn. What does this one planned burn tell us about what's going on across the whole landscape? These results can't necessarily be generalized across a broader landscape.

In thinking about this my research group at the University of Melbourne's been working in the Otway Ranges for the last 7 or 8 years (Slide 8). This is our study area the Otway Ranges and it covers an area of about 60,000 hectares. It consists of the Great Otway National Park and Forest Park. This edge of the study area here is the Great Ocean Road, a pretty tough place to work. There's a range of different vegetation types across the Otways, it's quite diverse. Mainly what I'm talking about today is foothill type forest, so blue gum/messmate forests (Slide 9). Alan alluded to our work in this landscape before, much of which has been looking at this question of pyrodiversity and biodiversity. In relation to my work the main thing to note is that we've got landscape-scale sampling units across the whole landscape, with individual study sites within those (Slide 10).

This diagram (Slide 11) shows planned burns that have happened between 2010 and 2014 in the study area. There are a whole lot of sites that have been impacted by planned burning and a whole lot of sites that haven't. So it got me thinking that there's an opportunity to develop a before/after control impact fire experiment after the event. I'm interested in two questions here (slide 12). The first question is a very simple one - what effect does planned fire have on small mammal population size? Secondly, I'm also interested in looking at refuge effects. What I mean by refuge effects is how unburnt patches provide habitat for small mammals after fire. Effectively, is there any change in unburnt patches, or in patches adjacent to planned burns? We might expect an increase, if animals are displaced. But we're not 100% sure.

I've been focusing on two species, the agile antechinus and the bush rat, two ubiquitous small mammals in this part of the world. I'm talking about on-ground work that was done from 2010 to 2012 across 10 planned burns, 26 burn sites (Slide 13). I've looked at 48 control sites and 23 possible refuge sites. So refuge sites are sites that are within planned burn areas but not actually burnt by the fire. I conducted Elliott trapping in spring and post-burn surveys were conducted about four to six months after fire.

So looking now at the results (slide 14-15). This graph here is looking at the bush rat. Abundance is on the Y axis. Before the fire is the green bar here, and after fire is the grey bar. You can see there's a bit of a decrease in abundance from before to after fire in the bush rat. But if look at the confidence limits it doesn't appear that there's much going on there. But when you look at the control sites, there's a large increase from before to after fire. The reason we think this has happened is because at the control sites the before fire period was at the end

of the millennium drought and the after fire period was after the drought had broken, so there was a big increase in resources.

By looking at the controls, we actually do see that there is a fire effect. There's a significant fire effect with the traditional BACI response of a treatment by time interaction. So what I've said up the top of the slide (Slide 15), 'fire reduces bush rat population size' – I probably should have said 'fire results in bush rat population size not increasing as much as it otherwise would have'. It's important to note that there are still many individuals hanging on in many cases. So, fire's having an effect, but it's not having a very large effect on this species.

The results for the agile antechinus show a very variable response (Slide 16). There's large variation in their abundance. But it seems like there's not much effect from fire. From before to after fire there is very little change and the same is happening at the control sites. There is a little bit of an increase, potentially due to rainfall, but way too much variability.

Whilst there's a bit of a difference between these two species, overall planned fire's having a fairly minor effect on these species in this landscape (Slide 17). In the Otways, for the years that we've been working there, the planned fires were reasonably low intensity. There were a lot of habitat features that were still remaining after fire. A lot of coarse woody debris remained which we know is an important component for the agile antechinus especially. Whereas with the bush rats, they might have been influenced a bit more by fire, because of the importance of the low dense ground vegetation for them. Another difference is the agile antechinus is partly arboreal, so potentially have the ability to use those resources after fire.

Looking at the refuge effect (slide 18). There is a refuge effect in the sense that individuals are still remaining in unburnt patches after fire but there isn't an active refuge effect. By that I mean there's no increase of population size in unburnt patches after fire. There's an increase from before to after fire in the refuges, but in the controls, the same is happening. So it's more likely an effect of that rainfall effect that I was talking about. This data shows both species lumped together for demonstration purposes. The before/after control impact design was important for validating this.

The interesting thing about this work is that we did find a refuge effect at that small scale planned burn study that I was talking about before, for the agile antechinus. We found that agile antechinus populations increased in unburnt patches immediately after fire in that single planned burn. So, we're not really sure what's going on there and why this effect isn't replicated across the landscape. This shows the importance of replication, when something you see at a single planned burn, maybe that might not be replicated across the whole landscape.

To summarise (slide 19), in both cases we needed controls to detect fire effects, that's really important. Replicated BACI studies are great, but very difficult to achieve when you're dealing

with fauna and there's some really good examples of them out in the literature. Luke talked about a really good example earlier.

Planned burning in the Otways is having a fairly minor effect on these small mammals. I think this is a good story for management but the caveat is the influence of rainfall. Potentially, things might have been different if rainfall hadn't come in when it did. If these planned burns were happening during drought period, things might have been different. This work also shows the value of long term data sets. This was not the original objective of doing this work, but I there's a whole lot of value we can glean from long term data sets like this.

I'd like to thank the following people and thanks for listening (Slide 20).