

National Fire Fuels Science webinars

Wednesday 13 May 2020

The science of hazard reduction: what do we know, what are the knowledge gaps?

Presenters:

- Dr Neil Burrows, FireNinti Consultancy
- Prof Mike Clarke, La Trobe University
- A/Prof Tina Bell, University of Sydney and the Bushfire and Natural Hazards CRC
- Dr Phil Zylstra, Curtin University
- Prof Mark Adams, Swinburne University of Technology

Questions and comments from the audience:

- As climates get drier, we need every bit of 'litter', i.e., mulch we can get to buffer and build up the forest's soil resource. Would you agree the term 'fuel' is too simplistic for this important building block of life in the forest?
- Australia has a unique set of conditions and the ecology is driven mainly by fire and groundwater. In many areas the Jarrah forest is simply drying out as groundwater recedes. Should we focus on overall ecological health instead of separating each land management element (e.g. fire, weeds, ferals, etc) to have better success in the future? Particularly as climate change takes hold. Thank you for the great presentations.
- Can someone please comment on the destruction caused by the bushfires on the north coast of NSW, particularly to the koala populations? Keeping in mind these forests were well managed state forests 20 odd years ago, with thriving native wildlife populations. They are now mostly unmanaged national parks with huge fuel loads. It's not all about prescribed burning, but vegetation management is a major consideration.
- Carbon figures are in the same range as for Tasmania - above ground 385 t/ha and soil carbon about 200 t/ha. Interestingly rainforests have about half the above ground carbon of mixed eucalypt forests they replace. Paper to be published soon in *International Journal of Forestry*.
- Compare all the studies and fire modelling programs currently being conducted by universities, with the 40 thousand years of Indigenous land management that didn't rely on modern technology. The uncertainties and theoretical concerns displayed by some professors shows that these leading advisors have inconclusive convictions leading to confusion within government agencies about preparing for drought-related megafires. Add into this mix, the reticence of forest management agencies to conduct hazard reduction burns due to concerns over adverse publicity with escaped burns, we end up with the current lack of prescribed burns.

- As fire frequency increases it's a bit of a moot point because there will be little opportunity for mature forests to develop, especially as the climate dries out? What is the solution?
- For Phil: How can we keep areas long-term unburnt, when we haven't been successful so far and climate change is exacerbating the situation?
- Given the many hundreds of so-called FRB's conducted over the last 10 years in Gippsland, with very few repeated and what we know about fire and the increased return of fuel loads and more flammable vegetation, does this add to the problem, especially with unforeseen (although inevitable) climatic conditions?
- We are now seeing uncontrollable fires running through these afflicted areas even without the other variables that dictate high intensity fire.
- Has climate change had any measurable effect on litter fall and decomposition?
- Hi Phil, would you say then that bushfires across south eastern and south western Australia are made much worse by vast areas of logging regrowth?
- How are biodiversity objectives/outcomes measured by various governments undertaking prescribed burning - is there a systematic approach used anywhere?
- How are ecological responses to fire at a regional and local scale considered in prescribed burn planning and do any of the speakers know what or how the government is evaluating/monitoring before and after fires - planned and unplanned fires (besides threatened species/communities)?
- How broadly do we define 'assets'? Often this is directed to life/infrastructure - how often do we consider ecological communities as assets? In that case, is there a case to use PB as a tool to protect ecological (fire sensitive) assets like habitat or rainforest?
- How can we better incorporate the effects of climate change into our thinking and planning for ecosystem management with prescribed fire?
- How come settlers managed to control fires in December 1792 under extreme weather conditions whereas they were uncontrollable under the same conditions in 2019?
- How do we collectively assist private landowners/managers to carry out prescribed burning on private property/leaseholds with consideration for fire safety for life and property, biodiversity conservation and primary production?
- How important is the role of vegetation management in reducing bushfire severity and intensity? For instance, the management of say a state forest which is actively managed, compared to a national park?
- I feel like we are caught in the middle. We're not paying enough attention to the origins of these megafires - the areas where they start and escalate. Similarly, we're not paying

enough attention to working with communities to manage local fuels (public and private), given the majority of fatalities and house loss are from close-proximity flame and ember impacts. We can also better understand the pathways of megafires as distinct areas will encourage spotting and megafire growth more than other areas.

- I feel we need to remember there are many ways to manage the land other than just PBs. A lot of fire regimes in different vegetation and we are so focused on one solution fits all when it is more complex than that, and a range of solutions will need to be implemented in different regions that best suits that region. Including communities deciding what's an asset to them and protecting those assets, opposed to what state government claim as an asset. Also need to bring private land and managing that into the conversation. This is much bigger than just 'reducing fuel for less intense fires'. We think to streamline, and one solution fits all.
- In my experience in south west Australia, frequent prescribed burning promotes open forest - towards parkland cleared - where fires spread more rapidly though fine fuels such as grasses and weeds. How do we address that?
- In the areas where further research is needed, don't we also need to consider the impacts of ecosystems being repeatedly burnt by severe fire at a periodicity less than the calculated ecosystem recovery period?
- Interested in presenters' thoughts on the value of landscape burning to help reduce severity of bushfires that may then benefit biodiversity and ecosystem recovery across the landscape please?
- Is it fair to say that the amount of planned burning undertaken in Victoria and NSW is in reality so low that we are not actually able to see the real effect possible by more extensive cool burn programs?
- Is there any point talking about prescribed burns as protection against/promotion of, bushfire, if we don't also talk about logging?
- It appeared Prof Adam's fuel load graph was curving down after 50 years since fire, so what does that say about old growth forest and fire? No easy solution and would hate to see adoption of simplistic solutions given climate change and needs of biodiversity.
- The oft repeated claim that south east Australia is the 'most flammable area in the world' might be overdramatic; it might be wrong. Could this claimed inherent flammability be the result of post-European intense modification, manipulation of original (pre-European) forest ecosystems changing forest structures and killing the 'fuel reducing component' of forests that once assisted fire resistance (Mooney et al)? Could the response also address the claim that Indigenous burning regimes is 'the answer'? This is widely claimed but also becoming widely challenged.
- Knowledge about Indigenous burning is more comprehensive from the central deserts and northern savanna regions of Australia compared to the south, where exclusion of first nations people rapidly ensued followed European settlement. And southern Australia also contains very different ecosystems and species to the north. How, therefore, can a fire practitioner be confident in transferring first nations burning practices from the north or

centre to Australia's south, and how can Indigenous burns be integrated with scientific understanding of the function of species and ecosystems?

- Land managers report on burnt area but not effective burnt areas by intensity, sure this effects frequency. How can the policies be changed to include this effect?
- Mark, what published climatic zoning have you used? It would be appreciated if you could acknowledge your sources.
- Mark Adams: Are studies that provide new or different insights not part of the literature? Surely good science is about challenging or extending, rather than just repeating what has come before?
- Mike, I'm concerned that most of our discussions are focused on the impact of prescribed burning on the environment. Do you see scope for us to invest more in working out how we can use prescribed burns to achieve ecological outcomes? I.e. moving away from the assumption that we should simply try to do low intensity patchy burns as a way of minimising ecological impacts to recognising that for some habitats moderate intensity burns may be required. As you say, different habitats need different fire regimes - why aren't we recognising this more and using it to our advantage?
- Much of the scientific basis for prescribed burning rests on traditional views of fire behaviour; in particular, simple relationships between fuel load, rate of spread and fire line intensity based on quasi-steady assumptions. Given that we now know that dynamic fire behaviours, such as junction fires and spot fire coalescence, can invalidate quasi-steady assumptions, how should the 'science of prescribed burning' evolve to accommodate the reality of extreme bushfires, in which severe fire weather and dynamic interactions between the fire and the environment can override the role of fuel load?
- Natural fuel reducers in healthy forests include: invertebrates, fungi, small digging mammals, lyrebirds and scratching wildlife which turn and tumble smaller fuels, increasing breakdown. Due to burning, logging and other manipulations, these once numerous 'fuel reducers' are now rare to non-existent. What studies have been done on this aspect? Constant burning destroys these free services.
- Neil Burrows: I can show you photos of prescribed burns that are much closer to high intensity bushfires than the low intensity burns you describe. Perhaps you know of the November burn North of Mount Lindsay. I also refer to you a burn area near Collie of over 56,000 hectares. How do burns like these reflect your commitment to low intensity burns that have little impact on species or ecosystem diversity?
- No-one has spoken about relationship of ground fuels to crown height and what are the drivers for a crown fire. Has anyone done any work on this?
- Observations during fire and burning operations would suggest that FFMC is more critical to intensity and rate of spread than the volume of fuel, the assumption that regrowth that is dominated by moisture retaining green fuels will present greater fire intensity than aging forests dominated by dead or decaying surface fuels is flawed. With hotter and drier conditions becoming the 'new normal', surely reduction of dead fine fuels will aid fire suppression.

- Over the summer, RFS Commissioner Shane Fitzsimmons said that hazard reduction burns are not a panacea. Given the continued opposition, difficulty in conducting effective strategic burns, and entrenched views for/against that are unlikely to change, what can agencies, researchers, practitioners and landowners do to further reduce bushfire risk?
- Phil - do you think it's the case that, even though waiting up to decades for the understory to thin out would reduce the hazard over the long term, we as a society cannot (for e.g. political reasons) in practice wait for that to happen, and thus we are now trapped in a cycle of having to keep the system in the early stages of recovery?
- Planned burns do not produce the risk reduction where it is most needed. Planned burning effectiveness is minimal when weather conditions are severe (Price and Bradstock 2012) with less than 10% likelihood of a planned burn stopping an unplanned fire (Price and Bradstock 2010). Yet, house loss rarely occurs when the fire danger rating is not severe (Blanchi et al. 2010). Shouldn't we be looking at other methods of fuel hazard reduction in close proximity to assets?
- Populations of many native species and the integrity of many ecological communities are threatened by too-frequent fire and some plant species require occasional intense fire for seed germination. So given this, how can scientific knowledge of species dynamics influence policies on hazard reduction burning?
- Professor Zylstra, don't you understand the difference between mild fire and wildfire? Your model has no application to mild burning.
- Gary Morgan, where are the studies that show that "there is no evidence of biodiversity losses from prescribed burns"? Since many prescribed burns are of large scale and too hot, how can you substantiate this claim?
- Phil Zylstra, "Old forests are the places where fires die", then how do we explain the severe burning of Kuark, a very old forest in East Gippsland? Would you explain this by the size of the old forest? Kuark was segmented and surrounded by logged and regrowth logging coupes. What size old forest is necessary then?
- Philip Zylstra (and others), given climate change and industrial logging impact on flammability - the latter stripping protective canopies, promoting desiccation and same aged immature regrowth stands - we have created a perilous feedback loop. We've made our forests more flammable; if they burn, we create more emissions and will increase flammability for some time; that will exacerbate climate change that will dry them out more, and so on. In the absence of restorative action our forests won't withstand climate change impact. The critical question has to be: How do we protect and restore our forests as we must - to protect our best terrestrial sequestration and storage system for what is now mandatory carbon dioxide removal. So, how do we allow our forests to grow to maturity for maximum resilience when some have already become highly flammable from industrial logging, and with climate change will become increasingly vulnerable? What practical solutions can we employ to protect our forests from burning while we allow them to recover, to grow to maturity to regain protective canopies and be more resilient to fire and climate change? Are there any practical things we can do - beyond immediately ending industrial logging of native forests?

- Michael, Neil and Mark were on the 2014 DEPI Expert Reference Group (Bushfire Management Reform Program) that recommended that “that DEPI consider independent validation of its risk-modelling, including validation of input data, sub-models and investigation of alternative modelling systems or methodologies.”
 1. Should this review still be undertaken?
 2. Should Phillip’s model be seriously considered as part of such a review?
- Phil: As we must allow highly degraded forests to recover and to grow to maturity to regain protective canopies to thereby minimise flammability and enhance resilience to climate change and for many other reasons, how do we protect our forests that are recovering from industrial logging impact? How do we stop them burning while they recover?
- Phil, fuel hazard is a standard measure of fuel contribution to fire in Australia - is it fair to characterise Australia as being fixated on litter load?
- Referring to 'green groups and green academics' is an ad hominem response. People who take a different view on the risks and benefits are also supported by or can point to science and competing priorities. It would be more helpful to address those arguments than dismiss them out of hand as 'green' as if being concerned for issues other than human interests is a bad thing.
- Referring to vegetation and life-giving mulch as 'fuel' is problematic. Mulch keeps the soil, microclimate and general environment moist, reducing flammability. Science by Zylstra and others show that longer in burned forests become less flammable over time. Fernwood prescribed burning increases flammability of forest biology, so how can governments keep justifying it?
- Smaller burns on the interface are often placed at a higher importance to larger landscape burns in remote locations. However, many of the fires in Victoria this summer that impacted on communities started in highly remote areas were able to build up steam in these remote areas before burning into communities. How can we better evaluate the benefit of larger landscape burns in remote locations to burns close to the interface?
- TFI's are not seriously looked at or implemented in Victoria's prescribed burning planning. Burns in asset protection and other zones close to 'assets' and even in the broader landscape are conducted on 5-15-year rotations. This is too frequent when some ecosystems may not naturally burn more often than 80-several hundred years, if at all. The current trajectory is causing ecosystem collapse. Where is the science behind this regime of frequency or is there no science?
- The application of PB's in Australia takes far too much of a 'broad brushstroke' approach. Australia has many and complex environments and ecosystems. As Phil says, keep most forests out of that of very flammable zone of regrowth. The current approach without question CREATES vast landscapes of the most flammable class of forest in terms of 'time since last burnt'. Keeping forest in this state is the most dangerous thing we could be doing. Many forested landscapes are on the verge of ecosystem collapse, devoid of mixed age classes, long unburned vegetation, critical habitat and moisture retaining qualities. We are sending our environment into the furnace. This approach must change, and quickly.

- The evidence from last summer suggests vegetation burned irrespective of land use. If fires are burning in vegetation types that previously didn't burn, doesn't that put the hypothesis about forestry increasing fire risk pretty shaky? Do we need to be managing landscapes or do we leave it to nature?
- There appears to be individual research, but we need large scale discussion with all interested groups, and that includes Indigenous people.
- Tina Bell: Are the data you describe on water and carbon recycling disaggregated according to the intensity of the prescribed burn?
- Dr Burrows: Isn't it horses for courses? How does the Jarrah forest situation extend to other ecosystems?
- To Phil, with 50 years of recorded fire history and <1000 fires in the Alps. Would deriving 36,000,000 points of data require pseudo replication? Wouldn't that mean that effects are overestimated?
- Two things are necessary to provide better hazard reduction. Remove all the clutter of red tape and start involving Indigenous advisors or other experienced experts to provide best advice on optimum times and conditions for hazard reduction.
- Vegetation type, structure and composition are basic to fuels, yet vegetation varies in fine detail across the landscape. What work is going on to cope with this critical nuance in fire management?
- What about the documented effects of WA's prescribed burning on the increasing incidence of *Phytophthora cinnamomi*?
- What evidence is there that suppression is easier, safer, and cheaper? Suppression costs have been going up, more resources are being used and people are still being injured/killed.
- When Mark is done with his various graphs and maps, could he give us some sense of the degree to which any of this affects existing fire spread models, or estimates of fire hazard (e.g. fire danger ratings)?
- Why can't we burn more often? If climate change is drying fuels out, then more opportunities will present in traditional winter and early spring months.
- Why do proponents of fire management rely on anecdotal accounts from early settlers rather than current scientific evidence on forest dynamics and fire. Can the landscape be burnt to reduce fuel levels or is this just rhetoric given that fuel reduction burning requires relatively high fuels to be subsequently conducted.
- Why doesn't every government department involved in hazard reduction include Indigenous advisors to provide practical and common-sense advice in decision making?
- Why don't you measure impacts of not burning? Burning was natural maintenance for tens of thousands of years.

- Why is lightning ignored as a major cause of ignitions for hundreds of thousands of years as Australia's climate dried? The constant presence of fire in the environment when fuels are dry enough to hold and carry fire must be the reality of dry Sclerophyll cool regular fire regimes.
- Why is there so much focus on prescribed burning, when there are other fuel reduction strategies available, such as mechanical fuel reduction?
- Why is there such a focus on litter when one of the main benefits of a successful FRB is reducing the bark fuel hazard, thereby reducing spotting from a subsequent bushfire.
- Why isn't data collected by government on public lands openly accessible to the public? We need all minds on this issue - not just governments and scientists. It is very difficult to stay informed and dispel myths when the data is not openly shared or communicated to the public.
- Why should all decisions on hazard reduction burns and open-air burning be controlled by theorists? We need to involve practitioners who have actual experience and knowledge.
- Why was the webinar titled 'the science of hazard reduction' when it was only about planned burning?