Conference Proceedings – Speaker Transcript

When is burning good for the bush?

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Link to slides

I'd like to acknowledge the Gadigal people and all the first Australians across this beautiful country that all of us have a stake in and a responsibility to care for. I really enjoyed the video just now, that was a lovely image with the smoke and I got a lot from your talks, thanks very much.

For something completely different, with regard to Andy's talk, as this presentation could be interpreted as an ambassador's call for fire sensitive vegetation. Actually this contribution today is about possible research areas and considerations that might inform a balanced approach for fire in ecological restoration, looking at both risks and benefits.

This is a topic that has brought many parties together. The same or the similar end point for everyone here is ecological restoration. Ways to achieve ecological restoration for some might be more fire and for others less. Finding the middle ground will need understanding the risks.

A feature of scientific knowledge is that it always changes. Many ecologists and scientists are passionate one minute about something and move on the next. What we are doing today is not necessarily what we did 20 years ago nor what we'll do in 20 years. Scientists are famous for enthusing people to come on board with new ideas and then leave them behind when they move onto the next idea. This phenomenon can catch Governments out. By the time they have developed plans for adopting the latest theory the science has moved on. At the moment, fire is being promoted as a major tool in environmental management. This promotion appears to be overshadowing discussion and consideration of the risks.

As new information comes to light what is thought of as best practise today may well change in the future. This point is raised because some consequences of fire are irreversible. It is a powerful blunt instrument that might have very good outcomes or very bad outcomes depending on the circumstances. In the absence of the risks being front and centre and a paucity of botanists and plant ecologists on the ground in this space, there is a risk to Australian biodiversity.

Fire is revered in numerous cultures through deities and narratives about its destructive and resurrective power. Children are taught not to play with fire. Stories from across the world command respect for fire and warn of its deadly force. Having become a human activity the challenge is the balancing act to use fire safely.

Today is a bit of a challenge, speaking to an audience which is enthusiastically tied to this issue. There's a lot of emotional investment and perspectives, and there's also a place for theoretical rigour. As a serious issue, we need to grasp the risks surrounding the use of fire and formulate where to from here.

Fire is regarded as a major force in the natural world, but prior to humans on the planet it was a relatively rare. Only 2-5% of fires start from lightning in most of Australia. But fire has become a human activity, a human tool and a common occurrence. It's still an environmental factor but more common than ever. Other stochastic forces like flood, drought, cyclones, tsunamis are impossible to invoke and difficult to manage. However, fire is easy to start, flick a match in the bush, use a drip torch and a deadly force has been invoked. Notwithstanding the restorative benefits that may follow, fire will always carry risk. It's something humans have a fascination with (see quote, slide8 from Pyne 1991). Burning country is being seen to be doing something even if there is no clear reason. Concerns are being increasingly voiced about burnt country in Australia and environmental damage to match. Being easy to start or a popular tool, which fire appears to be at the present, shouldn't detract from it being a major issue with considerable impacts.

A second observation is the underlying tensions between using or not using fire (slide5). For example, bushfire is listed as an EPBC threatening process whilst on the other hand it is used as an ecological restoration tool. The world is trying to reduce carbon emissions, while on the other hand fire accelerates carbon emissions. The exception is where judicious researched fire management can offset large fires. There are national policies about soil carbon because it is a significant compartment of the carbon cycle. Carbon needs to be somewhere, either in the atmosphere, soil, vegetation, oceans, deep oceans, fossil fuels - and if we take it from one pool and put it in the atmosphere we risk change to the climate. If you look through the many National policy and program documents about maintaining and increasing soil carbon they do not mention fire. It's about retaining organic matter on and in the ground; the opposite of burning organic matter or 'litter', where much carbon is lost to the atmosphere. There is also a tension between fire as a management tool and the adverse health effects of smoke.

Parallel to these tensions is the need to understand the ecological impacts of burning for ecological purposes. Evidence is important and some unanswered questions in this space are here framed as research ideas. Realising that in the future things are going to be slightly different as new information comes to hand, and results from people's activities are built upon. This presentation aims to balance the heart and the head, because it is an emotional subject and a theoretical issue. Resolving uncertainty, clarifying assumptions and ambiguous language are areas that stand out for investigation and clarification.

Back to the driving forces. Fire is all about vegetation and ecological restoration is all about native vegetation. So is fire a fundamental driver of vegetation in Australia? There is a lot of very good literature in this country, and it's interesting to see modern day ecologists going back to some of the work done many years ago. I don't know if anyone had the privilege to go on one of Professor Bill Jackson's field botany camps at the University of Tasmania. He inspired generations of ecologists. He was an elderly in 1983 when I did this course, one of the last times it ran. He could identify every Eucalypt with his eyes closed from the chemical constituents of the different oils and was able to combine chemistry, geology, geography, botany and paleo-everything to explain the Tasmanian environment. Especially the fire regimes of rainforests, Eucalypt forests and woodlands, treeless plant communities and so on. They ranged from the highest fire frequency in grasslands to 1 in 100-300 year fires in various Eucalypt forests to 1 in 2000 year fires in the Huon pine forests. He and others (see Horton 1993) and ecologists that are revisiting his studies and new data are concluding that Australia's vegetation is primarily shaped by topography, climate and soil. These are the major factors that supply the essential requirements of plants. Plants need several things, 101 in plant ecology, water, carbon dioxide, oxygen, light, nutrients and space. However, fire isn't a requirement for growth. Topography

climate and soil differ from stochastic disturbances, major irregular forces such as fire, flood, and drought which are non-essential factors in the environment.

One research question is to clarify the difference between essential and non-essential factors in ecological restoration, ecosystems needs and what humans believe are needed, and environmental factors and human activities. We need to explore the merit of statements such as "the bush needs a burn" and the difference between plant tolerance versus plant adaptation. I don't know if anybody's read Dr David Horton's contribution to the 2003 Senate Bushfire Inquiry, I commend it to you. His paper already summarises many points I had set about to convey today. I stumbled on it recently. One comment of his goes as follows:

"The Australian environment is adapted to fire - not true. This is usually said to be a sequence of the first point, but no animals are adapted to fire and very few, if any, plants are. Almost everything that people are referring to in terms of adaptation to fire is really just the ability of plants and animals to recover from catastrophic events and some species are better than others at this. The only possible example of plants being particularly well suited is the presence of chemicals in smoke in Western Australia, however, this is preliminary work. No Australian plants need fire, conversely, there are large number of species, almost all, in fact, which are badly affected by fire."

What he says and what I reiterate today is that plants that remain after fire are not necessarily adapted to fire. They have some traits that have enabled them to withstand fire. Plants surviving fire have been selected for because of these traits, which is different from saying they are adapted to fire. An analogy might be that a person can hold one's breath (for a certain time) underwater, but humans are not adapted to live underwater.

Another research question is to distinguish between what a plant needs and what it can withstand or tolerate. Epicormics shoots have been selected for, however this does not equate with Eucalypt forests needing fire to function. Epicormic shoots are not necessarily an adaptation but a response to stress, all kinds of stress. It is what Eucalypts do. Similarly, smoke can help seeds to germinate in some situations. However, dormancy can be broken by many, many cues, and fire and smoke is just one possibility.

We've only got a few terms in the fire space and there's an opportunity for a lot more language which describes all the nuances and different aspects of the environment. Aboriginal languages have numerous words for all kinds of aspects of water, fire and smoke and the limited vocab used in English may be restricting understanding and opportunities to manage environments in the best possible way.

For example, fuel is something you put in your motor car. There is the opportunity for a new word to describe 'dead and decomposing plant and organic material' that isn't 'fuel' (petrol) or 'litter' (rubbish). The dead leaves, twigs and branches are habitat for biota that support second order consumers, pollinators and so on that allow the ecosystem to function. This material on the ground is in the process of becoming next year's soil. The carbon will be locked away. It doesn't take long.

Also, this 'fuel' or 'litter' always looks more than it actually is. If you stand in the Savanna grasslands and look down through the sorghum you will see the stems are quite small and well separated. The dry weight per unit area is less than you would expect from looking at the grasslands from the side, from a car window. This plant material provides all the benefits of water retention, protecting the soil from erosion, habitat for biota that cycle nutrients and many other things.

Ecological restoration often seeks to remove this layer but could this be achieved by native animals on the forest floor - not a new idea but worthy of more research. For example, lyre birds do a lot of scratching and foraging, as do bandicoots and echidnas. These and many other animals are turning over the forest floor, they're recycling nutrients, they're fertilising the soil and keeping 'litter' loads down. They're also controlling weeds. In Australia we've lost a lot of our smaller ground foraging animals and maybe they could be re-introduced in place of fire.

Another research topic is consideration of where the best place for carbon is, as well as essential nutrients such as nitrogen and phosphorous the latter so poor in many Australian ecosystems it limits plants growth and ecosystem productivity. After fire, there can be short spikes in availability of some elements, but often longer term overall net loss to the atmosphere and others through wind and water erosion. This makes it harder for plants to recover because growth is controlled by the relative availability of carbon, nitrogen and phosphorous (C:N:P). A large tree is usually old because it takes a very long time to collect the requisite elements in the right ratios and grow. Scarce resources become scarcer when repeated fire sets an ecosystem back to the starting line. The carbon a plant has slowly accumulated over long periods by matching it with essential elements is rapidly lost in hours during fire. Is this desirable in ecological restoration?

To conclude, without plants there is no fire. Australia's Native Vegetation Framework was passed in 2012. Goal 1 (of 5) is to maintain and increase the natural extent and connectivity of Australia's vegetation by 2020. For this to occur and for fire to be managed judiciously, there is an opportunity for a new generation of plant ecologists. People who understand and know the names of all our plants, their behaviours and characteristics as if we don't know what is where we don't know what we're losing. Fire for ecological restoration is all about vegetation and this deserves many plant ecologists working in this space. If you know country, you can love it, and if you love it, you'll look after it, just like a person.

Questions from audience

Q - In my taking of what you just said, leaving a lot of the leaves and everything on the ground, they'll break down. Now, in saying that, that wouldn't have worked in Victoria when the bushfires went through there. How long are you talking about, the process of litter breaking down instead of putting a fire through it to control it?

NR – it is often said that litter builds up and builds up, but it's also breaking down at the same time. Most ecosystems have a steady amount of litter because it's being turned over all the time. The problem with burning and the bare ground that results is that water retention decreases, soils dry out, vegetation further suffers. Everything needs protection, just as humans need clothes to reduce water loss. The earth needs a protective cover and that is what plants do, including dead and decomposing plant material. Microorganisms in the organic soil layer and in the litter are important for breaking down material. It's about balance, if a fire removes the litter there will be consequences, sometimes good sometimes not so.

Q - Well, I'm from Wagga, I'm in a dry area. The fuel on the ground, if you're just going to leave it there, it becomes more of a hazard?

NR - It does build up when it gets drier, it's not getting decomposed as fast. Drought can lead to more dry material, but then there's less input of material too because there is less growth in a drought.