

Submission to Bushfire Inquiry

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1. Introduction and terms of reference for the inquiry.

I understand that the federal Standing Committee on the Environment and Energy will inquire and report on the efficacy of past and current vegetation and land management policy, practice and legislation and their effect on the intensity and frequency of bushfires and subsequent risk to property, life and the environment.

The inquiry will have particular regard to:

- **Past and current practices of land and vegetation management; Refer submission input below in Section 2.**
- Whether current legislation and regulation is in conflict or causes confusion for landholders; No input.
- **The science and research behind activities such as hazard reduction burning, clearing and rehabilitation; Refer submission input below in Section 3.**
- Legislative capability at local, state and federal levels requiring landholders to reduce fire risk on their properties; No input.
- **The impact of severe fires on the economy in urban, regional, rural and remote areas; Refer submission input below in Section 4.**
- **The progress and implementation of mitigation strategies recommended in state reviews over the last decade; Refer submission input below in Section 5 and**
- The role that emergency services have working with land management officials in managing fire risk.

The focus of this submission is on the bolded inquiry items, responding to the relevant TOR in the section nominated in this submission.

As a forester/ District Forester, natural resource manager, fire manager and environmental manager, with over 40 years experience, I am providing input to the inquiry. My experience is extensive, enabling me to provide practical input to the inquiry, including:

- Broad natural resource and environmental skills over 40 years with the then Forestry Commission, Hydro Electric Commission, EPA and RTA/ RMS.
- Worked for the Forestry Commission of NSW from 1978 to 1989 as a Forester/ District Forester and have worked closely with forestry since in roles with EPA and RTA.
- Involved in coastal forestry, alpine/ tableland and inland cypress, ironbark and river red gum forests.
- Authorised officer under the Bush Fires Act.
- I have had extensive wildfire control and hazard reduction experience in NSW, including aero burning.
- Managed/ participated in wildfire control and in 4 forestry Districts, including the very large 60,000 hectare Dora Dora wildfire in 1984, 1983 Tantangara wildfire in KNP, Khancoban, Lankeys Creek and other wildfires. This included many wildfires each year over 11 years. Experienced in use of tankers, slip on units, fire towers, dozers, drip torches and other techniques. Very good understanding of fire fighting techniques.
- I was in charge of Hume Snowy Bushfire Prevention Scheme for 4 weeks in 1980 and completed 4 large scale aerial hazard reduction operations and also organised aerial hazard reduction for State Forest areas. The Hume Snowy Bushfire Prevention Scheme was responsible for fuel reduction burning in Kosciuszko National Park, managed by the then Forestry Commission.
- I completed aero burning operations on Maragle SF in 1983, of the order of 4000 hectares plus, in very high fuel load forests.
- Managed many first rotation second rotation burns before we stopped second rotation burning to focus on nutrient retention in pine plantations.
- I was in charge of fuel reduction/ establishment burning post hardwood logging, including alpine ash.
- Completed 30 km of new logging/ fire trails, improving access.
- Managed fire trail maintenance, using graders, herbicides and manual removal of trees/ branches.

- Regularly on fire call out/ standby.
- Experienced in working with bush fire brigades. At Castlereagh SF, the brigades conducted hazard reduction most years, reducing fuel loading and risk.
- Developed Action Fire Plan for Gloucester Forest District.
- Involved in the fires at Tumbarumba in early January 2020 over 13 days, including mopping up with slip ons, edge fire control, patrolling, preparing breaks, improving house safety, moving stock etc.
- On behalf of the Hydro-Electric Commission, I prepared three new detailed Fire Management Plans for the West Coast of Tasmania, including King River, 27,100 ha; Anthony, 30,000 ha and Tullah, 2000 ha, and handled consultation with forestry/ national park organizations.
- Managing the environmental aspects of the HEC schemes in Tasmania.
- Environmental Manager for the Pacific Highway for 12 years.
- Have a good understanding of Aboriginal burning practices, the forest at the time of first contacts, and the causes of forest dieback, which relate to the lack of burning/ build up of organic matter.
- Good understanding of flora and fauna.

Being involved in the fires at Tumbarumba in early January 2020, I have seen a huge amount of great on the ground efforts.

I fully acknowledge the efforts of the fire fighters in the recent 2019 wildfires, they have been absolutely amazing. The town support in Tumbarumba and other towns has also been great.

A lot has been learnt in regards to fire fighting safety, tanker design, equipment, warnings, web, Fires Near Me, stay or leave, Radio Scanner, My fire watch etc

There are still learnings that need to be applied, especially in regards to hazard reduction and research learnings.

2. TOR-Past and current practices of land and vegetation management.

There are a number of past and current practices of land and vegetation management that have great impact of wildfires, wildfire intensity, hazard reduction, fire trail access, community safety, fire fighter safety and fauna safety.

2.1 Current fire management approach and Australian bushfire seasons.

As extracted from Wikipedia 20 December 2019:

Australia's climate has been trending toward more bushfire weather over the last 30 years. The Climate Commission found that "The intensity and seasonality of large bushfires in south-east Australia appears to be changing, with climate change a possible contributing factor."

A 2006 report by the Bushfire CRC acknowledges the complexity of climate predictions pointing out "Much of [Australia's] vegetation has a complex evolutionary and dependent relationship with fire. Fire has been part of these environments for tens of thousands of years and much native flora and fauna remains dependent on it in various ways." In 2007, a study by the CSIRO (the national government body for scientific research in Australia), found evidence that climate change will lead to increases in very high and extreme fire danger rating days and earlier onset of the fire season. Other studies investigating the historical record identify significant changes in Australia's bushfire season as a result of human activity.

Climate Council, Be Prepared: Climate Change and The Australian Bushfire Threat, Professor Lesley Hughes and Professor Will Steffen 2013 notes: *In the southeast and southwest (of Australia), it is very likely that an increased incidence of drought—coupled with consecutive hot and dry days—will in turn result in longer fire seasons and an ever larger number of days of extreme fire danger (e.g. Clarke et al., 2011, 2012).*

Climate Council, Be Prepared: Climate Change and The Australian Bushfire Threat, Professor Lesley Hughes and Professor Will Steffen 2013 notes: *The influence of weather conditions on the likelihood of bushfire spread is captured in the Forest Fire Danger Index (FFDI), an indicator of extreme fire weather. Some regions of Australia, especially in the south and southeast (Victoria, South Australia and New South Wales) have already experienced a significant increase in extreme fire weather since the 1970s, as indicated by changes in the FFDI. The FFDI increased significantly at 16 of 38 weather stations across Australia between 1973 and 2010, with none of the stations recording a significant decrease (Clarke et al., 2013). These changes have been most marked in spring, indicating a lengthening fire season across southern Australia, with fire weather extending into October and March. The lengthening fire season means that opportunities for fuel reduction burning are reducing. Overall, these trends mean that fire-prone conditions and vulnerability to fire are increasing, especially in heavily populated areas in the southeast.*

Fire intensity is essentially a function of rate of fire spread and the amount of available fuel for combustion (Byram 1959). Prescribed fire decreases the intensity of a subsequent wildfire primarily by reducing fuel loads, especially of the finer elements in the more aerated fuel layers that govern fire spread (Rothermel 1972), but also by disrupting the horizontal and vertical continuity of the fuel complex. Fuel modification from a prescribed-burning treatment is expected to improve directly the probability of successful fire control by reducing fire intensity. International Journal of Wildland Fire, 2003, 12, 117–128 A review of prescribed burning effectiveness in fire hazard reduction Paulo M. Fernandes A,B and Hermínio S. Botelho A.

Using information quoted from the in the article “Climate patterns behind Australia’s bushfires, heat and drought set to improve”, The Guardian Graham Readfearn Wed 1 Jan 2020 06.00 AEDT

- Dr Andrew Watkins, the head of long-range forecasts at the bureau, told Guardian Australia the damage caused by the two patterns – the positive phase of the Indian Ocean Dipole (IOD) and a negative Southern Annular Mode (SAM) – would likely remain for several months. “We can’t rule the westerlies out of course, but at least the odds of more bad fire weather starts to reduce,” he said. On Monday, the IOD dropped into neutral from a phase that sees cooler ocean temperatures off the north-west of Australia, causing moisture to be drawn away from the continent. But Watkins said: “The damage from the positive IOD and the negative SAM has been done – the landscape is extremely dry. This means that fire danger will remain high for some time. “And it certainly does not mean the end of the drought – that will take some time; many months, especially for those rivers to rise again and for the soils to even reach average wetness.” Watkins said the IOD had been acting “like a wall” and blocking a separate system that delivers monsoon rains to northern Australia. Weakening trade winds also meant the monsoon had a greater chance of forming and moving over northern Australia.
- The bureau’s climate experts have said the IOD and the SAM have combined with climate change to deliver Australia’s recent run of record-breaking heat. Australia recorded its hottest day on record on 18 December, with an average maximum temperature of 41.9C (107.4F), beating the previous record by 1C that had been set the previous day. Rainfall across most of the continent has been well below average in 2019. Spring 2019 was the driest and second-hottest on record, and also the worst on record for dangerous bushfire weather.

From my perspective, the wildfire occurrence and severity we have relates to five critical issues, not one. These are:

1. Fuel loads, in many cases they are huge and over large areas, due to inadequate fuel management/ hazard reduction burning;
2. Weather conditions, slope etc;
3. Indian Ocean dipole positive phase as well contributing to this major drought;
4. Pacific ocean negative Southern Annular Mode cycle contributing to this major drought; and
5. Climate change appears to be extending and intensifying bushfire seasons as noted above.

These five issues numbered 1 to 5 need to be understood in the inquiry. Many persons/ organisations focus on just one of these issues, it is much more complex than that.

The SMH Berejiklian government to spend \$1b rebuilding fire ravaged NSW. By Alexandra Smith and Sally Rawsthorne Updated January 9, 2020. *The Berejiklian government will spend \$1 billion over the*

next two years rebuilding roads, rail lines, schools and bridges in towns that have been devastated by the bushfires. Premier Gladys Berejiklian and Treasurer Dominic Perrottet said the new allocation of money would ensure the recovery process could start without delay.

As of 9 January 2020 in NSW (The SMH, Berejiklian government to spend \$1b rebuilding fire ravaged NSW. By Alexandra Smith and Sally Rawsthorne Updated January 9, 2020):

- 1870 homes destroyed across the state this horror fire season, 954 had been lost this year.
- A further 196 facilities have been destroyed and 3774 outbuildings.
- Twenty people have died so far this fire season in NSW, including 3 RFS volunteers.

2.2 Not managing the land/ minimum hazard reduction burning approach.

I am not just focussing on NSW. Ten years ago the Victorian Labor government, with the support of the Greens, passed a bill to lock up another 143,355 hectares of river red gums. The government justified the decision on the recommendations of a three-year investigation by the Victorian Environmental Assessment Council (VEAC). VEAC claimed the Victorian red gum forests needed "additional protection." I believe that this was a flawed decision, as the foresters kept the forest healthy, pushed to stop unplanned flooding and constructed small diversion to keep red gums from dying from lack of water, the same as in NSW. This same lock up happened in the river red gums in NSW.

This lock up is again happening in Victoria, where all native forest harvesting operations are planned for closure in 2030, these will be locked up as well under an inadequate hazard reduction/ no grazing regime.

Land is being locked up for "conservation" all over Australia, foresters, loggers and skilled people kicked out and skills and resources lost. But when land isn't managed and hazard reduction adequately completed, the land becomes a time bomb, ready to explode. This has happened yet again in 2019/ 20 and a large number of times before that.

There are totally inadequate hazard reduction burning programs across Australia, except for Northern Australia. Very high fuel loads have contributed to catastrophic fuel loads/ fire intensity, along with the factors listed above, and many extremely hot fires across Australia.

2.3 Underestimating the importance of hazard reduction burning and extent required.

Hazard reduction rarely stops wildfires dead but does reduce wildfire intensity, depending on timeframes since last hazard reduction burning. This needs to be clearly understood. This assists in being able to managing wildfires. We can influence this aspect of fire, not temperatures, droughts, soil dryness, fuel dryness etc.

NSW hazard reduction operations.

The issue of inadequate hazard reduction burning is very important. As noted in *The SMH, state burns, Berejiklian government at loggerheads over hazard reduction 13 November 2019* Mr Kean said the government had exceeded its own "five-year rolling target for hazard reduction". "That target says that over five years on average we will do hazard reduction of 135,000 hectares," Mr Kean told Parliament. "We exceeded it and burnt 137,000 hectares of national parks [last year]". In reality, this is a very small area, of the order of 2 % of NPWS lands, and I believe totally inadequate for the state's protection.

ABC NEWS, Are hazard reduction burns effective in managing bushfires? The answer is complicated RMIT ABC Fact Check Updated Fri 20 Dec 2019, 5:11pm notes:

According to the NSW Department of Environment, hazard reduction efforts in NSW have increased under the Enhanced Bushfire Management Program (EBMP), which came into effect in 2011. The statewide program began with a five-year commitment to treat 135,000 hectares of bushland (on average) each year. In 2017, the NSW Government extended the program to 2022. The NSW National Parks and Wildlife Service operates under the Rural Fires Act 1997 and under the National Parks and Wildlife Act 1974. Over the last eight years, according to its website, the NPWS carried out hazard reduction burns in NSW parks and reserves covering more than 680,000 hectares — more

than double that of the previous five-year period. ((Note only, 680,000 hectares over 8 years equals 1.2 % of NPWS estate per year)).

"NPWS has undertaken 80 per cent of the total hazard reduction burning effort recorded in NSW, despite managing less than 9 per cent of the state," its website states.

Recent hazard reduction burns are part of the NSW Government's six-year \$76 million package to boost preparedness and double hazard reduction in NSW national parks, where conditions allow. Paper article "Hazard reduction burns near Tumbarumba and Batlow" (burns in KNP). I could not find further information in regards to this matter. This equates to \$12.7 M a year, a fair amount of money for hazard reduction, but \$93/ hectare is about right.

I understand that this package was provided to NPWS but not Forest Corp nor Councils for hazard reduction. If correct, this is disappointing and needs to be rectified.

I suggest hazard reduction hasn't been adequate in NSW and some of the other states for many many years.

I also suggest that there be COAG annual review of fuel reduction/ areas hazard reduced in all the states annually and that this be reported in the media. An incentive system could be developed to encourage state to complete more hazard reduction burning.

27 million hectares of NSW is forested of the 80.2 million hectares in NSW. A minimum of 10-15 % of forested area per year for hazard reduction burning should be set, I believe, using a 5 year hazard reduction cycle. The focus should be meeting the 15 % in most years:

- Meeting 15 % would mean of the order of 75 % of forest areas were hazard reduced under a 5 year cycle.
- If only meet 10 % in one year, hazard reduction would be increased the next year.
- This could be greater area with overlapping areas burnt near critical structures/ towns/ cities etc.
- Then consideration needs to areas not burnt in the 5 year cycle.
- Excluded areas wouldn't be included such as rainforest, very sensitive habitat etc.

This would be a tough task, but does emphasise the average current targeted hazard reduction figure appears to be on the low side, also noting the extent of wildfires this year and associated fauna impacts. Other states are very likely in the same situation. I do recognise the ideal burning time is autumn and warmer conditions, winds, soil dryness indexes, houses, fences and other factors can reduce hazard reduction burning options, but burning can be delayed to the next year in most cases.

As a forester, I organised and completed aero burning operations on Maragle SF way back in 1983, from memory 4000 hectares plus, in very high fuel load forests. Timing was critical as was the spacing of ignition capsules to achieve a cool burn, this was achieved.

Use of air craft/ drones increases the area that can be burnt. It is much smarter to use small aircraft for these burns than very expensive larger aircraft for longer periods fighting major wildfires. Drone technology has now been tested by Forest Corp.

Victoria hazard reduction operations.

I am advised that fuel reduction area on public land in Victoria to fell below 75,000 hectares in 2017-18, if so this has exposed fringe Melbourne and regional communities to a totally unacceptable fire risk. This is 1.1 % of public forests per year, when cool burns are needed every 5 years to reduce fuel loads.

WA hazard reduction operations.

Climate Council, Be Prepared: Climate Change and The Australian Bushfire Threat, Professor Lesley Hughes and Professor Will Steffen 2013 notes: *In southwest Western Australia, the Department of Environment and Conservation protects an estate of approximately 2.5 million hectares. **Prescribed fire is applied to treat approximately 6-7% per year. Wildfire costs, losses, and damages have***

been reduced since the program began (Sneeuwjagt, 2008; Boer et al., 2009; Williams et al., 2011), although 100 houses were lost in a wildfire in 2010/11 and 40 in a prescribed fire in late 2011.

Queensland hazard reduction operations.

Queensland Parks and Wildlife Service, which manages primarily native forests and state-owned land, is exempt from obtaining a "permit to light fire". It has its own procedures and burn targets, and collaborates with the QFES on initiatives such as operation Cool Burn. ABC NEWS, Are hazard reduction burns effective in managing bushfires? The answer is complicated RMIT ABC Fact Check Updated Fri 20 Dec 2019, 5:11pm notes:

"From 1 January [2019] to date, QPWS conducted 291 planned burns over 1,443,882 hectares — which is the largest area covered in the last six years," a statement provided to Fact Check said. "QPWS's annual target for Protection Zones burns is 90 per cent (14,884 hectares). In 2018-19, QPWS achieved 118 per cent of this target."

I presume the figure of 1,443,882 is correct as it was sourced from RMIT ABC Fact Check. This represents 4962 hectares per burn area. There is no information provided on protection zones, nor area of these.

USA hazard reduction operations.

Other information on successful programs of hazard reduction in reducing wildfires in the USA is outlined in Section 2.6.

General.

It is clear from Qld and WA information that hazard reduction programmes can increase.

As noted above, I note that hazard reduction seasons are reducing, but we need to address this sensibly, using aero burning, ground burning and other options.

The Parliament of the Commonwealth of Australia A Nation Charred: Report on the inquiry into bushfires House of Representatives Select Committee into the recent Australian bushfires 23 October 2003 Canberra. There were two major recommendations, Recommendation 2 and 13.

- Recommendation 2. The Committee recommends that the Commonwealth through the Council of Australian Governments ensure that states and territories have adequate controls to ensure that local governments implement required fuel management standards on private property and land under their control.
- Recommendation 13 The Committee recommends that the Commonwealth seek to ensure that the Council of Australian Governments seek agreement from the states and territories on the optimisation and implementation of prescribed burning targets and programs to a degree that is recognised as adequate for the protection of life, property and the environment. The prescribed burning programs should include strategic evaluation of fuel management at the regional level and the results of annual fuel management in each state should be publicly reported and audited.

I am not sure where recommendation 2 and 13 is at, if they were acted on.

As noted in Science News, Reducing wildfire risks for better management and resource allocation December 10, 2019 Society for Risk Analysis. *Difficult to contain, wildfires consume everything in their path and wreak havoc on human and animal lives, homes and landscapes. From 1995 to 2015, wildfire management has cost the U.S. \$21 billion. Over the past 10 years, the National Interagency Fire Center reports that there were 1.4 million fires with an average of 67,000 wildfires annually and an average of 7.0 million acres burned annually. Most of these wildfires are caused by human activity. Management resources are becoming strained and funds that were earmarked for promoting forest health and fuel reduction are being diverted to fire response activities.*

I believe the same is happening in NSW.

Figure 4.8: Geographic Areas Affected by Fires Day 33, 9 February 2003



Figures above. Extracted from Report of Inquiry into the 2002-3 Victorian Bushfires, Victorian State Government. 2003.

On January 8, 2003, a major storm passed over the mountains and lightning strikes ignited 185 fires in Victoria, NSW and ACT. 555,000 hectares of Park Service managed lands affected by fire, including 522,000 hectares (71%) of Kosciuszko National Park and 18,000 hectares (94%) of Brindabella National Park. Extracted from Australian Alps National Park Education Resource. As noted by G Worboys in "A Brief Report on the 2003 Australian Alps Bushfires In the summer of 2003", the Australian Alps experienced their largest bushfires in over 60 years, with an estimated 1.73 million hectares burning. The bushfires burnt across Victoria, New South Wales (NSW), and the Australian Capital Territory (ACT) during a drought that ranks as one of the worst in 103 years of official Australian weather records.

However, if the Hume Snowy Scheme had continued, or an effective aero burning scheme continued, I believe it is likely the outcome would not have been as severe on flora, fauna, erosion, water quality etc or as large in extent and the wildfires easier to contain.

As noted Jurskis et al, 2006 (Attachment 3), in 2001 the NSW Government determined to review the plan of management for Kosciuszko National Park, and appointed an Independent Scientific Committee (ISC) to assess the values of the park. The following paragraph summarises their views on fire management (Leaver and Good 2004).

Fire management in the park has progressed from simplistic fuel reduction burning to a sound ecological approach providing for nature conservation, catchment protection and maintenance of acceptable risk. Aboriginal people burnt small areas, whereas grazing and burning caused

erosion, shrub invasion and increased fire hazards. "The (Hume – Snowy) fuel reduction program never reduced the fire hazard if one ever existed". Large tracts of the park are at a "primary state of succession", and fire should be excluded from most ecosystems for long periods, for example, alpine ash requires one high intensity fire every 150 years. All species of plants in the park are adapted to high intensity fire. Heavy fuel loads are required to stabilise steep slopes. Only about 7% of the park should be burnt. Increased prescribed burning is a serious concern.

As Jurskis et al 2006 explain in the paper: *After the 2003 fires, a post script to the ISC report explained that the multiple lightning ignitions, which eventually culminated in Canberra's disaster, were unexpected. In fact multiple lightning ignitions during severe fire seasons have occurred repeatedly in the past, but have not had such severe consequences as in 2003. Multiple lightning strikes in State Forests and private lands to the west of the park at the same time caused little damage, and were all controlled within three days.*

I believe that the Jurskis et al, 2006 (Attachment 3) paper highlights that foresters and graziers had the right approach in the mountain/ alpine areas. If we as a society say that you can only burn this area, that area and not other extensive areas and set up restrictive rules, we are doomed to failure.

2.5 The Canberra 2003 wildfires and causes.

As another example, the 2003 Canberra bushfires caused severe damage to the suburbs and outer areas of Canberra, the capital city of Australia, during 18–22 January 2003. As a note, information in Wikipedia. On 8 January 2003, lightning strikes started four fires in New South Wales, over the border but in close proximity to Canberra. Despite their proximity and very small initial sizes, low intensity, and low rate of spread, these fires were not extinguished or contained by New South Wales emergency services personnel. Subsequent inquiries into the bushfires, including the Roche report, the McLeod inquiry, and the Coroners Report, identified poor management of the initial response as a key contributor to the disaster that unfolded on 18 January 2003.

Almost 70% of the Australian Capital Territory's (ACT) pastures, pine plantations, and nature parks were severely damaged (Wikipedia). Four people died, there were 435 non fatal injuries, 488 houses were destroyed and the cost was \$350 M. The ACT Government McLeod Inquiry to examine and report on the operational response to the ACT bushfires of 8 to 21 January 2003 found amongst a number of issues that management of fuel load in parks and adequate access to remote areas were both lacking (August 2003).

In summary, it appears the major factors in relation to these wildfires were:

- poor management of the initial response as a key contributor to the disaster
- management of fuel load in parks;
- inadequate access to remote areas.

2.6 A USA study on prescribed burning.

Exploratory Data Analysis Of Wildfires In USA prepared by Arpit Rana June 2019 outlines:

In this research, we used the NIFC wildfire and prescribed fire data set and analyzed over 14 years (2003 to 2017) aggregated wildfire and prescribed fire data points for different agency and states. We used exploratory data analysis methodology to develop a data driven model to quantify the effectiveness of using prescribed fire as wildfire risk reduction strategy. Out of the different agency and states in question, we find that USFS and Oregon has a significant negative correlation between acres of wildfire and acres of prescribed fire. USFS and Oregon are successful in reducing prescribed fires to reduce wildfire acres as a mitigation strategy, we also see that this agency and state has a significant wildfire activity under their jurisdiction

The Figures on the US Forest Service and Oregon data are outlined below, covering 14 years.

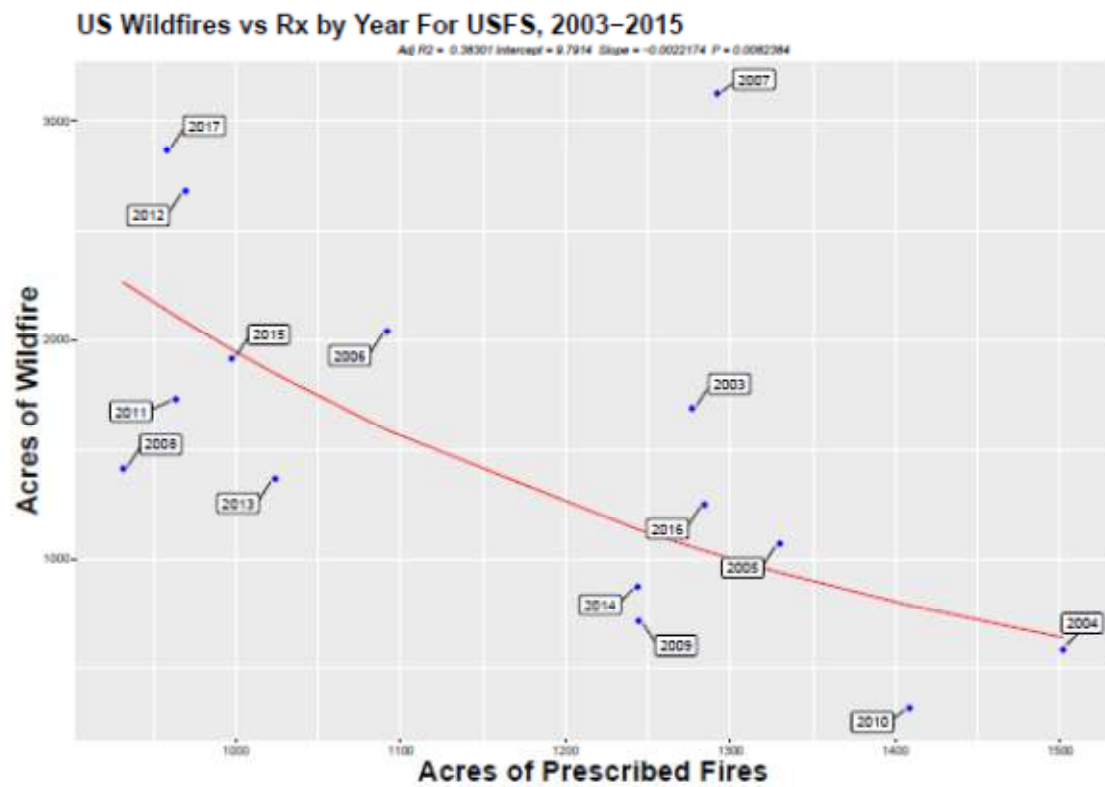


Figure 4.5: USFS Exponential Model Fit

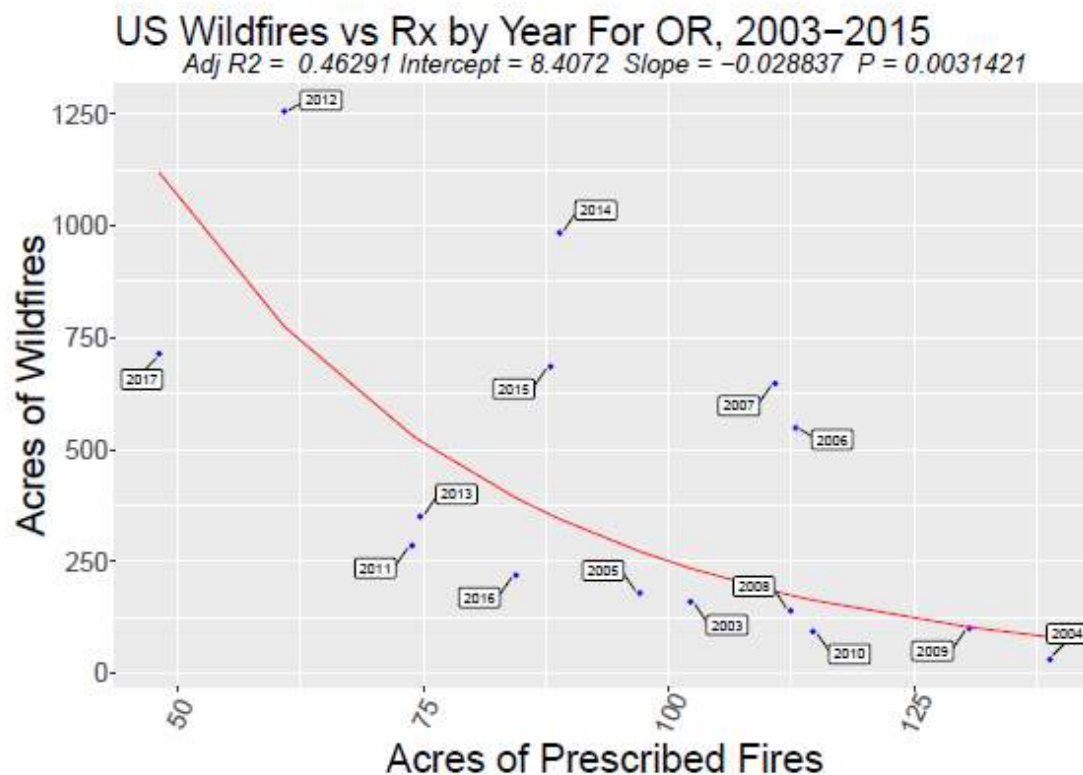


Figure 4.7: Oregon Exponential Model Fit

Forest land managements in United States are increasingly focused to mitigate damage from wildfires, in areas of forests land that are characterized as frequent, low intensity surface fires regimes [2]. There has been a steady increase in wildfire events with higher intensity over the past several years despite increased investment in prevention and suppression. There has also been a sharp increase in the suppression costs, which have been about a billion dollars per year, and hence more focus is needed in reducing the suppression costs by expanding the use of mitigation strategies such as prescribed burning. Exploratory Data Analysis Of Wildfires In USA by Arpit Rana June 2019.

2.7 Inadequate hazard reduction actioning to reduce risks and improve human safety.

The area of wildfire in NSW to the end of 2019 into 2020 is huge. The Figures below highlight many, not all of the wildfires on the north coast of NSW, around Sydney, south cost and inland southern tableland/ riverina. The wildfires are numerous, adjoin in many cases, and cover very large areas. There are many wildfires not included in the figures due to low safety risk now, eg the Whiporee fires earlier in the season. These wildfires are a major threat to human safety, towns, infrastructure, flora and fauna.

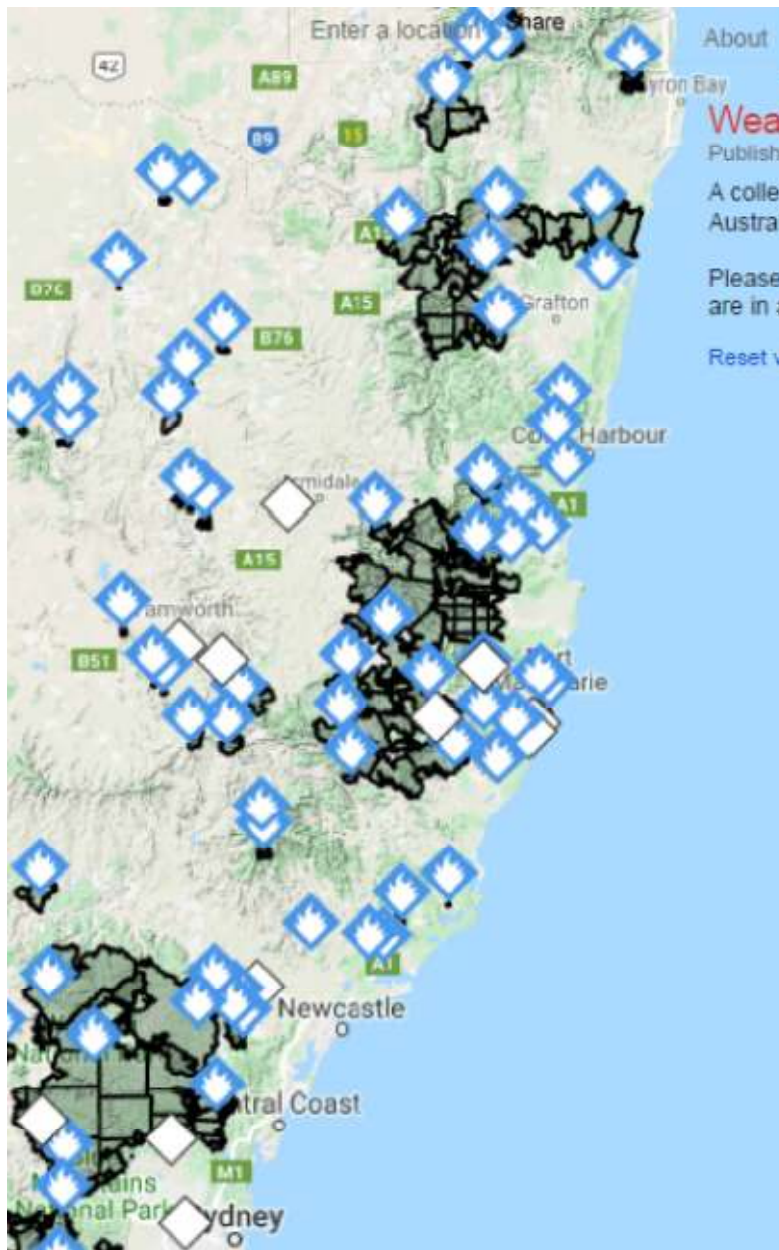


Figure. Wildfires in the North Coast NSW area at 30 December 2019.

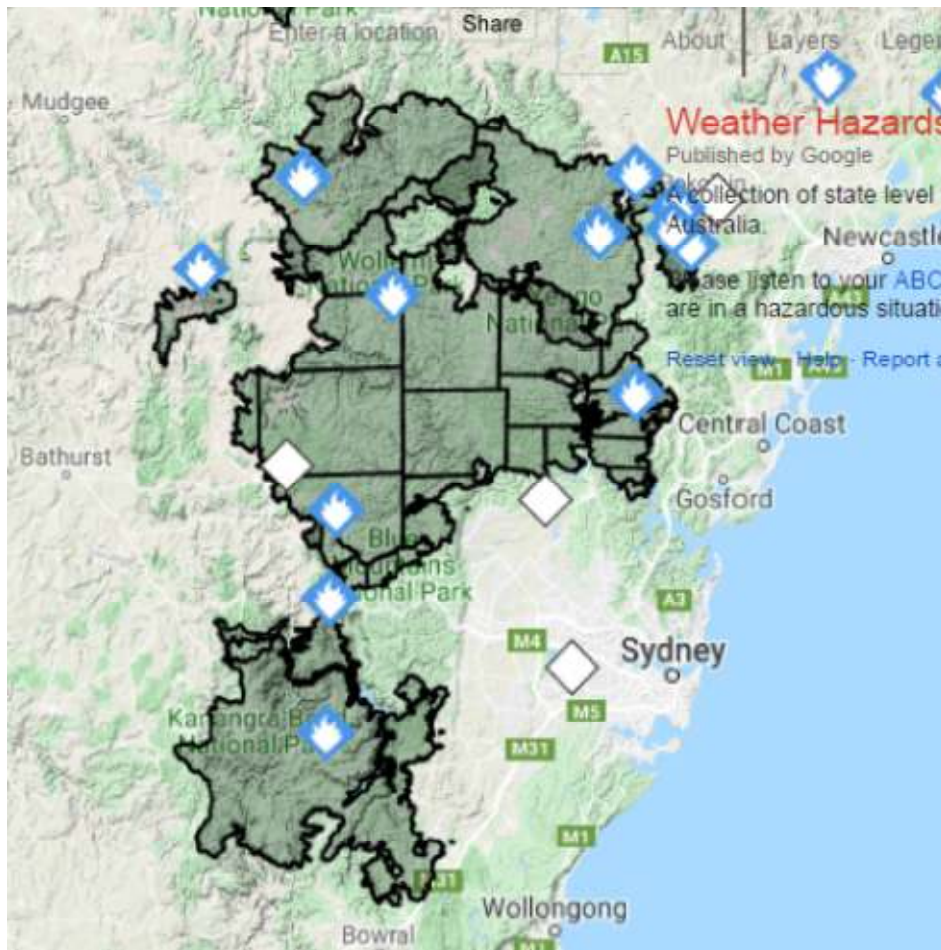


Figure. Wildfires in the Sydney area at 30 December 2019.

These Figures, I believe, highlight a missing factor, hazard reduction burning. In regards to community/ structure and wildfires, hazard reduction burning is critical to reduce risks. This doesn't seem to be happening to adequate levels. There appears to be a lack of actioning at state government, local government, RFS, town brigade, landholder and other levels.

Hazard reduction rarely stops wildfires dead but does reduce wildfire intensity, depending on timeframes since last hazard reduction burning. This needs to be clearly understood. This assists in being able to managing wildfires. We can influence this aspect of fire, not temperatures, droughts, soil dryness, fuel dryness etc.

One recommendation would be that local government have a fire safety committee/ action plan for all towns and cities and annual burns, hazard reduction, audits, non compliances, community training, access to hydrants, land owner fire plans etc are discussed. RFS and town brigades would need to be included.

Planned and adequate hazard reduction reduces fuel loading and consequent fire intensity, of that there is no doubt. This reduces overall risks to fire fighters. However, it also provides opportunities for brigade members to undertaken forest hazard reduction burns and gain experience on equipment, using fire, understanding fire, and understanding fuel loading/ soil dryness issues.

2.8 Inadequate fire trails, inadequate maintenance and closure of fire trails.

Closing fire trails is another area of concern, not only because of the impacts of fire access and hazard reduction burning but also due to cost saving. Another issue is that fire trails can provide a barrier to fight/ contain wildfires. A commonsense approach is needed, reviewing all fire trails in NSW and where there are gaps. Flatter logging roads should be left open for fire access.

2.9 Inadequate town outside, edge and internal defences.

Without naming towns, I believe that there are inadequate town outside, edge and internal defences in a lot of towns in NSW and across Australia. This would be visible in the house loss assessments.

I suggest that there needs to be a review of all town fire safety systems and measures across NSW and other states.

- Outside towns include permanent roads, farm roads, breaks slashed/ etc before every fire season.
- Edge breaks include permanent roads, farm roads, breaks slashed/ etc before every fire season.
- Internal breaks haven't normally been installed but are good to restrict wildfires. As well, I have seen large blocks of land that haven't been slashed in towns that need to be slashed before every fire season and where necessary during the fire season.

Town fire plans should be prepared and updated annually, addressing all these issues.

Please find attached a good town edge/ on the outskirts break installed at Tumbarumba to restrict fire movement, provide for access, improve surveillance. If these can be kept permanently, they are very good breaks for back burning, access and fire protection.



Figure. A good town edge (on the outskirts) access and break installed at Tumbarumba during the January 2020 wildfires.

Other ideas:

- New products such as gels could be tried that last the fire season.
- Grazing could be used.

- Audits could be conducted on each town and non-conformance issued for non compliance where required.

This all indicates to me that Councils need to be more actively involved in planning fire defence with RFS.

3. TOR-The science and research behind activities such as hazard reduction burning, clearing and rehabilitation.

There is new science, research, common sense, fauna kills and fire fighter/ safety issues that highlight the importance of the need for increased hazard reduction burning in NSW and the other states. This is outlined below.

3.1 What Australia was like before and at time of early white contact/ settlement.

200 years ago the forests were very different, they were park like and the explorers and early settlers saw this. Refer to the papers below, the Aboriginal community and many landholders. The land was managed, it was burnt regularly and it wasn't locked up.

This is documented:

- Firestick Ecology by Vic Jurskis.
- Forests burn and reason goes up in smoke: a family memoir. Tony Wright 15 November 2019, based on fire management in Victoria. SMH/ The Age.
- The Biggest Estate on Earth : How Aborigines Made Australia Bill Gammage
- Dark Emu Bruce Pascoe

I suggest that the inquiry team take time to buy/ read these documents. If we are to learn and move forward, we all need to understand critical issues living in the landscape we have from the time at and before European settlement. It was an open landscape and the soils were soft. It didn't take long for white man's impact to be felt, refer to the 1850's wildfire in Victoria that covered 5 million hectares. By that time Aboriginal burning practices had been reduced/ stopped.

3.2 Inadequate common sense and science in calculating required area of annual hazard reduction burning.

Hazard reduction is a cooler burn that reduces fuel loads, provides wildfire barriers for other wildfires, reduces tree death/ loss, reduces fauna loss, reduces impacts on communities and reduces impacts on communities associated with wildfires.

Hazard reduction burning is undertaken irregularly, is a cooler burn/ aiming to minimise crown scorch and usually only burns a portion of an area. Hazard reduction burning uses ground and aerial hazard reduction burning, using aircraft to drop fire capsules at a spacing that allows for cool burns and covering large areas safely. The cool burns are designed to join up late in the evening where conditions are cooler and the grid is designed for that to occur. It is important that flame heights are kept as low as possible and there are unburnt patches remaining. The usual technique is for a ping pong ball containing potassium permanganate which is injected with ethylene glycol at time of dropping the capsule.



Figure. A cooler hazard reduction burn underway on a grid pattern, note area of burn is fairly small.

The use of 10-15 %/ year of forested area hazard reduction burning is based on my experience and will be inadequate for some people, too often for others. 10-15 %/ year of forested area hazard reduction burning is my preferred approach, the focus on meeting the 15 %. It is important to note that this hazard reduction cycles won't last 5 years, but will reduce flame heights and fire intensities, increase odds of containment and reduce flora and fauna impacts. They will also increase safety of other hazard reduction burning.

There is rapid build up of litter after bush fires and hazard reduction burning is outlined in the paper referenced here. Australian Journal of Ecology/Volume 11, Issue 1 Decomposition and accumulation of litter after fire in sub-alpine eucalypt forests. J. Raison, p. V. Woods, p. K. Khanna First published: March 1986:

Accession, decomposition and accumulation of litter were studied in three sub-alpine eucalypt forest communities (dominated by overstoreys of Eucalyptus delegatensis, E. pauciflora or E. dives) located in the Brindabella Range. Australian Capital Territory, at an elevation of 1100–1250 m. The sites had either been protected from fire for more than 20 years or been burnt by low-intensity prescribed fires. After a prescribed burn, the rate of decomposition of abscised leaves was reduced by 22% in E. delegatensis forest and by 34% in E. pauciflora forest, but was little affected in the drier E. dives community. Lowered decomposition was apparently due to greater aridity after fire, a consequence of removal of the shading understorey and reduction in the depth and hence mulching effect of the litter layer. Litter accumulates rapidly after prescribed burning, reaching a mass of 10–12 t ha within 4–5 years in all communities. Such quantities are dangerous from a fire control viewpoint. The quasi steady-state mass of accumulated litter ranges from about 17 t ha in E. dives and E. pauciflora forests to about 25 t ha in old-growth E. delegatensis forests. The rapid re-accumulation of litter after fire is not the result of any significant change in litterfall rate, but is due to a marked reduction in the total amount of litter decomposing—and this reduction is more a consequence of a decrease in the weight of the forest floor than to any fire-induced lowering of the rate of litter decomposition. The rapid build-up of litter is a consequence of the relatively high rates of litterfall (3.4–5.0 t ha year) and low rates of litter decomposition ($k = 0.19–0.32$ year) in these forests.

Near towns and cities, sensitive infrastructure, and important fire protection boundary points, hazard reduction should be of the order of 2-3 years.

There are some exceptions to the regular hazard reduction cycle, including:

- Alpine heaths/ bogs.
- Critical threatened fauna issue areas.
- Newly regenerated areas, including non lignotuberous species such as the ashes.
- Some threatened flora species. Note failure to use fire adjacent to threatened flora species is a risk issue in itself when the inevitable wildfire occurs.
- Some areas near communities that are too dangerous/ where communities refuse to assist hazard reduction burns/ reducing fuels/ having fire control/ watering.
- Water catchments require special thought. Note total fire exclusion/ long hazard reduction cycles is a mistake, taking into account erosion and sedimentation from major wildfires.

We need to be very careful in putting too many restrictions on hazard reduction burning, otherwise hazard reduction burning won't occur, won't occur in key risk areas, won't be allowed to occur or become too bureaucratic. My strong suspicion is that this is restricting hazard reduction burning at the moment.

The current focus of inadequate hazard reduction combined with bad fire seasons has meant huge resources are tied up in fighting wildfires, over long periods, and at considerable cost. The risks to fire fighter and community safety in this approach are huge. This wild fire cost is increasing.

3.3 Inadequate use of aero burning hazard reduction.

Use of aero burning aircraft, helicopters and drones for hazard reduction:

- Increases the area that can be hazard reduced. It is much smarter to use small aircraft for these burns than very expensive larger aircraft for longer periods.
- Means hazard reduction can be undertaken on a grid pattern where flames reach each other at set times in the day when conditions are cool.
- Optimises hazard reduction area in the cool autumn periods or where required.
- Allows use of this technology to burn out large areas in wildfires, such as long unburnt ridges and high points that could spot over.

Another factor is the lengthening of the fire seasons. *"The lengthening fire season means that opportunities for fuel reduction burning are reducing. Overall, these trends mean that fire-prone conditions and vulnerability to fire are increasing, especially in heavily populated areas in the southeast"*, Climate Council, Be Prepared: Climate Change and The Australian Bushfire Threat, Professor Lesley Hughes and Professor Will Steffen. This point again emphasises the importance of both ground and aero burning to complete large areas of hazard reduction burning.

I was in charge of Hume Snowy Bushfire Prevention Scheme for 4 weeks and completed 4 large scale aerial hazard reduction operations in Kosciuszko National Park, an area of the order of 800,000 hectares. The Hume Snowy Bushfire Prevention Scheme was responsible for fuel reduction burning in Kosciuszko National Park, managed by the then Forestry Commission for over 30 years, more on this below. In my cases, small planes were used. I also completed aero burning operations on Maragle SF, from memory of the order of 4000 hectares plus, in high fuel load forests, as cool burns. I am able to note the value of aero burning as well as the value of the Hume Snowy Bushfire Prevention Scheme in reducing fire risks.

A legendary forester, Roy Free, wrote the initial Aero Aerial Hazard Reduction Plan for the Hume Snowy Bushfire Prevention Scheme in 1968. As noted by Roy, the Hume Snowy Bushfire Prevention Scheme lasted for 30 years and was closed in 1982, note other information indicates 1986. Roy's submission to the 2003 Bushfire Inquiry is attached, refer Attachment 1. It is an important reference work, outlining the case of the Hume Snowy Bushfire Prevention Scheme, where a scientific and effective approach lost out, for the loss of NSW, the fauna in the forests and people impacted by those very large 2003 fires. How this all happened indicates to me the risk of poor one off decisions happening again is too great. Often it is politicians that can make poor decisions, in this case it was a government agency/ employees, the eventual outcome a major wildfire with massive deleterious outcomes.

I have attached another submission to the 2003 Bushfire Inquiry, a submission by Vic Jurskis on the importance of hazard reduction and also adequate fire research, and this is attached as Attachment 2.

Other very good paper is a paper by Jurskis et al titled "Fire Management in the Alpine Region" at the Brisbane 2006 Bushfire Conference. This highlights Aboriginal burning, burning practices after that, the Hume Snowy Scheme and consequences of reduced burning programmes. This paper is attached as Attachment 3, it is focussed on alpine areas, but is applicable across much of Australia. The paper highlights the importance of extensive hazard reduction across alpine areas to mitigate the risk of wildfire, improved access to support hazard reduction operations and attack lightning strikes.

As Jurskis et al 2006 explain in the paper:

After the 2003 fires, a post script to the ISC report explained that the multiple lightning ignitions, which eventually culminated in Canberra's disaster, were unexpected. In fact multiple lightning ignitions during severe fire seasons have occurred repeatedly in the past, but have not had such severe consequences as in 2003. Multiple lightning strikes in State Forests and private lands to the west of the park at the same time caused little damage, and were all controlled within three days.

I note Forest Corporation staff have been trialling drones for aero burning and this appears to be working. This is great innovation. Risk of hazard reduction burn escapes should be borne by fund established with insurers, the state, Councils and community fees for management of hazard reduction burns.

Taking into account the 2019 wildfires and previous wildfires, it is very clear than hazard reduction needs to increase in NSW and across Australia to reduce the chance of major wildfires spreading, loss of life, loss of infrastructure and loss of fauna and flora. Aero burning is a great tool allowing large areas to be cool hazard reduced quickly. There also need to be clear controls that aero burning hazard reduction programmes can't be stopped, curtailed or closed without a clear state/ national level process.

I suggest that there needs to be established an independent aero burning branch be established across NSW and other states, with independence and reporting directly to the Premier. This could be within RFS or Forest Corporation. This branch should be at the forefront of hazard reduction burning across State Forest, National Park and freehold lands, working with RFS and applicable agencies.

3.4 Poor understanding of hazard reduction burning on forest ecology and forest health.

As noted Australian Forestry 2005 Vol. 68 No. 4 pp. 257–262 Decline of eucalypt forests as a consequence of unnatural fire regimes by Vic Jurskis:

- *Changes in fire regimes have upset the ecological balance in many eucalypt ecosystems (Attiwill 1994), and caused the health and predominance of eucalypts to decline (Jurskis 2005). Increasing populations of other species including mistletoes, shrubs, birds, possums and koalas have been seen by some ecologists as a sign of healthy ecosystems (e.g. Henderson and Keith 2002; Watson 2002; Keith 2004; Shaw et al. 2004; Kavanagh and Stanton 2005), and by others as a sign of ecological imbalance (e.g. Martin 1985; Neyland 1996; Jurskis 2002, 2005; Jurskis et al. 2003).*
- *A realistic view of ecology would recognise the imposition of unnatural fire regimes as a disturbance, and distinguish true biodiversity from an unnaturally high biomass of a few native weeds or pest animals (Jurskis 2003; Jurskis et al. 2003).*
- *Many ecological imbalances could be remedied at a landscape scale by reintroduction of more natural fire regimes (Jurskis 2005).*
- *Unfortunately ecologists and 'environmentalists' adhering to philosophies of 'non intervention' or passive management have supported misconceptions and confusion based on traditional concepts of disturbance and succession (Attiwill 1994), as well as the idea that populations are regulated by predators (White 1993). They have opposed any reinvigoration of prescribed burning in the landscape (Jurskis 2000, 2003, 2005; Jurskis et al. 2003). This, together with controversies about the recent widespread and disastrous fires resulting from 'non intervention' (e.g. Cheney 2005), will make it difficult to implement practical solutions to decline of eucalypt forests.*

Forest Ecology and Management 256 (2008) 1133–1142. Long term accumulation of nitrogen in soils of dry mixed eucalypt forest in the absence of fire by John Turner, Marcia Lambert, Vic Jurskis, Huiquan B:

- *Nitrogen appears to increase in quantity in the soil with time since fire, and the rate of increase is related in part to the basic soil fertility as indicated by soil phosphorus levels. The apparent rate of increase in the surface soils is approximately 11– 21 kg N ha¹ year¹ with the potential for higher levels on more fertile soils. The source of the N is assumed to primarily be N fixation, as the measured atmospheric inputs were of the order of 1 kg ha¹ year¹.*
- *The increases in N lead to a reduced soil C/N ratio, higher N mineralisation and reduced pH. It is proposed that the reduced pH is a result of a combination of nitrification, related to the increased soil N, and a reduction in base cations through uptake by vegetation.*
- *It is hypothesised that these changes create a poorer root environment and nutritional status for eucalypts, and these changed conditions can impact directly on tree health and increasing susceptibility to pests and pathogens.*
- *In the subsidiary study of paired plots found there was declining tree health in the long unburnt areas related to changes in soil characteristics, compared with the adjacent regularly burnt areas.*

This critical research as outlined above combined with other issues outlined in this submission outline the importance of regular hazard reduction burning. This one important issue, combined with the large number of other issues I have raised, emphasise the importance of regular hazard reduction burning

3.5 Not adequately using fauna kill knowledge from previous wildfires.

Fauna kills have been huge in pretty well all major wildfires in Australia. The loss of fauna over these fires has been huge. The extent of this fauna kill doesn't need to be, if hazard reduction is used, and a well spaced aerial grid pattern is used where fires don't join or join very late in the day, fire severity is dramatically reduced and fauna kill is small. I believe the optimum grid pattern is to minimise fires joining.

As noted by G Worboys in "A Brief Report on the 2003 Australian Alps Bushfires In the summer of 2003", two endangered animal species, the Corroboree frog and the mountain pygmy possum, were the 2 species thought to be most affected by the Kosciuszko National Park fires. Most of the Corroboree frog's habitat had been burnt, and it may be in real danger of extinction in the wild. Areas of mountain pygmy possum habitat at one of its more important locations, Mount Blue Cow, had been burnt.

As noted in the Sun Herald Snowy Mountain fires leave little natives on the brink By Alex Mitchell March 27, 2005, Keith McDougall, of the NSW Environment Department, and Neville Walsh, of the National Herbarium of Victoria, reported that some plant cover was wiped out and that bog vegetation, known as sphagnum moss, home of the rare frog, was burnt down to the peat layer. The tiny yellow-and-black-striped frog, which grows to about 25 millimetres, is only found in the 400 square kilometres of snow gum woodlands and sphagnum bogs in Kosciuszko National Park, and the Brindabella Range, near Canberra. "As a result of the fire, the frogs have vanished from more than half the sites being monitored by the National Parks and Wildlife Service," Opposition environment spokesman Michael Richardson said. He said the report predicted "the likely extinction of this species from the wild in the near future". The tiny mountain pygmy possum lives in the Snowy Mountains of NSW and Victoria. In the bushfire, 75 to 80 per cent of its Mount Blue Cow habitat was severely damaged and its slow recovery has caused concern for the 500 possums still in existence. "The possum's primary habitat is a dwarf conifer known as the mountain plum pine which was burnt so badly that many have died," Mr Richardson said. "Some of the shrubs were more than 200 years old and it will take generations for them to recover - if they ever do.

Two papers below outline the impacts of the 2003 wildfire on fauna.

Small Mammals Post-Fire in Kosciuszko National Park. Glenn Sanecki Centre for Resource and Environmental Studies, The Australian National University Ken Green NSW Department of Environment and Conservation. Fire Biodiversity in the Australian Alps National Parks Workshop Proceedings Albury NSW 2005

*The small mammal fauna of the Australian Alps does not only consist of the iconic Mountain Pygmy-possum *Burramys parvus*, but several other species that remain active throughout the year including winter during which they spend most of their time in the space that forms between the ground and the base of the snow-pack, the subnivean space.*

*The most common of these above the snowline include the bush rat, *Rattus fuscipes*, dusky antechinus, *Antechinus swainsonii* and the threatened broad-toothed rat, *Mastacomys fuscus*. Of these species *R. fuscipes* and *A. swainsonii* are the most commonly occurring small mammals in the Alps. Research and monitoring of these species, (especially *M. fuscus*) has been undertaken for some time in Kosciuszko National Park, the Smiggin Holes trapping grid being monitored since 1978. Prior to the fires, eight grids were being monitored during December, February and April each year. Augmenting this, a landscape scale transect had been established in the subalpine zone to investigate and monitor the distribution of small mammals in relation to snow cover and the development of the subnivean space.*

Recent research in particular, demonstrated the importance of habitat structure in the development and maintenance of the subnivean space; in particular shrub structural complexity and microtopographic relief.

The 2003 fire had a number of effects on small mammals. In the first instance there was a significant reduction in the population of each species at burnt grids. A second reduction occurred following the next winter when small mammal numbers on highly burnt grids fell to zero. A similar effect was also observed at the landscape scale with small mammals absent from burnt sites on the subalpine transect. We attributed this to the loss of the subnivean space which was almost non-existent at burnt sites.

Two years after the fire small mammals are being detected in small numbers on burnt trapping grids and at pre-fire levels on unburnt grids. At the landscape scale small mammals are still not being detected at burnt sites. We expect that small mammal recovery will be closely linked to the recovery of the subnivean space which is coupled to the regeneration of heathlands.

Post-Fire Recovery of Small Mammals in the ACT Murray Evans, Senior Wildlife Ecologist, Environment ACT Nicola Webb, Wildlife Ecologist, Environment ACT. Fire Biodiversity in the Australian Alps National Parks Workshop Proceedings Albury NSW 2005

The 2003 wildfires in the ACT were extremely hot (almost all areas burnt were classed as moderate to very high severity) and widespread (90% of Namadgi National Park affected). Such conditions have the potential to severely affect populations of small mammals and even cause localised extinction.

Environment ACT began monitoring of a range of fauna, including small ground mammals, within 6 weeks post-fire. Small mammal trapping was conducted in a range fire severity classes and vegetation communities, including Montane (Snow Gum) Woodland, Montane Tall Moist Forest (Alpine Ash), Montane Moist Forest, Dry Woodland and Riparian Forest. Between 75 and 100 Elliot traps were placed at nine sites in autumn 2003, with retrapping conducted in autumn during 2004 and 2005. Where possible trapping was conducted at locations where previous (pre-fire) trapping surveys had been undertaken.

*Three small ground-dwelling mammal species are known to occur in Namadgi NP, the Agile Antechinus *Antechinus agilis*, Dusky Antechinus *Antechinus swainsonii* and Bush Rat *Rattus fuscipes*. All three species were still present in the burnt areas six weeks post-fire, including the most severely burnt sites. Agile Antechinus were present at all sites trapped, whereas the other two species were present at all sites except those in Alpine Ash and dry woodland. Generally, trapping rates were surprisingly high for these species so soon after the fires. At sites where trapping occurred pre-fire, post-fire trapping rates were lower, though not significantly so.*

During the subsequent two years post-fire (2004 and 2005) trapping rates for both Antechinus species declined markedly (significant statistically) during the next two years post-fire, with Dusky Antechinus apparently becoming locally extinct at all trapping sites one year post-fire. Trapping rates for Bush Rats over the two-year post-fire monitoring period did not vary significantly.

*Post-fire habitats were invaded by House Mice *Mus musculus*, which had not been recorded in any pre-fire surveys and was not known to occur in Namadgi NP. No House Mice were caught in the first trapping period six weeks post fire, one mouse was trapped in the first year following the fire and by the second year trapping rates of House Mice had increased seven-fold to become the most trapped species at any time following the fires. Such post-fire invasions of house mice have been seen in other studies of fire and effects on small mammals.*

*Summary • There was surprisingly high survival of all three native small ground mammal species within the first 2 months following fire. • During two years following fire, trapping rates of both *Antechinus* species severely declined with one species apparently becoming locally extinct. • Numbers of House Mice exploded in post-fire habitats in the second year.*

The koala rescuers noted an estimated 3000 koalas dead as a result of the fires on the North Coast of NSW. Most Australians are concerned by fauna loss in these wildfires, including me, and we need to tackle the true issue, inadequate hazard reduction burning, not blaming others practices or organisations.

As noted in ABC News 'NSW bushfires lead to deaths of over a billion animals and 'hundreds of billions' of insects, experts say by Emma Elsworth Updated Thu 9 Jan 2020, 2:49pm, *over a billion animals and "hundreds of billions" of insects have been killed in bushfires throughout New South Wales this season, according to leading wildlife experts. The figure has more than doubled from an original estimate of 480 million animals lost, as the hectares razed by out-of-control fires increased from 3 million to now almost 5 million in NSW. Ecologist Chris Dickman from the University of Sydney said: "for some species we're looking at imminent extinction". "There will almost certainly be species of all geographical ranges and populations that are cooked before we've even had the chance to discover that they exist," Professor Dickman said. Wildlife is threatened by more than just flames in a bushfire crisis, says David Lindenmayer, a professor of forest ecology and management at Australian National University. "Australian wildlife has to deal with four things: the incredibly fragile overheated periods before fires, the fire itself, the lack of habitat and food after the fire, and the fourth thing is the invasion of foxes and cats in these burnt areas," he said.*

There needs to be much greater importance placed on the fauna loss in wildfires issue in fire planning and management to reduce these huge losses. Larger scale cool hazard reduction burning has a big part to play in this. I am staggered that fauna specialists aren't raising this issue to any great degree.

3.6 Inadequate consideration of wildfires and air quality.

In regards to air quality and wildfires, the air quality readings during the 2019/ 20 fire season are extremely high PM 2.5/ 10 microns and Total Suspended Particles and provide a data set over a long period that has greatly impacted n NSW. The fire season has dragged on and the impact on human health has been large. The news has focussed on Sydney, but country NSW has suffered as well. Refer to the Lismore, Grafton, Coffs Harbour, Port Macquarie data that Department of Planning and Environment has, monitoring set up in light of the wildfire crisis.

Personally, there were two days I had trouble breathing due to the wildfires:

- One day in Grafton where from memory the PM 2.5 got over 500 microns, sometime in November.
- One day near Whiphore in mid August when I was travelling north on the Summerland Way.

Suggest it would be good for the Inquiry to obtain graphs of all the NSW air quality data post August 1, 2019 to the present. It is concerning data and is over a very long period. Things need to change, lessons be learnt and large areas aero and ground hazard reduction burning operations completed.

Hazard reduction in autumn/ required timeframe also produces smoke but less of it, burns less of the heavier fuel, the area is usually not all burnt and for shorter periods. Planning of hazard reduction burns should and does take this factor into account.

3.7 Not using hazard reduction burning as an opportunity to mitigate climate change.

One component of the wildfire occurrence and severity critical issues is climate change. Our government, businesses, organisations all need to pull their weight and tackle this issue and meet commitments. This isn't happening adequately in Australia or most of the rest of the nations on the

earth. However, this issue isn't going away any time soon, so we need to manage the forests we have using the science we have.

In light of this, we need to focus on the fire issues we can address and these include:

- Hazard reduction burning in all forested areas, state, leased and freehold, usually autumn.
- Good access into forested areas.
- House design and location in regards to fire.
- Sound house protection. Many residences have rubbish around gardens, mulch gardens next to houses etc and are fire traps.
- Getting the bureaucratic restrictions out of hazard reduction burning.
- Greater control on hazard reduction burning planning to regional groups.

Fuel reduction burning mitigates wildfire effects on forest carbon and greenhouse gas emission, there is science on this in eucalypt forests. The abstract from the paper below states *"A high-intensity wildfire burnt through a dry Eucalyptus forest in south-eastern Australia that had been fuel reduced with fire 3 months prior, presenting a unique opportunity to measure the effects of fuel reduction (FR) on forest carbon and greenhouse gas (GHG) emissions from wildfires at the start of the fuel accumulation cycle. Less than 3% of total forest carbon to 30-cm soil depth was transferred to the atmosphere in FR burning; the subsequent wildfire transferred a further 6% to the atmosphere. There was a 9% loss in carbon for the FR-wildfire sequence. In nearby forest, last burnt 25 years previously, the wildfire burning transferred 16% of forest carbon to the atmosphere and was characterised by more complete combustion of all fuels and less surface charcoal deposition, compared with fuel-reduced forest. Compared to the fuel reduced forests, release of non-CO GHG doubled following wildfire in long-unburnt forest. Although this is the maximum emission mitigation likely within a planned burning cycle, it suggests a significant potential for FR burns to mitigate GHG emissions in forests at high risk from wildfires". Liubov Volkova , C. P. (Mick) Meyer , Simon Murphy , Thomas Fairman , Fabienne Reisen and Christopher Weston International Journal of Wildland Fire 23(6) 771-780 Published: 27 June 2014.*

Further information is outlined in a paper referenced below. Australian Forestry The effect of fire line intensity on woody fuel consumption in southern Australian eucalypt forest fires, J. J. Hollis , W. R. Anderson , W. L. McCaw , M. G. Cruz , N. D. Burrows , B. Ward. Pages 81-96 Published online: 15 Apr 2013. *The results of this research suggest that predicted changes to fire regimes and fire intensity associated with climate change in southern Australia could result in greater woody fuel consumption and carbon release during bushfires and a reduction in woody fuel loads in dry eucalypt forests. Use of low-intensity prescribed fires may provide a practical way of managing woody fuel stocks to achieve particular land management objectives.*

3.8 Fire science needs to be elevated.

There have been large advances in fire fighting and tanker design.

New advances include:

- Foam breaks.
- Gels.
- Retardants.
- Others.

Other advance areas needed include:

- Low cost gels that can be applied across road reserves as 30 metre wide breaks.
- 10 metre wide foam breaks.
- Products that can be used to suppress fires.

However, there is a lot of fire and wildfire research required to better protect ourselves, our land and fauna. CSIRO and Forest Corp fire research needs to be continued and expanded. But we have the basic science in as noted by Jurskis.

The fire and dieback research ascertained by Jurskis needs to be adopted. This is outlined in Section 3.4.

I believe there needs to be a degree system established in fire science and the logical place to do this would be at ANU Forestry and have close links with CSIRO experts. This could be a Bachelor of Science Forestry and Fire.

3.9 Is a management plan at a local level the right approach to handle hazard reduction burning.

As noted Jurskis et al, 2006 (refer Attachment 3), in 2001 the NSW Government determined to review the plan of management for Kosciuszko National Park, and appointed an Independent Scientific Committee (ISC) to assess the values of the park. The following paragraph summarises their views on fire management (Leaver and Good 2004).

Fire management in the park has progressed from simplistic fuel reduction burning to a sound ecological approach providing for nature conservation, catchment protection and maintenance of acceptable risk. Aboriginal people burnt small areas, whereas grazing and burning caused erosion, shrub invasion and increased fire hazards. "The (Hume – Snowy) fuel reduction program never reduced the fire hazard if one ever existed". Large tracts of the park are at a "primary state of succession", and fire should be excluded from most ecosystems for long periods, for example, alpine ash requires one high intensity fire every 150 years. All species of plants in the park are adapted to high intensity fire. Heavy fuel loads are required to stabilise steep slopes. Only about 7% of the park should be burnt. Increased prescribed burning is a serious concern.

The paragraph above has a number of very concerning statements and highlights how matters can go astray in Management Plan planning in regards to hazard reduction. I note that I am not sure if this assessment above was adopted in the KMP. I also note that NPWS have increased hazard reduction burning in NSW, and I suspect are doing the most area, but I believe this isn't adequate.

I believe that the paper highlights that foresters and graziers had the right approach in the mountain/ alpine areas. If we as a society say that you can only burn this % area, that area and not other extensive areas and set up restrictive rules, we are doomed to failure in wildfire control.

The question needs to be asked. Is management plan at a local level the right approach to handle hazard reduction burning areas and timing?

I strongly believe that there should be state hazard reduction principals applied to state lands that must be met and that local management plans cannot be changed to suit local requirements. Principles could include:

- Hazard reduce 10-15 % of forests in the state each year, with the focus on 15 %/ year.
- Where local exceptions are allowed to this approach, not endless restrictions that tie programs in red tape.
- Any changes must be signed off by the Premier, RFS and regional bushfire committees.

4. TOR-The impact of severe fires on the economy in urban, regional, rural and remote areas.

There is a fair amount of information in regards to the costs of the 2019/ 20 and earlier fires.

The impact on Tumbarumba and surrounds from the January 2020 fires is huge:

- Huge areas of pine plantations and associated big timber industries. There is huge employment in timber management, harvesting, milling and distribution.
- Large areas of alpine ash forest and other species and associated timber harvesting, transport and milling. Alpine ash is very badly affected by wildfires and is non lignotuberous.
- Viticulture.
- Farming.

Batlow, Wagga, Albury and Tumut will also have large economic impacts.

5. TOR-The progress and implementation of mitigation strategies recommended in state reviews over the last decade.

Have we learnt the lessons from wildfires in this country?

There have been a lot of very large wildfires in Australia since Aboriginal burning practices were curtailed, some of these larger wildfires are outlined below:

- 6 February 1851 in Victoria, 5 million hectares, 12 fatalities, 1 million sheep and 1000s of cattle lost.
- December 1938 – January 1939, peaking 13 January 1939, in Victoria, 2 million hectares, 71 fatalities, 3700 properties damaged.
- 7 February 1967, Tasmania, 264,000 hectares, 62 fatalities, 1293 homes.
- 1974/ 5 wildfires in western NSW (at a number of locations), 7.5 million hectares, 9 fatalities.
- 1984/ 5 wildfires in NSW (at a number of locations), 3.5 million hectares, 5 fatalities.
- 2003 Eastern Alpine fires, 1.3 million hectares, 3 fatalities, 41 homes. More on these below.
- 2003 Canberra bushfires caused severe damage to the suburbs and outer areas of Canberra, the capital city of Australia, during 18–22 January 2003. Almost 70% of the Australian Capital Territory's (ACT) pastures, pine plantations, and nature parks were severely damaged. Four people died, there were 435 non fatal injuries, 488 houses were destroyed and the cost was \$350 M. More on these below.
- 2003 Tenterden WA fires, 2.11 million hectares, 2 fatalities.
- 2006/7 Great Divides bushfires, 1.048 million hectares, 1 fatalities, 51 homes.
- February 2009 Black Saturday bushfires, 450,000 hectares, 173 fatalities, 2,029+ houses, 2,000 other structures.
- 27 December 2011 – 3 February 2012 Carnarvon bushfire complex 800,000 hectares, 11 pastoral stations.

Major wildfires happened very quickly in the early days of this country. This again supports the points I am making in this submission, we are undertaking inadequate fuel management in this country, especially in our forests.

The question also needs to be asked, have we learnt the lessons from these fires and a lot of other wildfires in this country. This is discussed further in my submission. I believe that in reality, we have only learnt some of the lessons.

The current fire management system is inadequate in hot dry drought seasons and for long periods of spring, summer and autumn.

I suggest your inquiry tabulate the lessons from all bushfire inquiries since 1851 and issue this as an attachment to your inquiry and make this public. Appendix C of the *2004, National Inquiry on Bushfire Mitigation and Management, Commonwealth of Australia, Canberra* by COAG inquiry included findings of previous inquiries, but hasn't tabulated them, to ascertain/ tease out similar recommendations.

6. Recommended fire management improvement areas.

The main issues in this submission that I have raised as fire improvement areas include:

It is time to learn the serious lessons.

1. I suggest your inquiry tabulate the lessons/ recommendations from all bushfire inquiries since 1851 and issue this as an attachment to your inquiry and make this public. This would be tabulated and cross linked for similar issues. Appendix C of the 2003/ 4 COAG inquiry included findings of previous inquiries, but hasn't tabulated them, to ascertain/ tease out similar recommendations, *Ellis, S, Kanowski, P & Whelan, R 2004, National Inquiry on Bushfire Mitigation and Management, Commonwealth of Australia, Canberra.*
2. There needs to be a national inquiry in regards to bushfire management using fire fighting expertise only with expertise in fire fighting and land management, with expertise not influenced by an individual agency. People such as retired fire fighters/ managers/ heads of agencies, retired research experts from CSIRO and forestry, people in the brigades on the ground and others as required. The time has come to look at fire management from a level closer to the Aboriginal burning approach across wide areas and by fire specialists, not necessarily high level managers. Too much forest and farmland is at stake, lives at risk, communities at risk and fauna at risk.
3. Review the state of play in regards to the Recommendation 13 of Parliament of the Commonwealth of Australia A Nation Charred Report on the inquiry into bushfires House of Representatives Select Committee into the recent Australian bushfires 23 October 2003 Canberra. Recommendation 13 The Committee recommends that the Commonwealth seek to ensure that the Council of Australian Governments seek agreement from the states and territories on the optimisation and implementation of prescribed burning targets and programs to a degree that is recognised as adequate for the protection of life, property and the environment. The prescribed burning programs should include strategic evaluation of fuel management at the regional level and the results of annual fuel management in each state should be publicly reported and audited.
4. Review the state of play in regards to the Recommendation 2 of Parliament of the Commonwealth of Australia A Nation Charred Report on the inquiry into bushfires House of Representatives Select Committee into the recent Australian bushfires 23 October 2003 Canberra. Recommendation 2. The Committee recommends that the Commonwealth through the Council of Australian Governments ensure that states and territories have adequate controls to ensure that local governments implement required fuel management standards on private property and land under their control.
5. Completed hazard reduction and wildfire areas in each state needs to be discussed at every Prime Minister/ Premier meeting.
6. It is clear from WA and possibly recently in Queensland information that hazard reduction programmes can increase in NSW, Victoria and other states. Pre 2003, I understand hazard reduction burning was much greater in NSW.
7. Ensure as a society that wildfire lessons are not lost. Unfortunately, they are, and I suspect at the minister, agency, manager and landholder level. We need to develop ways that these lessons aren't lost.
8. Wildfire and hazard reduction awareness notes need to be developed and issued to all fire fighting personnel to keep fire fighters informed, as well as the public. This isn't only for brigade members but for farms and foresters will fire fighting equipment. I believe I could find a team to prepare these.

Hazard reduction burning.

9. It is time to finally learn the lessons of Aboriginal burning practices and apply these to the denser forests we have now.
10. The current approach to inadequate hazard reduction burning impacts on the health of forests. This issue is of national importance and poorly understood or ignored. The time has come to use the research information tabled by Vic Jurskis, an eminent Australian scientist in forest fire, health, dieback and fauna. Information on this issue is outlined in this submission.
11. It is also time to listen to the land managers who understand the land, use its resources, manage the land and undertake practices that reduce wildfire risks. These land managers include the Aboriginal people, graziers/ farmers, foresters etc. It is time to avoid bureaucratic

restriction that lead to avoidance of cool burns near sensitive areas or species, as these increase major wildfires badly affecting these species.

12. Hazard reduction rarely stops wildfires dead but does reduce wildfire intensity, depending on timeframes since last hazard reduction burning. This needs to be clearly understood. This assists in being able to manage wildfires. We can influence this aspect of fire, not temperatures, droughts, soil dryness, fuel dryness etc.
13. Increase current inadequate hazard reduction burning in southern Australia. It is very clear than hazard reduction burning needs to increase in NSW and across Australia to reduce the chance of major wildfires spreading, loss of life, loss of infrastructure and loss of fauna. A minimum of 10-15 % of forested area should be hazard reduced per year, the focus being on meeting the 15 %. Compared to catastrophic wildfires that burn everything and often kill large areas of vegetation and fauna, forest hazard reduction burning is a better option, that also improves community safety and forest health associated with the build up of litter and nutrients. It is important to note that hazard reduction won't last 5 years, but will reduce flame heights and fire intensities, increase odds of containment and reduce flora and fauna impacts. They will increase safety of other hazard reduction burning. Near towns and cities, sensitive infrastructure, and important fire protection boundary points, hazard reduction should be at lesser intervals than 5 years, of the order of 2-3 years.
14. It isn't the time to apportion blame for inadequate hazard reduction burning. It is absolutely the time to properly learn the lessons and apply them. Environmental restrictions on hazard reduction burning need to be markedly reduced to favour a cool burning approach.
15. Increased use of air craft, helicopters and drones increases the area that can be hazard reduced each year. It is much smarter to use small aircraft for these burns than very expensive larger aircraft for longer periods in the wild fire season.
16. An Aerial Hazard Reduction Plan (or "essential forest health and human safety plan" be established for NSW and also developed for other states covering all forested areas in NSW under state, lease and freehold control.
17. An independent aero burning branch be established across NSW and other states, independent of the agencies and reporting directly to the Premier. This could be within RFS or Forest Corporation. This branch should be at the forefront of hazard reduction burning across State Forest, National Park and freehold lands, working with RFS and applicable agencies.
18. Development and use of drone aero burning technology is strongly supported and assists in completing large areas of hazard reduction burning.
19. Larger cool area burns of 10, 000 to 20,000 hectares need to be considered to reduce wildfire risks, assist coordination on the ground and air, aid in restricting unplanned access, reduce costs etc. As emphasised these need to be cool burns. These areas are important to assist in better and safer wildfire control as well, rather than small areas.
20. I understand that hazard reduction funding was provided in NSW to NPWS and not Forest Corp nor Councils for hazard reduction. If correct, this is disappointing and funding needs to be provided to Forest Corp nor Councils for hazard reduction. This disjointed approach is not reasonable, and the state pays the price, as obvious from the 2019/ 20 fires.
21. Risk of hazard reduction burn escapes should be borne by fund established with insurers, the state, Councils and community fees for management of hazard reduction burns.
22. There will be hazard reduction burn escapes. This needs to be accepted but minimised. Compared to wildfires, the risks and impacts are small.
23. Failure to cooperate in hazard reduction burning should be an offence, where cooperation is not warranted.
24. Where required 2019/ 20 wildfire locations be used for 2020 hazard reduction operations, with scrub/ organic matter build up in these forests happening because of the poor state of many of the forests, high organic matter and the extreme heat load in many of the fires. And new hazard reduction areas should be burnt. The 2020 and 2021 follow up hazard reduction burning should realistically be the largest forest hazard reduction burning undertaken in this country, apart from Aboriginal burning programmes in northern Australia and in earlier times.
25. I suggest an assessment of hazard reduction burning be undertaken over the last 5 years against wildfires in this year and the last 5 years using GIS. My suspicion is that one thing that will come out of this is that smaller hazard reduction burns are not as effective for managing large wildfires as larger hazard reduction burns 10-20,000 hectares, if they have been completed. It is important to remember that the forests of today are a lot denser with

higher fuel loads than the forests managed by the Aboriginal people, so size of aero burning operations is I believe important.

26. A better term to describe hazard reduction burning could be developed to take into account reduction of the hazard to better manage wildfires, community safety, fire fighter safety and the missing issue, maintaining forest health. This could be "essential forest health and human safety burning" or more simply "essential burning". I raise this as an idea to consider further.
27. COAG undertake annual review of fuel reduction/ areas hazard reduced in the states annually and that this be reported in the media annually and quickly. The Parliament of the Commonwealth of Australia A Nation Charred: Report on the inquiry into bushfires House of Representatives Select Committee into the recent Australian bushfires 23 October 2003 Canberra. There were two major recommendations, Recommendation 2 and 13.
Recommendation 2. The Committee recommends that the Commonwealth through the Council of Australian Governments ensure that states and territories have adequate controls to ensure that local governments implement required fuel management standards on private property and land under their control. Recommendation 13 The Committee recommends that the Commonwealth seek to ensure that the Council of Australian Governments seek agreement from the states and territories on the optimisation and implementation of prescribed burning targets and programs to a degree that is recognised as adequate for the protection of life, property and the environment. The prescribed burning programs should include strategic evaluation of fuel management at the regional level and the results of annual fuel management in each state should be publicly reported and audited.
28. Incentives be developed established where hazard reduction burning is completed as required at all levels, Federal, State and local government. This could involve payment systems, insurance, legislation etc.
29. Systems need to be developed so that State agencies, lessees, freehold lands, Councils and others cannot weasel out of their hazard reduction responsibilities. This is a very serious issue. This can be achieved by legislation, audit, insurance, incentive and other means.
30. There also need to be clear controls that aero burning/ ground hazard reduction programmes can't be stopped, curtailed, interfered with or closed without a clear state/ national level process.
31. Key forests have been linked to a number of very serious fires and impact key infrastructure, plantations, viticulture and farmland. . These are in critical zones protecting known wildfire hazard zones such as around Tarcutta, one example would be Ellerslie NR. Another is Woomargama National Park SW of Tumbarumba. Both these forested areas have contributed to a number of very large and expensive wildfires in NSW, the later National Park in NSW and Victoria. These forests and very dangerous for critical pine plantations in NSW and Victoria. I suggest that burning on these forest would be undertaken every 1-2 years and we would see safer forests. They should be establishing and legislated as Aboriginal land practice forests. It is time to progress alternative, rational and more innovative thinking, similar to the Aboriginal people.

Documenting the benefits of larger hazard reduction programs.

32. The current approach in relation to controlling, or trying to control wildfires is very expensive. It is also very dangerous, and lives are being lost. The inquiry should focus on benefits of larger area hazard reduction programs (10,000 hectares plus), improved community safety, improved fire fighter safety, less loss of infrastructure and improved forest health. This would reduce the costs and risks of the current management approach using small hazard reduction burning. A separate stand alone report could be issued on this subject to use as required to progress failures.
33. In large forested areas, I question the focus on small scattered hazard reduction areas and if they as effective as larger areas. I personally believe larger areas of hazard reduction are required. I am not talking about infrastructure protection burning here.

Fire management coordination.

34. COAG/ Commonwealth and State annual review of fuel reduction/ areas hazard reduced in all the states annually and that this be reported in the media. An incentive system could be developed to encourage state to complete more hazard reduction burning.
35. The current approach is not adequately focussed on large areas of hazard reduction burning. More control regionally is critical, especially in hazard reduction planning. Bushfire

Associations/ Regional committees in regional areas could be established to have a greater say in the planning and undertaking of hazard reduction burning at the local level and could be used to increase uptake of hazard reduction burning and reduce bureaucracy as much as is possible.

36. Councils be more involved in hazard reduction operations, especially in relation to fire planning and coordination of hazard reduction and town defences, having more slip ons and trained staff.
37. A commonsense approach is needed, reviewing all fire trails in NSW and ascertaining where there are gaps in trails.
38. When there is a lot of smoke about, it is apparently hard for aircraft to ascertain extent of wildfires and there can be gaps for days. It would be sensible to use heat/ scorched vegetation to better and more quickly map the extent of fires and supply of this information to the ground, this may be happening as My Fire Watch has this information.
39. There is another wildfire app called My Fire Watch, this covers all over Australia, by Landgate. This app covers Hot Spots at 0-12 hours old (great), 12-24 hours, 24-48 hours and 48-72 hours; vegetation greenness; lightning last 24 hours, 24-48 hours, 48-72 hours; and burnt areas. It would be fantastic if this My Fire Watch can be added as layers on Fires Near Me in NSW. This approach would assist fire fighters on the ground and affected communities. At the least an advice about this app on your web site and to brigade members would be good.

Human health and safety.

40. Local government have a fire plan and wildfire safety committee for all towns and cities and annual burns, hazard reduction, audits, non compliances, community training, access to hydrants, land owner fire plans etc are discussed. RFS and town brigades would need to be included. Annual updates of plans would be required. Annual reporting to State Government would be required. This needs to be a mandatory state requirement, poor and non compliance needs to be treated very seriously.
41. Street fire safety groups/ meeting be encouraged and progressed. This could be tied in with insurance premiums, no street group means slightly higher premiums, slightly lower with street fire safety groups. This creates incentive. The problem is non active members, this can be sorted over time.
42. Insurance premiums consider location of residences/ structures, house design, fuel management around houses, fire plans, membership of street/ town fire groups. This would increase risk reduction.
43. Further improve house and shed design and sound fire design. There are good house designs in place, this need to be updated in regards to recent wildfire learnings. Plantings of deciduous trees need to be considered. In country areas, access around house and sheds is a valuable additional protection.
44. Undertake annual voluntary fire protection house audits. Review more open, access, managing mulch, watering arrangement, vegetation types and removal of some conifers, etc. There could be a brochure prepared on this issue across all states.
45. A brochure prepared on web sites for fires, another on improvements in designs, across all states. A lot has been learnt in regards to fire fighting safety, tanker design, equipment, warnings, web, Fires Near Me, stay or leave, Radio Scanner, My fire watch etc.
46. Sprinkler system included on house/ shed roofs/ system to check it need to be included as standard design, nozzles need to be long life, not block up and not melt. Costs would be relatively low.
47. There are new hydro gels on the market that apparently can last a fire season. If these products could be sprayed onto houses, sheds, posts etc, damage could be markedly reduced. They can also be used for town defence tracks and roads. Corn starch derivative is one such product.
48. Fire fighter clothing/ goggles/ masks and gloves be totally claimable through the tax system as there are large numbers of fire fighters outside the tax system. This would be for those fire fighters not in brigades, on the land etc, and there are considerable numbers of them at every fire.
49. Older experienced fire fighters not in the brigades be encouraged/ authorised/ allow to work with no brigade slip on and tanker units. Large numbers of people on the ground are non brigade member farmers, forester, landholders etc and those with less experience would

benefit from training in hazard identification, dangerous trees, hot ash spots, slopes to avoid, placement of personnel etc.

50. Annual training programmes take place for non brigade members in towns/ locations as required.
51. Suggest the Inquiry obtain graphs of all the NSW air quality data across post August 1, 2019 during the wildfire. It is concerning data as the wildfires have gone on for 4-5 months and are continuing. Things need to change, lessons be learnt and large areas aero and ground hazard reduction burning operations completed.

Important fire infrastructure protection.

52. Telecommunication towers and accesses, large businesses eg sawmills, hospitals and schools, Council administration, telecommunication facilities be classified as important fire infrastructure protection areas.
53. Concrete/ steel poles need to be considered in timbered areas, communication shed design reviewed, cable design reviewed and trees kept well away from the towers/ sheds. Telecommunications at Tumbarumba were out for a considerable number of days, most of the wildfire period, reducing flow of information to the fire fighters and community.
54. Research be undertaken on commercial low cost spray on products protecting timber electricity poles over 12 months or longer from wild fire. This would be a good project for State Forests/ CSIRO. The same product/s could be used for fence protection.
55. Pine plantation protection on boundaries for large forests be reviewed, on all edges. This protection area could be a 500-1000 metre wide zone or wider. Ideas include widely spaced high pruned trees (say 600 trees/ hectare, sawlog production zones), water sprays that do 50 metres each way, water supply dams, access tracks every 40 metres between tree rows, area burnt or raked annually, weeds sprayed, retardant gel sprayed onto the ground and trees in fire seasons. Thinning mulch would need to be staked away from trees. The same approach could be used on more roads within the plantations, but the priority should be to reduce risk of fire entry into plantations. Hazard reduction on the outside of plantations should also be completed regularly.

Wildfire fauna loss.

56. An independent assessment of fauna loss in NSW/ Australian wildfires be undertaken so that this information is documented.
57. Greater importance placed on the fauna loss in wildfires issues in fire planning.

John O'Donnell

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