

**Submission
No 41**

**INQUIRY INTO HEALTH IMPACTS OF EXPOSURE TO
POOR LEVELS OF AIR QUALITY RESULTING FROM
BUSHFIRES AND DROUGHT**

Name: Mr John O'Donnell

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**Submission to NSW Inquiry into the health impacts of exposure to poor levels of air quality
resulting from bushfires and drought**

John O'Donnell

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Table of Contents

Introduction and terms of reference for the inquiry.....	3
1 The health impacts of exposure to poor levels of air quality resulting from bushfires and drought.....	4
1.1 Inadequate consideration of wildfires and air quality on human health.....	4
1.2 Inadequate consideration of air quality, wildfires and fire fighter health.....	5
2. The effectiveness of the NSW Government to plan for and improve air quality.....	5
3. Any related matters.....	6
3.1 Wildfires emit massive quantities of smoke over long periods.....	6
3.2 Inadequate hazard reduction burning impacts on human health.....	7
3.3 Inadequate hazard reduction actioning to reduce risks and improve human safety.....	10
3.4 Inadequate consideration of the combined advantages of hazard reduction burning as opposed to massive wildfires.....	10
3.5 Not using hazard reduction burning as an opportunity to mitigate climate change.....	12
Conclusions.....	13
Appendix 1. Recommendations made in this submission.....	14

Introduction and terms of reference for the inquiry.

Under the terms of reference, the inquiry is to consider, and report on:

Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought

TERMS OF REFERENCE

That Portfolio Committee No. 2 – Health inquire into and report on:

1 The health impacts of exposure to poor levels of air quality resulting from bushfires and drought including:

- (a) the impact of at-risk groups including children, pregnant women, people with asthma and other respiratory-related illnesses, the elderly and other high risk groups as well as vulnerable companion animals;
- (b) the impact on people who are exposed to poor outdoor air quality in the workplace;
- (c) the long term impacts of exposure; and
- (d) the effectiveness of various protective materials and strategies to mitigate the health impacts of exposure.

2. The effectiveness of the NSW Government to plan for and improve air quality including:

- (a) the measurement, reporting and public awareness;
- (b) the provision of various protective materials including face masks and air purifiers;
- (c) the ability to ensure the health of at-risk groups;
- (d) the suitability of work health and safety regulations, industrial provisions and related guidelines; and
- (e) the capacity to respond within existing resources and ongoing efficiency dividends.

3. Any related matters.

I have addressed submission issues below.

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 includes:

- 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. Was an authorised officer under the Bush Fires Act for 11 years.
- 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 1985, 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.
- In charge of Hume Snowy Bushfire Prevention Scheme for 4 weeks in 1980 and completed 4 aerial hazard reduction operations. The Hume Snowy Bushfire Prevention Scheme was responsible for fuel reduction burning in Kosciuszko National Park, managed by the then Forestry Commission. Organised two aero burning operations on Maragle SF in 1983, of the order of 4000 hectares plus, in very high fuel load forests (through the Hume Snowy scheme).
- Involved in the fires at Tumberumba in early January 2020 over 13 days, including firefighting, mopping up with slip ons, edge fire control, patrolling, preparing fire breaks, improving house safety, moving stock etc.
- 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. Understanding of the importance of fire in regards to forest health. Good understanding of flora and fauna. Environmental Manager for the Pacific Highway for 12 years.

1 The health impacts of exposure to poor levels of air quality resulting from bushfires and drought

including:

- (a) the impact of at-risk groups including children, pregnant women, people with asthma and other respiratory-related illnesses, the elderly and other high-risk groups as well as vulnerable companion animals;
- (b) the impact on people who are exposed to poor outdoor air quality in the workplace;
- (c) the long-term impacts of exposure; and
- (d) the effectiveness of various protective materials and strategies to mitigate the health impacts of exposure.

1.1 Inadequate consideration of wildfires and air quality on human health.

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 on 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.

I am a late onset asthmatic. Personally, there were a number of days I had trouble breathing due to the wildfires:

- One day in Grafton where from memory the PM 2.5 got to over 500 microns, sometime in November 2019.
- One day near Whiporie on 14 August 2019 when I was travelling north on the Summerland Way, refer image below. I was unwell for weeks after this.
- A number of days when I was firefighting/ patrolled the two big wildfires at Tumbarumba in January 2020. Refer detail below.



Figure. Smoke on the Summerland way on 14 August 2019.

I suggest that 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 aerial 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, burns less depth of the fuel, the hazard reduction area is usually not all burnt and burning occurs for shorter periods. Planning of hazard reduction burns should and does take this factor into account.

1.2 Inadequate consideration of air quality, wildfires and fire fighter health.

I was at the two big fires at Tumbarumba, southern NSW, for 13 days in January 2020. Refer the photo below of the air quality we endured during this period.



Figure. Hazardous smoke conditions in the Tumbarumba on 5 January 2020. These conditions were common during that period, common for fire fighters and emergency personnel.

2. The effectiveness of the NSW Government to plan for and improve air quality

including:

- (a) the measurement, reporting and public awareness;
- (b) the provision of various protective materials including face masks and air purifiers;
- (c) the ability to ensure the health of at-risk groups;
- (d) the suitability of work health and safety regulations, industrial provisions and related guidelines; and
- (e) the capacity to respond within existing resources and ongoing efficiency dividends.

As outlined in this submission, I believe that there is very low effectiveness of the NSW Government to plan for and to improve air quality. There is totally inadequate planning and actioning to reduce fuel loading before wildfire seasons, not undertaking adequate hazard reduction burning in the cooler months. Taking into account this factor, I believe the Terms of Reference matters are missing a key area to improve air quality in the summer months, and reducing the extent of time of impacts.

3. Any related matters.

There are a large number of related matters, not well considered by this inquiry, and they need to be.

3.1 Wildfires emit massive quantities of smoke over long periods.

To date in 2019/ 20 wildfires, there have been 25 fatalities in NSW, 2176 homes lost, and 5.2 million hectares burnt, likely more before the fire season is finished.

The satellite images below demonstrate intense wild fires in the one area of southern NSW Tumbarumba area, the two fires being the Dunns Rd fire and the Green Valley fire, both over 300,000 hectares in size, and I understand that both fires started from lightning in late December 2019. The weather, long drought and high fuel loading all contributed to these wildfires. The fire intensity is extreme, note the flame lengths/ heights. Note also, the very large smoke emissions.

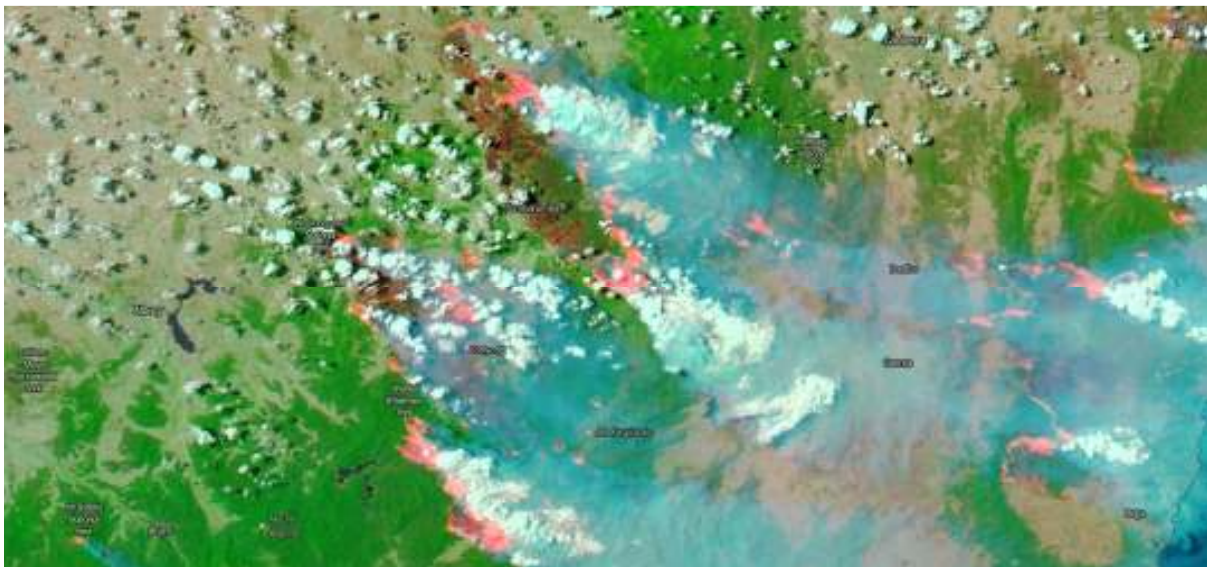


Figure. This satellite image of 4 January 2020 and shows very hot fires associated with the Dunns Road and Green Valley fires. EOS Worldview Aqua Modis Corrected reflectance bands 7 2 1.



Figure. This closer up satellite image of 4 January 2020 and shows KNP alight very hot, before the fires hit Cabramurra, the southern end of Maragle SF, pines to west shown as well and freehold forests. Over the far RHS of the image, check out the two spot overs. They are ending to Selwyn in KNP, which got destroyed in the wildfires. Check out the circles at the start of these spot overs, indicating initial very hot fires, flame distance ahead is huge. EOS Worldview Aqua Modis Corrected reflectance bands 7 2 1.

There are better ways, hazard reduction burning in the cooler months, burning only the top layer of fine fuels. Under this arrangement smoke emissions are much lower and for shorter periods. This issue doesn't appear to be seriously addressed in this inquiry.

3.2 Inadequate hazard reduction burning impacts on human health.

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 clearly documented in:

- 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 1851 wildfire in Victoria that covered 5 million hectares, by that time Aboriginal burning practices had been reduced/ stopped.

The wildfires in NSW started in NSW in August 2019 and went through to February 2020, 7 months and covered very large areas of NSW. The air quality impacts were huge.

As noted CSIRO Submission 09/355 Bushfires in Australia Prepared for the 2009 Senate Inquiry into Bushfires in Australia July 2009: Hazard reduction burning is not intended to stop wildfires, but it does reduce the intensity and the spread of unplanned fires, within the area treated by prescribed fire, by reducing the rate of fire growth from its ignition point; flame height and rate of spread; the spotting potential by reducing the number of firebrands and the distance they are carried downwind; and the intensity of the fire. As a consequence, hazard reduction burning lowers the risk of crown fires developing in medium to tall forests, will limit the rate of spread and potential impact of wildfires, and makes fire suppression actions safer, more effective and thus more efficient (Luke and McArthur 1978).

Hazard reduction burning is undertaken periodically, is a cooler burn/ aiming to minimise crown scorch and usually only burns a portion of an area. Hazard reduction burning can use ground and aerial hazard reduction burning, the later 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 the area of the burn is relatively small.

I have access to hazard reduction data in NSW over the last 20 years. This is tabled in Table 1 below.

Table 1. Key fuel reduction information over NSW over 20 years by government agencies and Councils across NSW.

Years	Area of fuel reduction by burning and mechanical means. From RFS annual reports.	Area of fuel reduction by burning (hectares)	Cost of RFS (\$'000). Plus, there are additional mitigation costs in some years.	Areas of grazing (hectares).
1999-2000	474,009	355,507	\$84,129	
2000-01	589,319	441,989	\$93,200	
2001-02	581,825	436,369	\$179,218	
2002-03	576,840	432,630	\$240,989	783,842
2003-04	322,568	241,926	\$141,074	1,058,339
2004-05	121,286	79,378	\$152,269	1,448,512
2005-06	107,742	71,861	\$177,519	535,213
2006-07	104,235	78,012	\$253,294	287,403
2007-08	124,552	98,198	\$223,312	14,085
2008-09	123,342	103,686	\$247,234	1,641

Years	Area of fuel reduction by burning and mechanical means. From RFS annual reports.	Area of fuel reduction by burning (hectares)	Cost of RFS (\$'000). Plus, there are additional mitigation costs in some years.	Areas of grazing (hectares).
2009-10	174,699	154,504	\$316,080	
2010-11	117,629	74,858	\$307,470	1,350
2011-12	138,210	89,884	\$286,771	3,403
2012-13	281,491	252,734	\$374,110	57
2013-14	157,222	136,102	\$412,051	198
2014-15	152,157	130,911	\$311,185	195
2015-16	285,401	264,927	\$326,590	299
2016-17	140,646	115,223	\$357,679	126
2017-18	147,626	129,472	\$371,370	54
2018-19	199,246	184,294	\$552,750	939

My comments in relation to this table:

- This table includes areas burnt/ mechanically treated by RFS, then BFMC PP, NPWS, Forest Corp, Lands Department and Councils.
- Fuel reduction burning decreased markedly around 2003. I note that this decrease was at the same time the 2003 Nairn Inquiry A Nation Charred emphasised the importance of hazard reduction burning. This marked decrease is concerning.
- Average fuel reduction (mechanical and burning) was 555,498 hectares for 2000 to 2003. Average fuel reduction (mechanical and burning) was 168,628 hectares for 2004 to 2019. The annual reduction is huge.
- Average fuel reduction burning was 416,624 hectares for 2000 to 2003. Average fuel reduction burning was 137,873 hectares for 2004 to 2019. The annual reduction is huge.
- I suggest hazard reduction hasn't been adequate in NSW for many many years. The low hazard reduction levels have resulted in large fuel loads over huge areas of forests.

Considering the 2019/ 2020 wildfires in NSW:

- The wildfires this year have burnt 5.2 Million hectares in NSW, not all forested, but I suggest mainly forested. Using a figure of 27 Million hectares of NSW being forested, this indicates of the order of 19.3 % of forests were burnt in wildfires in one year in 2019/2020. Taking into account non forested areas, a figure closer to 15 % of the NSW forested area burnt as wildfires in 2019/ 20 would be more reasonable to use, I suggest that this important issue be checked by the Inquiry.
- Comparing the 5.2 Million hectares of wildfires in NSW to the area fuel reduced in NSW in 2018/ 19, this was 184,294 hectares. The hazard reduced area in 2018/19 was 3.54 % of the 2019/ 20 wildfire area. Even considered over 5 years, hazard reduction burning totalled 825,000 hectares, only 16 % of the wildfire area in one year in NSW. To me, these figures emphasise how poorly hazard reduction have been managed in this state.

As noted, 27 million hectares of NSW is forested of the 80.2 million hectares in NSW. Considering the extent of hazard reduction burning further:

- Average fuel reduction burning in NSW was 137,873 hectares for the years 2004 to 2019. This equates to 0.5 % of forested area burnt annually by hazard reduction burning in NSW. Even considered over 5 years, the area would be 2.5 % of forested area, again I believe way too low.
- Using the figure of 137,763 hectares for NPWS in 2018/ 19, for hazard reduction burning and mechanical fuel reduction, applied over 7 million hectares of NPWS land, this represents 2 % of NPWS lands hazard reduced in that year. Hazard reduction rates would be higher in the coastal and tableland areas, but I don't have those figures. I understand that some areas wouldn't be burnt.
- Using the figure of 34,078 hectares for Forest Corp in 2018/ 19, for hazard reduction burning and mechanical fuel reduction, applied over 2 million hectares of Forestry Corp land, this represents 1.7 % of Forest Corp lands hazard reduced in that year. Hazard reduction rates would be higher in the coastal and tableland areas, but I don't have those figures. Grazing in State Forests does assist in reducing fuel loads.

It is clear from earlier years of NSW hazard reduction in the late 1980's and 90's and early 2000, Qld, WA and northern Australia program information, that NSW hazard reduction programs can significantly increase.

I recommend a minimum of 10 % of forested area per year for hazard reduction burning should be set for NSW forested areas, I believe, using a 5-year hazard reduction cycle:

- Meeting 10 % would mean of the order of 50 % of forest areas were hazard reduced under a 5-year cycle. Note: not all areas in each burning area burn under a cool burn, so areas of burning are actually less.
- If meet less than 10 % in one year, hazard reduction would be increased the next year/ following years till the 10 %/ year was achieved.
- This could be greater area with overlapping areas burnt near critical structures/ towns/ cities etc.
- Excluded areas wouldn't be included.
- It is likely there would be greater focus on coastal and tableland hazard reduction.

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

As noted, the area of wildfires in NSW in 2019/ 2020 was huge, currently 5.2 Million hectares. The wildfires were 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 Whiporie fires earlier in the season. These wildfires are a major threat to human safety, human health, air quality, towns, infrastructure, flora and fauna.

In regards to community/ structures 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.

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, air quality issues 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.

3.4 Inadequate consideration of the combined advantages of hazard reduction burning as opposed to massive wildfires.

Please find below in Table 2, a summary of the impacts of 2019/ 20 wildfires, this year they were extreme wildfires, as opposed to the impacts of hazard burning. Scoring is based on a maximum of 10 points, except where the issues involves human lives, human safety and native fauna, these are based on a maximum of 15 points.

Table 2. Summary of the impacts of 2019/ 20 wildfires as opposed to the impacts of hazard reduction burning, air quality is one improvement area.

Issue	Impacts of NSW 2019/ 20 wildfires	Score	Impacts of NSW 2019/ 20 hazard reduction burning	Score
Impacts on human safety in towns/ cities	In 2019/ 20 wildfires, there have been 25 fatalities in NSW, 2176 homes lost, and 5.2 million hectares burnt.	15	Limited, one backburn escape known, not hazard reduction.	0-1
Impact on fire fighter safety	Understand 3 fatalities and many injuries.	15	None known.	0
Impact on native fauna	Professor Dickman has noted as a result of the wildfires in NSW may mean <i>“species that are rendered extinct, ecosystems that have been eroded to the point where they are completely changed, and habitat in a state of widespread impoverishment”</i> . As well <i>“The loss of life we’ve estimated for NSW is 800 Million terrestrial animals, including birds and reptiles. But that figure doesn’t include frogs, fish, bats and invertebrates”</i> . NSW bushfires lead to the deaths of over a billion animals and “hundreds of billions of insects, experts say. Emma Elsworth Posted 9 January 2020.	15	Limited loss of some fauna in cooler burns, but limited, and limited to some species on the ground. Cool burning aims for a patchwork, not all burnt.	1
Impact on road infrastructure	Refer roads throughout the state, including the Gwydir Highway, south coast, many highways and roads.	9	No evidence as opposed to the huge impacts of the 2019/ 20 wildfires.	0
Impact on forest infrastructure	Loss of important pine and hardwood plantations in the Batlow/ Tumbarumba area (50,000 hectares), Whiporie etc	10	None known	0
Impact on forest ecosystems	Ecosystem impacts huge, fires extreme.	10	Low scorch height. Cool burning is essential to maintain forest health as outlined in this submission (positive aspect).	1
Impact on water quality/ erosion/ sedimentation/ waterways	Reported erosion/ sedimentation with follow up impacts, fish/ waterway impacts in the Macleay etc.	9	Extremely small-scale impacts, usually out of waterways.	0
Impact on air quality	Season has gone from early August 2019 at Grafton/ Casino to February 2020 in southern NSW.	10	Cool burning does have short term impacts but air quality impacts are much shorter lived than wildfires and only fine fuels are normally burnt.	2

Issue	Impacts of NSW 2019/ 20 wildfires	Score	Impacts of NSW 2019/ 20 hazard reduction burning	Score
Impact on climate change.	The wildfires have had a huge impact on greenhouse emissions, as outlined in this submission.	10		1
Impact on heritage sites.	The wildfires have had a huge impact on heritage sites as outlined in this submission	9	Heritage impacts not known, but unsure.	0
Costs of implementing the action, either wildfire control or hazard reduction.	Huge costs in wildfire control, resources on the ground, dozers, tankers, large planes etc. Risk to planes and fire fighters is high.	10	Low. Use small planes, helicopters, drones and ground crews.	1

The above scoring is subjective, but I believe in the right ballpark and designed to tease out important issues and assess activities in an integrated way to assess risks and opportunity areas. The scoring clearly demonstrated hazard reduction is a much safer approach to use in NSW and the benefits apply across many areas as outlined in Table 3. Reducing the risks to communities, fire fighters, fauna etc with wildfires under current fuel regimes is a critical issue to a safe future in NSW.

3.5 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.

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.

As noted in Bushfires in Australia Wikipedia 15 Feb 2020: In January 2020, the British Met Office said Australia's bushfires in 2019-2020 were expected to contribute 2% to the increase in the atmospheric concentration of major greenhouse gases which are forecast to hit 417 parts per million,

one of the largest annual increases in atmospheric carbon dioxide on record. Interesting, I checked the NOAA CO2 daily/ weekly/ monthly means at Mauna Loa. There is definitely a rise in CO2 to around 416 ppm but this peak was present last year as well. The CO2 data drops to around 408 ppm in the southern winter/ cooler months, the data appears quite cyclic.

There is an opportunity to use hazard reduction to reduce climate change impacts from those of massive wildfires.

Conclusions.

There are important issues that need to be addressed in NSW:

1. A culture of inadequate hazard reduction burning in NSW and a number of other states. This is a very serious matter, with lives, infrastructure and communities at stake, let alone a range of other important issues. Hazard reduction areas have gone down from inadequate to very inadequate, at no chance of success levels. Not adopting a landscape approach to cool hazard reduction burning in NSW, with massive risks and impacts in not undertaking this.
2. Continuing to not think through the full overall impacts from wildfires as opposed to cool hazard reduction burning is a very serious issue in NSW. I have worked through this issue in this submission. NSW is not integrating and assessing all the impacts of wildfires as opposed to cool burns. Air quality impacts can be reduced in wildfire periods by using hazard reduction burning and the season of duration of air quality impacts reduced.
3. At times, NSW has become focussed on using heavy aircraft to fight wildfires, these are very expensive to run and dangerous to operate. The focus needs to be reversed, focussing on light aircraft, helicopters and drones for autumn and winter hazard reduction burning in forests across NSW. This would be much cheaper, safer, better on the environment etc.

I have raised a number of recommendations above in order to assist in obtaining a better outcome in NSW, improving wildfire safety in NSW for our communities, fire fighters, ecosystems, fauna, waterways, air quality and other variables. I have summarised these in Appendix 1, numbering these there for ease of reference.

John O'Donnell

Appendix 1. Recommendations made in this submission.

I have tabled the recommendations made in this submission in this Appendix.

Consecutive recommendation number.	Recommendation.
1	As outlined by Jurskis, Bridges and de Mar, precautionary fire management should be undertaken across forested areas of NSW, developing guidelines and prescriptions for landscapes, not individual plants and animals; developing prescriptions to control the extent and spatial variability of fires by controlling fire behaviour, rather than prescribing artificial exclusion zones and fire intervals; recognising that low intensity burning protects edaphic controls and sensitive species, so that perceived conflicts between human and environmental protection are largely unreal; recognising increasingly extensive high intensity fire regimes and eucalypt decline as consequences of fire exclusion that must be considered in planning. Develop sound principles for hazard reduction burning programs, including ground and aerial programs. It is important to understand that grid patterns for aerial burns are set to minimise flame heights where individual ignition points join at the end of the day. As well, only parts of the aerial hazard reduction burns actually burn.
2	Hazard reduction minimum standards for burning be developed for NSW and the other states. This must be no less than 10 % of forests per year. 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.
3	Hazard reduction burning seasons are reducing, and we need to address this sensibly, using aero burning, ground burning and other options and better coordinating operations over a short period. We need to learn to do this much better and complete hazard reduction programs more quickly.
4	In undertaking thorough hazard reduction programs and avoid massive wildfires, it is essential that the impacts of wildfires on communities, individuals, fire fighters, infrastructure, forest, fauna, water quality, waterways, fish, air quality and heritage all be considered. It is clear to me that these factors haven't been addressed adequately by government at any stage in NSW's European history. However, major barriers to cool hazard reduction burning have been put up. NSW and Australia need a complete change in thought processes.
5	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.
6	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 over 6 months. Things need to change, lessons be learnt and large areas aero and ground hazard reduction burning operations completed before wildfire seasons.
7	Steep areas receive periodic cool hazard reduction burns. In wildfires, fires on these slopes are very hot, increasing fire spread and intensity into adjacent lands. Fires in these locations emit large volumes of smoke. The soils on the slopes can also erode after wildfires. Refer satellite imagery in the attached photo extracted near Tumberumba.
8	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.