



Lessons to be learned in relation to the Australian bushfire season 2019-20

22 May 2020

Thank you for the opportunity to make a submission to this inquiry: ***Lessons to be learned in relation to the Australian bushfire season 2019-20.***

Science & Technology Australia (STA) is the peak body for the nation's science and technology sectors. We represent more than 80,000 scientists and technologists through our member societies, research institutes, and research strategy bodies. We bring the combined expertise our membership to assist the committee with its work.

The 2019-20 bushfire season was the most terrifying in living memory.

Megafires of unprecedented scale and ferocity burned across vast tracts of the Australian continent. Firefighters described freakish new fire behaviours they had not witnessed before, including mini weather systems created by the force and intensity of the blazes. The tinder dry landscape sped the trajectory of these fires – raging from inland towns all the way to the coast. Entire townships sought shelter on beaches and in lakes as toxic smoke and walls of flame roared towards them. Lives and homes were lost – and so, too, were precious native animals and landscapes, as delicate ecosystems were ravaged. Many regional and rural communities were the hardest hit – living on the frontlines of this terrifying new threat.

In NSW, fires burned for 240 days – from the mid-winter all the way through to the following autumn. In South East Queensland, rainforests thought to be immune from fire burned for the first time.^{1,2}

This fire season turned the predicted effects of climate change into a stark reality.

As the Australian landscape dries and weather patterns change, such fires will become more common. Coordinated action to mitigate Australia's contribution to climate change – drawing together industry, the research community and Government – can help to address this threat. New fire management tactics and enhanced satellite surveillance equipment, better fireproofing of homes, towns and landscapes, and closer cooperation across the Australian federation, will also be crucial. Emergency communications infrastructure needs to be strengthened. And more sophisticated air quality monitoring systems to identify particulate hazards must be developed and index readings published. Insights from Indigenous knowledge in fire and land management should be drawn into our firefighting and land management practices and policies.

We must learn the right lessons from this summer of terrors – and apply them to help our communities and our nation mitigate future risks and continue the recovery from this last devastating season.

The science and technology sector renews our offer of expertise to help the nation manage this threat. This will be a long-term task. We offer some initial recommendations in preparation for the 2020-21 fire season.

STA recommends:

1. To mitigate the scale and danger of future bushfires beyond the short-term, the Australian Government enhance Australia's contribution to take action on climate change;
2. To speed the development of technologies to identify fires rapidly at outbreak and mobilise resources most effectively to control fire spread, establish a research translation fund to help tackle new threats identified in real-time by fire authorities and Governments;
3. Resource an expert body such as the [Rapid Response Information Forum](#) to muster expert real-time advice on how to enhance firefighting techniques, hazard reduction burning, emergency responses and public health during bushfires (similar to the role of the [AHPPC](#) during the COVID-19 pandemic);

4. Where there are gaps in our knowledge, the Australian Government should address these by direct investment in research (via Cooperative Research Centre funding, Cooperative Research Centre Projects, and grants by the Australian Research Council and National Health and Medical Research Council) or via a research translation fund that could leverage additional private sector R&D.
5. To protect Australia's unique natural habitats, native animals, threatened species and fragile ecosystems in the wake of this devastating fire season, support rescue, recovery and research initiatives to save species and avoid extinction;
6. That Australia produce and stockpile safe, high-quality N95 masks to distribute in future emergencies in which air safety is compromised; and
7. The Australian Government task CSIRO and the Bureau of Meteorology with developing technologies and monitoring systems to detect and report particulate hazards, similar to published UV index readings.

We thank the committee for its consideration.



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Introduction

The 2019-20 bushfire season, now known as “the Black Summer”, was one of the worst disasters in Australia’s recent history. The fires claimed 33 lives, burnt 10 million hectares and destroyed 3,000 homes.^{3,4} Toxic smoke threatened communities for weeks on end. And the environmental damage was extensive, with some ecosystems likely to have changed forever.⁵

The cost of the recovery is expected to exceed \$100 billion.⁶ Yet the true economic and social cost of this disaster could be even higher and last far longer. Secondary effects of the bushfires such as smoke exposure, and the long-lasting mental health effects, may take years to reveal their true toll.

While these fires were without precedent, they were not without prediction. Scientists, economists, and fire chiefs have previously warned about the coming tragedy due to a changing global climate.

The megafires of 2019-20 confirm that the effects of climate change are no longer just a future concern, but a real and present danger.

The science and technology sector renews our offer of expertise to help the nation combat this threat.

In this submission, STA will focus primarily on the following terms of reference:

- (a) advice provided to the Federal Government, prior to the bushfires, about the level of bushfire risk this fire season, how and why those risks differed from historical norms, and measures that should be taken to reduce that risk in the future;
- (b) the adequacy of the Federal Government’s existing measures and policies to reduce future bushfire risk, including in relation to assessing, mitigating and adapting to expected climate change impacts, land use planning and management, hazard reduction, Indigenous fire practices, support for firefighters and other disaster mitigation measures;
- (g) the role and process of advising Government and the federal Parliament of scientific advice;
- (h) an examination of the physical and mental health impacts of bushfires on the population, and the Federal Government’s response to those impacts; and
- (i) other related matters.

(A) Advice provided about the level of bushfire risk this season, how and why those risks differed from historical norms, and measures that should be taken to reduce that risk in the future.

The 2008 Garnaut Climate Change Review examined scientific evidence on the impact of climate change on Australia and its economy.⁷ It predicted that, due to the effects of climate change, the nation would face a more frequent and intense fire season by 2020.⁷

The biennial State of the Climate reports by CSIRO and the Bureau of Meteorology over the last decade also set out evidence for how our climate and our environment are changing – and the associated fire risks.⁸ The 2018 report notes “there has been a long-term increase in extreme fire weather and in the length of the fire season across large parts of Australia since the 1950s.”⁸

It continues: “Fire weather in largely monitored in Australia using the Forest Fire Danger Index (FFDI). This index estimates the fire danger on a given day based on observations of temperature, rainfall, humidity, and wind speed. The annual 90th percentile of daily FFDI (i.e. the most extreme 10 per cent of fire weather days) has increased in recent decades across many regions of Australia, especially in southern and eastern Australia. There has been an associated increase in the length of the fire season. Climate change, including increasing temperatures, is contributing to these changes”.⁸

Quality long-term analysis of the levels of bushfire risk and its links to climate have been produced by the science agencies of Government to help Australia navigate these risks. This crucial work must continue to inform policymaking into the future.

RECOMMENDATION 1: To mitigate the scale and danger of future bushfires beyond the short-term, the Australian Government enhance Australia's contribution to take action on climate change.

(B) The adequacy of existing measures and policies to reduce future bushfire risk, including assessing, mitigating and adapting to expected climate change impacts, land use planning and management, hazard reduction, Indigenous fire practices, support for firefighters and other disaster mitigation measures.

The changing conditions that Australia faces require constant vigilance. In a dramatically changing environment, regular reassessment of our policy responses is essential. We must continuously enhance effectiveness and respond to new challenges that emerge from fire grounds and fire-affected communities.

A review of the research by members of the Ecological Society of Australia suggests the occurrence of longer, more frequent, and possibly more intense droughts has led to a greater drying out of fuel in the landscape.⁹ This is having an impact in fire-adapted ecosystems, but it is also changing ecosystems that researchers thought would never burn – such as rainforests – into fire-susceptible environments.

The ESA also reports that particular ecosystems can be more susceptible to fire approximately 5-10 years post burn.⁹ While risk is mitigated before and after that window, there is a higher risk in that timeframe where they could be more likely to burn. In the current context, this could mean that in 5-10 years' time, the areas burnt this year could be highly susceptible to another major fire season.

The longer dry periods associated with longer periods of warmth also translates into smaller windows of time to do hazard reduction burns where they are appropriate.

While the use of hazard reduction burning may seem like a logical way to reduce the severity of bushfires, recent research indicates that its effectiveness for controlling life threatening fires or fires during extreme fire danger days is limited. A recent review of the available research into hazard reduction burning by The Ecological Society of Australia highlighted that⁹:

1. Hazard reduction burning can only reduce the intensity and spread of bushfires, and aid suppression activities, in limited circumstances;
2. Its effectiveness in altering fire behaviour is greatest in approximately the first 6 years after burning in many forest types and can diminish significantly after that;
3. It is most effective when targeted strategically within 500m of the asset to be protected, and may be ineffective if, after conducted, vegetation is retained within 40m of the asset;
4. Its effectiveness is lowest on days of extreme fire weather when most loss of life and property occurs, but it can assist suppression efforts on more benign days;
5. It is infeasible in landscapes dominated by improved pasture or crops;
6. Hazard-reduction burning can have both positive and negative effects on natural ecosystems, but negative effects will be substantial if fire return intervals are short enough to have some effect on unplanned fire; and
7. Hazard reduction burning is just one method of reducing risk to life and property.

There is substantial scope to develop better and more integrated planning for towns and infrastructure, with hazard reduction focused around these. Further rapid research into enhanced fire-resistant materials and improvements to building and planning codes to protect lives and property would be invaluable.

The fragility of our communications infrastructure and the risk to our supply chains of essential goods such as food, water and fuel into communities was exposed during these fires. Large

numbers of coastal regional communities were trapped without these basic services and supplies for significant periods during this fire season.

There is much more we can learn and adapt from Indigenous fire and land management practices to assist in the nation's preparedness for the next bushfire seasons. Indigenous Caring for Country Rangers have brought this knowledge to their work across the country with strong positive benefits.¹⁰ Indigenous ranger projects support Indigenous people to combine traditional knowledge with conservation training to protect and manage land, sea and culture. Indigenous ranger groups also develop partnerships with research, education, philanthropic and commercial organisations to share skills and knowledge. STA believes there is strong scope to expand these programs and draw on this expert knowledge in Australia's broader fire management approaches.

Support for firefighters and for fire-devastated communities – especially for their mental health and resilience – should be a continuing national priority. Social sciences research highlights the high toll on firefighters and other first responders in emergency and disaster roles, and the importance of proactive support for mental health, resilience and trauma recovery.¹¹

RECOMMENDATION 2: To speed the development of technologies to identify fires rapidly at outbreak and mobilise resources most effectively to control fire spread, establish a research translation fund to help tackle new threats identified in real-time by fire authorities and Governments for rapid short-term projects.

(C) the role and process of advising Government and the Parliament of scientific advice.

Scientific advice is crucial to our ability to conquer this threat. Expert scientific evidence should guide every element of Australia's bushfire prevention, mitigation and recovery.

In the same way the Australian Government has relied heavily on the advice of science and medical experts to navigate the nation carefully through the COVID-19 pandemic, a similar approach should be applied to embed scientific expertise in bushfire policymaking.¹²

A significant body of work has been developed over many years by individual researchers, universities, the CSIRO and the Bushfire and Natural Hazards Cooperative Research Centre. This includes bushfire behaviour modelling. One example is a project of CSIRO and Data61 called Spark, a piece of predictive simulation software that can be used to predict the spread of bushfires based on the current circumstances.¹³ Such modelling will become even more valuable with larger megafires which have been shown to develop their own weather systems – making spread and direction difficult to determine.¹⁴

While fire spread modelling has a long history of research, smoke modelling is less understood. Given the damaging health effects associated with smoke inhalation, being able to predict the movement of smoke plumes in advance is an essential safety priority. Research using the 2016 hazard reduction burns in New South Wales has provided two models for the spread of bushfire smoke.¹⁵ The extraordinary spread of smoke during the Black Summer fires will also provide invaluable data for the modelling of smoke movement for future fires.

The quality of these predictive models, and the potential to apply artificial intelligence systems, are only as good as the data to which they have access. A current impediment is the variety of data and the format in which it is recorded. A simple example of this is how fires are named in different States and Territories, which led to the same fire fronts having different names. Federal and State Government agencies should seek to develop a national standard for naming fires, and a national framework or data commons in which to capture data to enhance cooperative federalism coordination of resources and capability.

A consequence of Australia's changing environment is the narrowing of time in which hazard reduction burns can take place. We must adapt current management practises and

technologies to this new reality. Where there are gaps in our knowledge or new solutions required, the Australian Government should address these by direct investment in research (via [Cooperative Research Centre](#) funding, [Cooperative Research Centre Projects](#), granting by the [Australian Research Council](#) and [National Health and Medical Research Council, or tasking government agencies](#)) or via a research translation fund that could leverage additional private sector R&D.

RECOMMENDATION 3: Resource an expert body such as the Rapid Response Information Forum to muster expert real-time advice on the latest evidence on firefighting techniques, hazard reduction burning, and public health emergencies during bushfires (similar to the role of the AHPPC during the COVID-19 pandemic) to better equip fire authorities and Governments in rapid decision-making.

RECOMMENDATION 4: Where there are gaps in our knowledge, the Australian Government should address these by direct investment in research – guided by a new national science and research priority focused on bushfires – via Cooperative Research Centre funding, Cooperative Research Centre Projects, and granting by the Australian Research Council and National Health and Medical Research Council or via a research translation fund that could leverage additional private sector R&D.

Scientific advice is also crucial to the recovery of ecosystems after fires have been extinguished. While the Australian landscape may be adapted to fire, recent research has highlighted that fires of such intensity as the Black summer fires may be more than the landscape can manage.¹⁶

Ecological recovery from these bushfires must be led by expert advice and evidence. This has been reflected by the formation of the wildlife and threatened species bushfire recovery expert panel, however, ongoing support for research and recovery will be necessary to monitor and implement these recovery strategies.¹⁷

The Ecological Society of Australia proposes four urgent actions to achieve this aim;¹⁷

- 1) Urgently allocate funding to management and on-ground monitoring actions deemed critical to maintain species' populations and avoid extinctions;
- 2) Guarantee ongoing funding for discovery and translational research via the ARC, NHMRC and CRCs;
- 3) Prioritise assessment and listing (if needed) of impacted species under the Environment Protection and Biodiversity Act 1999. There have been no new listings of species since the bushfire crisis;
- 4) Deliver strong national and international leadership and coordination across government portfolios in bushfire disaster response to ensure an improving trajectory for biodiversity.

RECOMMENDATION 5: To protect Australia's unique natural habitats, native animals, threatened species and fragile ecosystems in the wake of this devastating fire season, support rescue, recovery and research initiatives to save species and avoid extinctions.

(H) An examination of the physical and mental health impacts of bushfires on the population, and the response to those impacts.

During this catastrophic bushfire season, large parts of regional New South Wales, Victoria and South Australia were covered in smoke for days and weeks at a time. Public health officials warned the air quality was highly hazardous – and advised people to stay sealed in their homes to avoid the health risks of breathing air with very high concentrations of particulate matter.

Many regional cities, along with Melbourne, Sydney and Canberra were effectively shut down. Canberra, as one of the worst effected cities recorded a total of 39 days of hazardous air pollution with levels reaching the worst in the world.¹⁸

The exposure to bushfire smoke had immediate effects on the Australian public with an estimated 417 excess deaths and 4252 extra people hospitalized across NSW, Queensland, Victoria and the ACT from respiratory issues.¹⁹ The long-term effects of inhalation of ultrafine particles from bushfire smoke is still being conducted, however, one study has already highlighted that long-term exposure to such pollution increases the risk of stroke.²⁰

It is clear we need to improve our air-pollution monitoring in Australia. An article published in the Medical Journal of Australia recommended that hourly PM_{2.5} data rather than an index needed to be made available to the public.²¹ It was also recommended that consistency of air quality information and public health advice was essential to guide personal behaviour and minimise exposure.²¹

RECOMMENDATION 6: That Australia produce and stockpile safe, high-quality N95 masks to distribute in future emergencies in which air safety is compromised.

RECOMMENDATION 7: The Australian Government task CSIRO and the Bureau of Meteorology with developing technologies and monitoring systems to detect and report particulate hazards, similar to published UV index readings.

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