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Inspector General for Emergency Management Inquiry into the 2019-2020 Victorian Fire Season.

Phase 1: Community and sector preparedness for and response to the 2019-20 summer season

Submission by the Victorian National Parks Association

The Victorian National Parks Association (VNPA) is an independent, non-government organisation dedicated to the protection of Victoria's biodiversity on land and water, and in the ocean.

The VNPA recognises the difficult and dangerous work undertaken by so many volunteers and professionals, over many months, during last summer's fires in Australia. We recognise the considerable cost in lives, health and human welfare, as well as economic costs, to the community; and we recognise the increasing difficulty of managing fire in the Australian landscape as our climate changes.

We also recognise the considerable and growing impacts of frequent and increasingly severe fire on the environment.

The VNPA has a long history of involvement in advocating for effective fire management in Victoria. In recent years our involvement has included (among other things):

- We were granted leave to appear before the Victorian Bushfires Royal Commission (2009), and made substantial submissions to that Commission.
- We are a long-term (and founding) member of the Victorian Government's Land and Fire Management Stakeholder Roundtable
- We made a substantial submission to the Victorian Inspector General for Emergency Management's (IGEM) 2015 inquiry into Victoria's target to burn 5% of Victoria's public land annually.

Primary recommendations for future fire management

1/ Though many improvements in bushfire management have been made in recent years, our lives, the environment and the economy remain increasingly at risk. More of the same isn't the solution.

2/ One area where considerable improvement has been made in Victoria is point of ignition control. This program should be expanded. Radically increased effectiveness of point of ignition control, and secure funding for that, has the potential to reduce the number and frequency of landscape-scale fires. That can:

- Increase protection of human lives
- Increase public health (including benefits for asthma sufferers)
- Increase protection of homes and infrastructure
- Reduce the heavy burden placed on volunteer (and professional) firefighters
- Increase the viability of insurance companies
- Increase the viability of agriculture (reducing both smoke and fire impacts)
- Increase the viability of tourism
- Improve the quality of water catchments
- Reduce carbon emissions and…
- Help long-term recovery of the natural environment, and the plants and animals that depend on it.

3/ There is currently little acknowledgement by government agencies that both fuel reduction burns and wildfire generally reduce fuel for a few years only, before fuel loads can climb to levels considerably higher than pre-burn conditions and stay that way for decades. The actual results from "fuel reduction" burns should be routinely monitored and recorded over time. Current and future evidence-based understanding of fuel responses should be reflected in changes in management.

4/ Fuel reduction burns offer most protection if conducted frequently and close to assets in need of protection, especially in extreme fire weather. This should be a management priority.

5/ When fires do become relatively uncontrollable, approved private bushfire shelters and compulsory evacuation are the two most effective strategies for the protection of human life. Resourcing for these should be a priority.

6/ The maintenance of a full range and extent of tree hollows, and of hollows on the ground, is critical for the future of many animal species in Victoria. Loss of hollows is one of a number of critical habitat features threatened by current fire management. This should be acknowledged, routinely assessed, and taken into account in fuel and fire management.

7/ Long-unburnt (and near long-unburnt) forests and woodlands are now rare in Victoria, and should be protected as critical habitat.

8/ There is a lack of accountability in applying tree-clearing protocols related to safety, emergency management during a fire, and also salvage logging. This should change.

Overview

We are convinced that the truly effective strategies for minimising impacts of fire on public welfare are compatible with environmental protection. There is little, or no, need for a 'trade-off' of competing objectives. Business as usual is not the answer – we need a significant, evidence-based, realignment of management tools.

Our submission is focused, to a large degree, on the long-term protection of Victoria's great natural heritage – currently facing pest plant and animal invasions, habitat fragmentation and climate impacts. Fire has long been part of Victoria's natural environment, and over some 45 million years, it has largely driven the evolution of such typically Australian flora as the eucalypts and wattles. Many, but by no means all, of our plants and ecosystems depend on occasional fire.

However the increased frequency and severity of fire in recent years is now adding significantly to existing impacts. Over 500 native plant and animal species are listed as threatened under Victorian legislation (Flora and Fauna Guarantee (FFG) Act 1988) and more, well over 2000, are included in the Department of Environment, Land, Water and Planning's (DELWP) Threatened Species Advisory Lists. https://www.ari.vic.gov.au/research/threatened-plants-and-animals Many more species are in a trajectory of long-term decline, and inappropriate fire regimes are a contributing factor in that situation. *"Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity*" is now listed as a Potentially Threatening Process under Victoria's FFG Act. https://www.environment.vic.gov.au/__data/assets/pdf_file/0012/50241/201612-FFG-Processes-list.pdf

In Victoria, there have been four fires extending above one million hectares since the year 1900, and three of those have occurred in the last 20 years. That is consistent with climate change predictions for more frequent severe fires in south-eastern Australia (see Attachment 1: Victoria's Fire History to 2020).

A more clearly integrated management approach is needed.

Management tools should not be assessed in isolation. We need to employ a full range of tools and strategies, tailored to local situations, as in the diagram below:

The most important of the tools in the above diagram are likely to be:

1. **Improved point of ignition control**
   . A very significant additional expansion in aerial fire-fighting capacity, primarily aimed at effective point of ignition control across the landscape.
   . An increase in power line safety, including burying power lines, installation of automatic circuit re-closers, and encouraging local power generation.
   . A comprehensive strategy to deal with arson.

2. **Improved fuel and fire management**
   . The employment of an evidence-based planned burn program, based on objective, science-based ecological and flammability assessments and on-ground observations of the effectiveness/ineffectiveness of fuel reduction. Importantly, fire can, in well documented cases, cause an increase fuel levels for decades.
   . Concentration of fuel reduction programs close to assets in need of protection.
   . Objective assessment of ecological impacts of fire management on native flora, fauna and essential habitat structures

3. **Improved impact control**
   . Compulsory evacuation powers, and comprehensive regional and local advance planning for evacuation.
   . Education about and support for private bushfire shelters/bunkers to approved design standards.
   . Stronger planning regulations for new buildings (including requirements for private bunkers).
   . Effective advice and support for ember-proofing existing buildings.

While strategic fuel reduction programs have a role, we do not believe that current programs of broad scale fuel reduction will significantly protect people or the environment. We've relied on them for decades, but the risk reduction they provide remains small. On the contrary, there is strong evidence that the increased rate of fire (planned or otherwise) in the landscape in recent years has actually increased the fuel load.

Just doing more of what we currently do is not the answer we need.

VNPA responses to the Terms of Reference

(ToRs appear in **blue**)

•Effectiveness of emergency management command and control and accountability arrangements in Victoria.

Given the problem of protecting the public, the economy and the environment at a time when climate change and other factors are generating fires of increasing frequency and severity, Victoria does very well in the command and control sphere.

However the seriousness of the situation does demand changes in management effectiveness, and an objective realignment of management actions and priorities. The lack of a body clearly responsible for the full gamut of management priorities and actions makes

accountability difficult. More importantly, that lack must compromise the strategic and efficient allocation of resources.

•Effectiveness of Victoria's operational response to the 2019-20 fire season.

We don't yet have a full understanding of the progress of this summer's fires. However it seems that, in regard to the Snowy complex fire, many fires resulting from a series of lightning strikes were fairly quickly controlled, but not all. Those uncontrolled fires seem to have burnt for a month of more in remote country before a large and effectively unfightable fire front developed.

We strongly believe that a radical ramping up of point of ignition aerial control, right across the state, though expensive, would be very cost effective. The cost of just one large fire comes to the billions these days. An initial estimate we have for tourism costs alone is $2 billion in losses, and a projected $4.5 billion future loss.

We are concerned that Federal funding for aerial control is not generally available for point of ignition response, but only for fires when there is an imminent threat to human life.

•Review of the effectiveness of the declaration of a state of disaster under the Emergency Management Act 1986 – including the appropriateness of supporting legislative and administrative processes, communication, and community compliance.

Potential for questionable use of emergency management provisions
There is a lack of vigilance over some activities that take place under emergency management provisions, especially in regard to tree felling operations.

Within an impacted area of a bushfire, any areas of unburnt vegetation can be crucially important for ecological recovery. However there is a large amount of tree clearing and vegetation removal done in the name of fire prevention and control. Much of this is not done in a transparent way, with little evidence of detailed ecological assessment against national or state environmental laws and policies. While we acknowledge that there are some key safety reasons from removal of hazardous tree, however some operations seem excessive.

There are three different areas of concern:

- Hazardous Tree removal in preparation for prescribed burning (not actually under EM provisions, but still an issue).
- Scale of Emergency Tree/Vegetation removal
- Salvage logging/ salvage clearing after a fire.

Hazardous Tree removal in preparation for prescribed burning

In Victoria, in recent years, there has been an extensive program for the removal of unsafe trees, primarily aimed at protecting fire crews. This has resulted in the loss of thousands of mature trees, including hollow-bearing trees, throughout the state. While we acknowledge the importance of maintaining a safe workplace for crews, the process has generally not taken place under any rigorous guidelines or oversight or consistent with procedures developed for other elements of clearing on crown land.

Since May 2018, roadsides and other clearing on crown land, including lands managed by Parks Victoria, must follow the "*Procedure for the removal, destruction or lopping of native vegetation on Crown land"*. This policy does not however include assessment under national environmental laws and it is not clear if it includes fire preparation works. The procedure aims to "ensure a robust and transparent approach to the removal, destruction or lopping and counterbalance of all native vegetation managed by, or on behalf of DELWP and PV on Crown land".

It is not clear if the extensive number of trees, many hollow bearing, cleared in preparation for planned burning are assessed, accounted for or "counter balanced" by additional protection elsewhere under this policy.
https://www.environment.vic.gov.au/__data/assets/pdf_file/0033/408489/CrownLandProcedure.pdf

Scale of Emergency Tree/ Vegetation Removal

In particular, the emergency management provisions in place during this summer's fires have generated an apparently unprecedented clearance of unsafe trees and fire breaks. Emergency Management Act and current native vegetation clearing rules exempt emergency work under specific conditions.
https://www.environment.vic.gov.au/__data/assets/pdf_file/0018/91251/Exemptions-from-requiring-a-planning-permit-to-remove,-destroy-or-lop-native-vegetation-Guidance.pdf

For emergency works, this exemption comprises seven separate parts, each with a specific purpose:

1. Firefighting covers activities required to fight an active bushfire. It does not include activities that are in preparation for a bushfire or after a bushfire has occurred.

2. Planned burning refers to both ecological and fuel reduction burns, and includes the establishment of fire control lines.

3. A fuel break is defined as a strip of land where vegetation has been removed or substantially modified to reduce the risk of bushfires starting and/or reduce the rate of spread and intensity of fire. A fire fighting access track is expressly for bushfire management purposes and not for other purposes. Fuel breaks and firefighting access tracks should be combined where possible, with the total width not exceeding 6 metres. Multiple fuel breaks and/or fire-fighting access tracks cannot be constructed abutting one another where the total width is greater than 6 metres. There must be a clear need for a fuel break and/or a fire fighting access track to protect life and property, in order to rely on this part of the exemption.

4. A strategic fuel break is a fuel break between 6 and 40 metres wide, created for the protection of strategic assets, such as water catchments. To rely on this exemption the fuel break must be established in accordance with a strategic fuel break plan approved by the Secretary to the DELWP.

5. This part of the exemption allows native vegetation removal to be undertaken in accordance with a fire prevention notice or direction issued under the relevant Act, without requiring a permit.

6. This part of the exemption allows native vegetation removal when undertaken to establish a clear zone, or minimise the risk of bushfire ignition from an electrical line, from requiring a permit. Native vegetation removal must be in accordance with the

relevant Code of Practice.

7. This part of the exemption allows the removal of native vegetation on public roadsides managed by a responsible road authority to minimise the risk to life and property from bushfire. The road authority must obtain the written agreement of the Secretary to DELWP allowing them to undertake native vegetation removal in accordance with a work plan. The work plan is developed by a multi-agency group in accordance with the requirements of Roadside vegetation management for bushfire risk mitigation purposes.

The guidelines suggest that *"exemptions must be relied upon sparingly. Consider using one exemption to meet multiple objectives"* and *"..any limits for native vegetation removal specified in an exemption are maximum amount, and it is not expected that native vegetation should necessarily be removed up to the limit. The onus is on those relying on the exemption to only remove that vegetation necessary to undertake the activity, use or development"* and *"only remove native vegetation for the purpose specified in the exemption."*

While we understand that vegetation needs to be cleared during the process of combating fire, however at this stage there appears no detailed assessment of vegetation lost by emergency management activities in the 2019/2020 fire season, either pre or post fire, or when the exemptions under the Emergency Management Act start or finish.

It seems clear that there has been significant areas of clearing along roadsides post fire in East Gippsland and Gippsland, which do not appear to be "expressly for bushfire management purposes and not for other purposes", as per the exemptions. Rather much of this appear to be driven by commercial interests and handed to the timber industry.

Cox Boundary Track, near Mt Alfred State Forest, East Gippsland. This is just one of many examples of extensive logging under 'emergency management provisions', in the last weeks of the fires in East Gippsland this summer.

Salvage logging/salvage clearing for fire management

It appears that, in case of large scale clearing of the Princes Hwy in East Gippsland, it was approved as in large part a salvage logging operation, which seems inconsistent with the other policies and procedures outlined in native vegetation controls (as outlined above). There is an apparent clash between prescriptions authorized for timber production, including national environmental laws, and undertaking works form emergency response or control https://www.vicforests.com.au/fire-management-1/vicforests-starts-post-fire-timber-recovery

The scale of clearing along the Princes Hwy and other roads in Gippsland is significant; the speed at which the works were undertaken post fire raises the questions about the level of ecological assessment undertaken. While native forest logging is exempt from national environmental laws under regional forest agreements, large scale land clearing is not. Likewise "logging" in this instance is unlikely to fit the definition in regional forest agreements as the clearing is intended to be permanent and not re-grown for future harvest.

These inconsistencies undermine community confidence in emergency management systems. At a minimum this Princes Hwy project should have been subject to detailed assessment under national and state environmental laws and relevant "offset" or "counter balance" measures put in place as per native vegetation policy.

Princess Hwy roadside clearing, 25th March 2020: typical of many sections of the Princess highway between Genoa and Cann River, approx. 40kms west of Genoa near Wingan River.

•State evacuation planning and preparedness processes/practices and their effectiveness with an emphasis on remote/isolated communities and Victorian peak holiday season locations.

Evacuation strategies

Victoria belatedly came close to compulsory evacuation in this summer's fires, and the Mallacoota evacuation went well. However we still lack the necessary legal clout to achieve it routinely. Compulsory evacuation is one of the best ways to save lives, and saving lives is the prime objective of fire management.

In Canada and the USA, compulsory evacuation is well-established. In 2006, for example, the 88,000 citizens of the Canadian town of Fort Murray were evacuated in the face of a several hundred kilometre fire front. The town was lost, but everyone lived. All regions should have well-developed evacuation strategies in advance of any fire season. We believe evacuation strategies would best be developed by state and local authorities, however the Commonwealth Government should facilitate the capacity for defense forces to be involved in evacuation plans, well in advance of any future fire event.

•The timeliness and effectiveness of activation of Commonwealth assistance, and Commonwealth resource availability

Commonwealth (including military) support for early evacuations would improve if evacuation plans for rural (or city) communities were established well in advance of any event.

•Preparedness ahead of the 2019-20 fire season; including the effectiveness of regional emergency management work undertaken to inform and educate the community about the coming season, community engagement, impact of lengthening fire seasons, and any relevant legislation, policy and practice.

The 2009 Victorian Bushfires Royal Commission (VBRC) made an urgent interim recommendation for an approved standard design for private bushfire shelters. This standard design was approved before the final VBRC report, so little emphasis was placed on this issue. However, short of evacuation well in advance of a fire, well-designed private shelters are the best way to save lives in the case of severe fire. But the public have not been well-advised of this, shelters are not required in new homes in vulnerable areas, and there has been no support for installing them in existing homes (eg subsidies or interest free loans). This important life-saving strategy should be strongly encouraged and supported by government.

•Consider all challenges and implications for bushfire preparedness arising from increasingly longer and more severe bushfire seasons as a result of climate change.

IGEM inquiry into fuel reduction targets

As ever, after a large fire, there is a call for a high state-wide target for fuel reduction. While a large hectare target for fuel reduction burns may appear to be an obvious solution to the

fire problem, reliable evidence to support that proposition has not surfaced in expert evidence to the various fire inquiries in Victoria over the last decade or so.

Victoria's IGEM inquiry sensibly recommended abandoning Victoria's then statewide fuel reduction burn target of at least 5% of Victoria's public land annually, and replacing it with a risk-based approach to fuel management.

The IGEM review had been prompted by the 2009 Victorian Bushfire Royal Commission (VBRC)'s Implementation Monitor, Neil Comrie. In his 2012 final report, Comrie said that Victoria should replace the 5% burn target "with a risk-based approach". He added that the 5% of public land (i.e. 390,000 ha) target "may not be achievable, affordable or sustainable", and that "it will not necessarily reduce the bushfire risk to life and property in Victoria and may have adverse environmental outcomes".

The VNPA's submission to the IGEM review (See Attachment 2: VNPA submission to 2015 IGEM inquiry) pointed out that:

- An earlier (2008) Victorian Parliamentary Environment and Natural Resources Committee (ENRC) inquiry was the first to recommend a 5% minimum statewide target for Victoria, however that decision was largely based on flawed or misrepresented evidence presented to the inquiry.
- The 2009 Victorian Bushfires Royal Commission also recommendation a 5% statewide target, however a statewide target was not finally recommended by the Commission's own expert fuel reduction panel. There was, instead, general agreement from the panel for a monitored program of burning 5% of the 'foothill forests' (largely the stringy-bark forests), as an experiment only. One clear reason put forward for *not* applying a statewide target was that it would lead fire planners and managers to reach that target by doing large burns in remote areas, where they were generally less effective, or even counter-productive.
- The 2009 VBRC also called for more research on the topic, so that "*… more informed and scientifically-based decision making can accompany the development of prescribed-burning regimes that meet conservation objectives as well as accommodating bushfire safety considerations*". (VBRC Final Report: Summary. July 2020, P15.

Much has been learnt in the last decade, but we are yet to see a published, peer-reviewed paper that outlines how a large hectare target for fuel reduction burns could actually be achieved. On the contrary, there are now many papers outlining problems with area targets.

Hazard reduction burns

We strongly advise against setting national, or state, area targets for fuel/hazard reduction burning, however the sharing of data and research conclusions between states, territories and the Commonwealth should continue to be encouraged and facilitated.

Many fire managers strongly support broad-scale fuel reduction as the most effective means to mitigate fire, even in relatively remote areas, because their modelling shows that reduced fuel levels at a remote burn site can locally decrease the incidence of crown fire, and hence

reduce the capacity of a severe fire to send embers kilometres ahead of a fire. However a number of peer-reviewed scientific papers published since Black Saturday, and particularly relevant to south-east Australia, seriously question the significance of that scenario, given other factors.

Burning close to assets is most effective

A number of peer-reviewed papers have concluded that fuel reduction close to assets in need of protection, while it may be more difficult to achieve, is the most effective (and the most cost-effective) application.

"Results of this study demonstrate that treatment of fuels at the interface [ie close to buildings] is not only the best means of reducing risk, it is also the most cost-effective."

T.D. Penman, R.A. Bradstock, O.F. Price. (2013) **Reducing wildfire risk to urban developments: Simulation of cost-effective fuel treatment solutions in south eastern Australia.** Environmental Modelling & Software 52 (2014) 166e175.

"Our results imply that a shift in emphasis away from broad-scale fuel-reduction to intensive fuel treatments close to property will more effectively mitigate impacts from wildfires on peri-urban communities."

Gibbons P, van Bommel L, Gill AM, Cary GJ, Driscoll DA, et al. (2012) L**and Management Practices Associated with House Loss in Wildfires.** PLoS ONE 7(1): e29212. doi:10.1371/journal.pone.0029212.

"In extreme weather, even 1-year-old patches have a low likelihood of stopping unplanned fires. Fuel age had little influence on the spread of unplanned fires. Consequently, prescribed fires will be most effective when sited at the urban interface where resultant reduced unplanned fire intensity will be a benefit." … "Some studies from forests in south-eastern Australia report that fine fuels are back to significant levels (i.e. likely to lead to fire intensities that are unsuppressible) after between 3 and 5 years (Conroy 1996; Adams and Simmons 1995; Morrison et al 1996; Annon 2003; Gould et al 2007). The present study suggests that the modest effect of fuel reduction on ability to stop a subsequent unplanned fire is essentially gone after 5 years." … "Under extreme weather conditions, unplanned fires may not be controllable unless they have been recently burnt (Grant and Wouters 1993). Thus it is sensible to place prescribed burns in areas where maximum advantage can be gained from suppression of subsequent unplanned fires: that is, primarily close to the assetts that need to be protected."

Owen F. Price A B and Ross A. Bradstock A. (2010) **The effect of fuel age on the spread of fire in sclerophyll forest in the Sydney region of Australia.** International Journal of Wildland Fire 19(1) 35-45 https://doi.org/10.1071/WF08167

"A recently burnt patch may slow or stop an unplanned fire should one occur, but low encounter rates make this unlikely. The most efficient use of prescribed fire is applying it to the immediate proximity of assets, where a resultant reduction in fire intensity can be of immediate benefit in terms of impacts on structures and ease of suppression."

Owen F. Price, Trent D. Penman, Ross A. Bradstock, Matthias M. Boer and Hamish Clarke. (2012) **Biogeographical variation in the potential effectiveness of prescribed fire in south-eastern Australia.** Journal of Biogeography (J. Biogeogr.) (2015) 42, 2234–2245.

Fuel "reduction" can actually cause a fuel increase

Studies have pointed out that fuel reduction burns are generally effective in reducing fuel loads for a few years at most. In the medium-term in many or most forest ecosystem types, fuel is likely to increase for decades before reverting to a low fuel level in the long-term absence of fire.

Each ecosystem responds differently to fire. However a likely progression from low to medium fuel levels pre-fire, to low levels for a few years post fire, to potentially high fuel levels for decades, and eventually relatively low levels again in long-unburnt country is not generally recognised in discussions of fuel management. It should be.

The above photograph, taken adjacent to Kinglake National Park (Victoria), and typical of fuel levels in that immediate area before the Black Saturday fire, speaks to two important points reinforced by a number of scientific studies quoted below:

a) *Recently burnt woodland adjacent to the photographed area was thick with understory shrubs, however in the photographed long-unburnt area, any previously fire-generated undergrowth had senesced, leaving a long-standing, low ground fuel condition. The full "fire/fuel scenario over time" sequence, included by Jenny Barnett in her (VNPA's) submission to Victoria's 2007* Parliamentary Inquiry into the Impact of Land Management Practices on Bushfires in Victoria *can be seen in*
(See Attachment 3: Fire sequence Kinglake)

b) *Despite this relatively low fuel level, the woodland here burnt with explosive severity on Black Saturday 2009, killing the photographer, Jenny Barnett, VNPA's long-standing advocate for evidence-based fire management. That scenario is supported by scientific studies saying extreme weather, not fuel, is the prime cause of bushfire fatalities.*

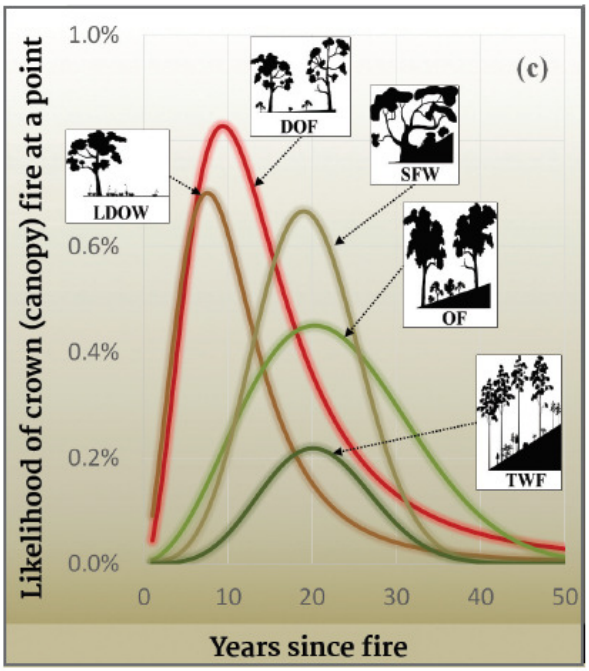
A study of fire history in south-eastern Australia's alpine region, commissioned by the Australian Alps National Parks (a co-operative body consisting of park agencies in NSW, the ACT and Victoria), comprehensively assessed that history.

"Apart from low, dry open woodland where there was insufficient data to detect a trend, all forests were most likely to experience crown fire during their period of regeneration. The implications of this are significant for the Alps, as increasing fire frequency has the potential to accelerate by producing an increasingly flammable landscape" and *"Across the Australian Alps, recently burnt forests have been on average more flammable than mature forests, consistent with historic observation and the mechanistic understanding arising from plant growth and species' change."*

Philip J. Zylstra. (2018) **Flammability dynamics in the Australian Alps.** Austral Ecology (2018)

The above paper includes this diagram (below, with our commentary), indicating increases in the likelihood of a canopy fire in five different forest types over a 30-50 year post-fire period.

How fire can increase fuel



Immediately after a fire, understory flammable shrubs etc are largely gone (year zero here), so any new fire is unlikely to generate enough flame height to reach the canopy. However the shrub layer quickly regenerates after a fire, soon greatly increasing the possibility of a canopy fire developing. In long-unburnt forests, the flammable shrubs die off, reducing the likelihood of a canopy fire.

LDOW = Low, dry open woodland.
DOF = Dry open forest.
SWF = subalpine forest and woodland.
OF = Open forest.
TWF = Tall wet forest.

Source: Zylstra, PJ. *Flammability dynamics in the Australian Alps.* Austral Ecology 2018.

A number of other papers confirm those findings.

"The influence of prescribed burning on subsequent fire behaviour diminishes within 2 to 10 years."

Nicholas Wilson, Geoffrey J. Cary and Philip Gibbons. (2018) **Relationships between mature trees and fire fuel hazard in Australian forest.** International Journal of Wildland Fire 2018, 27, 353–362

"Overall fuel hazard was higher in forests and woodlands burned 6–12 years previously than those unburned for at least 96 years" and "*Frequent burning can maintain forest understorey in an early successional 'shrubby' state, leading to higher overall fuel hazard than forests where a lack of fire is associated with the senescence of shrubs."*

Kelly M. Dixon, Geoffrey J. Cary, Graeme L. Worboys, Julian Seddon and Philip Gibbons. (2018) **A comparison of fuel hazard in recently burned and long-unburned forests and woodlands.** International Journal of Wildland Fire. July 2018.

And a paper co-authored by eight south eastern Australian fire behavior scientists and fire ecologists has drawn attention to the importance of avoiding simplistic fuel flammability models. There is evidence that repeated fire in some ecosystem types can produce a greater abundance of more flammable plant types.

"Our study found that for these sites, plant traits were more important for predicting flame height than was surface fuel load."

Zylstra P, Bradstock RA, Bedward M, Penman TD, Doherty MD, Weber RO, Gill AM, Carey GJ. (2016). **Biophysical Mechanistic Modelling Quantifies the Effects of Plant Traits on Fire Severity: Species, Not Surface Fuel Loads, Determine Flame Dimensions in Eucalypt Forests.** PLoS ONE 11(8): e0160715. doi:10.1371/journal.pone.0160715

We need to look more closely at the actual (rather than the assumed) effects of planned burns in different ecosystems, and take good note of the relative effectiveness/ineffectiveness of fire at reducing fire intensity and severity. Actual fuel reduction is hard to achieve at a landscape scale, as burns would have to be done at short intervals to avoid a large build up of fuel. Given the now increasingly significant weather and safety limits to frequent broad-scale burning, we have not seen any convincing evidence that the amount of fuel reduction needed to achieve consistently low fuel levels at a landscape scale is actually achievable.

Weather trumps fuel levels as driver of fire

Other research has shown that extreme weather is the prime driver of large uncontrollable fires, not fuel levels.

"Fatalities were dominated by a few bushfires that have occurred under catastrophic weather conditions. These conditions should be used as the context for discussing appropriate defensive actions for communities faced with a bushfire threat."

Raphaele Blanchi, Justin Leonard, Katharine Haynes, Kimberley Opie, Melissa James, Felipe Dimer de Oliveira. (2014) **Environmental circumstances surrounding bushfire fatalities in Australia 1901–2011.** Environmental Science & Policy 37 (2014) 192-203.

"An increase in fuel treatment, such as prescribed burning, may reduce crown fire risk but it has also been shown that fire severity in these fires was not reduced by recent burning (reduced fuel) under very severe weather."

Owen Price, Ross Bradstock. (2013). **Landscape scale influences of forest area and housing density on house loss in the 2009 Victorian Bushfires.** PLoS One, 8 (8), e73421-1-e73421-6.

A 2012 paper looked specifically at evidence from Victoria's Black Saturday fires in this respect:

"The results suggest that recently burnt areas (up to 5–10 years) may reduce the intensity of the fire but not sufficiently to increase the chance of effective suppression under severe weather conditions. Since house loss was most likely under these conditions (67%), effects of prescribed burning across landscapes on house loss are likely to be small when weather conditions are severe. Fuel treatments need to be located close to houses in order to effectively mitigate risk of loss."

Owen F. Price, Ross A. Bradstock. (2012) **The efficacy of fuel treatment in mitigating property loss during wildfires: Insights from analysis of the severity of the catastrophic fires in 2009 in Victoria,** Australia. Journal of Environmental Management, Volume 113, 30 December 2012, Pages 146-157

Ignition management is critical

A number of papers point out that an increased emphasis on ignition management (i.e. aerial attack capability, power line management, arson vigilance etc.) should be receiving attention in fire management policy and planning.

"The findings demonstrate that year-to-year variation in weather and the success of ignition management consistently prevail over the effects of fuel management on area burned in a range of modelled ecosystems." … "Weather and ignition management effort were more important than fuel management approach and effort in determining total area burned in five landscape fire models. Modelled area burned decreased with increasing levels of ignition management effort in all models. Increasing effort in a random fuel reduction approach resulted in decreased areas burned in the model systems but the effects were unimportant compared with that of varying weather and level of ignition management."

Cary, G. J., Flannigan, M. D., Keane, R. E., Bradstock, R. A., Davies, I. D., Lenihan, J. M., Li, C., Logan, K. A. & Parsons, R. A. (2009). **Relative importance of fuel management, ignition management and weather for area burned: evidence from five landscape-fire succession models.** International Journal of Wildland Fire, 18 (2), 147-156.

"Despite policy imperatives to expand fuel treatment, a reduction rather than an elimination of risk will result. Multifaceted strategies will therefore be required for the management of risk." … "*Feasible fuel treatment strategies are likely to leave considerable residual risk in many Australian forested ecosystems and this risk may be expected to increase in the future. Explicit recognition of this fundamental conclusion and its attendant consequences, including costs, will be needed to build a more comprehensive approach to the management of risks to people and their infrastructure."*

R.A. Bradstock, G.J. Cary, I. Davies, D.B. Lindenmayer, O.F. Price, R.J. Williams. (2012) **Wildfires, fuel treatment and risk mitigation in Australian eucalypt forests: Insights from landscape-scale simulation.** Journal of Environmental Management 105 (2012) 66e75.

We believe that the importance of this last point, that we need to be increasingly looking at a range of strategies, especially on ignition control, cannot be underestimated. Fuel reduction has a role, but it is an over-valued management tool, especially in regard to effectiveness in severe fire weather when most lives can be lost.

While an open and objective review of the relative effectiveness of fuel reduction burns is long overdue, a look at the history of the recent fire around Mallacoota (in a map produced by the VNPA using data currently available to us) raises a few issues. (See Attachment 4: Burn history around Mallacoota). Mallacoota was one of the townships most seriously affected by Victoria's fires this last summer, with a large part of the population having to be evacuated by sea. The map shows a concentration of planned burns around the north-eastern edge of the township – the sort of strategy that many scientific papers recommend. However those planned burns weren't very recent, the most recent being a number of relatively small burns in 2013, 2015 and 2016 – a full 7, 5 or 4 years before this summer's fire. Other planned burns (and some 1980s bushfires) took place many more years ago. Unfortunately Forest Fire Victoria rarely documents the rate of recovery of fuel after planned burns; it would be useful to have accurate records of the extent to which fuel had returned after those 'strategic' Mallacoota burns.

This is the problem: the most effective burns, close to assets, are the most difficult to do and are likely to be left undone so long as plans and policies encourage broad landscape burns across the state. Strategic close-to-asset burns are the most effective, but contribute little to any statewide hectare target. (This summer's fire appears as black diagonal cross-hatching in the map.)

Timber harvesting can increase the fire risk

There is substantial evidence that timber harvesting, especially in Victoria's tall Ash forests, has also contributed to the flammability of forests.

"Stands of Mountain Ash trees between the ages of 7-36 years mostly sustained canopy consumption and scorching, which are impacts resulting from high-severity fire. High severity fire leading to canopy consumption almost never occurred in young stands (less than 7 years) and also was infrequent in older (more than 40 years) stands of Mountain Ash."

Taylor C., McCarthy M.A., Lindenmayer D.B. **Nonlinear Effects of Stand Age on Fire Severity**. Conservation Letters, July/August 2014, 7(4), 355-370

•In the context of bushfire preparedness, assess the readiness and responsibilities of statutory agencies, Local Government and State Government bodies.

In response to Black Saturday, the Victorian Bushfire Royal Commission (VBRC) made a number of recommendations about building standards, land use planning and public infrastructure, which have been implemented to varying degrees, some barely at all, in the subsequent years.

A VBRC recommendation that power lines should be buried has not been followed, due to cost. Rather, automatic circuit reclosers have been installed across the network. Unfortunately a recommendation has never been made to keep power generation close to remote assets (wind, solar generation etc), which would avoid the need for vulnerable long transmission lines. Undergrounding should be considered in new developments, in high risk areas.

The VBRC made a number of recommendations, which lead to a range of planning and building control including the 10/30 and 10/50 rules. There were 19 recommendations in this category (Rec 37 to 55). These included improved mapping of bushfire prone areas, more efficient regulation regarding vegetation management around buildings, and a requirement for new buildings to meet specific construction requirements in bushfire prone areas.

The Planning and Building System Improvements included reviewing the statutory tools for regulating development on small lots in high bushfire risk areas.This included changes to planning provisions relating to native vegetation removal for bushfire-related purposes. For more information on the framework see: https://www.cfa.vic.gov.au/documents/20143/202133/royal_commission_implementation_plan.pdf/

In 2011 a new entitlement was introduced to clear vegetation without a permit and reduce fuel loads around homes by using the "**10/30 right**", which would apply until the new planning provisions for bushfire and vegetation removal were implemented. As of 2019 an amendment made in November 2011 is still in force, but slightly expanded, which includes provisions for a "**10/30 and 10/50 rule**" for clearing around houses constructed before 10 September 2009. See: https://www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/vegetation-management-for-bushfire-protection

These rules include:

- The removal, destruction or lopping of any vegetation within 10 meters of an existing building used for accommodation and the removal, destruction or lopping of any vegetation, except for trees, within 30 meters of an existing building used for accommodation applies to the whole State except for metropolitan areas (in general).
- The removal, destruction or lopping of any vegetation within 10 meters of an existing building used for accommodation and the removal, destruction or lopping of any vegetation, except for trees, within 50 meters of an existing building used for accommodation applies to any land that is covered by the Bushfire Management Overlay.
- The removal, destruction or lopping of any vegetation for a maximum width of four meters either side of an existing fence on a boundary between properties in different ownership that was constructed before 10 September 2009 applies to the whole state except for metropolitan areas (in general).

Since the Victoria Bushfire Royal Commission, native vegetation regulations in Victoria have been changed twice. The last review was initiated in 2015, with new regulations being put in place in 2017. Under the current rules, in addition to **10/30 and 10/50 rule** here are currently 34 exemptions for clearing, which do not require a permit including Emergency Works and Roadsides https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/91146/Guidelines-for-the-removal,-destruction-or-lopping-of-native-vegetation,-2017.pdf

While we strongly recommend fuel reduction activities close to homes and other assets, these 10/30 and 10/50 rules have lead in some places to significant clearing of native vegetation, some of it high conservation significance, and much of it has not been assessed before clearing, or attempted to avoid, minimise or offset which is required for other clearing activities.

Importantly, the clearing of native vegetation close to assets is of little value if the structures it is intended to save is highly vulnerable to ember attack. There are now clear recommendations for 'ember-proofing' buildings, and clear guidelines for buildings in areas vulnerable to fire. A requirement for clearing should be subject to appropriate ember-proofing of buildings.

The Royal Commission also made Recommendation 42 "*The Department of Sustainability and Environment develop and administer a collective offset solution for individual landholders who are permitted to remove native vegetation for the purpose of fire protection*" It would appear that the intention of this recommendation has not been delivered as "no collective offset solution" has been provided for areas cleared under the 10/30 and 10/50 rules.

The Bushfire Royal Commission Recommendation 46, which focused on resettlement strategies and voluntary buybacks, was the only recommendation from the Royal Commission that the government did not originally accept, even in principle. The rejection of Recommendation 46 "*The State develop and implement a retreat and resettlement strategy for existing developments in areas of unacceptably high bushfire risk, including a scheme for non-compulsory acquisition by the State of land in these areas*", could have had value in very high risk areas, and should be re-considered for implementation in a strategic and focused way.

•Review of all opportunities and approaches to bushfire preparedness, including different methods of fuel and land management (for example 'cool burning', mechanical slashing, integrated forest management, traditional fire approaches) to protect life and property as well as ecological and cultural values.

Some issues around Indigenous land and fire management

Our comments here are based on our best understanding; we can't, of course, speak for local Indigenous understanding of Country.

The VNPA supports knowledge-based fire management, and there is little doubt that before European occupation Indigenous Australians incorporated fire management techniques learnt from observation over a very long time. Their management included the use of fire to manipulate the landscape to favour a local range of food and fibre resources, and to allow

easy passage through more inhospitable areas. As far as we can ascertain, there is little resemblance between current planned burn practices in Victoria and traditional Indigenous burning.

However, there is currently quite a range of understandings of the nature of Indigenous fire practices, and some are highly questionable. In particular, the claim by some that Aboriginal Victoria was broadly maintained as an open, low-ground-fuel condition by Indigenous burning as a uniform pattern across the state is not supported by evidence.

The best non-Indigenous authority we know of for an understanding of Victoria's landscape at the time of European occupation is a book published in 2010 by the late Ron Hateley, a lecturer in ecology at the Victorian School of Forestry at Creswick. He had searched all available records of early colonial 'exploration', and discovered that Aboriginal people had, indeed, employed a range of burning practices across Victoria, and that much of the landscape was native grassland and open woodland (though applied fire would have been only one of several causes for that).

Importantly he also found that large areas of Victoria's forests were so thick with undergrowth it hopelessly entangled early white explorers. Among his abundant references indicating thickly forested undergrowth across much of the state, Hately quotes an account from James Tuckey, First Lieutenant of the Calcutta, anchored in 1803 near present day Sorrento in Port Phillip Bay: "… *we found the country grows still more impenetrable, vast fields of shrub as prickly as furze arresting our progress every moment".*
The Victorian Bush: Its "Original and Natural" Condition. Ron Hateley, 2010
https://trove.nla.gov.au/work/37181019?selectedversion=NBD45488513

Aboriginal people, before and shortly after European occupation of Victoria, applied fire for a range of purposes, in different seasons in a range of ecosystem types. Generally, it seems, their burns were smaller, cooler and more controllable than the large, single purpose planned burns currently employed across the landscape. There is no evidence we have seen that they broadly burnt the entire landscape, and its multitude of habitat types. It would be a huge and difficult task to extend cool, controllable burns over the broad landscape.

Currently, DELWP/Forest Fire Victoria fuel reduction burns are constructed under a great range of 'prescriptions'.

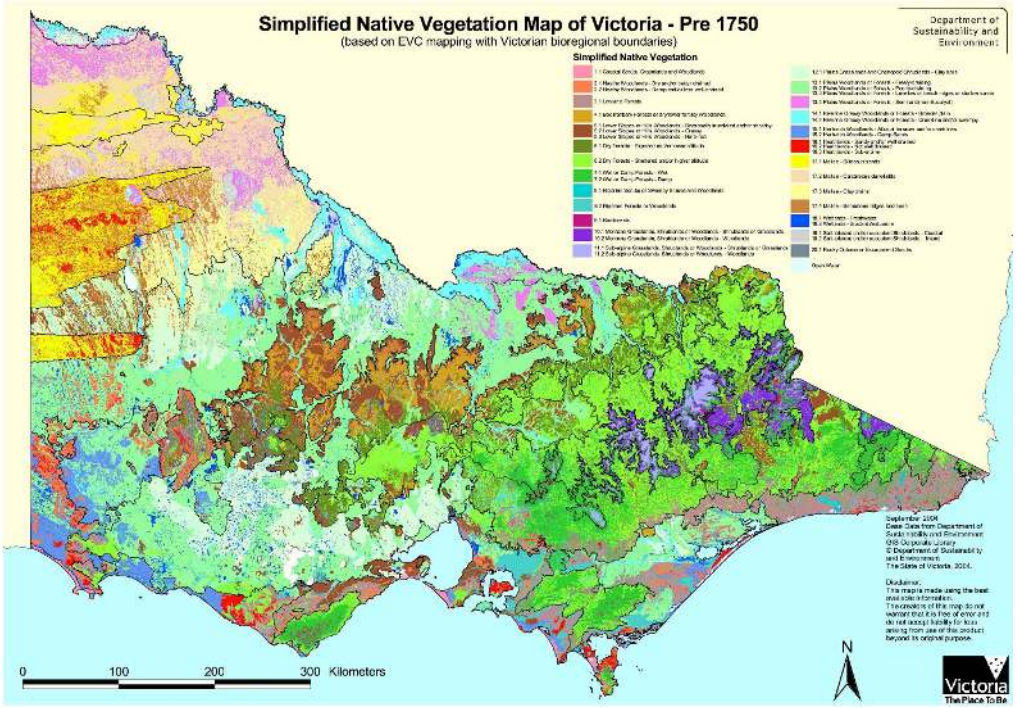
This fuel reduction burn in Central Victoria's Box-Ironbark country may have been similar in intensity and severity to Indigenous burning practices.

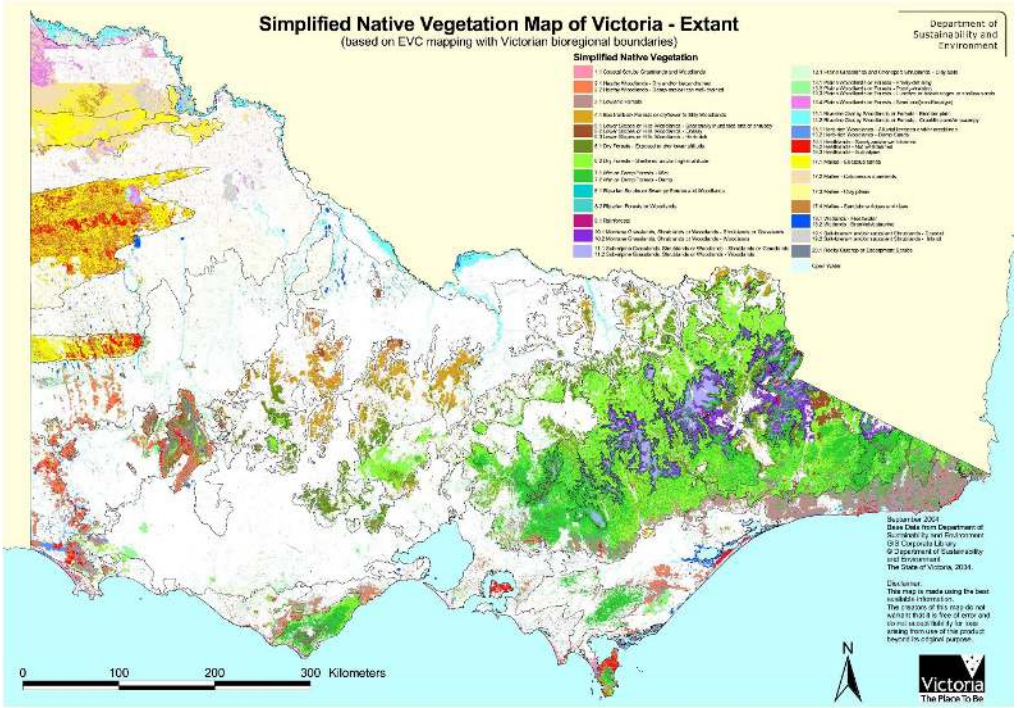
The above extensive 2019 prescribed fuel reduction burn near East Gippsland's Radar Hill is unlikely to resemble Indigenous burning practices.

Some issues we must also consider in relation to Indigenous burning include:

- The appalling treatment of Aboriginal communities since European occupation of Victoria has led to a loss of some of the depth of knowledge about local fire management.
- While there is abundant evidence that pre-European Victoria had large areas of open grasslands, and also woodlands with a grassy understory, most of that land is now farmland. In the two maps below (Victoria's pre 1750 vegetation types; and current native vegetation extent), the second map shows that almost all of the pre-

European native grassland and open grassy woodland has since been cleared for farmland and other reasons.





- The last two hundred years have greatly altered the landscape, especially due to habitat fragmentation through land clearing; timber harvesting; and invasions by a large and increasing range of pest plants and animals. And climate change has introduced a significant, and very difficult, complication into the management of fire in our natural areas. What once worked won't necessarily produce the same results now.

Programs working with Traditional Owner groups are increasingly being introduced by DELWP and Parks Victoria. We should learn whatever we can from the historical burning practices of Aboriginal communities, and from their concern for and care of Country; learning, surely, is the key here. The VNPA supports these programs for both cultural and environmental reasons. And we support the Victorian Traditional Owner Cultural Fire Strategy: the Victorian Traditional Owner Cultural Fire Knowledge Group (2019) (e.g. on p. 7: *"Cultural burning is Right Fire, Right Time, Right Way and for the right reasons, according to Lore"*). https://knowledge.aidr.org.au/media/6817/fireplusstrategyplusfinal.pdf

Indigenous burning evolved from knowledge gained through repeated observation of the effects of different burns in different times in different locations. In that sense, it differs little from western science – tested observations of the behaviour and effects of fire. This is, to a large degree, the process missing from much current fire management in Victoria. Observation of the return of fuel levels, and the plant species that return after burns, is rarely undertaken by our fire managers.

•Consideration of the effectiveness of Victoria's Code Red day arrangements and their application in practice.

Our understanding is that warnings of Code Red days work fairly well. However most Victorians remain unsure of the terminology for the range of fire weather warnings.

•In considering effectiveness of Victoria's operational response to the 2019-20 fire season, IGEM should particularly consider:

◦effectiveness of the State's response priorities, including primacy of life

The over-riding priority for fire management is, rightly, the protection of human life. But unfortunately Forest Fire Victoria, in its planning, actually uses buildings as a surrogate for human life. Why anyone would need such a weak surrogate for such a critical and clear objective is a mystery; it's possible to save buildings but lose lives, and possible to lose buildings while saving lives.

If we drop the surrogate, at least two life-saving options come into the picture that are far more effective than 'fuel reduction' burning:

- Compulsory evacuation
- Private bushfire shelters/bunkers

The 'buildings for lives' surrogate should be dropped, and something like the attention fuel reduction gets should be given to evacuation strategies and private shelters.

◦effectiveness of public information and warning systems, including cross-border coordination and communication

Cross-border coordination and communication seems to work well, but can always be improved. Importantly, given the scale and extent of this summer's fires, relying on the capacity to share staff and resources comes into question, as resources were clearly needed in all eastern states.

◦impact of increasingly longer fire seasons on the ability to prepare, deploy and sustain efforts directed towards emergency events in Victoria

There are two issues here:

- The exhaustion of crews (especially volunteers) during a long fire season
- Work that is not being done while crews fight fires (eg DELWP and Parks Victoria staff are taken away from other land management tasks, such as pest plant and animal management, for long periods of time).

Given predictions that fire seasons will get worse still, we probably need a larger professional fire fighting force. They could also be trained in other duties such as pest plant and animal management. This would seem be a sensible avenue for boosting regional employment.

◦impact of providing Victorian responder officers to other Australian jurisdictions to assist with emergency events (as early as September 2019 this summer season)

As mentioned above, this is becoming increasingly difficult. States can't securely rely on other states (or international crews etc) for timely assistance. Victoria should be self-sufficient, including developing aerial ignition control capacity across the state.

◦availability and utilisation of private assets and resources (including plant equipment) to support emergency preparedness and response

Expansion of point of ignition control

Effective ignition control has the potential to:

- Increase protection of human lives
- Increase public health
- Increase protection of homes and infrastructure
- Reduce the heavy burden placed on volunteer (and professional) firefighters
- Increase the viability of insurance companies
- Increase the viability of agriculture (reducing both smoke and fire impacts)
- Increase the viability of tourism
- Improve the quality of water catchments
- Reduce carbon emissions and…
- Help long-term recovery of the natural environment, and the plants and animals that depend on it.

That has to be a very strong return on any solid investment.

Improved point of ignition control across the state would involve a considerable investment, but potentially bring far greater benefits socially, economically and environmentally.

We note the report in the Sydney Morning Herald of February 28, 2020, quoting ex-fire chiefs saying that current Federal funding arrangements are effectively "*preventing emergency services from water-bombing small fires before they turn into mega blazes that destroy homes and kill people*". They pointed out that *"Federal funding can flow to state governments under the Disaster Recovery Funding Arrangements with up to 75 per cent of costs covered - but only in "extraordinary" circumstances when firefighting was targeted at "imminent" risks to lives and property*". https://www.smh.com.au/politics/federal/ex-fire-chiefs-say-ridiculous-bushfire-funding-stymies-waterbombing-20200228-p545dz.html

The Commonwealth has a role in funding state programs, particularly for expensive infrastructure such as capacity building for aerial attack on points of ignition. Again, however, those programs are most effectively designed and administered by the states and territories, where local knowledge is critical.

It is critical that that funding criterion be replaced with funding arrangements that facilitate strong deployment for point of ignition control right across the landscape. That means not just funding for an appropriate range of aircraft, but also for the necessary supporting infrastructure and training. (We note here Victoria's sensible initiative in developing aerial fire-fighting capacity at night, when many fires start and when control efforts can be most effective. That capacity should also be expanded.)

Landscape-scale ignition control programs would mean developing the capacity to get two or three aircraft to an ignition point within about 15 minutes, even in remote areas. This would not just mean radically expanding investment in and deployment of a full range of aircraft, but expanding crew training, establishing the necessary infrastructure (including water sources) and making use of effective lightning detection networks and satellite sensing capacity etc.

There have been many successful aerial point of ignition interventions, but to the best of our knowledge they have not been followed by modelling the likely path of an escaped fire, and its likely impact on lives, property and the economy. This would establish beyond doubt the

cost-effectiveness of these interventions, and their capacity to save lives. For example, a fire that started on Black Saturday in Quarry Road, Ferntree Gully (at the foothills of Victoria's Dandenong Ranges) was successfully extinguished by a helicopter at the point of ignition. If that fire escaped, it could have extended the Black Saturday havoc through the highly populated Dandenongs, but there has been no modelling of that fire's likely progress and likely loss of life and economic costs.

Aerial point of ignition capacity should be supported by strategies for:

- Avoiding power line failure (burying lines, installation of automatic circuit re-closers, and encouraging local power generation etc.)
- Increased action (both social and enforcement) on arsonists
- Increased community education.

Improving ignition point control will be very costly, but that investment is needed if we are to reduce the number and extent of mega-fires. An investment capable of reducing the frequency and great cost of large, uncontrollable fires, would produce economic, social and environmental dividends. Stopping just one large fire at its source could save billions of dollars.

◦planning and response mechanisms to protect biodiversity threatened by bushfire

Impacts of current fire management on biodiversity

Fire has always been part of the Victorian landscape, indeed it has driven the evolution of much of the typical 'Australian flora' over the last 45 million years or so. Many Victorian plants have developed resilience to fire, and some plants actually depend on occasional fire. However resilience always has limits, and there is abundant evidence that those limits are being reached, due to increased wildfire, and increased management burns.

The impact of increased fire frequency and severity

The most striking evidence of that from last summer's fires in East Gippsland is the number of rainforest pockets that have burnt. Rainforests (botanists prefer them to be called 'fire-free forests'), are remnant ancient Gondwanan forests that have largely sheltered from fire in deep valleys; they have little resilience to fire, take a long time to recover, and can be destroyed (replaced by eucalypt forests) by repeated fire.

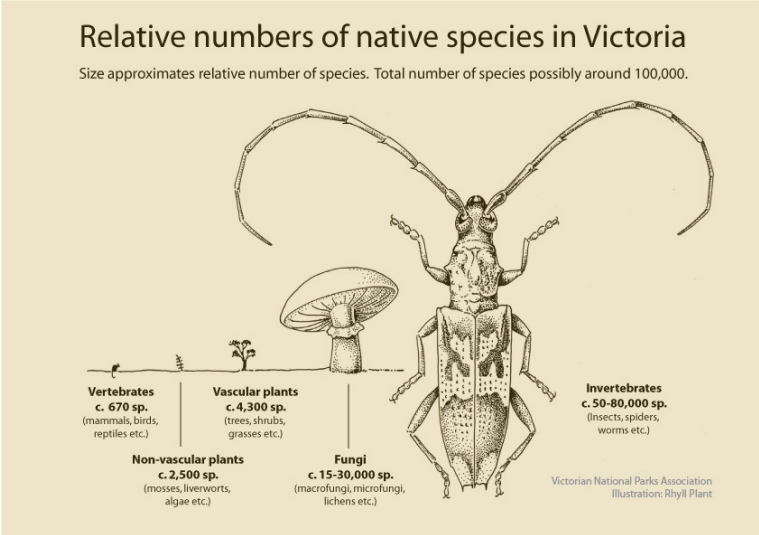
Long-unburnt warm-temperate rainforest near Bruthen.

The same warm-temperate rainforest near Bruthen after the 2020 fire. (Photos Tom Crook)

The impact of the 2020 fire on East Gippsland's many pockets of warm-temperate rainforests has been close to catastrophic, especially as some, including Victoria's largest patch at Jones Creek, have now suffered repeated fire and are unlikely to recover (especially under the current climate scenario).

But repeated fire can also challenge the recovery of many fire-adapted species. Snow Gums, for example, can quickly re-sprout from a large underground lignotuber when an occasional alpine fire has killed the above-ground parts of the tree. Yet three fires in recent succession can weaken and kill them. This scenario has happened now around The Horn in Mount Buffalo National Park, and in the southern parts of the Bogong High Plains in the Alpine National Park.

While people see a remarkable re-greening of the landscape after a fire, the situation is not as simple as that; there are many plants and animals that struggle from frequently repeated fire. There are approximately 100,000 different native species inn Victoria, most of which are insects and fungi; the larger native animals and plants total around 5,000 species. Most have very specific habitat requirements which can be impacted by frequent fire.



Relative numbers of native species in Victoria (compiled by VNPAS from a range of published sources)

Loss of hollows and other essential habitat features

Many studies have recognized the importance of maintaining or improving the presence of a large range of tree hollows in the landscape. The presence of hollow logs on the ground is also a critical habitat feature for many species, and once lost can take a very long time (decades to a century or more) to become re-established.

Many birds, for example, rely or largely depend on hollows, and a population of any particular species will need an abundance of hollows of a particular size, shape and orientation within their preferred habitat. Victorian birds that make use of or depend on hollows, include:

Australian Wood Duck, Pacific Black Duck, Pink-eared Duck, Grey Teal, Owlet-nightjar, Brown Falcon, Nankeen Kestrel, Glossy Black Cockatoo, Red-tailed Black Cockatoo, Yellow-tailed Black Cockatoo, Major Mitchell's Cockatoo, Gang-gang Cockatoo, Galah, Long-billed Corella, Little Corella, Sulphur-crested Cockatoo, Rainbow Lorikeet, Little Lorikeet, Purple-crowned Lorikeet, Musk Lorikeet, Australian King Parrot, Superb Parrot, Regent Parrot, Cockatiel, Crimson Rosella, Eastern Rosella, Australian Ringneck, Blue Bonnet, Red-rumped Parrot,

Mulga Parrot, Elegant Parrot, Turquoise Parrot, Scarlet-chested Parrot, Budgerigar, Powerful Owl, Barking Owl, Southern Boobook, Sooty Owl, Eastern Barn Owl, Masked Owl, Laughing Kookaburra, Sacred Kingfisher, Red-backed Kingfisher, Dollarbird, White-throated Treecreeper, White-browed Treecreeper, Brown Treecreeper, Chesnut-rumped Thornbill, Southern Whiteface, Striated Pardalote, Tree Martin.

Victorian mammals that frequently use or completely rely on hollows in trees or on the ground include:

Short-beaked Echidna, Yellow-footed Antechinus, Brown Antechinus, Dusky Antechinus, Spot-tailed Quoll, Brush-tailed Phascogale, Southern Brown Bandicoot, Mountain Brushtail Possum, Common Brushtail Possum, Pygmy Possum, Leadbeater's Possum, Yellow-bellied Glider, Sugar Glider, Squirrel Glider, Greater Glider, Feathertail Glider, Yellow-bellied Sheathtail Bat, Southern Freetail Bats, White-striped Freetail Bat, Gould's Wattled Bat, Chocolate Wattled Bat, Eastern False Pipistrelle, Large-footed Myotis, Lesser Long-eared Bat, Gould's Long-eared Bat, South-eastern Long-eared Bat, Inland Broad-nosed Bat, Eastern Broad-nosed Bat, Inland Forest Bat, Large Forest Bat, Southern Forest Bat, Little Forest Bat.

Many other animals, including reptiles, amphibians and a large range of invertebrates also rely on hollows.

Fuel reduction burns, as well as bushfires, can reduce the abundance of hollow logs on the ground, a critical habitat feature that can take many decades, or more than a century, to reappear. This 'Radar Hill' fuel reduction burn took place in East Gippsland in 2019.

The need for appropriate fire regimes has been acknowledged in a Potentially Threatening Process listing in Victoria's Flora and Fauna Guarantee (FFG) Act – the highest available threat listing. And that threat listing has been strongly justified by the following quoted scientific studies in south eastern Australia, published since Victoria's Back Saturday Royal commission. Frequent fire can adversely affect many important habitat components of forests and woodlands.

One study, published by Victoria's Department of Environment land, Water and Planning (DELWP) specifically associated fuel reduction programs with impacts on vertebrates. While fire can create hollows, it more commonly destroys them:

"Tree hollows are a key habitat component for some 300 Australian vertebrate fauna species, of which a third have formal conservation status (Gibbons and Lindenmayer 2002)." …. "This study has demonstrated that planned burns in Gippsland increase the collapse risk of HBTs [hollow-bearing trees] significantly and, by implication, are likely to cause loss of habitat for hollow-dependent fauna in areas where hollows are needed."

Lucas Bluff. (2016) **Reducing the effect of planned burns on hollow-bearing trees.** Victorian Government Department of Environment, Land, Water and Planning, Melbourne, February 2016.

Another DELWP study highlighted the importance of a broad range of fire age classes (time since fire), allowing the ongoing development of tree hollows and other habitat features.

"For birds the strongest relationships related to fire frequency, with nectarivores responding negatively to frequent fires, and two other guilds showing weaker positive responses. Ground nesting birds were scarce at sites that had been burnt below the minimum Tolerable Fire Interval." .. "The study examined a subset of the biota and so a precautionary approach is warranted to fire planning and implementation, taking account of other studies and future work dealing with groups such as lichens, fungi, owls, arboreal mammals, microbats and invertebrates." … "Frequent burning will benefit some plant and bird groups and disadvantage others (and probably also mammals). Hence it is important to continue generating a mix of fire regimes across the landscape, and a mix of age-classes."

Annette Muir, Josephine MacHunter, Matthew Bruce, Paul Moloney, Garreth Kyle, Kasey Stamation, Lucas Bluff, Phoebe Macak, Canran Liu, Geoff Sutter, David Cheal and Richard Loyn. (2015). **Effects of fire regimes on terrestrial biodiversity in Gippsland, Victoria: a retrospective approach.** Arthur Rylah Institute for Environmental Research, DELWP 2015.

A number of other studies have found similar results:

"Charring effects on hollow formation, increasing hollow size but decreasing overall hollow presence, demonstrates the complex effect of fire on this resource."

Mitchell G. Stares, Luke Collins, Bradley Law and Kristine French. 2018) **Long-Term Effect of Prescribed Burning Regimes and Logging on Coarse Woody Debris in South-Eastern Australia.** Forests 2018, 9, 242; doi:10.3390/f9050242.

"We conclude that low intensity prescription burns may cause levels of destruction of hollow-bearing trees that are substantial enough to warrant immediate attention from managers."

Harry Parnaby, Daniel Lunney, Ian Shannon and Mike Fleming. (2010) **Collapse rates of hollow-bearing trees following low intensity prescription burns in the Pilliga forests, New South Wales**. Pacific Conservation Biology 16(3) 209 – 220.

"Our work highlights the need for management of fire regimes to be complemented by an understanding of the underlying environmental gradients and key elements of habitat structure that influence resource availability for plants and animals." … "Time since fire influenced vertebrates, particularly bird abundance, more than plants. Of species that responded to time since fire, most were associated with older fire ages."

Kelly, L. T., A. Haslem, G. J. Holland, S. W. J. Leonard, J. MacHunter, M. Bassett, A. F. Bennett, M. J. Bruce, E. K. Chia, F. J. Christie, M. F. Clarke, J. Di Stefano, R. Loyn, M. A. McCarthy, A. Pung, N. Robinson, H. Sitters, M. Swan, and A. York. (2017). **Fire regimes and environmental gradients shape vertebrate and plant distributions in temperate eucalypt forests.** Ecosphere 8(4):e01781. 10.1002/ecs2.1781

"Longer-term impacts of prescribed burning will be strongly influenced by the return interval, given the slow rate at which some structural components accumulate (decades to centuries)" and *"Replacement of components such as large logs, first requiring older trees with large trunks/limbs, potentially requires a century or more … A key point is that, despite being relatively mild and patchy, prescribed burns may continue to influence forest structure for more than a century into the future … More than 150 years of European settlement and diverse land use has left the box-ironbark forests of southeast Australia in a highly disturbed and simplified state, with structural components such as large logs and deep litter layers being extremely scarce (ECC 1997)."*

Greg J. Holland, Michael F. Clarke, and Andrew F. Bennett. (2017) **Prescribed burning consumes key forest structural components: implications for landscape heterogeneity.** Ecological Applications, 27(3), 2017, pp. 845–858.

A series of studies over many years has looked at the declining habitat features of Victoria's Ash forests. To quote just one of those papers:

"Large trees with cavities provide critical ecological functions in forests worldwide, including vital nesting and denning resources for many species." … This large cavity tree crisis in Mountain Ash forests is a product of: (1) the prolonged time required ([greater than] 120 years) for initiation of cavities; and (2) repeated past wildfires and widespread logging operations." … "Significant negative ecological consequences will arise from the Mountain Ash-wide absence of large cavity trees [including] impaired key ecosystem processes like the recruitment of large logs to the forest floor. In the particular case of Mountain Ash forests, a paucity of large-diameter dead trees will deplete the nesting and denning resources required by, ~ 40 species of cavity-dependent vertebrates in these ecosystems."

Lindenmayer DB, Blanchard W, McBurney L, Blair D, Banks S, Likens GE, et al. (2012) **Interacting Factors Driving a Major Loss of Large Trees with Cavities in a Forest Ecosystem**. PLoS ONE 7(10): e41864. https://doi.org/10.1371/journal.pone.0041864

Inappropriate fire regimes

A recent (August 2018) paper, looking at the causes of endangered species Australia-wide, lists inappropriate fire regimes as one of the most significant impacts on these species.

"Since European occupation, many areas have experienced dramatic changes in fire regime, ranging from reductions in the incidence of fire to increases in the frequency, extent and

intensity of fire." … We highlight that if Australia is to conserve its globally significant biodiversity, a better-planned response supported by adequate funding and effective policy and legislation is urgently needed."

Stephen G. Kearney, Josie Cawardine, April E. Reside, Diana O. Fisher, Martine Maron, Tim S. Doherty, Sarah Legge, Jennifer Silcock, John C. Z. Woinarski, Stephen T. Garnett, Brendan A. Wintle and James E. M. Watson (2018) **The threats to Australia's imperiled species and implications for a national conservation response.** Pacific Conservation Biology. CSIRO https://doi.org/10.1071/PC18024

Increased fire in the landscape (both bushfires and planned burns) over recent years has resulted in a significant depletion of older age classes, and these are very hard to re-establish once lost. As DELWP fire ecologist David Cheal pointed out in 2010, in a page of caveats to his extensive report on suitable growth stages for different habitat types:

"Early growth stages can be created far more easily than can late (mature) stages. Recently burnt vegetation can be created in a single season. Some important habitat features occur only in mature to senescent vegetation and thus take decades, or even centuries, to develop."

David Cheal (2010) **Growth stages and tolerable fire intervals for Victoria's native vegetation data sets.** Fire and adaptive management report no. 84. DELWP 2010

Protection of remaining long-unburnt areas is now crucial
A number of papers have been published recognizing the importance of protecting long-unburnt (or near long-unburnt) vegetation.

"For example, the long-unburned sites in our study area are disproportionately more important for reptile and mammal richness and abundance than those with a shorter time-since-fire" and *"Regardless what management action is applied for reducing overall fuel hazard, our results suggest that long-unburned forests should be protected from fire".*

Kelly M. Dixon, Geoffrey J. Cary, Graeme L. Worboys, Julian Seddon and Philip Gibbons. (2018) **A comparison of fuel hazard in recently burned and long-unburned forests and woodlands.** International Journal of Wildland Fire. July 2018

"Additionally, prescribed burns carry significant side effects, such as ecological harms, both through degrading faunal habitat (Catling et al. 2001; Andersen et al. 2005) and disadvantaging some plant species that require long fire-free intervals to complete their life cycle."

James M. Furlaud, Grant J. Williamson, and David M. J. S. Bowman**.** (2017) **Simulating the effectiveness of prescribed burning at altering wildfire behaviour in Tasmania, Australia.** International Journal of Wildland Fire.

"Our review reiterates the vulnerability of 'fire sensitive' obligate seeder forests, but also highlights similar threats to 'fire tolerant' resprouter forests posed by multiple recurrent wildfires of high severity." … "Our review highlights that even in forest types well adapted to

fire the consequences of increasing wildfire frequency are worth renewed and directed attention."

Thomas A. Fairman, Craig R. Nitschke and Lauren T. Bennett. 2015) **Too much, too soon? A review of the effects of increasing wildfire frequency on tree mortality and regeneration in temperate eucalypt forests.** International Journal of Wildland Fire. 14 September 2015.

"There is little evidence for any ecological benefit from the planned burns, at least in the short term. … In contrast, there is evidence that burning results in depletion of habitat resources for a range of faunal species." … "Given the commitment to increased levels of burning on public land annually, it is critical to undertake strategic planning to develop a vision and target for the post-fire, age-class structure of these forests. … A high priority is to determine those areas to be maintained as the 'long unburnt' growth stage."

Greg Holland, Andrew Bennett, Mike Clarke and others (2015) **Box-Ironbark Experimental Mosaic Burning Project.** Report to the Department of Environment. Land, Water and Planning and Parks Victoria, 2015.

And a paper assessing claims of biodiversity impacts after the 2003 alpine fire in Victoria and NSW pointed out that frequent fire in that landscape was historically uncommon. Frequent fire, rather than severe fire after long intervals, was more likely to adversely impact alpine plants and animals.

"We conclude that infrequent extensive fires are a feature of alpine Australia. For both the flora and the fauna, there is no quantitative evidence that the 2003 fires were an ecological disaster, and we conclude that the flora and the fauna of alpine Australia are highly resilient to infrequent, large, intense fires."

Richard J. Williams A H , Carl-Henrik Wahren B , Arn D. Tolsma C , Glenn M. Sanecki D I , Warwick A. Papst B , Bronwyn A. Myers E , Keith L. McDougall F , Dean A. Heinze G and Ken Green. (2008) **Large fires in Australian alpine landscapes: their part in the historical fire regime and their impacts on alpine biodiversity.** International Journal of Wildland Fire 17(6) 793-808 https://doi.org/10.1071/WF07154

Importantly, these impacts from inappropriate fire frequency must be placed in the context of other current and future impacts on biodiversity, such as pest plant, feral animal and pathogen invasions, habitat fragmentation, logging, stock grazing and a growing range of recreational impacts. The growing list of threatened species in Australia is a function of the observed downward trajectory of many common species. Even Kookaburras are now in decline in Victoria.

Catchment and marine impacts

There are also significant issues of river health, and subsequently catchment health. Erosion is common after fire and, when flooding rains follow a severe fire event, that impact can be considerable.

Siltation of the Tambo River, East Gippsland, when heavy rain followed the 2020 fires.

A new report from the Australian Marine Conservation Society, *The impacts of bushfires on coastal and marine environments*, has highlighted the impacts of bushfires on estuaries and the marine environment.

"*Research has shown that when the nutrients, ash, debris, sediments and metals released by bushfires are washed into waterways, they can remove the feeding and breeding areas of aquatic animals, clog the gills of fish, and undermine the breathing of filter feeding animals such as mussels. The contaminated sediment slug can slowly work its way downstream to the coast, harming aquatic life along the way… Metals such as copper, zinc, lead and mercury, and other contaminants released by the bushfire, could change the physiology and behaviours of marine animals and work their way up the food chain*." and …
"More bushfires will likely worsen the scale of degradation of coastal and marine habitats, such as seagrass meadows and mangroves, and the decline in water quality of major estuaries, threatening the future of commercial and recreational fishing (and related tourism) and aquaculture."

Smyth C. **The impacts of bushfires on coastal and marine environments: A review and recommendations for change**. Report to the Australian Marine Conservation Society (2020). https://www.marineconservation.org.au/wp-content/uploads/2020/03/Bushfire-Report_February-2020_Final-full-for-web-1.pdf

◦effectiveness of the existing workforce model to support response, relief and recovery.

As mentioned above, there is a need for an increased year-long fire management capacity (both people and infrastructure, including aerial capacity) that does not overly rely on volunteers, or on the re-deployment of PV and DELWP staff who should be doing their

regular tasks. Flexibility for staff to engage in pest management control seems sensible. That expansion can only help regional employment.

•Review support available to staff and volunteers in terms of mental health and wellbeing.

People engaged in fire management and control should have all the support they need. A more adequate capacity to manage fire must help here.

•Consideration of the adequacy of existing administrative and funding mechanisms in place at a state level to support the operational response efforts.

See comments about aerial capacity, and inadequate federal funding arrangements, above.

•In considering the timeliness and effectiveness of activation of Commonwealth assistance, and Commonwealth resource availability, IGEM should particularly consider:

◦effectiveness of current national resource sharing arrangements when multiple and simultaneous fire events are occurring

As above, last summer's fires demonstrate the need for an adequate Victorian fire response capacity. According to Australia's constitution, the states have responsibility for the management of Crown Land. And in a country as large as Australia, a Federal agency would be unlikely to possess the local knowledge necessary for effective land/fire management. We believe the role for the Commonwealth is one of facilitating co-ordination, and delivering supporting funding, especially in relation to:

- Effective deployment and funding for aerial point of ignition capacity.
- Facilitation of evacuation strategies.
- Fire management planning across state and territory borders (though this generally works well along Victoria's borders).

We believe it should primarily be the states which plan for, establish and perform fire mitigation strategies, and plan for and establish deployment of aerial capacity and ignition control in their territory.

◦effectiveness of existing governance arrangements supporting access to Commonwealth and State air fleets

This needs significant reform. See earlier comments.

◦use and integration of Australian Defence Force assets into Victoria's emergency response and relief operations.

There is room to improve co-operation in fire planning between the states and the Commonwealth. This should be developed by setting up an agreed and adequately resourced consultative process, dealing with all aspects of fire resourcing and management, including deployment of defence forces.

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