

Submission: *Review of performance targets for bushfire fuel management on public land*

Via email: igem.info@justice.vic.gov.au

17 March 2015

REPORT OF THE 1939 ROYAL COMMISSION

The Causes of and Measures Taken to Prevent the Bush Fires of January, 1939. (pp 10-13)

(Conclusion)

The causes, of the fires under discussion are set out as follows:—

(a) Dry Season and Dry Forests.— Further elaboration is unnecessary.

(b) The Condition of the Forests.— When the early settlers came to what is now this State, they found for the greater part a clean forest. Apparently for many years before their arrival, the forest had not been scourged by fire. They were in their natural state. Their canopies had prevented the growth of scrub and bracken to any wide extent. They were open and traversible by men, beasts and wagons. Compared with their present condition, they were safe. But the white men introduce fire to the forests. They burned the floor to promote the growth of grass and to clear it of scrub which had grown where, for whatever reason, the balance of nature had broken down. The fire stimulated grass growth, but it encouraged scrub growth far more. Thus was begun the cycle of destruction which can not be arrested in our day. The scrub grew and flourished, fire was used to clear it, the scrub grew faster and thicker, bush fires, caused by the careless or designing hand of man, ravaged the forests; the canopy was impaired, more scrub grew and prospered, and again the cleansing agent, fire, was used. And so today, in

EEG appreciates this government's decision to review the 5% burn targets to determine if it is the best method of mitigating the tragic impacts on communities from bushfire. Since the BRC recommendation of a 5% burn target EEG has taken a keen interest this seemingly expedient but questionable political 'solution'. We see it has caused immense damage for little to no mitigation effect. Our interest in burns, combined with many of our members' direct experiences has provided us with valuable insight and scientific data which we hope will be useful in this review by the IGEM.

EEG represents around 1000 supporters and members from both regional and metro areas and has been a voice for environmental issues in this region since 1983.

Content:

- Environment as natural fuel reducer
- Myths that inform planned burns
- Burns - Political placebo - alternative measures for public safety
- Economics of fire
- Alternative fuel management
- Selection of news reports

Environment as an essential fuel reduction agent

We realise this review does consider the environmental impacts of burns, but prioritises human safety. The two are not mutually exclusive. EEG will present scientific research which we believe is relevant to the review's ToR. However, much of the evidence on damage to the environment is strongly linked to our forests', woodlands' and heathlands' natural abilities to fire-proof itself from large uncontrolled bushfires. We strongly believe that large, coarsely-planned landscape scale burns are counter-productive to genuine community safety. Their main purpose has been to placate a fearful, if ill-informed public.



If this review's recommendations include continuation of some burns in sensitive areas, EEG strongly recommends that these burns be paused while another review is carried out. The review should assess the effectiveness and the ecological damage caused by planned burns in various vegetation types. Currently there is no fine tuning of burns and no knowledge of the ecological vegetation classes being burnt. The horrendous destruction of wildlife and habitat, the cruelty imposed on millions of individual wildlife and the loss of protected species is of major concern to

many people, rural and town based alike. The fact that these are carried out under the altruistic guise of 'ecological burns', does not make them any less destructive or excusable.

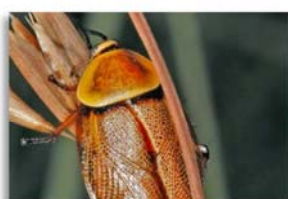
As an example, EEG questioned a planned 'ecological' burn in the Brodribb Wilderness inside the Errinundra National Park several years ago. This burn was very large, consisted of 70% wet, damp or rainforest vegetation, had never been surveyed, was untracked and assumed to be in very good natural health supporting many rare species that exist on the plateau. The burns manager admitted they did not know the age class of the forest, the species they were burning, what rare fauna might exist there or any other 'ecological' information. This is an example of the paucity of knowledge used when claiming burns



Control Burn, Grampians N.P

are 'ecological' as opposed to burns to fit the numbers game. We are pleased that the new Labor Government seems to be aware of these senseless designer bushfires, a result of a haphazardly chosen hectare target.

Another example was from Hoddles Creek, where a supposed patchy, low level burn destroyed 100% of an extremely valuable ecosystems and a wildlife corridor in the Kirth Kiln Regional Park (March 2013). It was ignited two days before a total fire ban day when rainfall for the prior six months had been the lowest ever recorded. The fire managers called it an 'ecological burn', but it had absolutely no ecological purpose. It destroyed non-target gullies, remnant hollow-bearing trees and was conducted within a protected water supply area. Other examples abound of 'ecological burns' taking out the ecology.



Hundreds of species of invertebrates are specific litter recyclers, but populations are killed off in many burns, compromising the natural ability of forests to reduce 'fuel'.

Although there are environmental arguments against these burns, they would also have had major and long-term impacts on the forest's natural ability to reduce its own leaf and bark layer. Fire

can also dry out an otherwise damp, enclosed understorey. Fire sensitive and supressing vegetation (ferns and so on) is replaced with fire resistant but flammable plants. Fires can not only create more dead 'fuel' but kill off the important living components that turn under leaves and bark (lyrebird, Bassian thrush, bandicoot,



Wood devouring fungi create 'mud logs' that are impossible to burn.

potoroo et al). Some 'digest' and decompose ground level 'litter' recycling the offensive forest debris into damp protective humus (fungi, moth larvae, termites and other invertebrates carry out this function). The system is brilliant, time tested and is free. The effectiveness of this unpaid workforce would be enhanced by a parallel project to reduce feral predator numbers.

Myths that inform planned burns

Prescribed burning as practised by the state government has three underlying assumptions:

1. That it is the most effective way of combating wildfires.
2. That it has beneficial or minimal adverse impacts on the environment.
3. That it replicates Aboriginal burning regimes.

All assumptions are false.

1. As a means of moderating the impacts of killer fires that threaten lives and property, there are a multitude factors worth considering.

- The weather and rapid management of a reported fire are more important than fuel management (e.g., burning) for minimising the area burnt in wildfires.ⁱ
- The fuel-age paradigm, on which the frequency of fuel-reduction prescribed burning is based, is flawed as prescribed burning may increase, not decrease, the 'fuel load'.ⁱⁱ
- A shift in emphasis away from broad-scale fuel-reduction burning to fuel treatments (not necessarily by fire) close to property or on private land might moderate impacts from fires on peri-urban communities. These would need to be carried out in appropriate vegetation types that have been fully assessed for environmental values and threat/risk levels.ⁱⁱⁱ

2. Contrary to DELWP's claims, prescribed burning does not enhance the environment.

- Land managers are attempting to use fire to reduce 'fuel loads', an ecosystem service formerly provided by digging mammals, birds and an array of invertebrates and fungi. These were present in very large numbers and many of the mammals are now locally extinct or threatened with extinction. *Predation of the remaining populations is increased after burns.*^{iv}
- Under current land management small mammal populations can never recover. Inappropriate burns of our native vegetation regardless of where, are depriving forests of the many ecosystem services once provided by a functional healthy ground layer, which in turn encourages the natural fuel reducers.^v
- DELWP claims that it conducts patch' mosaic' burning (impossible over hundreds or thousands of hectares in one burn) to protect and even enhance biodiversity. Recent research shows that patch mosaic burning, even if achievable, does not necessarily conserve biodiversity.^{vi}
- Plants that recover from a fire by resprouting may take 15-25 years to be able to tolerate another fire. Plants such as Banksia need to be mature and require an unburnt period of around 20 years or more before seed is viable.^{vii} Repeated fires at intervals shorter than resprouters or seed regenerators take to become fire tolerant may make the species locally extinct.
- The FFGA lists as a Threatening Process: *High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition. As well as Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity.*^{viii} These roughly managed burns fit these categories perfectly.

- Burning to protect *flora* can't be assumed to protect *fauna*. The responses of fauna species to fire are largely unknown.^{ix}
- Frequent low-intensity fires ('prescribed burning') cause substantial changes in the structure of invertebrate assemblages and the loss of species associated with the decomposer cycle. This has serious implications for not just forest health but for a forest to 'fire-proof' itself.^x
- The most detailed long-term study suggests that frequent deliberate fires will lead to the decline and loss of some species of birds that are now perceived as common and little affected by low level fires.^{xi}

3. Contrary to DELWP's beliefs, prescribed burning does not replicate Aboriginal burning in south-east Australia

- It has been claimed by people such as Bill Gammage that Aboriginal people burnt most of Australia about every one to five years. Basic common sense as well as scientific research soundly disproves this claim.^{xii xiii} In fact, Mooney et al (2012) have shown that fire frequency astronomically increased after the arrival of Europeans.^{xiv}

Burning – a political placebo?

As stated in previous correspondence from environment groups to the Minister, the BRCs expert panel did not recommend a 5% statewide burn target (quotes from the panel were included in the corro). In fact most scientists believed this experiment was far too dangerous and damaging with unknown effects.

Paternal politics and fear mongering has tragically dictated how this very important life or death issue is handled.

A fearful public has been created by drama-driven media, ill-informed old guard attitudes, spokespeople who rely on 1870s belief systems and fire management bureaucracies which love their work, ongoing funding and the public attention. It appears that all of this combined creates a government which has felt it must show voters a powerful attack plan to provide more safety from the threat of fire. It has defined and targeted the 'enemy' as the forests and uses large machines, planes, vast armies of men all creating massive landscapes of flame and smoke to weaken the 'enemy'.

Tragically, this costly show of force against a mostly innocent 'enemy' has been unable to prevent other catastrophic fires. In dangerous weather conditions, fires will move through burnt forests with as much speed and ferocity as an unburnt forest. It is blind recent burns. What is needed is a more creative, resourceful, cost-effective, innovative and effective means to keep the public safe. Governments need to seek advice from others



DEPI control burn in Combienbar East Gippsland

besides those who benefit financially or gain personal gratification.

More creative, effective and current day solutions using up to date, peer reviewed, credible science from a variety of disciplines is long overdue.



Planned burn - Westernport.

Economics of fire

The new economy of fire became known as “Red gold” after the 2014 Gippsland fires. Generous bonuses and payments to contractors were seen by the public as incentives to those on the front line and in decision making roles, to keep certain fires going, especially if they did not directly threaten larger communities.

The 2014 Goongerah-Deddick fires alone are believed to have cost the government between \$140M and \$300M. Add to this amount, the similar annual cost of planned burning and associated works (see below), and the money spent on these possibly ineffective burn operations could purchase five to ten Elvis Aircares.

Major Outputs/Deliverables Performance measures	Unit of Measure	2013-14 Target	2012-13 Expected Outcome	2012-13 Target	2011-12 Actual
Personnel accredited to serve in a senior capacity (level 2 or 3) in a fire role	number	300	270	300	267
The lower 2012-13 expected outcome reflects a decrease in the number of staff with a level 2 or level 3 accreditation due to a higher than anticipated fire suppression season.					
Timeliness					
District fire operations plans completed	Date	Oct-13	Oct-12	Oct-12	Oct-11
Fires controlled at First Attack to suppress fires before they become established, minimising impact	per cent	80	80	80	86
Readiness and response plans completed prior to fire season	Date	Dec-13	Dec-12	Dec-12	Jan-12
Cost					
Total output cost	\$ million	338.7	345.3	353.2	315.0
The lower 2013-14 budget is due to the bulk purchase of fire equipment in 2012-13 to assist with the increased planned burning targets.					

Source: Department of Environment and Primary Industries

'... it costs \$1.5 million to hire one Elvis (S-64 Aircrane) for 12 weeks... the cost of buying one new is estimated at \$30 million to \$40 million.'

SMH, Nov 4, 2013

Buying 10 Elvis (S-64) Aircranes would cost c. \$400 million. The Black Saturday fires cost Victoria at least \$4.4 BILLION, and 173 lives.

Alternative fuel management

The term 'Fuel' needs redefining. Fuel management must look at what creates the fuel, if it's indeed flammable and what works most effectively at reducing or transforming it to further assist fire suppression.

2007), any attempt to reduce flammability premised on the goal of reducing the fuel load therefore imposes an identical view of flammability dynamics across all forests; a view which runs counter to the empirical evidence and has been demonstrated to be significantly less effective than expected. If fuel management is to be made more effective then, it is critical that an evidence-based understanding of the fuel-flammability relationship is adopted so that the different dynamics between ecosystems can be identified and quantified. Effective fuel management requires that we no longer see Australian forests as just "the bush" with one management tool to fit all. This is consistent with Australia's history of Indigenous fire management, which was characterised by specific approaches in different environments (Zylstra 2006a, 2011a).

very rapidly with even minor changes in factors such as slope or wind speed, and that vegetation can also act to slow fire spread by reducing wind speed or maintaining more moist fuels. The Forest Flammability Model quantifies these effects, providing improved accuracy in fire behaviour forecasts and identifying new options for fuel management that take into account the effect of forest structure and seral stages on fire spread and intensity.

xv

This could be a radical idea but forest fuel can be *managed* to be *self-managing*. If mining and chemical industries can be trusted to self-regulate, surely we can be confident that the ground dwelling organisms which have evolved in Australian forests for hundreds of thousands of years can become the new trusted army to continue working 24/7 – free of charge. Part of any new fuel management system should include 'self-management'; to encourage more life and diversity at ground level including small soil turners, diggers and scratchers, leaf eaters and wood rotters. Nature's own fuel reducers simply need a predator-free, fire and bulldozer free environment to do it. We have observed that in damp shady forests that has a natural array of birds, mammals and invertebrates, there are a myriad of large and small fungi and fauna constantly devouring and turning 'fuel' into humus. Where forests and native vegetation still retains a semblance of its original ecology, this should be considered a viable, tried and true alternative to the burning entire mountain sides or miles of coastal heathlands.

There should also be different management for the many nuances of native vegetation types. A more useful computer model would detail the natural fire breaks in a landscape (south facing slopes, damp forest, gullies, fire-suppressing vegetation and so on) and the direction of greatest fire threat closer to towns and settlements.

During the 15-18th January 2014 lightning storms, there were 49 recorded lightning strikes, and 12 did not create fires, 23 small burns were easily contained or self-extinguished. Forest can easily absorb and extinguish fire if it has an undisturbed damp understorey creating a microclimate. We witnessed this one night at a single tree fire from a lightning strike.

There needs to be a fresh look at how 'fuel' is defined. We understand that fuel is considered to include vegetation such as tree ferns and ground ferns, the fire suppressing wattles and damp forest species such as blanket leaf and pomaderis. This is absurd to define fire suppressing plants as needing to be burnt. Currently silver wattle is defined as fuel, yet it is an amazingly fire resistant native species. An assessment of the fire dampening or 'absorbing' effects of various native plants could help protect assets and lives if planted strategically near communities.



A single tree fire north of Goongerah did not burn out further than several metres from the tree after many hours in damp forest.

Complimentary measures

Although the main focus of this review and of the public eye is on dry leaves, fallen twigs and undergrowth. This one small aspect of fire threat can be addressed without major blitz burning crusades. Such a misplaced focus can be counter-productive where more effective and time/resource-efficient suppression measures are implemented.

Other considerations should include:

- **Remote heat sensing cameras** constantly rotating at high points across the landscape. Placed in strategic positions this would alert fire agencies almost instantly a bushfire starts. This would have the added advantage of deterring fire-bugs.
- **Intense spotlight on pyromania and identifying problem people.** Although the 170,000ha fires of 2014 in East Gippsland were from lightning and the subsequent back burns, we believe that addressing the other major causes of fires could be much more cost effective. This should also include psychological tests of fire fighters themselves. If genuine, fire fighters should happily submit to any investigations needed if it can cull problem people. Over 70% of fires are human caused. It would be vastly more effective to educate landholders

Torching forests - an Aussie tradition
"European settlement certainly brought an extraordinary increase in both frequency and intensity of fire in south-eastern Australia. People lit fires everywhere, at any time, to burn off or to clear land. Rural manhood was forged in fighting fires."

Paul Collins - Burn

and to deter/track/identify fire-bugs than attacking dry leaves with a massive workforce armed with drip torches.

- **Windspeed** is another aspect of fire which some claim is beyond altering. This is untrue. It is evident that an enclosed forest 'tangles' and slows wind speed considerably. Healthy mature forest with a mix of living biomass and lower/mid-stories very markedly and effectively slows down wind speed altering fire behaviour. Burning to kill these layers off opens up the forest to more sun, unrestricted wind and of course drying the soil (now missing a humus layer). In many situations planned burning could not create a more flammable version of a forest if a team of ecologists and physicists were employed to design a fire-friendly landscape. An enclosed forest can be a natural 'wet blanket' where both humidity and temperature are maintained at levels that are 'fire-unfriendly'.
- **Topography** and the **land's natural fire breaks** such as wetter south facing slopes, gullies and damp or less flammable vegetation should be enhanced, not dried out by burning and modification.
- The **extremely flammable nature of regrowth from logging** must become a serious consideration, as politically fraught as this might be. Given the rapidly declining state of the native forest logging industry, and given the peer reviewed and published research from Dr Chris Taylor^{xvi}, we strongly believe this must be part of the fire response/planning mix. If risk based management is to be adopted. Having 7-25 yo regrowth close to towns and settlements is like building a funeral pyre next to communities. We can do little about bushfire regeneration in ash forests (mixed forests regenerate as a mixed age stand) but governments certainly have choices regarding logging regrowth.
- The other aspect of risk based management must include **nature's own hard-working and purposely-built (evolved) fire supressing agents** (see section above on Alternative fuel management). These are regularly killed off during



Potoroo killed in a fuel reduction burn. Potoroos are prodigious diggers that spread fungi spore and turn leaf litter under the soil.

planned burns. Much land has been burnt and reburnt, shoulder to shoulder in bushfires or planned burns over the past 12 years (animals and fungi are no less impacted depending on our definitions). There is almost little to no opportunity for these helpful composting agents to rebuild their populations and find suitable ground litter, secure cover, food, humidity and other requirements needed to flourish



More dead wildlife collected after a planned burn in western Victoria.

and perform their natural fuel breakdown. Unburnt islands should never be targeted to burn out as seems to be the joy of many fire controllers and managers. Regardless of fuel, the above could

make a huge difference to mitigating bushfire impacts. Working WITH nature may not be possible in every modified landscape, but is possible in many.

- **Small scale mechanical ground treatment** in identified 'danger zones' close in to towns and settlements. However, in the catastrophic fires which are the ones needing to be addressed here (most threat to human life), this may not even be effective.
 - **Planting fire retardant vegetation** bands around the most fire-prone sides of communities.
 - **Redefining and grading 'fuel'** so that the current definition that includes fire suppressing vegetation is excluded; so that long dry grass around towns and properties are included; so that thick young regrowth is classified as the potential bonfire it is and given a high rating as severe fuel danger.
 - **Reduce human caused fires:**
 1. a total ban on **machinery use** on hot days in the open – no exceptions,
 2. mandate installing high voltage power line spreaders to avoid clashing and sparks in high wind events.
 3. On catastrophic fire days the government should **order power distributors to turn off the power** until gale force winds abate (as per SA power networks).
 4. **Maintaining powerline infrastructure** to ensure safety (would have probably prevented most of Black Saturday's destruction).
 5. **Dry pasture grass** should be considered as a threat in rural areas.
 6. **Education and incentives to maintain safer farm landscapes** could be considered. Many fires on Black Saturday started in open pasture and spread into forests.
 7. Continue and develop the call for **greater preparedness on private land**,
 8. Higher **penalties for those carrying out their own unauthorised burns** on public lands.
 - **Effective rapid attack capacity** coupled with early detection (see earlier mention of remote sensing cameras).
 - Although not exactly a pre-bushfire action, the **review needs to include how fire fighting techniques should change to actually STOP a fire** and pull it up at its edges. Cooler evenings and night is when flame height is nonthreatening. As local CFA volunteers, many of us used this time to extinguish fires along tracks quite easily in 2014. Much to our astonishment, DEPI crews lit them up again the next morning to continue burning through the heat of the day!
- We were puzzled to say the least by this method which did not use water, did not go near a safe fire edge and did little real work. Instead the orders were to light more edge all day and also when heading home at 5pm. This increased the fire edge and



Local CFA volleys working at 1am to successfully extinguish a DEPI lit fire threatening to jump a track and enter private land – Feb 2014.

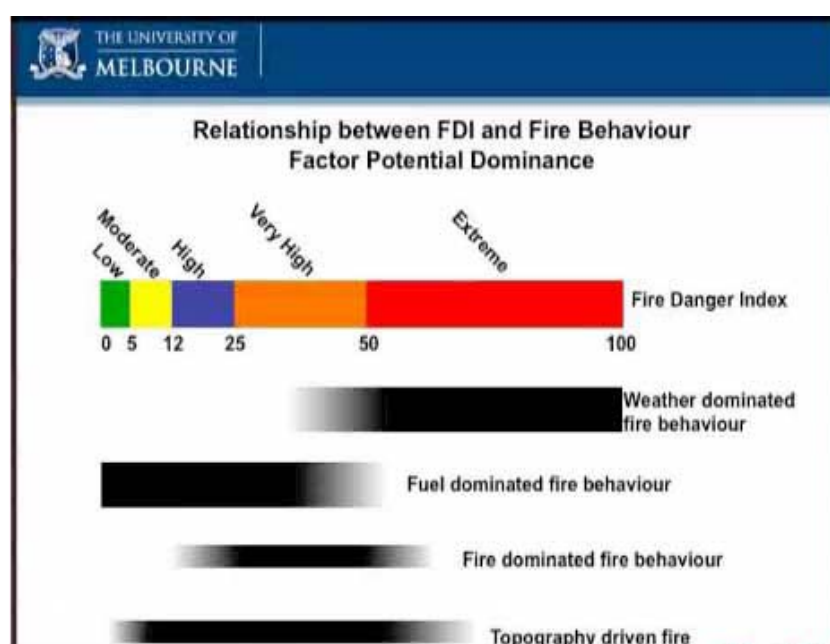
dragged the fire across the landscape prolonging the fire through two months. Visiting fire fighters from NZ and even NSW were astounded at this method of fire 'control' often joking about the methods of bushfire enhancement the Victorian's use! There was also no mapping or record kept of where these back-burns were carried out so that we are unable to ascertain which were back-burns and which areas were the original fires. From personal observation, we believe that up to half of this fire's size was the result of constant DEPI back burning.

There is one other very important measure that must be looked at to ensure more effective fire control, but which was brushed under the carpet during the Goongerah Deddick and Glenaladale fire inquiry. It is still regarded by many within the government as taboo but must be dealt with – in-house or publicly. Another review is needed to look at how bushfires are now fought, the methods employed and why decisions are made. The testosterone element is very real and manifests on the fire-line. To many of us it was striking and often uncalled for. A small bracken fire at the base of a tree could have been easily extinguished with a nearby tanker hose, but the officer in charge called in a bulldozer to push the tree over. This was but one example of dozens.

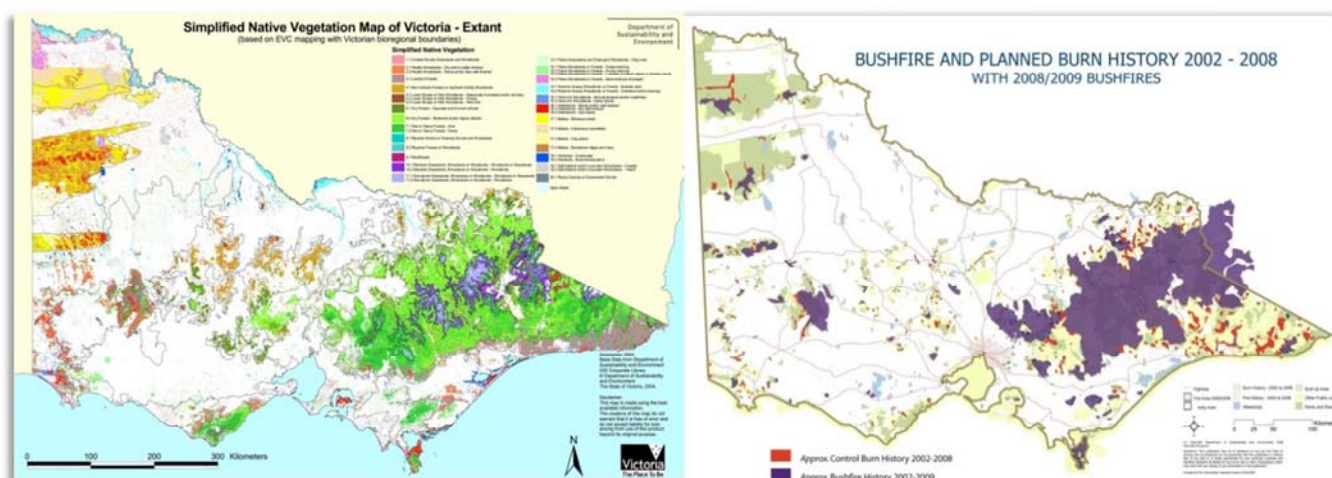
The factors which influence decision making on the fire-lines includes the excitement and enjoyment of drama. The Background Briefing program (8/3/15)^{xvii} summarised the problems in the NSW fire service – “Big fire, big drama, big money”. Add to that big heroes, big excitement and it can disastrously distort logical decision making.

The twisting of good judgment can sometimes be due to a common phenomenon seen when fire hype clouds logical decisions. The obvious way to help remedy this is to train up and place more women in positions of decision making. To have an impact there would need to be a 50% gender balance or their insight, observations and opinions would be easily invalidated.

A one-size fits all management regime to do battle with forests might gain some public support, placate old-school ideologues and create a fire fellowship in regional areas but it is an extremely dangerous and expensive game when effective risk-based bushfire suppression is the aim.



In extreme weather conditions, fuel levels are irrelevant. These are the conditions that are life-threatening, making the costly war on 'fuel' pointless.



Left: map illustrates the 30% of native vegetation which remains after Europeans arrived. What remains has been subjected to serious degradation - grazing, mining, burning, logging and feral invasions.

Right: map shows areas still being systematically degraded by planned burns for little to no effect on public safety.

Selection of news reports

EEG does not anticipate the following news reports will be read fully. We do hope however, that it will illustrate the weight of evidence that is publicly available and has been questioning the planned burn dogma for years.

[29 August 2013 Bushfire strategy needs rethink](#)

[Scratching lyrebirds create forest firebreaks](#)

Monday, November 24, 2014

Originally published at:

<http://www.abc.net.au/science/articles/2014/11/24/4111718.htm> (link is external)

<http://www.eastgippsland.net.au/news/how-forests-carry-out-their-own-fire-suppression-management>

How forests carry out their own fire suppression management

Thursday, April 10, 2014

How did forests cope before the era of government planned bushfires? Forests had many brilliant systems in place that digested leaf litter, kept the understory damp and a layer of nutrient rich humus at ground level, all operating with clever symbiotic relationships between plants, animals and fungi.

Below is just a selection of extracts from research which shows how important these ground layer ecosystems are – and how vulnerable they are to planned government burns.

Blue Tongue lizards as fungi dispersers

'...The authors of the paper given in the next reference button wrote...we observed a large adult Eastern Blue-tongued Lizard *Tiliqua scincoides*, move towards the base of a mature Coastal Rosemary shrub *Westringia fruticosa* and commence digging. We realised that the lizard was digging for fungi when it retrieved and quickly consumed a white, ball-shaped mass that had not been visible from the surface. At this point we disturbed the animal (which retreated a short distance) and recovered three more ball-shaped fungi which resembled the 'eggs' of immature stinkhorn or anemone fungi...One of these was offered to the lizard which immediately consumed it...and another was allowed to mature in our laboratory...

The fungus turned out to be *Aseroe rubra*. The authors summarized the reports of fungus consumption in two species of *Egernia* and six of *Tiliqua*. Taken together, these seven lizard species have been seen to eat a variety of fungi (mushrooms, boletes, truffles) but generally the fungi had not been identified even to genus. Earlier research had shown that some lizards had been shown to be capable of identifying plant food chemicals. The authors of the above-mentioned paper therefore suggested that lizards could be significant spore dispersers in areas where few mycophagous mammals...

Moths as leaf-litter converters

For CSIRO entomologist, Dr Marianne Horak, winning the prestigious John Obadiah Westwood Medal is the result of a lifetime studying Australia's moths. Dr Horak is the only scientist in the country who is a lepidoptera (moths and butterflies) taxonomist. Her unique reference guide, "Olethreutine Moths of Australia", describes 350 of Australia's estimated 20,000 moths. Dr Horak explains in this podcast how the role of moths as biological controls for Australian horticulture is well known, but their value in preventing bushfires is not widely recognised.

Dr Marianne Horak: Yes, and especially in Australia there is an aspect which most Australians still don't know, and is not known sufficiently; it's that one large group of moths in Australia, 5000 species, their caterpillars largely feed on eucalypt and other myrtaceous leaf litter. *They recycle the nutrients and they are very threatened by controlled burning in winter, which means the leaf litter builds up even quicker after that.*

NC: So that could lead to more bushfires?

Dr H: Quite definitely. The controlled burning not only selects for fire resistant plants but by destroying those animals that break down the leaf litter, the leaf litter will build up more and quicker.

Ted Edwards, and Entomologist, wrote similarly of the effect of fire on forest litter decomposing insects in the ACT National Parks Association Bulletin in 2009 in which he states;

‘...Control without fire

Biological agents are able to control litter without fire [italics added, Ed.]. There are numerous sites which may be cited, without fire for 50 years, which have no excessive litter build up. Unfortunately some studies of litter build up after fire have had no adequate controls where a genuinely unburnt treatment was part of the experiment. Most have had an “unburnt” treatment which has had less than a decade to recover and no cognizance was taken of the possible proximity of refugia. There have been no adequate studies on the effect of control burning on biodiversity. Such studies as have been done selected one or two groups to study and ignored the vast remainder of species affected. Often these groups were chosen inadvisedly: for example, ants were chosen because they were ubiquitous, common and comparatively easily identified. But ants are only one family, have a fairly standard biology, nest in protected places and are largely carnivorous or nectar feeders and can switch between numerous food sources. Biodiversity studies are notoriously difficult. As a retired Lepidoptera taxonomist (and there is only one full time working Lepidoptera taxonomist in Australia), I know that no even vaguely complete inventory of moths for any site has ever been attempted in Australia and Australia’s Oecophoridae moths are probably a major contributor to dry leaf litter breakdown. Attenborough says with some justification (Life in the Undergrowth) that if a virus wiped out all vertebrates the natural plant communities as we know them would hardly change but if the invertebrates were wiped out the world would change dramatically. Yet vertebrates are studied to exhaustion and invertebrates ignored...’

From CSIRO Ecos Magazine 1999 and article by Anna van Dugteren and Robin Taylor;

The chronicles of a great recycler

ALMOST 50 years after unfolding the story of the bogong moth, Dr Ian Common has completed the final volume of what some might call his magnum opus: The Oecophorine Genera of Australia. The three-volume set of mono- graphs presents all that is known about the sub-family Oecophoridae or mallee moths, and is rapidly becoming known as the ‘bible’ on this extraordinary insect group. For Common, it represents a lifetime of discovery. There is the species he first caught as a child, the species he worked on while at university and then as a junior entomologist in Queensland, the species he trapped on Black Mountain behind CSIRO and around Canberra, and the many new species he captured on insect-collecting trips across Australia. More than 5000 species, or some 20% of the continent’s moth fauna, are mallee moths, making it by far the largest moth group in Australia. An estimated 3500 species are represented in the Australian National Insect Collection (ANIC), many of them undescribed. The whole of Europe, by comparison, has just over 100 species. Common believes the great diversity of Australia’s mallee moths is a product of their unique taste for myrtaceous species, in particular the eucalypts. The evolution and

speciation of the eucalypts after the Australian continent split from Gondwana opened a window of opportunity for the parallel evolution of mallee moths,' he says. 'Mature and dead eucalypt leaves are tough and leathery, have low nutritive value and are rich in phenolic compounds, including tannins, which makes them unpalatable to many organisms. Here was a developing food source that wasn't seriously exploited by other insects.' Through his research at CSIRO Entomology, Common discovered that mallee moths larvae could digest mature and dead eucalypt leaves. He and his colleague Dr Marianne Horak have since found that some mallee moths species even consume the faeces of animals that dine on eucalypt leaves, such as koalas and possums. The findings have helped to explain the amazing proliferation of mallee moths alongside eucalypts in many different habitats, from high-rainfall areas of northern Queensland to arid inland locations and temperate, sub-alpine and alpine environments. While the mallee moths depend on eucalypts, ecologists are now realising that eucalypts in turn depend on the moth to break down leaves and recycle nutrients back into Australia's poor soils. But Common believes the moths' crucial role in nutrient recycling is under threat from controlled burning practices which circumvent this natural breakdown by releasing nitrogen to the atmosphere. He points to the controlled burning of Jarrah forests of south-western Western Australia. 'Way back in the early days of insect collecting, the Jarrah forests were rich in mallee moths,' he says. 'In more recent years when I have collected insects in these forests I have had an extremely small yield as the leaf litter and the mallee moths have been depleted.'

Mallee moths usually lay their eggs in narrow crevices or between living or dead leaves, often in large groups or masses. This helps to protect the eggs and larvae from temperature extremes and predators. Some species construct portable cases from leaf fragments, enabling them to move to the most favourable leaves for food.

Some species of mallee moths feed in the droppings of native animals such as koalas and possums which contain organic materials derived from eucalypt leaves. The caterpillars of most of these species complete their development in a single dung pellet in which they spin their cocoons, later emerging as adult moths. One of the koala scat feeding species was named in honour of Australia's chief scientist, Dr John Stocker, as *Telanepsia stockeri*.

From

www.uoguelph.ca/~gbarron/MISC2003/feb03 (link is external)

Effects of Logging on Fire Regimes in Moist Forests

Monday, September 8, 2014

Does logging affect the fire proneness of forests? This question often arises after major wildfires, but data suggest that answers differ substantially among different types of forest.

Logging can alter key attributes of forests by changing microclimates, stand structure and species composition, fuel characteristics, the prevalence of ignition points, and patterns of landscape cover. These changes may make some kinds of forests more prone to increased probability of ignition and increased fire severity.

Such forests include tropical rainforests where fire was previously extremely rare or absent and other moist forests where natural fire regimes tend toward low frequency, stand replacing events. Relationships between logging and fire regimes are contingent on forest practices, the kind of forest under consideration, and the natural fire regime characteristic of that forest. Such relationships will influence both the threat of fire to human life and infrastructure and biodiversity conservation. We therefore argue that conservation scientists must engage in debates about fire and logging to provide an environmental context to guide considered actions.

Read the paper (PDF) [here](#)

[Logging can 'greatly increase' fire severity for 50 years, researchers say](#)

Monday, August 4, 2014

Originally published at:

<http://www.abc.net.au/news/2014-08-04/logging-greatly-increases-fire-risk-black-saturday-study/5646220> (link is external)

Logging practices can "greatly increase the severity of fires" in extreme weather conditions such as Black Saturday, Australian researchers have said

[Fire regimes in Australia](#)

Saturday, October 16, 2010

[This paper \(PDF\)](#) by Mooney et al from 2010 shows that since the arrival of Europeans there has been a massive increase in fire. It also shows that since the arrival of Aborigines 40,000 – 70,000 years ago, there was very little increase in the charcoal record compared to pre-Aboriginal times.

It is fairly clear evidence that adds to the ***increasing proof that Aborigines did NOT burn every part of Australia on a regular basis as Gammage and the other burning advocates claim.***

Scientists say: “Beware of simplistic conclusions about the fires”

A group of scientists from across Australia – with vast experience in research in fire ecology, wildlife ecology, biodiversity, forest ecology, and conservation biology – cautions against the knee-jerk reactions of blame, recrimination, and simplistic ‘solutions’.

Speaking for the group, Professor Rob Whelan (Dean of Science at Wollongong University) expressed deep concern at the misleading and inaccurate statements about the current fires.

“National parks are not the reason for these fires. More extreme hazard-reduction in forests will not guarantee protection from fires in severe conditions, but will threaten biodiversity.”

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Hollow tree collapse

Thursday, March 5, 2015

Once the landscape was well endowed with mature large trees and the wildlife that evolved to make use of these trees were numerous. Now they are extremely rare and becoming more threatened with every burn, with every logging operation and a government fearful that a falling tree could mean litigation.

We all know that rare wildlife regard old hollow-bearing trees as very sought after real estate. Old trees with hollows can be from 200-800 years old. They should make up a majority of the age class in forests and woodlands. The largest impact on these trees for minimal human time and effort are the government approved controlled bushfires. These are lit annually to supposedly mitigate real bushfires. The older trees that collapse can be in the hundreds per burn. These papers (PDF below) explain the grim situation for hollow trees and how we are carelessly destroying these critical structures of a forest ecosystem.

[Collapse rates of hollow-bearing trees following low intensity prescription burns](#)

Lyrebird - forests gardeners

Wednesday, March 4, 2015

Lyrebirds are but one aspect of our forests' natural army of 'fuel reducers'.

Bandicoots, Potoroos, and other small diggers, hoppers and scratchers are all extremely important in turning over the forest's compost daily. Add to this work force the insects and their larvae, termites and fungi that are constantly devouring leaves, twigs and even logs.

Sadly these effective and efficient natural fuel reducers are killed off, displaced or lose their cover and are eaten by foxes and cats every time the government land managers perform their burns; many are over hundreds and sometimes thousands of hectares of forest per burn.

To those with an ecological understanding these burns are destructive and counterproductive. To the government it's a way to give the public a false sense of security while performing massive eco-cide in our forests. It's overdue that this practice be reviewed.

Read The Age article ["Not just a pretty tail: The lyrebird is a superb firefighter". \(link is external\)](#)

Increased logging dressed up as 'bushfire mitigation'?

Monday, January 5, 2015

This is something to watch. In a [Productivity Commission draft report \(link is external\)](#) cited in early January 2015, the suggestion was that more needs to be spent on bushfire mitigation exercises (to save on disaster relief and recovery). Sounds reasonable? But this suggested \$200M mixed with the lobbying influence of the Australian Forest products Association (AFPA), and Abbott's anti-environment doctrine, this could well translate into giving money to states that will 'thin' native forests and National Parks, supposedly to reduce fire threat and then use the thinnings to fuel electricity furnaces.

The draft report recommended *"The Australian Government should use some of the imputed 'savings' from reductions in relief and recovery funding to increase funding for*

mitigation... The Commission recommends that Australian Government funding for mitigation be increased to \$200 million per year over a transition period."

Besides future disaster payments being cut to repair their budget, some of these funds might end up subsidising the logging of previously out of bounds forests.

AFPA has been pushing this convenient 'solution' to their overlogging and a scarcity of logs for years. With a wink and a nudge, it seems to have been accepted by the Coalition with \$15M set aside for this general purpose. It was part of their election platform and has since been [reconfirmed by Colbeck \(link is external\)](#).

The government has always been vague about what exactly it would be used for, but Colbeck's media statement shows the likelihood of dressing up an industry subsidy as bushfire mitigation.

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Monday, September 8, 2014

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Logging can alter key attributes of forests by changing microclimates, stand structure and species composition, fuel characteristics, the prevalence of ignition points, and patterns of landscape cover. These changes may make some kinds of forests more prone to increased probability of ignition and increased fire severity.

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Read the paper (PDF) [here](#)

[Landmark study - clearfell logging makes bushfires deadly](#)

Wednesday, August 6, 2014

A two-year landmark study of the deadly Black Saturday fires that killed 159 people shows conclusively that the intensity was significantly increased by clear-fell logging of forests.

The study is dynamite and is published in [Conservation Letters. \(link is external\)](#)

Scientists from Melbourne University and the ANU (Professor David Lindenmayer, Dr Chris Taylor and Dr Michael McCarthy) say the study showed conclusively that the thick flammable logging regrowth made the deadly blaze much more extreme.

They also warn that increased fire danger lasts for up to 70 years after logging, with the intensity threat peaking between 10 and 50 years.

This added severity is sufficient to kill people and add significantly to property and forest damage.

Regrowth forests have more trees growing close together and contain large amounts of flash fuels that makes fire burn more fiercely, the study found.

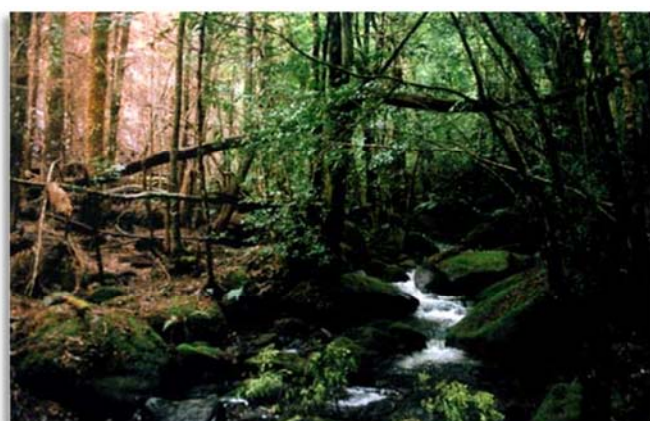
Old-growth forests usually have wet rainforest understorey canopies, which are less flammable than the drier understorey of regrowth forests.

In the past 50 years, more than 47,000 ha of wet forest have been logged with 17,600 ha to be logged in the next five years.

Influences of the Victorian fires of February 2009

Wednesday, October 23, 2013

This Report analyses the driving influences of the February 7 fires and looks at how the fires passed through and affected different areas of land including plantations, regrowth from logging and National Parks. The summary of the implications of the report is below and you can Download the full report [here](#) (PDF 6.2MB). This report was commissioned by combined environment groups.



Extent of fire limited by Cool Temperate Rainforest Community in the Upper Royston Valley. Chris Taylor August 2009.

Report conclusions

- Most fires started on private land
- The area burnt across Victoria comprised state forests (43 per cent), timber plantations (5 per cent), private land (29 per cent) and National Parks (23 per cent).

- Fires that started on private or leased land on 7 February were uncontrollable by the time they arrived at the boundaries of National Parks (e.g. Kinglake and Yarra Ranges).
- Fires that started within parks and protected areas (e.g. Wilson's Promontory and Mt Riddell in Yarra Ranges National Park) were mostly contained within National Parks; the exception being the fire in the Bunyip State Park
- The condition of vegetation plays a significant role in the intensity and spread of fire (i.e. there is evidence fire spreads more readily in modified and disturbed vegetation)
- Climate change is likely to be having a significant influence on droughts, maximum temperatures, the low moisture content of fuel, decreased humidity levels and an important contributing factor in the unprecedented maximum temperatures on 7 February 2009
- The number of high, very high, extreme and catastrophic fire danger days is predicted to increase under climate change
- The number of extreme fire danger days already exceeds those predicted to occur in 2050
- The probability of previous prescribed burns slowing a head fire significantly decreases with increasing FFDI
- On 7 February many areas of forest that had been treated with prescribed burns were still severely burnt because of the extreme conditions

It was recommended that the Royal Commission, fire management agencies and the community consider the above aspects of land management for fire risk, and the implications for the appropriate and effective use in mitigating bushfire risk. Reliance on any one method of fire management and/or focusing on one land tenure type could increase risk, particularly given the observations and predictions being made with the increasing intensity and frequency of fire danger days under climate change scenarios.

There's an urge to fuel reduction burn, but not to learn

Wednesday, August 27, 2014

Originally published at:

<http://www.weeklytimesnow.com.au/news/opinion/theres-an-urge-to-fuel-reduction-burn-but-not-to-learn/story-fnkerdb0-1227037499666?sv=ef2852e78dbcca4bdc48e59f32684fe4> (link is external)

FOR three years the Victorian Bushfires Royal Commission's independent monitor Neil Comrie has strongly advised the Victorian Government to abandon one of the commission's recommendations: the call to burn 390,000ha of public land annually for fuel reduction.

Yet Environment Minister Ryan Smith is sticking to that target and, even more puzzling, DEPI plans to increase that annual target to an extraordinary 450,000ha.

Former police chief commissioner Comrie understands the importance of fuel reduction, but he sees the target as unachievable, and that it compromises a strategic burn program.

He says it “will not necessarily reduce the bushfire risk to life and property, and may have adverse environmental outcomes”. That’s an expensive lose-lose situation.

Minister Smith says he is listening to the latest science, but is he?

Five leading fire behaviour scientists in Australia, Canada and the US have demonstrated that managing the ignition point of a fire through increased capacity for rapid attack, and by closing public access to remote areas during high fire danger days, was more effective in reducing the extent of fire than fuel management.

And other published papers, from leading Australian fire scientists and ecologists, convincingly show that fuel reduction burns are most effective when performed close to the assets they are meant to protect. This is the sort of strategic effort — small, difficult and expensive local burns — that Neil Comrie says is less likely to happen when managers are struggling to sign off on a large area target.

Many studies show that we now have very little long-unburnt bush left in Victoria, even in remote areas such as the Mallee, and that the impacts on native wildlife are serious and growing.

One of the best ways to survive a severe bushfire is to have your own well-designed bunker at your home. That crucial fact never made it to the commission’s final recommendations.

We need to develop a more comprehensive strategy for bushfire management and direct more attention to the whole range of available tools, including building a serious rapid attack capability, encouraging well-designed bunkers in existing homes, and developing a far more strategic burn program. Lives would be saved, and our great natural heritage would benefit.

Is the loss of Australian digging mammals contributing to deterioration in ecosystem function?

Monday, July 1, 2013

Australia’s once common digging mammals that played an important role in ecosystem function, have been largely lost from our landscape. Around half of digging mammal species are now extinct or under conservation threat, and those that still exist have very contracted ranges.

Bioturbation (digging and scratching) significantly alters soil processes, altering the chemical and structural properties, allowing water infiltration, decreasing surface run-off/erosion, increases soil moisture and captures seed thereby increasing germination. These are just some of the ways small mammals – victims of feral predators and large scale government burns. [This paper](#) (PDF) has researched the vital role of mammals, which have now largely disappeared.

Government burns outdo bushfires

Wednesday, June 19, 2013

DEPI burn

The bushfires of 2012-13 in Victoria covered around 130,000 ha. The government proudly announced they burnt 250,000 ha of forest in Autumn 2013. As well they have pumped about 18.3 million tonnes of CO₂ into the atmosphere.

So what does this mean?

Besides this being one massive unscientific experiment based on politicians trying to placate nervous electorates, rather than effective asset protection, it has also:

- Added around 18.3 million tonnes of carbon dioxide to the atmosphere. About 20 tonnes a hectare of stored carbon is estimated to be lost during burns ($\times 3.67 = \text{CO}_2$ created).*
- Taken out healthy functioning ground soils' duff and compost layers which keeps the soil damp and cool – and fire resistant.
- Burnt the fungi that are so important for 'digesting' leaves, twigs and even logs.
- Wiped out ground habitat for micro-organisms that small birds, lizards and frogs feed on, the very basis of a forest's food chain.
- Incinerated large areas of cover for the ground dwelling wildlife exposing them to predation, exposure and starvation.
- Ignorantly destroyed the habitat of many rare and threatened plants and animals as there are no surveys done before igniting large patches of forest.
- Burnt out and destroyed thousands of highly valuable hollow bearing trees, critical for so much rare wildlife.
- Exposed delicate soils to rain wash and erosion.

**This CO₂ figure is more than agriculture's but just under the transport sector's annual figures (2007) and around what Victoria's dirtiest power station, Hazelwood pumps out every year!*

Kevin Tolhurst Bushfire Modelling

Saturday, October 30, 2010

Plans to burn the state's public land at a rate of 5% a year is the biggest and most risky experiment ever carried out on our environment. Already it is destroying huge swathes of the Mallee and threatening its already fragile ecosystem and species.

The VNPA and the Royal Society in late 2011 hosted a seminar to look at what this might mean. The summary of findings and presentations are [here \(PDF\)](#).

Attended by 120 scientists, land managers and other interested people, the symposium looked at many aspects of this new policy and what we still don't know about the impacts of inappropriate fire regimes.

It was fairly clear that the 5% target was not something recommended by the expert scientific advisory panel of the Bushfire Royal Commission. It seemed to be more of a political recommendation to appease certain sectors of the community. This decision could only add to the loss of species and habitat which is already struggling with climate change, developments, logging and so on. The other devastating part of this is that there is no evidence these planned burns do anything to prevent large bushfires. In fact their broadscale application could be counter-productive.

Fire regimes in Australia

Saturday, October 16, 2010

[This paper \(PDF\)](#) by Mooney et al from 2010 shows that since the arrival of Europeans there has been a massive increase in fire. It also shows that since the arrival of Aborigines 40,000 – 70,000 years ago, there was very little increase in the charcoal record compared to pre-Aboriginal times.

It is fairly clear evidence that adds to the increasing proof that Aborigines did NOT burn every part of Australia on a regular basis as Gammage and the other burning advocates claim.

Fire science vs political science

Tuesday, September 9, 2008

Science is clearly not a part of the Brumby government's justification to triple burns across the state to almost 400,000 ha, or 1/20th of public land a year.

Despite the ENRC inquiry quoting scientific papers, Jenny Barnett from the VNPA, discovered that these papers didn't back up calls for increased burning at all. They in fact cite computer simulations from the US and Tasmania's Button-grass Plains. They also misquote fire scientists to suit their own agenda.

An article by Dr Michael Clarke from Latrobe University in Wildlife Research (Vol. 35 Issue 5) says that plant survival does not mean animals also survive. Increased predation and loss of food and shelter could make animals locally extinct. He also suggests that land managers should never assume that burning an over abundant older age class will create a younger age class. Climatic effects can impact on regeneration causing a gap in age class.

Dr Clarke agrees that there needs to be research beyond just plants, to include fungi, invertebrates, reptiles, amphibians, birds and mammals. Managing the forest without this information is like farming without knowledge of the soil or weather.

VNPA's Parkwatch Sept '08/Jill

Victoria, the charcoal state

Thursday, September 11, 2008

Blindly supporting blind burning

Here's another example of the government being at odds with itself. Two recent reports contradicted each other. In early December, at the same time the Environment Commissioner, Dr Ian McPhail, released his damning State of the Environment report for Victoria, the Brumby Government supported the other bushfire report and a trebling of burns across our forests.

The State Government now spends \$100 million on fire fighting, up from \$30 million in 1999. Little of this goes to ecologists and biologists, but there's no shortage of funds for spin doctors to abuse the term "ecological burns" in their propaganda.

Brumby will now spend another \$10 million so DSE can *"work with the community to develop and implement large scale, planned burning"*. Hey - hang on - didn't they hear? Not all communities or landholders want these burns.

The Environment and Natural Resources Committee (ENRC) was co-chaired by East Gippsland's Craig Ingram and started in March 07. John Pandazopoulos and Craig Ingram were in charge of the committee.

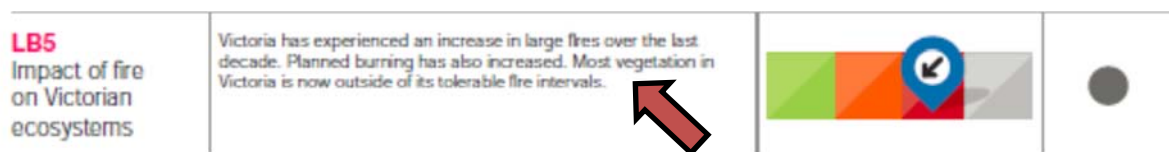
Despite many submissions highlighting the negative impacts of large scale burns, the report chose to cite *"several submissions (that) acknowledged that burning is a powerful tool"*.

Environment Minister, Gavin Jennings has asked DSE to *"develop a plan to continue the expansion of large scale, mosaic burns and monitor their effectiveness"*. What?! - they still don't know how effective they are?

Although he also said *"There is a need to begin to move away from hectare-based targets and start thinking about reduction of fuel loads across the board, understanding community sensitivity to planned burning and better mirroring nature through the effective use of fire as a land management tool."* Well for starters, nature never burnt 1/20th of the bush every year.

With climate change making summers more extreme, and previous burns proving useless in these extreme conditions - the one thing that can be guaranteed if the blitz-burn plan is adopted is that certain forest types will be changed to tinder-box dry ecosystems.

The highlighted box in Chapter 2 of the report's Executive Summary pretty well sums up the redneck element within this enquiry. To paraphrase it - "if anyone is opposed to torching the bush more often, then they need to change their attitude and unite with us lot. It's really good for the environment you know."



From the Victorian State of the Environment Report 2013

[State of the Environment report - on burning](#)

Thursday, June 7, 2007

These comments from the State of the Environment (SoE) report 2008 -

Inappropriate fire regimes (too much or too little fire) threaten the persistence and condition of some species and ecosystems.

Uncertainty exists over optimal levels of planned burning in Victoria for ecological benefits and protection from wildfire.

Human sources of ignition account for at least 70% of fires on public land in Victoria.

The following states pretty clearly that the fire managers still have little clue as to the ecological impacts of their burning plans.

<http://www.smh.com.au/news/opinion/the-dangers-of-fighting-fire-with-fire/2008/09/07/>
(link is external)

"Much prescribed burning is to create a false sense of security rather than to reduce fire risks, and the effect on wildlife is virtually unknown."

"With all due respect, I do not think " this was the biggest bushfire in 100 years ? I think it's the biggest back-burn in living memory"

Quote from Charles Slade, Channel Nine reporter in the Federal enquiry into the 2003 fires. 28.7.03

"40-60% of the '03 and '06 wildfires were due to backburns carried out by the DSE".
Protected source.

State bushfire report knocks fire furrphies on head

Thursday, January 1, 2004

The release of the findings of the Victorian Bushfire Inquiry on 14 October should have put an end to the unsophisticated, self-interested and blame-apportioning comments that followed the 2002-3 fires. It is refreshing indeed to have the old furrphies of fuel reduction, grazing, tracks and Aboriginal burning knocked on the head as 'solutions' to fire. In particular, the report says:

"It is important to note that prescribed burning will not prevent bushfires;

That, according to available scientific evidence, a decision regarding cattle grazing in the High Country should not be based on the argument that 'grazing reduces blazing';

It is easy to say that there should be more or fewer tracks, but not easy to provide an

adequate justification for any change;

That we do not know enough about traditional burning in southern Australia to be able to re-create an Aboriginal burning regime'.

The inquiry found that firefighting efforts were laudatory, that some improvements could be made in communication and coordination, but that fires will always be with us. Coincidentally, release of the report corresponds with celebrations to mark 200 years of settlement in Victoria. It seems we are finally making some progress in living in and with our challenging environment, rather than endlessly confronting it, as the first settlers did and as many seem to want to do in the present day.

The report highlights the need for a strategic and thoughtful approach to fire and our environment. Sadly, such an approach seemed to deem the 334-page report almost unnewsworthy in the eyes of the media. This is in stark contrast to the acres of print and hours of 'news' devoted to hysterical stories and accusations about the fires over the last ten months.

Michael Fendley VNPA

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ⁱⁱ Zylstra, Philip J. (2011). Rethinking the fuel-fire relationship. IN Proceedings of Bushfire CRC and AFAC 2011 Conference Science Day, 87-99. Gibbon, Philip, van Bommeli, Linda, Gill, Malcolm, Cary, Geoffrey J. Driscoll, Don A., Bradstock, Ross A.,

ⁱⁱⁱ Knights, Emma, Moritz, Max A., Stephens, Scott L., Lindenmayer, David B. (2012). Land management practices associated with house loss in wildfires PLoS ONE | www.plosone.org 4 January 2012 | Volume 7 | Issue 1.

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[http://www.eastgippsland.net.au/news/how-forests-carry-out-their-own-fire-suppression-management,](http://www.eastgippsland.net.au/news/how-forests-carry-out-their-own-fire-suppression-management)
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http://www.eastgippsland.net.au/files/documents/Digging_mammals_paper_Fleming_et_al_2013.pdf

^{vi} Parr, Catherine I. and Anderson, Alan N. (2009). Patch mosaic burning for biodiversity conservation: a critique of the pyrodiversity paradigm. *Conservation Biology* Volume 20, No. 6, 1610-1619.

^{vii} http://en.wikipedia.org/wiki/Ecology_of_Banksia#Response_to_fire

^{viii} http://www.depi.vic.gov.au/_data/assets/pdf_file/0019/251515/201207-FFG-processes-list.pdf

^{ix} Clarke, Michael F. (2008). Catering for the needs of fauna in fire management: science or just wishful thinking? *Wildlife Research*, 35, 385–394.

^x York, A. (1999.) Long-term effects of repeated prescribed burning on forest invertebrates: management implications for the conservation of biodiversity. IN *Australia's Biodiversity - Responses to Fire. Plants, Birds and Invertebrates*. Biodiversity Technical Paper, No. 1, 181-266. Department of the Environment and Heritage. Canberra.

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^{xii} <http://candobetter.net/node/4240> Did Aboriginal people burn the bush as we are told?

^{xiii} <http://www.eastgippsland.net.au/news/bill-gammage-and-the-white-fella-myth-of-aboriginal-burning>

^{xiv} Mooney, S.D., *et al.* (2012). Late Quaternary fire regimes of Australasia, *Quaternary Science Reviews* Volume 30, Issues 1-2, 28-46.

^{xv} Proceedings of Bushfire CRC & AFAC 2011 Conference Science Day

1 September, 2011, Sydney Convention Centre, Darling Harbour

^{xvi} <http://www.abc.net.au/news/2014-08-04/logging-greatly-increases-fire-risk-black-saturday-study/5646220>,
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