

## Royal Commission into National Natural Disaster Arrangements 2020

The Australian Forests and Climate Alliance (AFCA)<sup>i</sup> welcomes the opportunity to provide information, analysis of information, recommendations as well as warnings to the Commission in relation to the Letters Patent under parts a) b) and c) these being:

- a) the **responsibilities** of, and coordination between, the Commonwealth and State, Territory and local Governments **relating to preparedness for, response to, resilience to, and recovery from, natural disasters, and what should be done to improve these arrangements**, including with respect to resource sharing
- b) **Australia's arrangements for improving resilience and adapting to changing climatic conditions, what actions should be taken to mitigate the impacts of natural disasters**, and whether accountability for natural disaster risk management, preparedness, resilience and recovery should be enhanced, including through a nationally consistent accountability and reporting framework and national standards
- c) whether changes are needed to **Australia's legal framework for the involvement of the Commonwealth in responding to national emergencies**, including in relation to the following: **ii) whether the Commonwealth Government should have the power to declare a state of national emergency**

In relation to a) and b) we will address:

- improving resilience and adapting to changing climatic conditions
- acting to mitigate impact of changing climatic conditions and,
- preparing for.
- responding to
- and recovering from natural disasters,

with specific reference to bushfires.

In relation to c) we think the Federal Government should declare a National State of Emergency in relation to climate change and that it should act on this as a matter of urgency so that there is a nation-wide uniform response to the greatest risk we face.

*AFCA's input focuses on cause, prevention, preparation for, response to and recovery from bushfires (as detailed in 5 sections)*

**In Section 1 we provide evidence that the primary cause of increasing bushfire risk** is climate change induced global heating and drought and argue that it should be the cardinal point of reference by which strategies for prevention, response, mitigation for resilience and mechanisms for recovery are assessed. We demonstrate the significant role played by the industrial logging and clearing of forests as a secondary and inter-related cause, (exacerbating both climate change and forest flammability). **Please refer to Appendix 3: Studies relating to logging inducing fire risk**

We argue that to end native forest logging is to both immediately mitigate global heating and promote resilience of the landscape to fire risk.

**In Section 2 we address a perilous feedback loop threatening native forests subjected to intense industrial logging** under Regional Forest Agreements (RFAs), logging that has reduced canopies and forest age inducing flammability across millions of hectares. Logging thus contributes to bushfire incidence and severity, adds to global emissions and decreases sequestration which further

exacerbates climate heating further drying out and heating landscapes rendering them more fire prone. In the absence of restorative action our forests will be so degraded by logging (and burning) they could become emission sources. This raises the very important question: **How do we protect and restore our forests so that they can grow to maturity for maximum resilience and perform CDR most efficiently when some have already become highly flammable and with climate change are likely to remain flammable? That we must grow them to maturity is a scientifically**

In **Section 3** we recommend caution when assessing information likely to be provided to the Commission by industry groups with vested interests, particularly where these will advocate logging forests to reduce fuel load. We will examine the logging industry agenda to increase access to forested lands by promoting logging as a bushfire preventative, and provide scientific evidence for why hazard reduction logging and burning are not a panacea against bushfire.

We have studied **mechanical fuel load reduction (MFLR)**, for which trials have been underway since 2017 in three states, examining trial intentions and methods and comment on this.

In **Section 4** we address **the imperative to protect and restore native forests for Carbon Dioxide Removal (CDR)** which must accompany emission reduction if some ‘tipping’ points for irreversible climate change are to be avoided. We will explain what is now IPCC and IUCN policy, i.e. **‘Natural Solutions’** as our best tool for achieving sufficient CDR for survival to prevent increasing global heating. Natural Solutions involves **Proforestation**, the protection and restoration of primary and degraded forests as opposed to simple tree planting (Reforestation or Afforestation). We will explain why the **Federal government should adopt and promote IPCC endorsed ‘Natural Solutions’ as opposed to Bioenergy with Carbon Capture and Storage (B.E.C.C.S), i.e. substitution of wood for fossil fuels combustion to address climate change and bushfire risk.**

In **Section 5** we outline how the Federal government might go about implementing **Proforestation for protection and restoration of the native forest estate** to reduce forest flammability, increase carbon carrying capacity, promote resilience and recover what has been lost (not only in recent bushfires but through many decades of industrial logging).

**Below are our recommendations, based on the 5 sections of our submission that follow:**

**Recommendation 1:** Recognise climate change as a primary driver of bushfire risk and logging native forests a major contributing factor to both climate change and bushfire risk

**Recommendation 2:** The Commonwealth to develop new policies for an end to native forest logging and to the production, use and export of native forest biomass; and open negotiations with the States and Territories on implementing legislation

**Recommendation 3:** Declare and publicise a National State of Emergency in relation to climate change

**Recommendation 4:** The Commonwealth to negotiate with the States/Territories to repeal the Regional Forest Agreements and related State/Territory legislation and develop new programs for restoration of forest ecosystems

**Recommendation 5:** Propose “Natural Solutions” as the policy base for CO2 emissions reduction measures

**Recommendation 6:** In consultation with the State and Territory Governments establish a national campaign on native forest protection for addressing bushfire risk

**Recommendation 7:** Propose reestablishment of export controls on all native forest wood and wood products

**Recommendation 9:** Negotiate with the State and Territory governments to end subsidies supporting combustion and refinement of native forest biomass for energy and other bio-products.

**Recommendation 11:** Promote proforestation in both domestic and global forums

## Section 1

### 1: Primary drivers of increased frequency and intensity of bushfires

#### 1a) human induced climate change

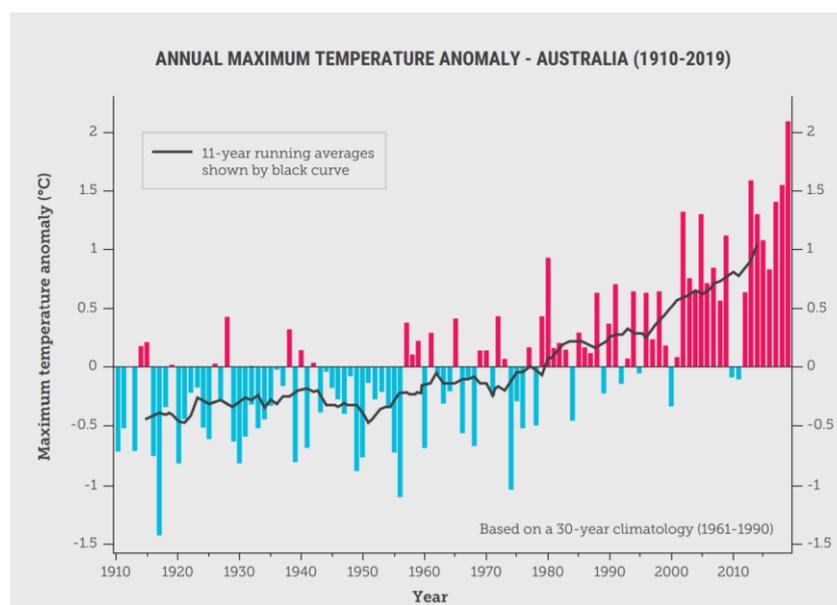
#### 1b) forest degradation from intensive industrial logging

Evidence pertaining to both 1a and 1b is increasing.

#### 1 a) Climate Change is now the primary driver of bushfire risk

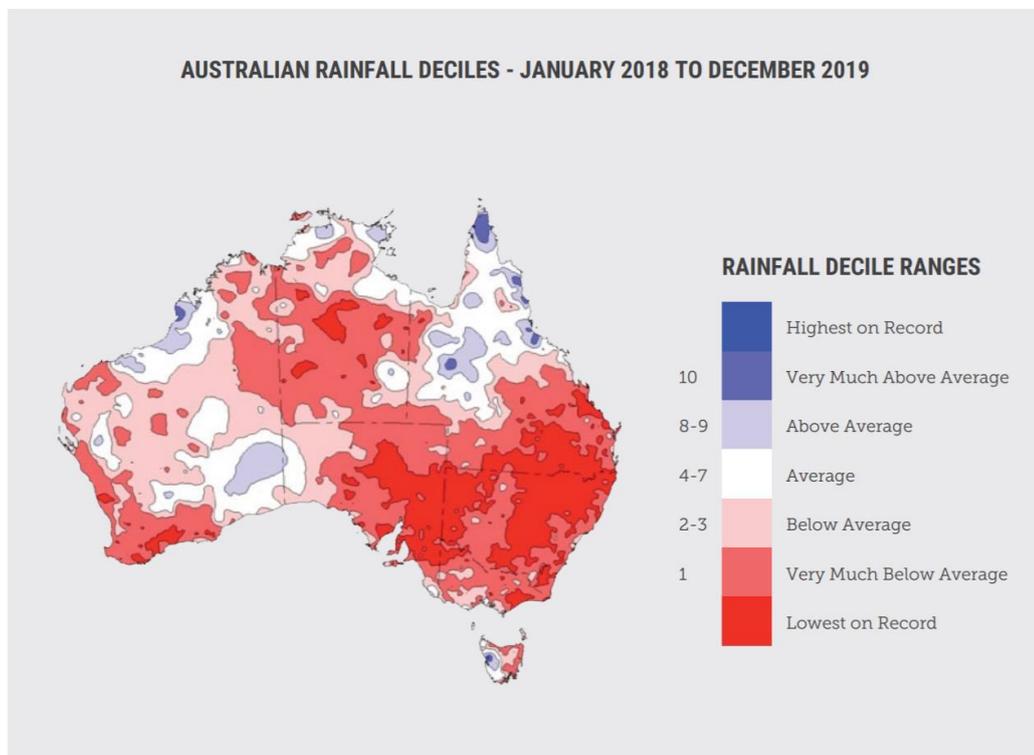
Decades of opportunity to address the climate change emergency have been squandered by the Federal and some state governments, which prolonged the climate change denial debate motivated by economic and political self-interest. Two facts stand out: temperatures are increasing and rainfall is decreasing, these trends were predicted years ago by climate change modelling.

**Heat:** 2019 was Australia’s hottest and driest year on record.



Annual maximum temperature anomaly Australia (1910 to 2019). Source: BoM (2020b)

**Reduced Rainfall:** Throughout 2019 Australia recorded rainfall 40 percent below average (BoM 2020a). In some parts of northern NSW and southern Queensland rainfall was 70-80% below average between January and October. This followed a long period of low rainfall across most of south-eastern Australia since 2017, leading to one of the worst droughts on record. The reduction of rainfall in south Eastern Australia had long been predicted as a likely climate change impact.



Australian rainfall deciles – 1 January 2018 to 31 December 2019. Source: BoM (2020c)

The 2018 State of the Climate Report<sup>ii</sup> reported on climate change as an existing driver of bushfire risk and predicted the escalation of risk in the absence of action to address climate change:

## 2018 State of the Climate Report

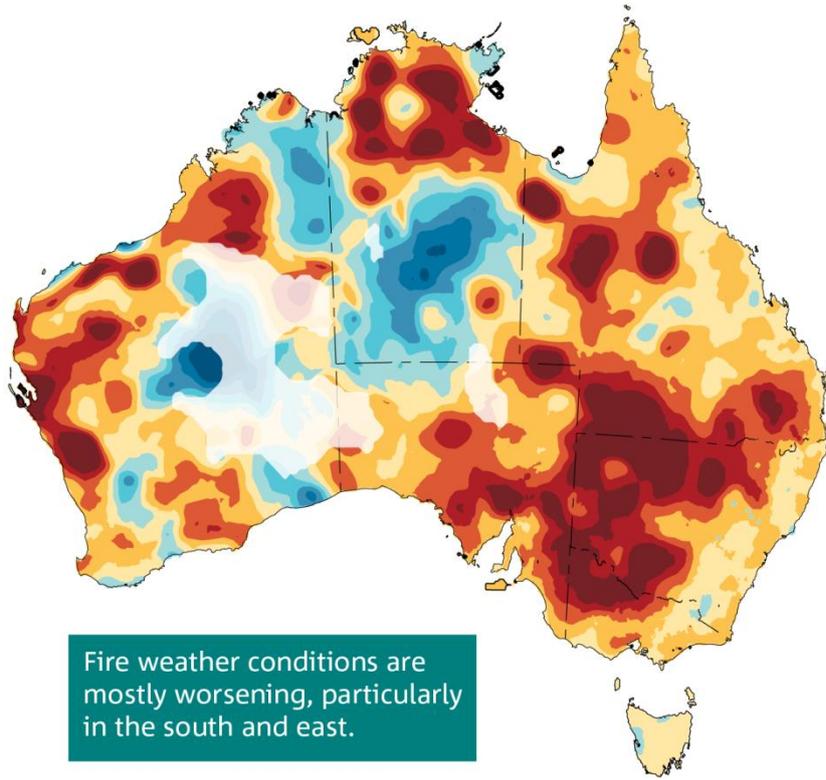
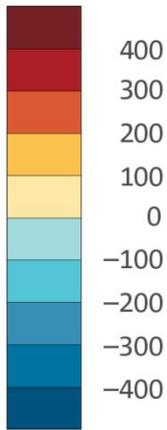
### Key points

Australia's climate has warmed by just over 1 °C since 1910, leading to an increase in the frequency of extreme heat events.

### Fire weather

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

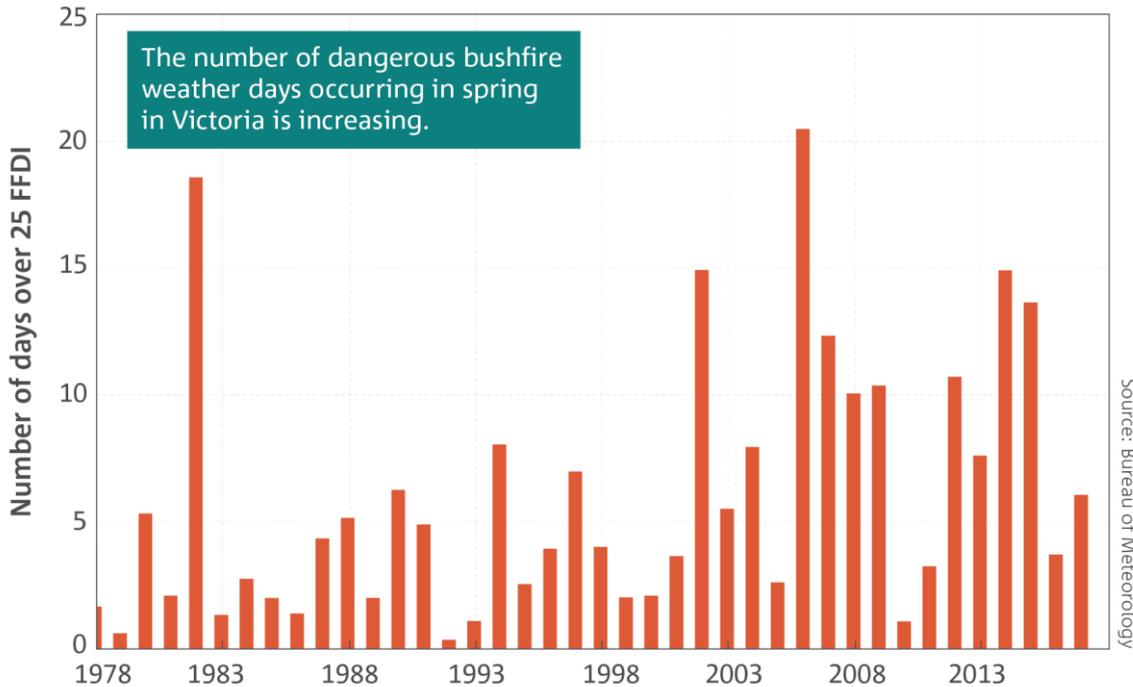
Forest Fire Danger Index points/decade



Fire weather conditions are mostly worsening, particularly in the south and east.

Source: Bureau of Meteorology

Trends from 1978 to 2017 in the annual (July to June) sum of the daily Forest Fire Danger Index—an indicator of the severity of fire weather conditions. Positive trends, shown in the yellow to red colours, are indicative of an increasing length and intensity of the fire weather season. A trend of 300 FFDI points per decade is equivalent to an average trend of 30 FFDI points per year. Areas where there is sparse data coverage such as central parts of Western Australia are faded.



The number of dangerous bushfire weather days occurring in spring in Victoria is increasing.

Source: Bureau of Meteorology

Area average of the number of days with FFDI greater than 25 (very high fire danger) in Victoria in spring for the years starting in July (1978–2017). Although there is considerable interannual variability in the index, there is also a clear trend in more recent decades towards a greater number of very high fire weather days in spring.

#### Key points

- There has been a long-term increase in extreme fire weather and in the length of the fire season across large parts of Australia since the 1950s.

**Compound Events:** The 2018 State of the Climate Report also made special mention of the likelihood of an increase in the incidence, magnitude and impact of compound events due to climate change. It specifically referred to the danger of the confluence of background warming and drying trends on fire frequency and risk and warned of the likelihood that this would also allow bushfires to generate thunderstorms leading to extremely dangerous fire conditions as observed in Canberra in 2003 and in the Black Saturday fires in Victoria in 2009. It also warned that these conditions would include the likely generation of even more fires from lightning strikes.

#### 1b) Forest degradation from intensive industrial logging

Evidence of the impact of intensive industrial logging on forest flammability has emerged since at least the last decade. From 2009 studies of the aftermath of the Black Saturday fires in Victoria demonstrated that fires were hotter and swifter across intensively logged regrowth forest stands than they were in intact areas, even stopping at the boundary of an unlogged national park. Some general observations follow: **Forests and moisture, regional micro-climate variations.** There is substantial, well documented evidence that forests are associated with higher localised rainfall, and reforestation can help prevent drought.

<https://www.abc.net.au/news/science/2018-09-15/trees-make-rain-ease-drought/10236572>

#### Industrial logging involves clear fell of vast swathes of native forests which regrow into small even aged regrowth stands perpetually harvested immaturely inducing forest flammability

The following short film clips show the manner in which native forests are now logged in Australia, i.e. clear fell and virtual clear fell, which destroys canopies drying out the landscape. These clips don't the resultant regrowth stands that are highly flammable; subsequent images do.

Victoria: <https://www.dropbox.com/s/2br49n4x20sdr/z/-JVH-ACTU%20VIC.mp4.url?dl=0>

NSW: [https://www.youtube.com/watch?v=ycFjeew1\\_Wk](https://www.youtube.com/watch?v=ycFjeew1_Wk)

Tasmania: <https://youtu.be/j9ufqnLCLA>

WA: [https://www.youtube.com/watch?v=IIsT\\_IHTyBw](https://www.youtube.com/watch?v=IIsT_IHTyBw)

#### Industrial Logging Silvicultural Practices in Victoria and NSW

##### Victoria:

Clearfelling, or 'seedtree' (leaving a small scattering of trees in a clearfelled forest) is the common logging practice used by the government's logging monopoly VicForests. The conversion of public forests from multi-aged or old growth into single aged and single species stands, suits the demand for uniform pulpwood logs for the woodchip market. However the danger with this management is that it is turning a natural fire-resistant landscape into a very volatile stand of pulpwood stems with close spacing and a crown of dense young oily leaves. It also opens up a forest to drying out

through wind and sun penetration. The images below show how intensely logging regrowth will burn in a bushfire. This was on New Year's eve 2019 on the eastern edge of the Errinundra National Park in East Gippsland. It shows an entire landscape with a long logging history. The nearby National Park was less severely impacted when fire burnt over the intact old growth.



In the damp old growth on the western side of the same National Park the fire hit on a hot dry NW wind but the impact was far less severe. This shows the stark contrast between an enclosed forest with multiple ages and understorey which creates a cooler microclimate. It also supports the myriad of natural fuel-reducing 'ecosystem managers' such as fungi, invertebrates, potoroos and bandicoots and the lyrebirds, known to be able to dig over and help decompose 20 tonne of ground litter per hectare per year. Where forests are subjected to unnatural fire regimes called 'fuel reduction' and industrial clearfell logging, the ability of the forest to maintain its natural fire resistance is removed.

In intact forests leaf litter is constantly turned over and decomposed into moisture holding humus.





Dense forests reduce wind speed and drying

Contrasted below is logging regrowth created from plantation management of forests, creates the perfect fuel and conditions for intense fires across large areas of forest.



## New South Wales

Management of South East Australian native forests by state forestry agencies, in NSW Forests Corporation NSW (FCNSW) and in Victoria (VicForests) has increased forest flammability in two ways.

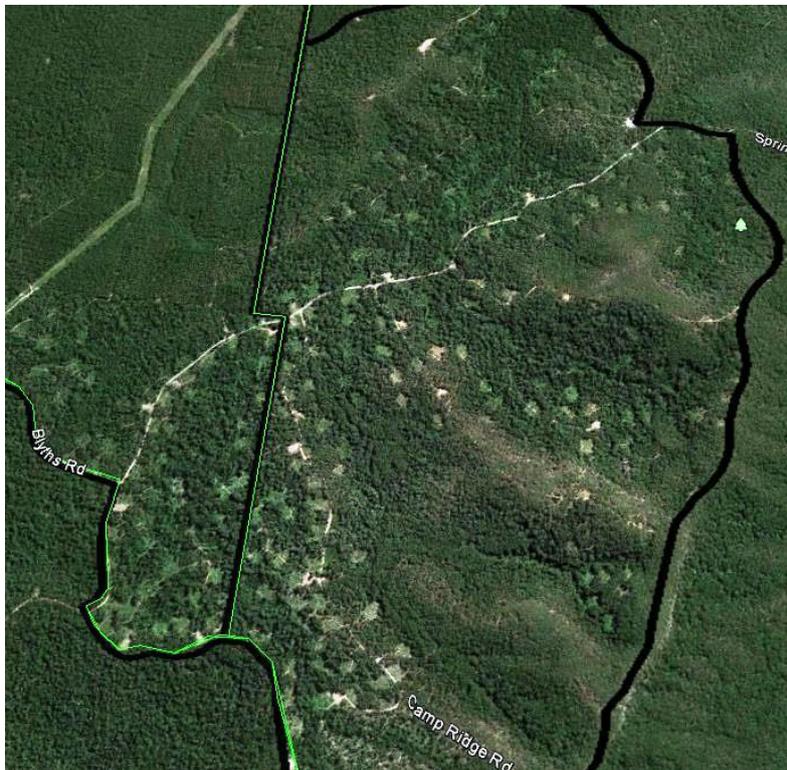
These forests, renowned for their carbon carrying capacity, in the past 20 years have had carbon carrying capacity drastically reduced. Representing some of the most significant carbon stores and sinks in the country, they have been logged in a manner that depletes both capabilities.<sup>iii</sup> Unlogged, the average tonne per ha of C stored is 640 tonnes. Some ecosystems exceed more than 1,600 tonne per ha. Millions of ha of this stored have been released to atmosphere by industrial logging. The result of the clear fell is immature stands of evenly aged flammable regrowth forests.

### **Silvicultural practices in the native forests of S.E. and N.E NSW since around 2003.**

On the South Coast throughout the first RFA (approx. 1998-2018) moist coastal eucalypt forests have been cleared felled according to a FCNSW silvicultural practice called Australian Group Selection (hereafter AGS), a method imported from the USA. On the South Coast this allowed clear felling across coupes in diameters of 250 metres. In northern NSW it was limited at first to 50 metre diameters.

### **Mid and North Coast NSW**

In Northern NSW the AGS clear fell experiment was abandoned after about 5 years when FCNSW admitted the clear fells were not regenerating. Google earth images show the 50 metre diameter clear fells from one of at least 20 forests subjected to this from around 2000 onward.



This is Queens Lake State Forest showing clear fell both from the air and on the ground.



Under pressure of unsustainable wood supply agreements with multinationals, (Nippon in the South, BORAL in the North, and to manipulate North East NSW forests into single species stands in order to supply predominantly Blackbutt regrowth preferred by BORAL, FCNSW simply 'overcut':

*NSW Auditor General's report, April 2009 "To meet wood supply commitments, the native forest managed by Forests NSW on the north coast is being cut faster than it is growing back."*

Community members were warning over a decade ago that the way the forests were being logged would produce highly flammable forests:

AGS was replaced in northern NSW by 'Single Tree Selection', a made up method whereby the tree to be kept is 'selected', not the mature tree that is to be logged. Blackbutt seed trees are left every 60-80 metres and all else is taken.

Here is visual evidence of the conversion of natural forests to 'stick forests', via Power Point presentations, film and images. The PPT illustrates how diverse moist eucalypt forests are deliberately logged to regrow into stands of even-aged young Blackbutt forests, for logging while immature to supply a 'pulp logs' market.

As the forests are cut to supply a high volume, low quality log market, the landscape becomes a vast pseudo plantation of immature trees – stick like stands that are highly flammable.







To view a detailed explanation of the impact of clear fell and intensive over-cutting, i.e. virtual clear fell, on native forest flammability go to

**<https://www.dropbox.com/s/d47qya80df5uusg/PPT%20CREATING%20FLAMMABLE%20FORESTS%20BY%20INDUSTRIAL%20LOGGING%20NSW.pptx?dl=0>**

On the South Coast this had been happening for decades where woodchip for paper dominated. On the North Coast logging for pulp is now also the norm, and will help BORAL enter the 'biofutures' market.

**Boral Timber turns by-products into value-added biofutures**

Boral Timber currently sources its products from 100 per cent sustainably managed forests certified by a third-party independent audit, with hardwood resources harvested under some of the most stringent environmental regulations in the world.

However, because of the nature of the hardwood timber business, where long rectangular boards are milled from round, and often not perfectly straight logs, a large proportion of timber logged can end up as some form of by-product. This, the company recognises, represents a unique opportunity to create a renewable, low-carbon energy source as well as a range of innovative value-added products.

To that end Boral Timber already uses a significant proportion of its residue by-products as biofuel. All three of our North Coast NSW finishing plants produce their own process heat on site, and at the Murwillumbah timber mill, chipped residue is used as boiler fuel for the cogeneration plant, providing electrical power to operate the plant.

Boral's timber residues are also sold to external electricity generators and large industrial users for the generation of process heat.

But we can do more, and Boral's timber operations are poised to take advantage of advances in technology to help turn more by-product materials into renewable, sustainable products.

This is known as "biofutures" which are created via a wide range of processes that have a biological source, including bioenergy, biofuels and biochemicals. The idea behind biofutures is to transform a low-valued biological by-product into value-added assets while benefiting the environment at the same time.

Keith Davidson, General Manager of Fibre Resources for Boral Timber, is a member of the team evaluating biofutures opportunities which could potentially create new revenue streams and reduce costs. "It's exciting that technologies are developing and governments are talking about stimulating industrial biotechnology," he said.

"We want to be part of the emerging biofutures industry, so we're exploring a range of opportunities to increase the use of residues. For example, we're looking at new, highly scalable electricity generating plants and working with our colleagues in the Construction Materials business to look at new additives in the formulation of asphalt for roads to improve the properties of bitumen. This is only the start of a continuing process to add value to our by-products," said Keith.

As of 2018, BORAL's intention to enter the 'bio-futures' market involves burning native forests to supply the energy for its Mid North Coast native forest biomass 'bio-diesel' plant (to power 15% of its national truck fleet), which includes processing native forest biomass for production of 'bio-bitumen' to supply its road-making division.

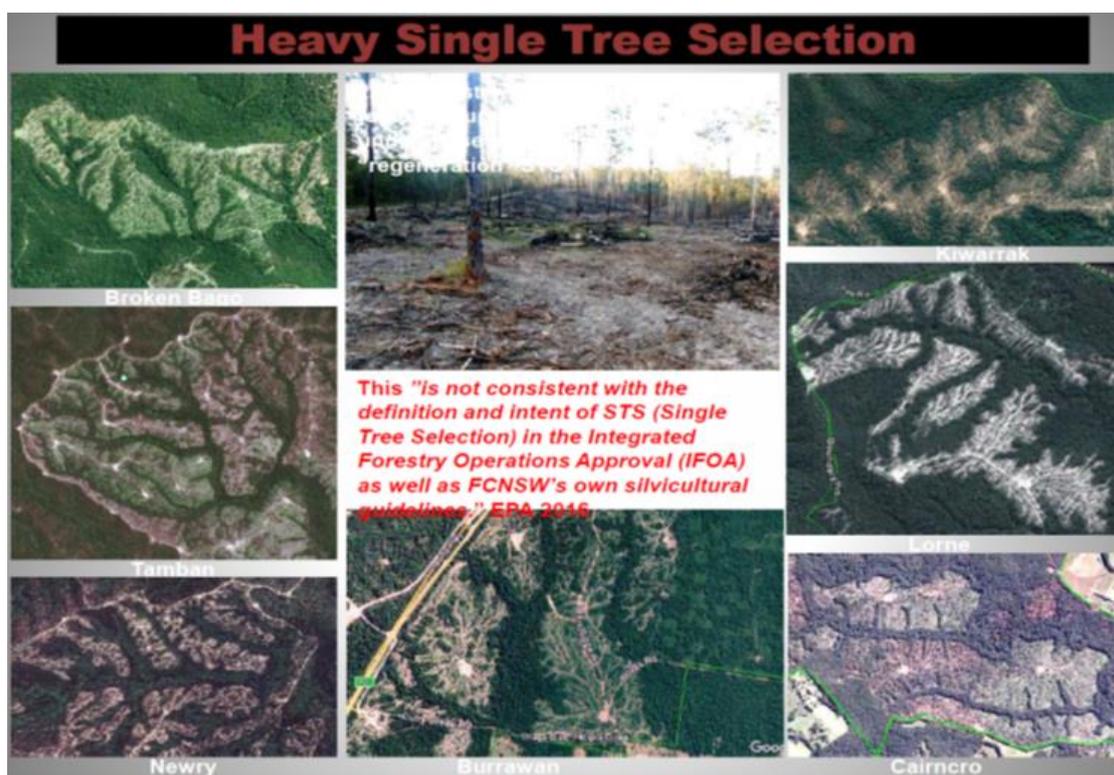
This is not restricted to residues from milling.

It includes the deliberate processing of entire native forest logs for this purpose.

In November 2017, the NSW Department of Primary Industries defined 'residue' as 'pulp' logs, and this definition of residue has also been included in the new NSW Regional Forest Agreements. Whole logs from NSW forests can now legitimately attract taxpayer subsidy as renewable energy.

'Heavy' single tree selection removes 80-90% of basal wood (trees) in any given compartment, regardless of biodiversity value, proximity to water courses or the desiccating effect on forest stands. In the centre of the illustration below is a quote from the NSW EPA which reads: "This is not consistent with the definition and intent of STS (Single Tree Selection) in the Integrated Forestry Operations Approval nor with FCNSW's own silvicultural guidelines." (2016). STS breaches forestry approval and guidelines but it is continuing across NSW.

### The result of 'Single tree selection' from the air on various native forests



**Intensive logging opens up mature canopies and exposes understoreys and undergrowth to desiccation by sun and wind. RFA industrial logging makes forests flammable.**

#### ***Citizen report, South Coast NSW, 27<sup>th</sup> April 2020***

"There's a chip mill in Eden, in my shire. When they wanted to 'log' (it's really more 'chip') the forests next to my home I met with company people and asked them to explain what timber they'd take and what would be left. They make out they only send the detritus from logging to the chip mill. That's completely wrong. They send logs. Large logs from big, old trees. We called out the lies and stopped them from logging near us, partly on the basis of increased fire risk in post-logging regrowth. It's now a flora and fauna reserve.

But a local councillor, Robyn Bain, continues to plug the chip mill as a great business in this shire and deserving of the multi-million dollar loan they just got. They employ around 40 people. And dense, dry, single-age post-logging regrowth south of Eden saw the Victorian bushfire rage over the border and almost reach the town of Eden.

As I understand the science, and advice from fire services heads, preserving those 40 jobs is going to cost us all of the koalas on the far south coast (and countless other species), the jobs of everyone

whose businesses are destroyed in the recent and future fires, and my home. Hundreds of homes. Dozens of lives. Millions of animals.”

(This information was sent to AFCA in response to the issuing of a Timber News post demonstrating the timber industry’s mission to use native forests to expand the ‘bioenergy’ industry with the support of the Australian government.

[https://www.timberbiz.com.au/opinion-martin-moroni-pft-bioenergy-can-boost-tassie-economy/?utm\\_source=DTN&utm\\_campaign=d949a5b779-DTN-2020-4\\_COPY\\_01&utm\\_medium=email&utm\\_term=0\\_2ffda6c090-d949a5b779-223565677](https://www.timberbiz.com.au/opinion-martin-moroni-pft-bioenergy-can-boost-tassie-economy/?utm_source=DTN&utm_campaign=d949a5b779-DTN-2020-4_COPY_01&utm_medium=email&utm_term=0_2ffda6c090-d949a5b779-223565677)

### **Observations of 2019-20 fire behaviour on the South Coast of NSW:**

On the South Coast the regrowth forests which replaced the old, moist, multi-aged forests are drier, denser, smaller, younger trees and of uniform age and crown height. Scientific evidence demonstrates wildfire burns more quickly through such forests.<sup>iv</sup>

FCNSW effectively acknowledged the history of logging in the region a factor in the summer fires. In a statement on its website about the amount State Forest burnt on the South Coast it says: "the region is characterised by even-age regrowth forests".<sup>v</sup>

The Border Fire, which travelled from the Victorian border to Twofold Bay in a single day burnt through some of the most heavily logged forest in Australia. It had been subjected to decades of “integrated harvesting” to supply the Eden chip mill. The area of forest was more heavily logged than many others because it was cheaper to do so, being closer to the chip mill.

Its decades long history of logging, including many post logging burns did not stop the fire, slow it down or make it possible to control.

To date, in the absence of Federal leadership, local and state governments have been left on their own to respond. 95 LGAs and 2 states, the ACT and SA’s upper house, have declared climate emergency in response to international decrees and evidence.<sup>vi</sup> The Federal Government has refused to heed scientists’ warnings, IPCC recommendations and its own citizens to continue policies that increasingly expose this continent to escalating climate change and bushfire risk. Government policies and rhetoric have minimised the threat and failed to adopt emission reduction targets required to prevent irreversible climate change. They continue to justify dependence on fossil fuels domestically and reliance on income from extraction and export of fossil fuels that drive climate change.

### **To correct the situation and address the risk the Federal Government has to acknowledge that Australia:**

- is the 14th largest emitter of greenhouse gases globally
- is the third largest exporter of fossil fuels (The Australia Institute 2019).
- emits more GHG per person than any other developed country

We should stop extracting, burning and exporting fossil fuels that increase our emissions and fuel our bushfire crisis. This includes coal and gas.

We should stop logging, burning and exporting forest 'biomass' (wood) under the guise of a 'renewable' energy.

The Federal Government needs to lead by example. It should establish a consistent response to climate change threat across Australia and explain to the Australian public that we are now in a climate emergency of the utmost priority to avoid imminent further climate induced disasters.

These comments relate to other matters the review is required to consider, i.e. *the responsibilities of, and coordination between, the Federal Government and State, Territory and local Governments relating to preparedness for, response to, resilience to, and recovery from, natural disasters, and what should be done to improve these arrangements, including with respect to resource sharing;*

Standard practice bushfire prevention and bushfire fighting, including planned burning 'hazard reduction' or prescribed burning and back burning should be replaced with responses that can be effective and safe responding to cause and changed circumstance.

To accommodate this there might need to be a restructuring of governance, so that bushfire preparedness and response do not occur in isolation from land management and energy policy.

With regard to land management, logging of native forests (the nation's best terrestrial carbon stores and sinks) will need to stop in relation to both reduction of climate change impact and the need to prevent activities that increase forest flammability.

Industrial logging, which exacerbates native forest flammability, must cease. Traditional approaches to hazard reduction, including the practice of planned burning, need to be challenged. Attempting to manipulate the 'fuel load' is no longer a valid option. When climate change induced drought has reduced an entire continent into a fuel loaded bomb, reducing the 'fuel load' can only logically mean destroying all vegetation. This is not an option. **We urge you to consider some of the studies in Appendix 3: Studies relating to logging inducing fire risk.**

The bushfire crisis is due to climate change and land use management. We can do much about both by allowing our forests to regrow to maturity, sequestering and storing increasing atmospheric carbon as they do. There is international scientific consensus that: *Rate of tree carbon accumulation increases continuously with tree size.* Stephenson, N.L. et al. Nature 507, 90–93 (06 March 2014) doi:10.1038/nature12914

## Section 2

### **The perilous feedback loop threatening the nation's forests**

Our native forests are being dried out not by climate change and industrial logging. Many are now extremely vulnerable, exposed by the loss of protective cooling canopies and depleted of biodiversity. Heavy logging machinery has compacted soils and damaged root networks. With certain increase in climate change induced drought and heat, it's now a logistical challenge to regrow them to maturity while ensuring they do not burn in the process.

First we need to Stop Logging. Section 4 provides reference to legislative basis for the abolition of native forest (RFA) logging in Australia.

We need to **develop protocols for co-operation between firefighters and those undertaking the restoration that will be required while our forests grow to maturity.**

**This will need to include:** Effective surveillance of forest perimeters where both active restoration is occurring and where forests are regenerating naturally, to prevent arson and/or accidental ignition from nearby property management or other activities.

- Provision for early detection using the human eye as per surveillance towers in remote areas
- Training of restoration and other forest field workers in any other early detection mechanisms that exist or are being developed
- Training for restoration workers in fire response; including protocols for effective interaction with dedicated on ground and rapid aerial response fire fighting personnel
- Investigate innovations in relation to water supply and distribution for protection of highly significant regenerating remnants i.e. self-catchment generating (high volume) tanks for placement in strategic locations, possibly transportable when empty.

### Section 3

Before proceeding with discussion of the long standing agenda of the logging industry to increase access for logging to forested lands in Australia, including national parks, reserves and private land we present information from forest fire ecologists and restoration ecologists about the impact of logging and thinning forests. We think it likely that the logging industry will present to the commission a programme of Mechanical Fuel Load Reduction (MFLR) and recommend that this be adopted across most forested landscapes. It is essentially, forest thinning, (logging).

#### Forest Thinning

For over three decades the call has been made that forests should be thinned to minimize bushfire risk. It is now established that this can actually make them more fire prone and prone to more severe fire behavior. Data shows that **thinning (logging) native forests is exactly what we shouldn't be doing.**

Extracts from a transcript of a conversation between Professor David Lindenmeyer and Linda Motram on forest 'thinning' (logging) demonstrate that this is exactly what should not occur. (ABC PM 8/1/20):

Professor Lindenmeyer:

*'In many cases, this is actually a sort of a crass pitch from the forestry industry to start logging areas that they shouldn't be logging and in fact that those logging operations will make the forest more prone to high-severity fire rather than less.*

LM: Why is that? Why does thinning add to risk?

DL: *It adds to risk because it dries the forest, it opens the canopy, it removes some of the wet understory which keeps the forest quite moist.*

*So it dries out the fuel and there's often logging slash or logging debris that's left in the forest that adds to the fuel-load. So, it's actually quite counterproductive. And a whole series of studies overseas has shown that.*

MFLR is **being marketed to the Australian and state governments as fuel reduction** but it appears from the way it is being conducted that its purpose is to manipulate forest stand species composition and spacing to satisfy timber customer requirements. [Please view interview with state forest worker explaining the trials.](#)

Conversations with MFLR Project Officer John Samuel, from NSW DPI convey that trials have found that: weather was delaying trials a lot of the time, either too moist or too hot or dry. In early 2020 he discussed the danger of ‘thinning’ forests, i.e. that it makes forests flammable, allowing sun to reach understorey and forest floor, desiccating forest stands. Summary of conversation is below. *John Samuel, 2020: “debris from the thinning trials, left behind in the understorey was leading to a much more flammable situation. So then in the mechanical fuel load reduction trials they started removing everything left behind. They’re finding in this part of the trials now that even if they remove all the debris, the branches and tops of the trees etc., it’s thinning out the forest, drying it out and making it more flammable. So they are now going down the track of thinning the forest and also burning them...that will then make them less flammable.*

*A problem had been that in their trials some of the forests in northern NSW are so moist that they wouldn’t get them to burn. So they are going through a process whereby they will let the forest dry out through sun and wind and exposure so they can re-burn them to make them less flammable.”*

AFCA considers that these ‘trials’ have a foregone conclusion, that the purpose has never been to reduce bush fire risk but to rationalise routine thinning of all forests in the guise of bushfire prevention. This would assist the industry in its desire to be able to recommend to government that all forested land ‘across tenure’ must be logged/thinned as a means of hazard reduction. AFCA contends this is an access initiative, not a fire reduction exercise.

Please see **Appendix ‘Logging Industry Agenda for Forest Management’** which summarises logging industry reports, discussion papers, corporate plans and subsidised trial programmes articulating the long standing logging industry agenda to:

- *promote increased logging under the name of hazard reduction or forest ‘thinning’*
- *persuade politicians logging is the way to manage both carbon sequestration and bushfire risk*
- *secure access to more forested lands, cross tenure*
- *subsidise combustion of native forest biomass as renewable energy*

The commission should note that to date the logging industry lobby has realised many facets of this agenda; it has secured semi-perpetual access to public native forests well into the middle of the century and in one state commercial logging has now commenced in a national park.

Its programme for logging under the guise of thinning – MFLR – is in process.

The industry is yet to achieve its articulated recommendations that:

- MFLR is adopted as the mechanism for reduction of bushfire risk across an expanded area, beyond state forests into national parks, reserve areas, indigenous managed and private lands. The Forestry Industry Advisory Council has already recommended (2016) a minimum of \$300 million be made available by the Federal government for the expansion of MFLR.
- national parks and reserves are opened up for logging under the guise of hazard reduction or ecological thinning
- inventories are established of private forested lands for certification re whether they are being managed for optimum delivery of ecosystem services, including whether they are thinned against fire risk
- inventories are established of Aboriginal indigenous held lands with view to their economic development in partnership with the logging industry

#### Section 4:

**Natural Solutions** is the term for protection and restoration of the natural systems that draw down carbon, i.e. perform **CDR**. It's now accepted that they must be protected from degradation in order to be able to continue functioning effectively, i.e. their resilience to climate change impact must be enhanced. For terrestrial systems this means immediate protection and restoration of native forests. Primary and recovering native forests are now considered a critical mechanism for the drawdown of excessive atmospheric carbon.

Australian is logging its carbon dense native forest carbon stores and sinks at an unprecedented rate destroying their CDR potential by not allowing them to grow old during which process they can sequester and store carbon at an exponentially increasing rate. The **Federal government should adopt and promote IPCC endorsed 'Natural Solutions', as opposed to Bioenergy with Carbon Capture and Storage (B.E.C.C.S), i.e. substitution of wood for fossil fuels combustion to address climate change and bushfire risk.**

The commission might not be aware that Australian native forests are currently being combusted at an industrial scale in at least two states, (NSW and Queensland). Under the guise of renewable energy significant emissions are entering the atmosphere while the sequestration and storage capacity of the native forest estate is being reduced. Native forest biomass is also being exported as whole trees for the international forest bioenergy trade. There is a concerted industry push to export as much native forest biomass as possible for wood pellet production to fuel power stations. Burning forest biomass is referred to as Bioenergy with Carbon Capture and Storage (B.E.C.C.S). This is promoting, not minimising GHG emissions.

The IPCC and IUCN advocate Natural Solutions, not B.E.C.C.S, to increase **CDR**, restrict global warming and hence, fire risk. The urgency of the need to adopt Natural Solutions and prohibit B.E.C.C.S as a climate risk avoidance strategy is evident from analysis of a) the understatement of climate risk to date <sup>vii</sup> and b) arguments under-pinning consensus that B.E.C.C.S. exacerbates rather than decelerates climate change.

Our (atmospheric) carbon debt <sup>viii</sup> is already such that we have to aim for zero greenhouse gas emissions across all sectors within the next decade <sup>ix</sup> **while** removing as much carbon-dioxide as possible from the atmosphere, **(CDR)**. <sup>x</sup>

Natural systems are most efficient for CDR. Forests are complex organisms/biomes that cannot survive without proper functioning of inter-dependent parts, i.e. soil microbe nutrient recyclers, pollinators, the micro-climates that intact canopies provide, including the global water cycle, to name but a few of the factors that contribute to diversity and resilience. Now severely degraded by industrial logging many of our native forests will need to be restored to promote resilience to climate change impact.

Natural Solutions is a climate change mitigation pathway now advocated by the IPCC, IUCN and world climate scientists while there consensus is that B.E.C.C.S is not only ineffectual but dangerous.

**‘The most ecologically sound, economical, and scalable ways to accomplish [increasing carbon uptake on land] are by protecting and enhancing natural climate sinks.’**

John M. DeCicco, and William H. Schlesinger, *“Reconsidering bioenergy given the urgency of climate protection”*, 9642–9645 | PNAS | September 25, 2018 | vol. 115 | no. 39,  
[www.pnas.org/cgi/doi/10.1073/pnas.1814120115](http://www.pnas.org/cgi/doi/10.1073/pnas.1814120115)

Protection and targeted reforestation of tropical forests would reduce total emissions by as much as 5 billion tonnes of carbon each year, i.e. a reduced source of 1 billion tonnes and an increased sink of 4 billion tonnes each year. <sup>xi</sup>

Australia has some of the most carbon dense forests in the world capable of storing more carbon per hectare than tropical forests. <sup>xii</sup> The carbon stock for intact South Eastern Australian eucalypt forests has been found to be about 640 tonnes per hectare. <sup>xiii</sup> In some of those forests the carbon stock is particularly high, with a total biomass density of 1,867 tonnes of carbon per hectare, <sup>xiv</sup> exceeding that of equatorial rainforests.

As CDR is regarded as an essential global climate mitigation strategy, <sup>xv</sup> Australia is well placed to become a world leader by adoption of this powerful climate mitigation tool.

B.E.C.C.S is a major contributor of carbon to atmosphere and a major risk to world forests. Emissions from combustion of forest biomass at the smokestack exceed those of coal per unit of energy produced; it is not carbon neutral'. <sup>xvi</sup>

Below are only some of the many warnings from scientists to policy makers of the extreme danger of using forests in this manner – unfortunately ignored to date. As a consequence emissions from global forest degradations roughly doubled in coincidence with the industrial scale uptake of B.E.C.C.S, from an average of 0.4 Gt CO<sub>2</sub> yr<sup>-1</sup> in the period 1991–2000 to an average of 1.0 Gt CO<sub>2</sub> yr<sup>-1</sup> for 2011–2015. Note, this figure is distinct from, and unrelated to deforestation from clearing for agriculture. <http://www.fao.org/docrep/009/j9345e/j9345e07.htm>.

## **International Warnings**

Letter from 600 scientists to the EU Parliament Regarding Forest Biomass, 2018

Letter from the European Academies Science Advisory Council (EASAC) to the President of the European Commission, <https://easac.eu/news/details/easacs-correspondence-with-the-president-of-the-european-commission-on-the-role-of-biomass-energy/>  
<https://www.euractiv.com/wp-content/uploads/sites/2/2018/01/Letter-of-Scientists-on-Use-of-Forest-Biomass-for-Bioenergy-January-12-2018.pdf>

<https://www.chathamhouse.org/publication/woody-biomass-power-and-heat-impacts-global-climate>

Opinion of the European Environment Agency Scientific Committee on Greenhouse Gas Accounting in relation to Bioenergy, 2011, <https://www.eea.europa.eu/about-us/governance/scientific-committee/sc-opinions/opinions-on-scientific-issues/sc-opinion-on-greenhouse-gas/view>

Scientists' letter from the Cary Institute of Ecosystem Studies, US to the British Secretary of State for Energy and Climate Change and the Chief Scientific Advisor to the Department of Energy and Climate Change, 2014

Agostini, A., et al. 2014. Carbon accounting of forest bioenergy JRC Scientific and Policy Reports. Ispra, Joint Research Centre, Institute for Energy and Transport, Italy

US Scientists to the EU Commission, 2013

US Scientists to the Speaker of the U.S. House of Representatives and the Majority Leader in the

U.S. Senate, 2010, Scientists letter to Honorable Roy A. Cooper, North Carolina Office of the Governor

## **Australian Warnings:**

*Scientists' Open Letter to The Australian Parliament, Senators and Members, re inclusion native forest biomass in the Renewable Energy Target, 2015*

*Scientists' Open Letter of Concern - incentives for native forest biomass burning to MP Rob Oakeshott and Members of the Australian Parliament, 2012*

## **General warnings:**

*Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO<sub>2</sub> of coal and 3x the CO<sub>2</sub> of natural gas because of wood's carbon bonds, water content (Table 2.2 of ref. 17) and lower burning temperature (and pelletizing wood provides no net advantages) (Supplementary Note 1) 6,16 (extracted from)*

*Increased atmospheric concentrations from burning bioenergy will worsen irreversible impacts of climate change before forests eventually grow back to compensate (Booth, 2018; Courvoisier et al., 2017 Schlesinger, 2018)*

*Europe's renewable energy directive poised to harm global forests*, Timothy D. Searchinger, Tim Beringer, Bjart Holtsmark, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven and Jean-Pascal van Ypersele

<http://ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief7.pdf>,

<http://www.ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief8.pdf>

Popkin, G. Tropical forests may be carbon sources, not sinks. *Nature*. doi:10.1038/nature.2017.22692. (2017).

*Real world implications of negative emissions and Bioenergy CCS (BECCS)*, May 12th & 13th 2016, Brussels, Presentation for Land use and Forests in the Paris Agreement, by Professor Brendan Mackey, Director, Griffith Climate Change Response Program

<https://www.birdlife.org/europe-and-central-asia/black-book>

*Are Forests the New Coal – a Global Threat Map of Biomass Energy Development*, Kuhlmann, Wolfgang and Putt, Peg, Environmental Paper Network. November 2018

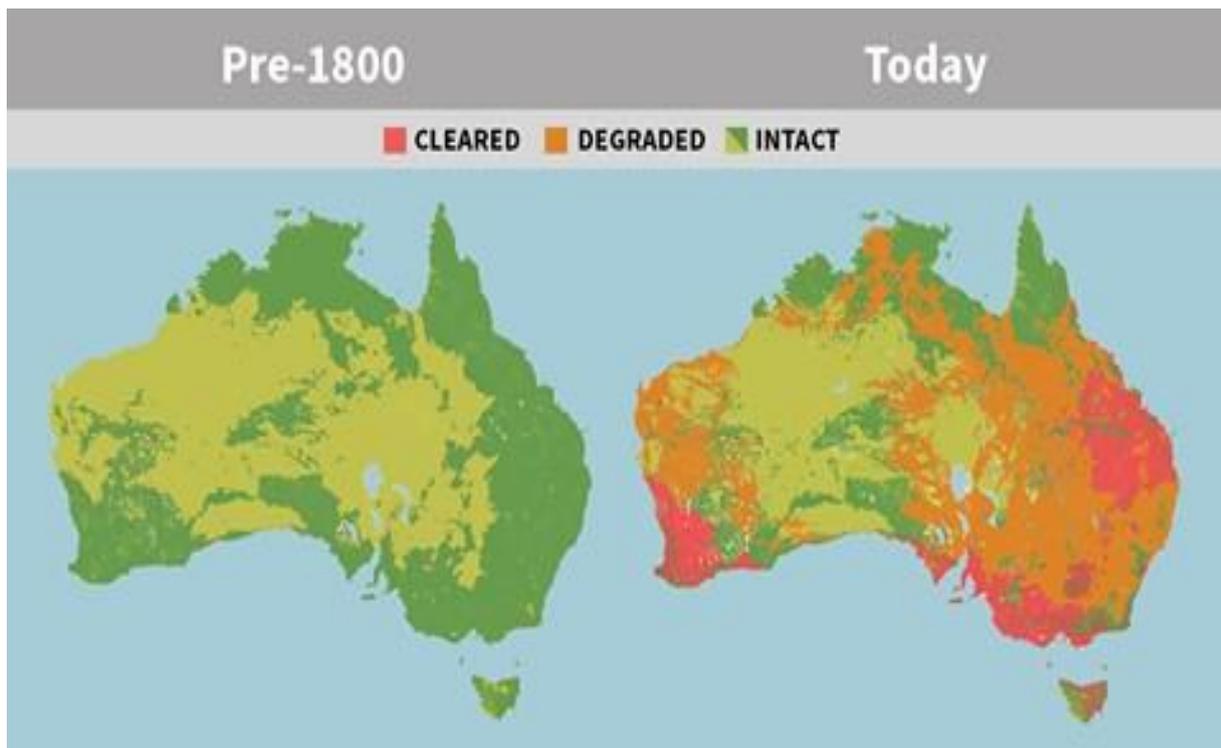
<http://environmentalpaper.org/wp-content/uploads/2018/11/Threat-Map-Briefing-Are-Forests-the-New-Coal-01.pdf>

For further discussion and evidence please see *Appendix 1 Industrial logging native forests and the use of forest biomass as a fossil fuel substitute disastrous for climate and biodiversity* is an explication with of the danger forest bioenergy represents to the planet and the science supporting Natural Solutions, referencing relevant evidence to May 2019. Australian policy makers need to be informed about the danger of B.E.C.C.S and the preferred strategy, Natural Solutions, as the Australian and many state governments have already embraced and are poised to expand uptake of the now discredited strategy, now considered not just ineffectual but dangerous. Embracing B.E.C.C.S will destroy our chances of employing Natural Solutions, as it destroys our nation's native forests.

The commission might bring to the attention of the Federal government of the dangers of B.E.C.C.S and the need to adopt 'Natural Solutions' to absorb excess atmospheric CO<sub>2</sub> to help reduce CC and bushfire risk.

## Section 5

**Proforestation is the logical basis for action to prevent, respond to and restore impact from bushfire risk across the continent.** AFCA is working with others in developing a national plan, or blueprint, implementation of parts of which could start immediately, but which should expand under ecological restoration guidelines.



**Lidar satellite depiction of the state of Australia's native forests 2016**  
**Millions more hectares since lost**

The first step for a Proforestation programmer is abolishing failed RFAs, the bi-lateral agreements legitimising native forest logging. Discussion on how this can occur is to be found in: *'No longer Tenable: Bushfires and Regional Forest Agreements'*, Margaret Blakers OAM, Brendan Sydes, CEO/Lawyer, Environmental Justice Australia, 2020. The following sections address the legal and policy aspects.

5.1 Policy basis for RFAs has become untenable

5.3 Possible invalidity?

5.4 Flow-on consequences – RFA exemptions under EPBC may longer apply

6 Bushfires – implications for the RFA system

6.1 RFAs cannot be fixed within the framework of the RFAs themselves

6.2 A new era legislative pathways state governments stop logging native forests.

Before the bushfires, AFCA drafted an outline for a nation-wide Proforestation programme (which included reference to addressing bush fire risk).

The Federal government is understood to be considering concepts (blueprints) for economic stimulus in the wake of pandemic induced recession.

An appraisal by the Australia institute of programmes that would both create jobs in the short term and have lasting national long term benefit, demonstrates that programmes similar to, but potentially far less economically and environmentally effective than Proforestation, rank highest when specific economic criteria are considered.<sup>xvii</sup>

Social and economic circumstances in the wake of the bushfire catastrophe and the current health pandemic now coincide to make such a Proforestation programme no longer just environmentally necessary, but economically strategic.

Project	Go early	Go hard	Go households	Domestic production	Employment intensity	Economic victims	Co-benefits	Regional disadvantage
Public housing	Partial	Yes	No	Partial	Yes	Partial	Yes	Yes
Housing for homeless	Yes	Partial	No	Yes	Yes	Yes	Yes	No
Maintenance of public buildings	Yes	Yes	No	Yes	Yes	Partial	Yes	No
Electricity grid for renewables	Partial	Yes	No	Partial	Partial	Partial	Yes	No
Capital for equity	Yes	Yes	No	Yes	Partial	Yes	Yes	No
Cancelling all 'robodebts'	Yes	Partial	Yes	Yes	Partial	Yes	N/A	Yes
Moratorium on HECS debt	Yes	Partial	Yes	Partial	Partial	No	No	No
Pausing PAYG for small business	Yes	Partial	No	Yes	Partial	Yes	No	No
Health messaging	Yes	Yes	No	Yes	Yes	No	Yes	No
Crown of thorns starfish	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Arts and entertainment fund	Yes	Partial	Partial	Yes	Yes	Yes	Yes	No
Building coal fired power station	No	Partial	No	Partial	No	No	No	Partial
Wages freeze	No	No	No	No	No	No	No	No
Local Government Infrastructure	Partial	Yes	No	Partial	Partial	No	Yes	No
Local Government JobKeeper	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Mass tree planting	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Digitising old records	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Urban beautification	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Yes
Big business tax cut	No	No	No	No	No	No	No	No



In the TAI table above, the heading Mass Tree Planting term includes the concept of targeted restoration and invasive species control together as part of bushfire recovery. The simplicity of this particular programme in the opinion of TAI precluded the outcome 'go hard' (which relates to scale). A comprehensive Proforestation programme which lends itself to many more activities and has a wider application than bushfire response and land rehabilitation, (i.e. can include extensive community education and communication activities) would allow a better rating under 'go hard' (scale) in that there can be an application across a range of sectors. This is not the place to analyse or explain how a variety of sectors could benefit. AFCA is involved with other stakeholders in pursuing development of this programme and would welcome the opportunity to discuss this further.

### **i About AFCA: Who we are, our membership base and our credentials**

Members of our organisation have kept abreast of peer-reviewed scientific evidence and government reports relating to bushfires that have affected forested land in four states for the last two decades. Many of our members are based in rural and high risk bushfire areas and have firsthand experience and knowledge of the conditions of forests and a honed appreciation of the risks.

As a non-profit organisation composed of a network of volunteers, we will not gain economically from the Commission's findings. Our intention is to promote policies that will increase preparedness and resilience of our landscape to bushfire, which will be exposed to increased intensity and frequency of fire.

ii <http://www.bom.gov.au/state-of-the-climate/australias-changing-climate.shtml>

iii Instead of reporting as required on CO<sub>2</sub> storage by forest type, age class, and successional stages, FCNSW falsely reports its contribution to the state's carbon emissions, neglecting to take into account the emissions caused by native forest logging. This misleading accounting is delivered to the community and government based on statistics from plantations alone. The most valuable components of the state's carbon sink - the older growth native and regrowth

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forests –are being destroyed. Huge emissions result from transporting heavy product long distances;. Regional resource destruction means more need for resource transportation. FCNSW is preventing forests to mature to sequester carbon. Climate Commission findings confirm logging impact.

*'Although a fast-growing, mono-culture plantation forest may have a rapid rate of carbon uptake for the years of vigorous growth, it will store less carbon in the long term than an old growth forest or a secondary regrowth forest on the same site.... 2. Natural ecosystems tend to maximise carbon storage, that is, they store more carbon than the ecosystems that replace them after they are converted or actively managed for production. An observational study of temperate moist forests in southeast Australia identified the world's most carbon dense forest and developed a framework for identifying the forests that are the most important for carbon storage....Recognition of the need to protect primary forests has helped to catalyse formulation of the REDD (Reduction of Emissions from Deforestation and forest Degradation) agenda item under the UNFCCC negotiations (<http://unfccc.int/methodsandscience/lulucf/items/4123.php> ).'*

<sup>iv</sup> <https://www.abc.net.au/news/2020-01-29/logging-bushfire-affected-areas-australia-increases-fire-risk/11903662?fbclid=IwAR2g4-XvtWxt5xtte4RRqlvezgTx4Afk11qJKtmJw5ssWEZohU5R7tdTsd4>

<sup>v</sup> [https://www.forestrycorporation.com.au/operations/fire-management/fire-impact-of-2019-20?fbclid=IwAR0p-TMfRKbarSbqBRAhRjiKsZnMzV2pJ\\_cMuZdePuMdEvBYyFDwg4weV6M](https://www.forestrycorporation.com.au/operations/fire-management/fire-impact-of-2019-20?fbclid=IwAR0p-TMfRKbarSbqBRAhRjiKsZnMzV2pJ_cMuZdePuMdEvBYyFDwg4weV6M)

<sup>vi</sup> <https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/>

<sup>vii</sup> The Paris Climate Agreement target to restrict global warming to less than 2<sup>o</sup> with an ambition to aim for no more than 1.5<sup>o</sup> degrees is now regarded as inadequate<sup>vii</sup> because the current 1.2°C above pre-industrial levels is already too dangerous.<sup>vii</sup> The wide-scale bleaching and foreseeable death of the Great Barrier Reef, collapse of river systems and drying out of Australian vegetation proves this.

Some of the 'tipping points' that compound global warming (summer sea-ice-free Arctic conditions, loss of West Antarctic glaciers and a multi-metre sea-level rise) will be passed at 1.2° or even 1<sup>o</sup> C. Current emission rates will activate other elements, compounding the rate and scale of temperature rise.

<sup>viii</sup> A carbon budget is an estimate of greenhouse gas emissions, in tons of carbon consistent with limiting global warming to a specified figure. We have exceeded the budget for limiting warming to 2 degrees, creating a 'carbon debt'. To close the 'emissions gap', maximum draw down of atmospheric carbon is 'non-negotiable'.

<sup>ix</sup> 2019 climate modelling indicates 2018 IPCC limits understate urgency:

<https://www.nature.com/articles/s41558-019-0426-8> but IPCC recommendations that *'Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems ... and imply deep emissions reductions in all sectors.*

<https://www.ipcc.c/summary-for-policy-makers/> is still true.

<sup>x</sup> More CDR is needed to restrain temperature increase. *All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal (CDR) on the order of 100–1000 GtCO<sub>2</sub> over the 21st century.* <https://www.ipcc.c/summary-for-policy-makers/>

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xi Presentation for Land use and Forests in the Paris Agreement, real world implications of negative emissions and Bioenergy CCS (BECCS), May 12th & 13th 2016, Brussels by Professor Brendan Mackey, Director, Griffith Climate Change Response Program

xii From analysis of published global site biomass data ( $n = 136$ ) from primary forests, we discovered (i) the world's highest known total biomass carbon density (living plus dead) of 1,867 tonnes carbon per ha (average value from 13 sites) occurs in Australian temperate moist *Eucalyptus regnans* forests, and (ii) average values of the global site biomass data were higher for sampled temperate moist forests ( $n = 44$ ) than for sampled tropical ( $n = 36$ ) and boreal ( $n = 52$ ) forests ( $n$  is number of sites per forest biome). Heather Keith, Brendan G. Mackey, and David B. Lindenmayer, *Re-evaluation of forest biomass carbon stocks*

xiii Brendan G. Mackey, Heather Keith, Sandra L. Berry and David B. Lindenmayer, Green Carbon: The role of natural forests in carbon storage: Part 1. A green carbon account of Australia's south-eastern Eucalypt forests, and policy implications, The Fenner School of Environment & Society, The Australian National University, 2008

xiv From analysis of published global site biomass data ( $n = 136$ ) from primary forests, we discovered (i) the world's highest known total biomass carbon density (living plus dead) of 1,867 tonnes carbon per ha (average value from 13 sites) occurs in Australian temperate moist *Eucalyptus regnans* forests, and (ii) average values of the global site biomass data were higher for sampled temperate moist forests ( $n = 44$ ) than for sampled tropical ( $n = 36$ ) and boreal ( $n = 52$ ) forests ( $n$  is number of sites per forest biome). Heather Keith, Brendan G. Mackey, and David B. Lindenmayer, *Re-evaluation of forest biomass carbon stocks*

xv Since global deforestation has resulted in about a third of total anthropogenic CO<sub>2</sub> emissions since 1850 it is obvious that stopping this process will be fundamental to emission reduction and CDR. Bagley, J.E. (2011) *Impacts of land cover change: energy regulation, breadbasket production, and precipitation*. Phd., Atmospheric and Oceanic Sciences, University of Wisconsin-Madison.

xvi Wood that reaches a power plant can displace fossil emissions but per kWh of electricity typically emits 1.5x the CO<sub>2</sub> of coal and 3x the CO<sub>2</sub> of natural gas because of wood's carbon bonds, water content (Table 2.2 of ref. 17) and lower burning temperature (and pelletizing wood provides no net advantages) (Supplementary Note 1) 6,16 (extracted from) *Europe's renewable energy directive poised to harm global forests*, Timothy D. Searchinger, Tim Beringer, Bjart Holtsmark, Daniel M. Kammen, Eric F. Lambin, Wolfgang Lucht, Peter Raven and Jean-Pascal van Ypersele, and also see:

<http://ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief7.pdf>

<http://www.ase.tufts.edu/gdae/Pubs/climate/ClimatePolicyBrief8.pdf>

xvii *Design Principles for Fiscal Policy in a Pandemic, How to create jobs in the short term and lasting benefits in the long term*, Discussion paper, Richard Denniss, Matt Grudnoff, David Richardson, April 2020