Protecting forests is climate action

North East Forest Alliance Inc submission to:

CLIMATE CHANGE (CONSEQUENTIAL AMENDMENTS) BILL 2022 & CLIMATE CHANGE BILL 2022

Dailan Pugh, August 2022

The Commonwealth Government needs to recognise that addressing our climate emergency requires reducing atmospheric carbon, and that protecting existing degraded native forests is the most effective and economic way to achieve immediate reductions.

It is well recognised that natural climate solutions are essential to draw down enough atmospheric CO_2 to give us a chance of limiting global heating to less than 1.5°C, or even 2°C (Sohngen and Sedjo 2004, Wardell-Johnson *et. al.* 2011, Keith *et. al.* 2015, Griscom *et. al.* 2017, Houghton and Nassikas 2018, Fargione *et. al.* 2018, IPCC 2018, Moomaw *et. al.* 2019, Goldestein *et. al.* 2020). Griscom *et. al.* (2017) consider that "*Forest pathways offer over two thirds of cost-effective NCS mitigation needed to hold warming to below 2°C and about half of low-cost mitigation opportunities pathway*". While ambitious reforestation and plantation projects have been launched, many have failed and all suffer from the problem of the lag between when they are conceptualised to when they begin sequestering significant volumes of atmospheric carbon (if ever).

By comparison there are millions of hectares of existing native forests that have had their carbon stocks depleted by past logging, that still have substantial carbon stocks, and which can immediately begin to regain their lost carbon. Many scientists have attested to the significant role that protecting degraded forests (sometimes termed proforestation) can have in reducing atmospheric carbon on a global scale with the urgency required (Mackey *et. al.* 2008, Houghton and Nassikas 2018, Moomaw *et. al.* 2019, Mackey *et. al.* 2022). As stated by Moomaw *et. al.* (2019):

> *Proforestation serves the greatest public good by maximizing co-benefits such as nature-based biological carbon sequestration and unparalleled ecosystem services such as biodiversity enhancement, water and air quality, flood and erosion control, public health benefits, low impact recreation and scenic beauty.*
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> *… proforestation provides the most effective solution to dual global crises – climate change and biodiversity loss. It is the only practical, rapid, economical and effective means for atmospheric carbon dioxide removal among the multiple options that have been proposed because it removes more atmospheric carbon dioxide in the immediate future and continues to sequester it into the long-term future.*

The IPCC (2021) identifies that, based on cumulative emissions to 2020, the world can release an additional 500 billion tonnes CO_2 to have a 50% chance of limiting global warming to 1.5° C. The budget shrinks to 400 billion tonnes to increase the chance to 67%. The world emits around 43 billion tons of CO_2, though emissions are rising as the world rebounds from Covid. At this rate we have about 9-11 years left to use-up our budget. Australia's share has been estimated as 3,521 million tonnes of CO_2 from 2021 (Climate Targets Panel 2021). In the year ended June 2020, emissions were 513.4 million tonnes. Based on this Australia has less than 7 years left.

IEA identify that global CO_2 emissions from energy combustion and industrial processes reached their highest ever annual level in 2021 of 36.3 billion metric tonnes. Worldwide forests absorb 15.6 billion metric tonnes of CO_2 per year from the atmosphere, though through clearing, logging and other disturbances they also emit 8.1 billion metric tonnes of carbon dioxide (Harris *et. al.* 2021). It is clear that we depend on forests to remove the carbon we emit to avoid runaway climate heating, though what is not clear in carbon accounting are the effects of logging on forest carbon stocks and the mitigation potential of protecting forests.

In 2018–19, NSW emitted around 141 million tonnes carbon dioxide equivalent (CO_2-e), which was partially offset by trees having the net effect of reducing total emissions by 5 million tonnes (3%) due to photosynthesis. The 2021 NSW State of the Environment Report considers the land use, land-use change and forestry sector (LULUCF) is currently considered a carbon 'sink' as it stores more carbon than it emits and thus reduces the state's emissions by 3%, while noting "*the sequestration by 'forest remaining forest' has halved*" since 2005, with "*a decline in the forest sink by around 14%*" relative to 2005, and warning that without further action the land sink is estimated to peak in 2022 as the "*forest land sink decreases*" (EPA 2021). Such statements are indicative of the value of forests as carbon sinks, their fragility, and the necessity of accounting for them in an open and transparent manner in carbon accounts (Mackey *et. al.* 2022).

There have been a number of assessments of the carbon benefits of protecting public native forests in south-east Australia (Mackey *et. al.* 2008, Dean *et. al.* 2012, Perkins and Macintosh 2013, Keith *et. al.* 2014b, Macintosh *et. al.* 2015, Keith *et. al.* 2015). For their assessment of 14.5 million ha of eucalypt forests in south-eastern Australia, Mackey *et. al.* (2008) found that:

> *… the effect of retaining the current carbon stock (equivalent to 25.5 Gt CO_2 (carbon dioxide)) is equivalent to avoided emissions of 460 Mt CO_2 yr^{-1} for the next 100 years. Allowing logged forests to realize their sequestration potential to store 7.5 Gt CO_2 is equivalent to avoiding emissions of 136 Mt CO_2 yr^{-1} for the next 100 years. This is equal to 24 per cent of the 2005 Australian net greenhouse gas emissions across all sectors; which were 559 Mt CO_2 in that year.*

While all sorts of methodologies, parameters and offsets have been variously applied, the conclusions have been that it is in our best interests to stop logging public native forests. Recently Frontier Economics (2021) found stopping logging of public native forests in southern NSW would produce a net economic benefit to the state of approximately $60 million, while also reducing net greenhouse gas emissions by almost 1 million tonnes per year over the period 2022-2041, compared to logging.

It is particularly important at this crucial time in our climate crisis to recognise that we need to protect forests to get the rapid reductions in atmospheric carbon we need. As part of their review of national greenhouse gas inventories, Mackey *et. al.* (2022) found:

> *… the State of Tasmania delivered negative emissions due to a change in forest management—a large and rapid drop in native forest logging—resulting in a mitigation benefit of ~22 Mt CO_2-e yr^{-1} over the reported period 2011/12–2018/19. This is the kind of outcome required globally to meet the Paris Agreement temperature goal. All CO2 emissions from, and atmospheric removals into, forest ecosystem carbon stocks now matter and should be counted and credited to achieve the deep and rapid cuts in emissions needed over the coming decades.*

REQUESTS

In the interests of transparency and accountability there is a need to clearly and accurately quantify the carbon balances for native forests in national carbon accounting, including accurately identifying maximum upper limits to biomass accumulation (including in more productive forests), current structure and biomass changes from the baseline (across all tenures), the carbon sequestration potential of each category, and the effects of logging and clearing on both carbon storage in biomass and carbon sequestration. The Federal Government's Full Carbon Accounting Model (FullCAM) needs to adequately reflect the maximum upper limit to biomass accumulation for NSW's more productive forests. It is essential that the current structure of native forests, and their current carbon storage is identified with a reasonable level of accuracy across all tenures, and separately reported on within the land use, land use change and forestry (LULUCF) sector.

Stopping logging of north-east NSW's public forests will avoid the emission of 820,000 tonnes of CO_2 per annum from tree biomass, and the creation of legacy emissions of 700,000 tonnes of CO_2

per annum that will be realised over decades as logs left in the forest decay and wood used in buildings reach the end of its useful life. Protecting the half a million hectares of north-east NSWs public native forests currently available for logging would allow them to sequester in the order of an additional 2.7 million tonnes of CO2 per annum. Stopping logging of public native forests will therefore make a significant and immediate difference in this current climate emergency. The Commonwealth is requested to withdraw its approval of the North East NSW Regional Forest Agreement.

Creating a market for burning native forests for electricity will increase logging intensity and log removal, and the rapid release of carbon from coarse woody debris that would otherwise be left in the forest to slowly decompose over decades. The Commonwealth must not allow a biomass industry to compound the impacts of export woodchipping.

The Commonwealth Government must ensure that all actual carbon emissions from burning wood for electricity are fully disclosed and considered, with any offsets clearly and separately distinguished.

We ask that the Commonwealth now amend the Renewable Energy (Electricity) Act 2000, and any other relevant instruments, to prohibit "wood obtained from native forests" being eligible for Renewable Energy Certificates, particularly large-scale generation certificates (LGCs). Amend clause 17 "(2) Despite subsection (1), the following energy sources are not eligible renewable energy sources" to include "wood obtained from native forests"

1. Australia's Greenhouse Gas inventory needs to clearly identify forests contribution.

The national Greenhouse Gas inventory for Australia is simplistic and opaque when identifying the drivers of changes within the land use, land use change and forestry (LULUCF) sector, which is one of the principal sinks for atmospheric carbon. Offsetting occurs between and within categories with the noticeable consequence of masking the emissions from logging and therefore the mitigation benefits from forest protection (Mackey *et. al.* 2022).

In the interests of transparency and accountability there is a need to clearly and accurately quantify the carbon balances for native forests in national carbon accounting, including accurately identifying maximum upper limits to biomass accumulation (including in more productive forests), current structure and biomass changes from the baseline (across all tenures), the carbon sequestration potential of each category, and the effects of logging and clearing on both carbon storage in biomass and carbon sequestration.

The Federal Government's FullCAM (Full Carbon Accounting Model) is applied at the national scale for land sector greenhouse gas emissions accounting. It includes a value for the maximum upper limit to biomass accumulation for any location based on potential site productivity, for NSW forests with a canopy cover >50% it identifies the upper limit of above ground dry matter of 210 to 287±9 t DM ha -1 (Roxburgh et. al. 2017). These are significantly below measured values, and thus bring into question the accuracy of FullCAM.

Ximenes *et al.* (2004) measured biomass in 3 "representative" south coast Spotted Gum forests on low, moderate and high site qualities which they claimed to be "close to, or at, maximum carbon carrying capacity" (though all had been logged in the late 1970s). The dry Above Ground Biomass was 220.2, 287 and 397.3 tonnes ha. for the low, moderate and high site qualities respectively. Given these forests had lost some of their larger trees they were not at the maximum upper limit to biomass accumulation, yet the higher productivity site was significantly above FullCAM's maximum. Most significantly, the "wet sclerophyll" forest types, dominated by species such as Brush Box, Tallowwood, Sydney Blue Gum and Flooded Gum are far more productive and do have far higher maximum upper limits to biomass accumulation that need to be accounted for.

The Federal Government's Full Carbon Accounting Model (FullCAM) needs to adequately reflect the maximum upper limit to biomass accumulation for NSW's more productive forests.

Logging reduces the age classes of trees in forests, particularly the old giant trees, and thus their carbon storage. On average, production forests are considered to have lost 40-60% of their carbon stores (Harmon *et. al.* 1990, Roxburgh *et.al.* 2006, Mackey *et. al.* 2008, Wardell-Johnson *et. al.* 2011, Dean *et. al.* 2012, Keith *et. al.* 2014b, Keith *et. al.* 2015, Noormets *et. al.* 2015). Carbon stocks are maintained at these low levels by repeat harvesting events, never allowed to regain their natural carbon carrying capacity. Mackey *et. al.* (2008) note:

> *The majority of biomass carbon in natural forests resides in the woody biomass of large old trees. Commercial logging changes the age structure of forests so that the average age of trees is much younger. The result is a significant (more than 40 per cent) reduction in the long-term average standing stock of biomass carbon compared with an unlogged forest.*

This suppression of carbon storage is illustrated by Keith *et. al.* (2014b):

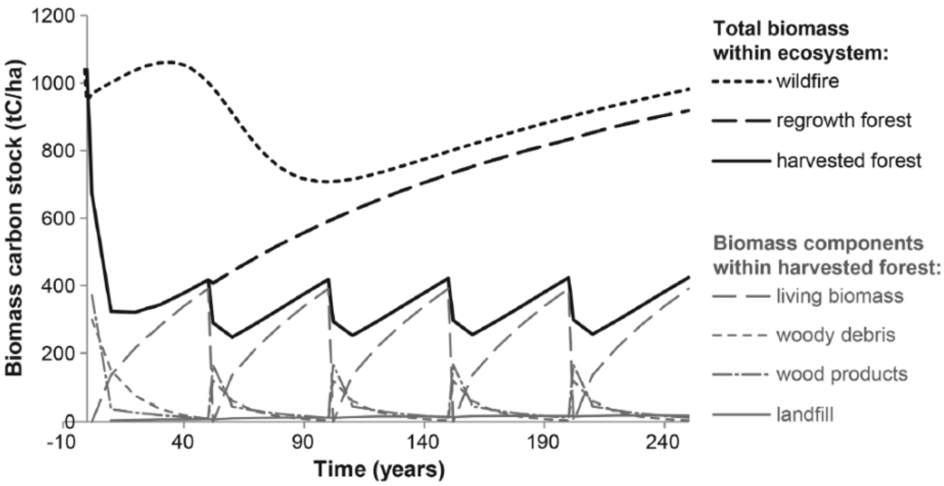


Fig. 10. from Keith *et. al.* (2014b): Changes in total biomass carbon stock of the ecosystem over time under three scenarios (shown as black lines) from an initial stock of a native forest: (1) wildfire that occurred at time 0 years and then the forest regenerated and dead biomass decomposed over time, (2) regrowth forest after logging once and regeneration, and (3) harvested forest under a regime of repeated logging rotations consisting of clearcutting and slash burning on a 50 year cycle

This 40-60% suppression in the carbon stored in logged forests is supported by the results of Ximenes *et al.* (2016). Ximenes *et al.* (2016) assessed live above ground biomass of what they considered representative sites managed for production and older forests with no management history, their dry above ground biomass was converted to account for below ground biomass (x1.25), with 50% of the dry weight taken to be carbon. For Silvertop Stringybark forests on the south-coast, this gives 128 tC/ha for the production forest and 298 tC/ha for the older forests, a loss of 170 tC/ha (57%). For Blackbutt forests on the north coast, this gives 161 tC/ha for the production forest and 261 tC/ha for the older forests, a loss of 100 tC/ha (38%), though the older forest had a low density of large trees and the "*"production" site yielded a slightly higher proportion of high quality logs than the average blackbutt forest"*, meaning they likely understate the average carbon loss.

It is important to recognise that recent heavily logged forests will have significantly lower carbon stores that need to be accounted for.

It is essential that the current structure of native forests, and their current carbon storage is identified with a reasonable level of accuracy across all tenures, and separately reported on within the land use, land use change and forestry (LULUCF) sector.

2. Logging of native forests is a significant contributor to atmospheric carbon.

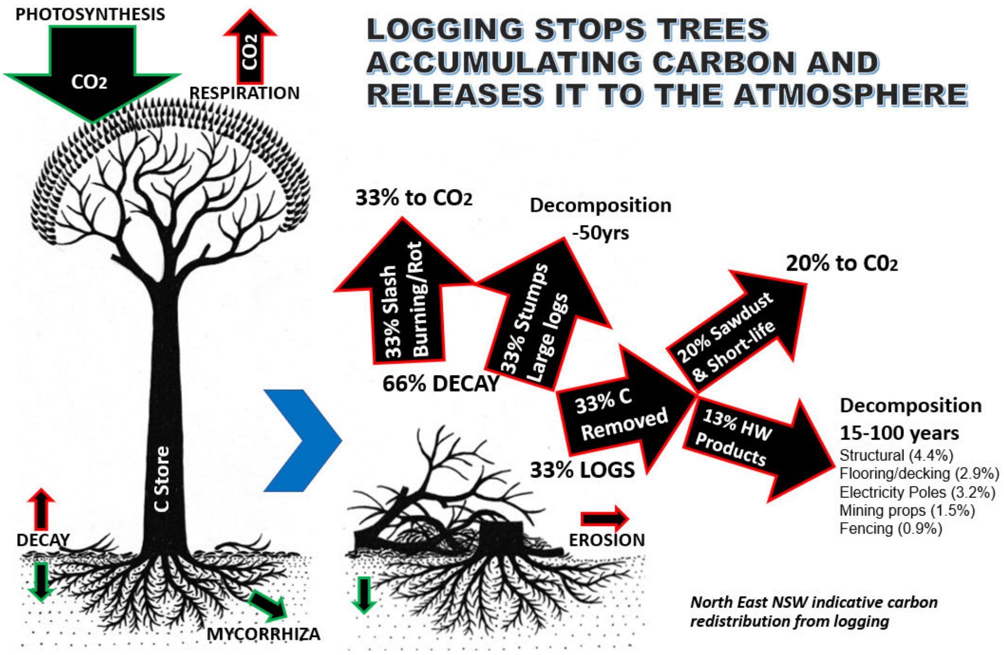
In regions with large pulpwood industries the majority of the logs removed from the forests are likely to be woodchipped and thus release their carbon quickly, with as little as 4-6% of the logged trees ending up in sawn products (ie Keith *et. al.* 2014). Export woodchipping from north-east NSW was stopped in 2013, and pulpwood currently comprises less than 5% of the logs removed from native forests.

Based on Ximenes *et al.* (2016) assessment of a north-east NSW blackbutt site, 52% of logged trees will be left on site with 48% removed in logs. Though with account for tree roots, it is likely that around 33.5% of each tree is removed in log form.

Meaning 66.5% of each tree is left in the forest. Leaves, bark and small branches and rootlets will rapidly decompose, releasing their carbon in the process, though stumps, sections of trunks, large branches, and large roots will decompose more slowly. In dry environments standing dead trees and other Coarse Woody Debris (CWD) may remain for decades, with longevity dependent on species and temperature (Woldendorp *et. al*. 2002, Mackensen *et. al.* 2011, Keith *et. al.* 2014b). Keith *et. al.* (2014b) assume that half the logging debris will have a life of around 50 years. Mackensen *et. al.* (2011) found:

> *In total, 184 values for lifetimes (t0.95) of CWD were calculated from studies available in the literature. In 57% of all cases, the calculated lifetime (t0.95) is longer than 40 years (Fig. 4). The median of this distribution is at 49 years and the mean is 92 years.*

Of the timber removed from the forest, according to Ximenes *et al.* (2016) 61.8% will end up as short-lived mill residues and products, and 38.2% as relatively long-lived hardwood products, this is just 12.8% of tree biomass. Of the hardwood products, over half can be expected to be in exposed situations conducive to decay (decking, poles, mining props and fencing) and thus have a lifespan of 15 to 40 years, with the balance (flooring, some structural timber) expected to have a lifetime equivalent to the building it is used in. After its useful life is over, a portion of the timber product may end up in landfill, where very low rates of decomposition are reported because of the anaerobic conditions. Keith *et. al.* (2014) consider the proportion of the initial forest carbon stock that remains in long-term storage in landfill is less than 3%.



Indicative fate of carbon in current logging in north-east NSW.

Before the 2019/20 wildfires some 400,000 m^3 of native tree logs per annum were removed from north-east NSW's public forests. Based on Ximenes *et al.* (2016) some 66.5% of the trees logged can be expected to remain in the forest as residues, meaning for the removal of 277,200 tonnes of dry biomass, 550,263 tonnes of dry biomass will be left in the forest, increasing the total generation of biomass from logging to 827,463 tonnes per annum. Some 50% of this can be assumed to be carbon, totalling 413,732 tonnes (t/yr) of carbon per annum.

Based on this (without an increase in pulpwood) 413,732 t/yr of carbon likely to be converted by logging from storage in living biomass to dead biomass per annum in north-east NSW's public forests, 275,132 t/yr will be left in the forest as residues where half will quickly release its carbon as CO2, and of the 138,600 t/yr of carbon removed as logs some 85,655 t/yr can be expected to be quickly released as CO2. This 223,221 t/yr of quick release carbon reacts with oxygen to form 819,220 t of CO2. The balance of 137,566 t/yr of carbon in CWD forest residues and 53,945 t/yr in longer-lived wood products will ultimately be converted to an additional 699,175 t of CO2, though over a timeframe of 15 to 100+ years.

The North-east NSW RFA regions, north from the Hunter River, total 8.5 million ha, of which 1,472,000 hectares is national parks and nature reserves and 838,000 hectares is State Forests. Some 278,000 ha of State Forests is classed as FMZ 1, 2 and 3A and taken to be informal reserves, 505,000 native forests available for logging in various stages of degradation, with 127,000 hectares of plantations. Around half the national parks and the informal reserves were protected either as an outcome of the Regional Forest Agreement process in 1998 or the Forest Icon decision in 2003, so significant parts had previously been logged.

Oldgrowth forests best approximates those forests that have not been significantly affected by logging or other disturbances such as intense wildfire, though many of these areas survived as oldgrowth because they are steep and low productivity forests (i.e. with relatively low carbon volumes). The last regional assessment of forest structure was for the Regional Forest Agreements, so can only be considered current as at around 1997. It is one of the biggest failings of the RFA process that the changes in forest structure since then have not been monitored or updated.

The 1997 data identifies 1.3 million hectares of old growth forest in that part of the North East RFA region north from the Hunter River. There has been no assessment of how much of the 462,000 ha of rainforest identified in the RFA is oldgrowth,

North East NSW (CRA Regions - north from Hunter River) broad forest structure as mapped at 1998 according to current tenure, note that growth-stage mapping was primarily limited to eucalypt and Brush Box dominated forests and excluded rainforest, melaleuca forests and non-forest communities.

GROWSTAGE	National Park (ha)	State Forest Informal Reserve (ha)	State Forest General Logging (ha)	Other tenures (ha)	**TOTALS (ha)**
Rainforest	263,504	81,491	2,862	114,227	462,084
Candidate Old Growth	720,120	120,347	49,674	419,075	1,309,216
Other Forests	348,306	61,298	452,516	1,508,017	2,370,136
TOTALS	1,331,930	263,136	505,052	2,041,318	4,141,436

Based on the CRA data from 20 years ago, around 2.3 million ha (64%) of remnant eucalypt forests had then been logged (or otherwise degraded) and had significantly reduced carbon storage below original carrying capacity. Since then it can be expected that most of the oldgrowth forest in the general logging area on State Forests has been logged, along with significant areas of oldgrowth forest on private lands, though it also needs to be considered that a large proportion of oldgrowth remaining at that time had survived because it was low-productivity forest on poor soils and steep slopes.

The following calculation is undertaken in order to identify the indicative magnitude of the carbon sequestration potential of north-east NSW's degraded forests if they were free of further disturbance. It can be expected that over 2.4 million ha of north-east NSW's eucalypt forests currently have carbon stores at varying levels significantly below their carbon carrying capacity. , comprised of 0.4 million ha of national parks and informal reserves, 0.5 million ha of loggable State Forests, and 1.5 million ha of private lands including significant areas of national parks. If, by way of illustration, the lower estimate of a Mean Annual Increment of 1.44 tC ha^{-1} identified by Keith *et. al.* (2015) for NSW south-coast forests is applied, this represents the potential to sequester 5.3 tonnes of CO_2 per hectare per annum. Application of this multiplier indicates that degraded forests in our current reserve system is recovering in the order of 2.1 million tonnes of atmospheric carbon per annum, if logging was stopped on public native forests another 2.7 million tonnes per annum could be sequestered, and if private landholders were encouraged to protect their forests (some of whom are) there is the potential for an additional 8 million tonnes of CO_2 to be sequestered per annum.

To put this into perspective, in 2018–19, NSW emitted around 141 million tonnes carbon dioxide equivalent (CO_2-e), so stopping logging of public native forests can have a significant and immediate effect on increasing the drawdown of atmospheric carbon, while avoiding increased emissions from logging.

Stopping logging of north-east NSW's public forests will avoid the emission of 820,000 tonnes of CO_2 per annum from tree biomass, and the creation of legacy emissions of 700,000 tonnes of CO_2 per annum that will be realised over decades as logs left in the forest decay and wood used in buildings reach the end of its useful life. Protecting the half a million hectares of north-east NSWs public native forests currently available for logging would allow them to sequester in the order of an additional 2.7 million tonnes of CO_2 per annum. Stopping logging of public native forests will therefore make a significant and immediate difference in this current climate emergency. The Commonwealth is requested to withdraw its approval of the North East NSW Regional Forest Agreement.

3. Creating a market for burning native forests for electricity will increase logging intensity and carbon emissions.

There is currently a proposal by Verdant Earth to restart a closed coal-fired power station at Redbank, near Singleton in the Hunter valley, with 850,000 tonnes of biomass, with at least 70% of the biomass sourced from forestry residues.

In most southern forests the majority of the timber removed from the forests is for woodchips or pulplogs, meaning most of their carbon is relatively quickly released to the atmosphere as CO_2. This is not currently the situation in north-east NSW as export woodchipping was stopped in 2013, and pulpwood currently comprises less than 5% of the logs removed from native forests. Ximenes *et al.* (2016) note:

> *The ratio of pulp logs to sawlogs (on a C basis) was 70/30 for silvertop ash, and 64/36 for mountain ash. There was no difference between the commercial log recoveries for blackbutt and for silvertop ash (59%) – however if there was a pulp market in the mid-North coat of NSW, the production log recoveries for blackbutt would have been considerably higher.*

One of the scenarios considered by Ximenes *et al.* (2016) was "*50% of forest residues left on site utilised for pulp*", which would predominantly be comprised of the relatively long-lived Coarse Woody Debris and trees which otherwise wouldn't be logged. Currently only some 20,000 m^3/yr is removed from north-east NSW as pulpwood, though DPI (2017) identify that 399,958 tonnes (247,974 tonnes dry biomass) per annum are potentially available from public native forests for biomass. The removal of this material, intended to be for burning to generate electricity, would significantly increase short-term CO_2 impacts.

Contrary to claims that the timber proposed to be removed from forests for biomass is waste, most will be removed as logs with leaves, branches, tree crowns, bark and stumps left in the forest. DPI's (2017) North Coast Residues report identifies:

> *For native forests, residue estimations were conservative, as we only considered logs that met the specifications for pulpwood as available for extraction (typically 10 cm small end diameter overbark, and a minimum of 2.5 m in length – no species restrictions – and the crown was typically left in the forest). This was partly due to the fact that the local industry already has experience harvesting and transporting pulpwood from the forest. Extracting pulpwood only, means that a significant proportion of the residues generated (stump, bark, leaves, small branches, large and defective stem sections) are left in the forest,*
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> *The values assume that a substantial proportion of the biomass (typically at least 20% of the total biomass) is left in the forest after harvest.*

Some of these pulplogs will be obtained from parts of trees otherwise felled for sawlogs, though most pulplogs will come from trees that would not otherwise be felled without a biomass market.

Creating a market for burning native forests for electricity will increase logging intensity and log removal, and the rapid release of carbon from coarse woody debris that would otherwise be left in the forest to slowly decompose over decades. The Commonwealth must not allow a biomass industry to compound the impacts of export woodchipping.

4. Recognise that burning forests for electricity is more polluting than coal:

We have the perverse situation where trees are increasingly being proposed to replace coal in power stations on the pretence that wood can be burnt without releasing carbon dioxide. The absurdity is that power stations burning wood can now pretend that they are not emitting any CO_2 at all. For example, the Planning Report (URBIS 2021) for Verdant Earth's Redbank power station claims the burning of 850,000 tonnes of biomass will result in no CO2 emissions what-so-ever, stating:

> *The National Greenhouse Accounts Factors state the emission factor for CO2 released from the biogenic carbon fuels is zero. This is in accordance with the position of the IPCC. The reason for this is, in simple terms, that the carbon emissions from the combustion of biomass from sustainable forestry are offset by the carbon capture from the regenerating biomass within the managed forestry system.*

DPI's Dr Cowie's Expert report on Climate Change and Ecologically Sustainable Development matters identifies that this annual volume used will be equivalent to 637,500 t dry matter. If half this is taken to be carbon, then its combustion will generate 1.2 million tonnes of CO_2 per annum, though this is not mentioned or considered anywhere in the supporting documents. Because of the Federal rules they just pretend these emissions don't exist.

This pretence is an outrageous sham, particularly as burning wood is worse than coal. Sterman *et. al.* (2018) emphasise that burning wood for energy is more polluting than coal and that it takes many decades for regenerating forests to regain that lost:

> *We simulate substitution of wood for coal in power generation, estimating the parameters governing NPP and other fluxes using data for forests in the eastern US and using published estimates for supply chain emissions. Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO2 relative to coal. The payback time for this carbon debt ranges from 44–104 years after clearcut, depending on forest type—assuming the land remains forest.*

Norton *et. al.* (2019) reinforce that burning biomass releases more CO_2 to the atmosphere than burning coal:

> *Woody biomass contains less energy than coal (biomass pellets 9.6–12.2 GJ/m3; coal 18.4–23.8 GJ/m3; IEABioenergy, 2017), so that CO2 emissions for the same energy output are higher (110 kg CO2/GJ for solid biomass, 94.6–96 kg CO2/GJ for coals in IPCC, 2006). Combined with the energy needs to gather from diffuse sources and intermediate treatment (drying and pelleting), replacing fossil fuels in electricity generation results in significant increases in emissions of CO2 per kWh. The net effect of switching to biomass is thus usually to increase emissions and thus increase atmospheric levels of CO2.*
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> *It is thus of considerable concern that scientific analyses indicate that, far from reducing GHG emissions, replacing coal by biomass for electricity generation is likely to initially increase emissions of CO2 per kWh of electricity as a result of the lower energy density of wood, emissions along the supply chain, and/or less efficient conversion of combustion heat to electricity (see later). The resulting increase in atmospheric concentrations of CO2 increases radiative forcing and thus contributes to global warming. This initial negative impact is only reversed later if and when the biomass regrows. Research has shown that the time needed to reabsorb the extra carbon released can be very long, so that current policies risk achieving the reverse of that intended—initially exacerbating rather than mitigating climate change.*

McKechnie *et. al.* (2011) undertook a life cycle assessment and forest carbon analysis to assess total Greenhouse Gas (GHG) emissions of forest bioenergy over time, finding:

> *For all cases, harvest-related forest carbon reductions and associated GHG emissions initially exceed avoided fossil fuel-related emissions, temporarily increasing overall emissions. In the long term, electricity generation from pellets reduces overall emissions relative to coal, although forest carbon losses delay net GHG mitigation by 16−38 years, depending on biomass source (harvest residues/standing trees).*

Ter-Mikaelian *et. al.* (2015) undertook a review of the theory and principles for correctly assessing the Greenhouse Gas (GHG) effects of forest bioenergy, observing "*accounting for emission benefits when fossil fuels are replaced requires accounting for forest carbon (either in forest or in traditional wood products) that would have continued to exist if fossil fuels were not replaced by bioenergy*", and noting:

> *When correctly accounted for, GHG emissions from live tree forest biomass used for energy exceed those from fossil fuels for periods of a few years to more than a century, and the difference can be substantial, depending on the characteristics of the forest harvested and the fossil fuel replaced by bioenergy. Even when bioenergy from live tree biomass from temperate forests replaces coal, a CO2-intensive fossil fuel, the time to obtain a net reduction in atmospheric CO2 can be decades; if it is replacing a less CO2-intensive fossil fuel, the time to achieve an atmospheric benefit may be more than 100 years.*

Recently Peter Raven, Director Emeritus Missouri Botanical Society, and around 500 scientist *co-signatories* wrote a Letter Regarding Use of Forests for Bioenergy (February 11, 2021) to President Biden, President von der Leyen, President Michel, Prime Minister Suga, and President Moon, urging them "*not to undermine both climate goals and the world's biodiversity by shifting from burning fossil fuels to burning trees to generate energy*", noting:

> *… In recent years … there has been a misguided move to cut down whole trees or to divert large portions of stem wood for bioenergy, releasing carbon that would otherwise stay locked up in forests.*
>
> *The result of this additional wood harvest is a large initial increase in carbon emissions, creating a "carbon debt," which increases over time as more trees are harvested for continuing bioenergy use. Regrowing trees and displacement of fossil fuels may eventually*

> *pay off this carbon debt, but regrowth takes time the world does not have to solve climate change. As numerous studies have shown, this burning of wood will increase warming for decades to centuries. That is true even when the wood replaces coal, oil or natural gas.*
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> *The reasons are fundamental. Forests store carbon - approximately half the weight of dry wood is carbon. When wood is harvested and burned, much and often more than half of the live wood in trees harvested is typically lost in harvesting and processing before it can supply energy, adding carbon to the atmosphere without replacing fossil fuels. Burning wood is also carbon-inefficient, so the wood burned for energy emits more carbon up smokestacks than using fossil fuels. Overall, for each kilowatt hour of heat or electricity produced, using wood initially is likely to add two to three times as much carbon to the air as using fossil fuels.*
>
> *Increases in global warming for the next few decades are dangerous. This warming means more immediate damages through more forest fires, sea level rise and periods of extreme heat in the next decades. It also means more permanent damages due to more rapid melting of glaciers and thawing of permafrost, and more packing of heat and acidity into the world's oceans. These harms will not be undone even if we remove the carbon decades from now.*
>
> *Government subsidies for burning wood create a double climate problem because this false solution is replacing real carbon reductions. Companies are shifting fossil energy use to wood, which increases warming, as a substitute for shifting to solar and wind, which would truly decrease warming.*

The claim that biomass is carbon neutral is based upon an accountancy trick that allows the emissions generated by burning biomass to be fully discounted on the assumption that sometime in the future the land from which it was obtained will be allowed to regrow and recapture the lost carbon, though even if the forest is allowed to regrow it may take decades or centuries to recapture the released carbon. In our current climate emergency, when we urgently need to reduce CO_2 emissions, biomass is part of the problem, not a solution.

Most significantly if the forest was left to grow older, rather than being logged, the trees and soils would go on sequestering ever increasing volumes of carbon over time. Logging trees for biomass creates an incentive to increase tree removal and land-clearing.

The Commonwealth Government must ensure that all actual carbon emissions from burning wood for electricity are fully disclosed and considered, with any offsets clearly and separately distinguished.

5. Exclude native forest wood from being eligible for Renewable Energy Certificates.

The Multi-Party Climate Change Committee, chaired by PM Gillard, agreed in July 2011 to exclude native forest wood from being subsidised as a renewable energy resource. The removal meant that native forest electricity producers could still produce electricity but they would not receive Renewable Energy Certificates. This was subsequently over-turned.

The recent NSW parliamentary inquiry into 'Sustainability of energy supply and resources in New South Wales' found the burning of forest biomass for power generation is *"not economically or environmentally sustainable, and it generates significant carbon emissions",* recommending *"the government takes steps to declassify forest biomass as a form of renewable energy and ensure it's not eligible for renewable energy credits"*. They note:

> *We consider that energy from native forest biomass is not sustainable, and should not be classed as a renewable source. Many inquiry participants told us that this form of bioenergy leads to deforestation, produces more emissions than fossil fuels, reduces the number of older trees that can reabsorb carbon from the atmosphere, and negatively impacts on biodiversity. It is also an expensive form of energy generation*

We ask that the Commonwealth now amend the Renewable Energy (Electricity) Act 2000, and any other relevant instruments, to prohibit "wood obtained from native forests" being eligible for Renewable Energy Certificates, particularly large-scale generation certificates (LGCs). Amend clause 17 *"(2) Despite subsection (1), the following energy sources are not eligible renewable energy sources*" to include "*wood obtained from native forests*"

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