North East Forest Alliance Inc.

NORTH EAST FOREST ALLIANCE

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Submission to DA183/1993

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The North East Forest Alliance Inc strongly objects to the proposed modification of DA183/1993 for the Redbank power station to use biomass.

The approval by the L&E Court for the modified development states (10217 of 1994):

> *Development consent is granted to the construction and operation of a power plant … and to the construction and operation of ancillary tailing collection, preparation and transportation facilities on adjacent land …. As specified in development application No. 183/93 as modified …*
>
> *16 At least the majority of the fuel burnt at the power plant in any one year after commercial operation, on a dry tonne basis, is to be derived from coal washery tailings obtained either directly from the Warkworth mine washery or indirectly from tailings storage dams on the Warkworth mine leases.*

The applicant is seeking to modify the original court consent using Section 4.56 of the EPA Act 1979 by claiming that the development is "substantially the same development as the development for which the consent was originally granted". The SEE's Table 1 basically claims that the only change is from coal to biomass, though their simplistic assessment fails to consider the multitude of changes:

- Change the fuel source from coal to biomass – while pretending it may still include coal.
- Increase in the volumes delivered to the site from 700,000t of coal tailings annually to somewhere around 1,000,000t of biomass annually
- Change in delivery of coal to the site from 7 km away using a conveyor, to reliance on trucks transporting biomass from hundreds of kilometres away. If the material is all obtained from forests and/or landclearing it would result in the removal of some 1.4 million tonnes of green wood from forests/plantations, transport through rural communities to some unidentified secondary processing sites, transport along unspecified routes of 1 million tonnes of partially treated and raw woodchips into the plant each year, and the removal of ash for disposal at unknown locations. The impacts on local roads, bridges and rural villages have not been considered, and neither have the associated CO_2 emissions.
- Significantly increase the environmental impacts of the development by obtaining biomass from the logging and clearing of native forests; increasing the unsustainability of logging, incentivising the removal of more trees and more extensive logging, increasing logging intensity and associated soil degradation, loss of understorey, loss of habitat and stream pollution. There has been no attempt to identify or consider impacts on soils, streams, ecosystems, flora, or fauna.

- Establish an unknown number of secondary processing facilities at unidentified locations to prepare woodchips for use, with no consideration of impacts.
- More than double the emission of CO_2 into the atmosphere on site, with site emissions likely to be over 2 million tonnes of CO_2 per annum, and total CO_2 emissions from associated logging, processing and transport far higher.
- Change the type and nature of pollutants released into the environment via smokestacks, wind and water erosion of woodchip and ash piles, and from ash disposal, that will affect human and environmental health in a very different way to coal pollutants.

NEFA considers that creation of a new market for pulpwood will facilitate an increase in logging intensity and environmental impacts, the removal of trees and logs providing essential habitat components for an array of fauna, and the logging of forests that would otherwise not be economic to be logged. Constraints on logging and clearing of forests in NSW have been significantly weakened in recent years, increasing landclearing is now mostly "unexplained", logging intensity has been (or is being) approved to increase, many prescriptions for threatened species have been removed or weakened, buffers to protect streams are inadequate and have been reduced, and forests have been extensively degraded by the 2019/20 bushfires. There needs to be a full environment impact assessment.

NEFA does not consider that the claimed volumes from the identified sources exist. As such it will incentivise the redirection of low quality sawlogs to pulpwood, increase logging intensity and encourage the clearing of private lands. As demonstrated by the export woodchipping industry, at this level biomass will become the prime driver of logging and clearing of public and private forests in northern NSW.

Climate heating due to CO_2 emissions is a clear and present danger as intensifying droughts and heatwaves increase mortalities and morbidities of plants and animals, dieback is spreading, and wildfires are increasing in intensity, frequency and extent. These changes are compounding logging impacts, while logging is amplifying their impacts, and climate heating is rapidly escalating.

The pretence that the development will result in no emissions of CO_2 on site is false and misleading. In reality it is expected that the burning of 850,000 dry tonnes of biomass on site is likely to result in annual emissions of some 2.16 million tonnes of CO_2 at the site. In addition to this there is likely to be more than twice this volume of CO_2 released from trees in the associated logging and processing. As well there will be significant CO_2 emissions associated with harvesting machinery, incidental tree and understorey damage, soil losses, and transport. There needs to be some honest carbon accountancy.

NEFA considers this proposal an existential threat to our future as it will increase the removal of trees essential to keep climate heating below the Paris target of 2^{o}C, and limit the growing threats of droughts, heatwaves and catastrophic fires. Urgent action needs to be taken to stop the clearing and logging of native forests (proforestation) so as to restore their carbon carrying capacity. This proposal will increase the loss of older trees and their ability to sequester carbon, and release their stored carbon to the atmosphere. With the collapse of forests already commenced, as evidenced by the 2019-2020 wildfires, this proposal will worsen an already deteriorating climate and extinction crisis.

It is clear that this proposal does not satisfy the most basic requirement of being in the public interest, due to the increase in CO_2 facilitating climate heating, and associated droughts, heatwaves, bushfires, floods and sea-level rises, and logging of native forests being unacceptable to the majority of people.

As found by the recent NSW parliamentary inquiry into 'Sustainability of energy supply and resources in New South Wales':

> *… steps must be taken to ensure* [the burning of forest biomass for power generation] *doesn't become a major energy source, and that it's not eligible for renewable energy credits. It's not economically or environmentally sustainable, and it generates significant carbon emissions.*

NEFA considers that should the proponents wish to proceed, that a new Development Application, including an Environmental Impact Statement, is required for what is a very different activity. This should include:

1. An honest carbon balance that truthfully identifies the CO_2 likely to be generated by the activity, both on and off site.
2. An assessment of all pollutants generated by the burning of wood, including contaminants, both within and outside the stack as well as in the residue ash. This needs to include a full assessment of their effect on human health and identification of the neighbours and communities likely to be most affected.
3. The identification of sources, types and quantities of biomass, and the potential effects of redirecting sawlogs into burners, increasing landclearing, and burning of tyres and other waste.
4. An assessment of the environmental impacts of harvesting the material, including:
    a. the effect of biomass removal on increasing logging intensity and extent,
    b. the effects of increased log removal on invertebrates, fauna , and CWD carbon stores.
    c. the effects that increased logging intensity and extent will have on soils, streams, ecosystems, flora and fauna.
    d. a nutrient budget analysis to identify, and mitigate, the loss of nutrients through both the harvesting of trees for biomass and increased removal of woody material, as well as the loss of soil nutrients and the loss of nutrients through pre/post-logging burns.
    e. consideration of the extremely poor performance of current land clearing and logging regulations for private and public lands, and the increased impacts that will eventuate from the reductions of those limited protections that is currently underway.
5. A full assessment of truck movements and routes, from the forests to secondary processing facilities, and from there to Redbank, and from the plant to the ash disposal sites, is required. This needs to include impacts on local road networks, bridges and towns.

NEFA has no conflicts of interest or disclosures to make.

Yours sincerely,

Dailan Pugh OAM

President

North East Forest Alliance Inc

Summary

1 Fuel

It is apparent that contrary to a pretence that coal will still be a feedstock, the intent is to wholly change the fuel source to biomass. This ruse that coal may still be used is intended to be misleading in order to pretend it is just a variation to the original consent, which it clearly is not.

The intent is to increase volumes imported to the site from 700,000 tonnes to something like 981,120 tonnes per annum, a 40% increase, which is not a minor variation.

Whereas before the majority of the fuel was delivered to the site primarily via conveyor direct from the Warkworth mine less than 7 km away, now the intent is to deliver all the fuel to the site by trucks from up to 300km away which is not a minor variation.

The proposal is now to establish an unspecified number of secondary processing facilities to process unspecified volumes of biomass, at unspecified locations, for supply to Redbank. This is not a minor variation.

The proposal is also to woodchip some of the wood and stockpile it in the forest, which will significantly increase site impacts and increase fire threat. This is not a minor variation.

1.1 Sources

The exhibited Supply Chain Report is an earlier version and apparently not that relied upon by the proponent.

The exhibited Supply Chain Report identifies a variety of potential biomass fuel sources, though it does not identify which of these, and what volumes, are to be used.

While there are claims of MOUs for unspecified volumes and claims of discussions with 15-20 suppliers, there is no indication of what volumes the proponent has commitments for, or where those volumes are to be sourced from.

The Forestry Corporation recently told NSW parliament that Redbank's resources "*will not be from public native forest"* and the EPA implied that Redbank can only use sawmill residues, and have had no engagement with Redbank. This puts into question a large proportion of their potential resources.

There are considerable questions about the availability and sources of the one million tonnes of wood biomass per annum to feed into the boilers. Will this proposal result in a massive increase in landclearing? Will they, like many similar plants overseas, be forced to burn more polluting materials (ie tyres, waste) in order to keep the boilers going? The proponent needs to clearly identify the actual availability and location of proposed feedstock.

1.1.1 Forestry Residues

Effectively any tree or part thereof that does not meet the definition of a high quality large sawlog may be classed as 'forestry residues' and removed for biomass fuel in the course of any logging operation, and may be the sole timber removed in broadly defined thinning operations. These broad definitions leave it open for small and low quality sawlogs to be burnt, and for logging operations to be undertaken solely for pulplogs.

The only resource assessment relied upon is DPI's (2017) North Coast Residues report, which only identifies a total of 648,500 dry tonnes of forest and plantation residues (pulplogs) potentially being available across the whole of north-east NSW, without accounting for existing commitments and those resources outside the 300km limit identified for Redbank.

In 2018 the Forestry Corporation issued an Expression of Interest for 321,850 green metric tonnes of pulp/residue logs from north-east NSW's State Forests and plantations, which was claimed to be the total volume available. Of this, 64,850 tonnes was available in supply zone 1, largely outside the identified catchment area for Redbank, leaving 257,000 green tonnes, or 185,000 dry tonnes potentially available to Redbank. It is not known what proportion of this was subsequently allocated. The DPI (2017) estimates of pulpwood availability are apparently grossly inflated, and could only come close to being realised if all committed and uncommitted low quality sawlogs were reclassified as pulpwood. NEFA does not accept either the estimates relied upon or the reallocation of low quality sawlogs to pulpwood for burning.

The 2019/20 wildfires resulted in widespread death and damage to trees, with a 25% loss of the smaller trees often used for pulplogs in north east NSW. A significant proportion of the volumes of pulplogs and sawmill residues identified in 2018 no longer exist. With climate heating causing an increase in the intensity and frequency of droughts and wildfires, this emphasises the folly of relying on what can be ephemeral resources.

The DPI (2017) estimates of volumes of pulplogs available from private properties are guess work, and realization of the claimed volumes would depend on reaching agreements with thousands of individual landowners, many of whom are unlikely to want to do so. Further to this, yields from private forests have been significantly reduced by the 2019/20 wildfires. It is pie in the sky.

The claim that there is a "minimum two million tonnes of available residues per annum from harvesting operations of private native plantation operations that are otherwise left and burnt in mass in situ" are unsubstantiated and unbelievable.

Claims that an additional 500,000 tonnes per annum of biomass is available through land clearance, bushfire zoning etc under an integrated approval under the Forestry Act 2012 is unreferenced and untenable.

1.1.2 Sawmill Residues

The way the data are presented by DPI (2017) precludes the identification of the total volume of sawmill wastes potentially available, most of which are already committed to other uses anyway.

2 Pollutants

2.1 Carbon Dioxide

The SEE makes the misleading claim that asses the "emissions from sources owned or operated by the facility", yet it makes no attempt to identify or consider the site emissions of CO_2 from incineration of a million tons of biomass, rather pretending they don't exist. This is erroneous and misleading. The pretence that emissions will be compensated for by their uptake in regrowth somewhere off-site is irrelevant to site emissions, aside from the fact that it will take decades or centuries to be realised.

Contrary to claims, the burning of 850,000 tonnes of biomass on site is likely to result in annual emissions of some 2.16 million tonnes of CO_2 at the site. In addition to this there will be significant

CO_2 emissions associated with harvesting machinery, soil losses, remnant forest residues, off-site processing, transport and the like.

2.1.1 Is burning biomass less polluting than coal?

It is evident that substituting wood biomass for coal will more than double site emissions of CO_2, with vast quantities emitted off-site.

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 CO2 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. The net carbon benefits of using a non-polluting energy source such as solar, and leaving the forest to age, needs consideration as an alternative in an EIS.

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2.1.2 Does biomass removal increase logging intensity and tree removals?

The NSW Government is reducing tree retention requirements to allow for increased tree removal for biomass. Creating a market for pulplogs facilitates increased tree removal and logging intensities. Meaning that without a market for biomass significantly more trees will be left standing to sequester carbon.

NEFA is concerned that if this proposal is approved that it will increase logging intensity, the removal of live trees, and the removal of large logs, thereby increasing the volume of CO_2 released in logging operations.

2.1.3 What is the carbon cost of obtaining biomass for burning?

When a tree is logged around 60% of its biomass, and therefore carbon, will remain in the forest as residues. It is important to recognise that large logs in a forest are essential habitat for a wide variety of fauna and may have an average lifetime of around 50 years, with some of their carbon being added to soil carbon. Where there is a market for pulpwood it will increase the removal of larger logs that would otherwise be left to slowly decay. Over time logging will run down tree and log sizes.

So at best, with a biomass market, of the logged trees 40% may be removed from the forest, of this 40% (16% of the trees) may be used for sawlogs, of this 40% (6.4% of the trees) may become sawntimber. At this stage 94% of the trees felled, and their carbon, are waste, though tree stumps, large roots and large logs may take decades to decompose. This low recovery is worse in some forests, and will get worse with repeated logging events.

The sawntimber will have variable lifespans, some will have short lifespans (ie pallets, garden stakes) while some may be stored for decades in buildings. At the end of its useful life some may be burnt and some may end up in landfill. Because of the anaerobic conditions, timber in landfill may take decades or centuries to decompose. Redirection of timber from landfill to burning will immediately release its carbon.

Around a third of the biomass from a logging operation may end up being burnt for electricity, meaning that total tree carbon emissions associated with obtaining that biomass may be 3 times greater. In the case of this proposal that's a total of 6.5 million tonnes of CO_2 released from forest trees associated with obtaining the fuel for Redbank. What proportion of that can be attributed to biomass is a moot point, it can certainly be attributed to the logging operations used to source the biomass.

In addition to this there are significantly increased forest emissions resulting from incidental death and damage to retained trees and loss of soil carbon. There are also significant emissions associated with logging machinery, truck transport, and sawing, chipping and drying timber. And there is foregone carbon sequestration that is lost by killing the trees to obtain the biomass.

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Logging, and post logging burns, also result in significant damage to retained trees. A significant proportion are killed or severely damaged, releasing their carbon or retarding carbon sequestration.

Loss of large hollow-bearing trees, and potential recruits, have significant impacts on a large diversity of hollow-dependent and nectivorous fauna, as well as carbon stores.

Loss of soil carbon can be massive during logging and carbon deficits may persist for decades, offsetting carbon uptake by regenerating or planted trees for a long time.

By reducing the ages and sizes of trees, past logging has generally halved the carbon stored in forests. The lost carbon is recoverable over time if forests are left to mature. If they are now relogged this will further reduce the sizes of trees and the forest's carbon storage, and it will take many decades to regain what was lost. Regrowth will always lag well behind the growth that would have occurred had it not been logged.

2.1.4 Does logging reduce the potential for large intense wildfires, which generate greenhouse gasses?

Contrary to the pretence that logging reduces the potential for large intense wildfires, which generate greenhouse gases, the evidence is that it increases the flammability of forests, the intensity of fires, and therefore the generation of greenhouse gasses.

2.2 The importance of retaining forests to reduce atmospheric CO2

A significant part of the solution to the climate crisis is to protect native forests from clearing and logging to allow them to regain their carbon carrying capacity. This will provide immediate results as growing trees take up and store ever increasing volumes of carbon as they age. We can take immediate and meaningful action on climate heating just by stopping logging of public native forests and offering incentives to private landholders to protect theirs.

2.3. Other pollutants.

The pollutants released from storage, processing, transport and burning of wood biomass are very different to coal, as such there needs to be a full and contemporary assessment of impacts on the receiving environment, air quality and the surrounding community.

2.3.1 Disposal of ash.

NEFA considers that there needs to be a full assessment of the pollutants in ash, identification of disposal sites, and an assessment of likely transfer of pollutants to surrounding environments by wind, runoff and leaching.

3 Environmental Impacts

As demonstrated by the timber industry's own report, it is clear that logging of native forests, on both public and private lands is considered unacceptable by the vast majority of Australians and thus is not in the public interest.

3.1 Private Lands

State and nationally listed Threatened Ecological Communities (TECs) on private lands have not been mapped and agencies responsible for overseeing their protection do not have either the will or the expertise to identify them, preferring to leave it up to landholders to decide for themselves what to

protect. If NEFA's experience from public lands is an indication, we expect that TECs are routinely cleared and logged.

After considering the evidence, the bipartisan Parliamentary inquiry into Koala populations and habitat in New South Wales found "*that the regulatory framework for private native forestry does not protect koala habitat on private land*". This view that private lands are not adequately managed have been echoed by the NSW Auditor General, the Natural Resources Commission and numerous local Councils. Yet as illustrated by the 2020 Koala wars the Nationals are progressively implementing their agenda of removing regulation of, and constraints on, logging and clearing. They want a free-for-all on private lands and they are getting it.

Local Governments have made it clear that the proposed changes identified by the NSW Government remove important protections for koala habitat and disenfranchise local Government's regulation of logging and clearing activities, while facilitating extensive and inappropriate land clearing and logging.

3.1.1 Landclearing free-for-all

Landclearing in NSW is literally out of control, with 72% of landclearing "unexplained", the Natural Resources Commission considering "*unexplained clearing pose a major risk*", the Auditor General finding landclearing "is not effectively regulated and managed, and the NSW Government intent on further weakening existing constraints. Landclearing permanently removes forests, their carbon sequestration ability, and the habitat they provide, while releasing large volumes of CO_2 into the atmosphere. Creating a market for biomass will provide a financial incentive to reward and encourage landclearing.

3.1.2 The PNF Code of Practice

The NSW Government has proposed extending PNF approvals from 15 to 30 years, thereby entrenching the problem that logging operations only need to comply with the Codes applicable at the time of approval. Meaning that when additional information comes to light, or logging rules are updated, they don't need to be applied. This is contrary to ESFM's basic principle of adaptive management.

Despite the overwhelming evidence of significant impacts on species, ecosystems, soils and streams from the Black Summer bushfires, and the expert advices to take additional measures to mitigate impacts (such as protecting unburnt refugia), the Local Land Services did nothing to mitigate impacts. It was business as usual. The failure of LLS to increase prescriptions for burnt forests to mitigate the greatly increased impacts of Private Native Forestry on soils, streams, ecosystems and species (including Koalas) exemplifies the parlous state of regulation of private lands in NSW.

NEFA considers that a large proportion of the 29,000 ha of mapped oldgrowth and 4,000 ha of mapped rainforest deleted by OEH (by 2018) has been erroneously remapped and made available for logging. While oldgrowth and rainforest were originally mapped in a process involving oversight by all stakeholders, the remapping is undertaken in a secretive process using different decision rules and methods. Even with the new rules an internal review found that oldgrowth was being erroneously deleted, and NEFA have documented a case where Critically Endangered Lowland Rainforest of Subtropical Australia was remapped as either cleared land or part of the logging area. The deleted oldgrowth and rainforest is now potentially available as fuel for Redbank.

Regrettably it is clear that for Koalas both the Conservation and Management Strategy and NSW Recovery Plan requirements relating to identifying and protecting important habitat areas,

identifying improved and standardised survey methods, and monitoring and reviewing the effectiveness of mitigation measures, are not being complied with on private lands

While the PNF logging Code does have a variety of prescriptions to protect habitat or habitat attributes around known records of threatened species, there are few existing records for private land and no requirement to look for them prior to logging. This means that in practice no specific mitigation measures are applied for most threatened plants and animals, even where the need for mitigation actions are recognised. PNF is a threat to a multitude of threatened plants and animals.

3.2 Public forestry

In adopting the new CIFOA logging rules for public lands the NSW Government has significantly eroded environmental protections and abandoned any pretence that logging is ecologically sustainable.

The new CIFOA logging rules have allowed a major intensification of logging throughout north-east NSW's public forests, with a 140,000ha North Coast Intensive Zone allowing clearfelling, and minimal tree retention elsewhere. Without requirements for retention of mature trees, those old trees left in logging areas will quickly succumb to old age, logging injuries and fire, converting native forests into pseudo plantations of regrowth. To achieve the increased logging intensity the Forestry Corporation needs a market for pulpwood, the intent is to use biomass logging to convert "*multiple use forests with significant biodiversity values to that of purely production forests more in line with plantations".* The environmental impacts will be massive.

Under the new logging rules most pre-logging survey requirements and most species-specific protections for threatened species were removed or reduced, leaving most threatened plants and animals with no or less protection from logging. The intensification of logging involving biomass removal leaves these now unprotected species particularly vulnerable.

The new CIFOA logging rules reduced buffers on headwater streams from 10m down to 5m contrary to the scientific advice that they should be at least 30m, removed existing increased riparian exclusions established around records of 17 threatened species, and removed protection for riparian areas that had existed for over 20 years against the explicit advice of the agency Threatened Species Expert Panel. There can be no doubt that a biomass market will increase the intensity and extent of logging in these sensitive riparian areas, and will have significant environmental impacts.

The new CIFOA pretends to compensate for the increased logging intensity, removal of most protection for mature trees, the removal of most pre-logging survey requirements for threatened species, and the removal of exclusions or modified logging around records of threatened species, by requiring that the Forestry Corporation choose 10-13% of the net logging area be protected in perpetuity. Though as surveys for threatened species are no longer required, and the Forestry Corporation are primarily concerned with limiting resource losses, the areas chosen are insufficient and often inappropriate to mitigate logging impacts on threatened species.

3.2.1. Large old trees

Tree hollows are used by seventy species (28%) of vertebrates in north-east NSW, providing essential roost, den and nest sites for many of these. The large hollows necessary for larger species such as Powerful Owl, Masked Owl, Barking Owl, Greater Glider, Yellow-bellied Glider, and Glossy-black Cockatoo are only provided by trees over 200 years old. It is essential to retain those hollow-

bearing trees remaining, and enough of the next largest trees so that they are able to develop into the hollow-bearing trees of the future.

There is abundant evidence that larger trees provide more nectar in more years than smaller trees and that consequently larger trees provide essential resources for nectarivores such as Regent Honeyeater, Swift Parrot, Yellow-bellied Glider and Squirrel Glider. Retention of mature trees of key nectar species is essential to minimise impacts of logging on nectarivores.

It is evident that a variety of animals rely upon larger trees for other food resources, such as Yellow-bellied Glider and Squirrel Glider for sap and Koalas for forage. We still don't know enough about most species' habitat needs to fully appreciate this reliance, though a precautionary approach necessitates increased protection of mature trees.

The new CIFOA has ignored the recommendations by one of the Threatened Species Expert Panel to retain all trees greater than or equal to 100 cm dbh, and the EPA's compromise of all trees over 120-135 cm dbh was over-ridden, instead the Government opted for the Forestry Corporation's limit of 140-160 cm dbh. It is those trees over 80-100 cm diameter that are of the utmost importance to the survival of a plethora of native species, and are thus essential to reduce logging impacts upon them. Allowing more of these giant trees to be logged significantly increases logging impacts.

The 2018 CIFOA removes protection for most mature trees, most significantly those previously required to be retained as recruitment hollow-bearing trees and nectar feed trees. There is no longer an intent to maintain hollow-bearing trees in perpetuity in logging areas, which also means the hollow-dependent animals that rely upon them. The removal of protection for most mature trees is a significant blow to the numerous animals that rely upon them for critical resources, whether it is a Koala relying on them for browse, birds searching decorticating bark for invertebrates, gliders tapping them for sap, or one of the many who depend on their abundant nectar. This has greatly amplified logging impacts on a broad range of forest species. The creation of a market for defective mature and old trees, or parts of them, will facilitate their removal.

3.2.2 Koalas

After 1997 the Forestry Corporation were required to undertake thorough searches for Koala scats to identify Koala High Use Areas to exclude from logging and intermediate habitat where 5 feed trees/ha were required to be retained. The Forestry Corporation refused to undertake thorough surveys, only identifying an average of 74.6 trees with Koala scats under them, and some 13ha of Koala High Use Areas, each year – despite logging tens of thousands of hectares of high quality Koala habitat. After NEFA caught the Forestry Corporation illegally logging Koala High Use Areas in 2012, the EPA briefly tried to enforce compliance, though quickly gave up and decided to abandon survey requirements.

For the CIFOA the Government adopted a model to identify two classes of Koala habitat, with requirements to retain 5 feed trees/ha >20cm dbh in one and 10/ha in the other. In adopting this they ignored the advice of their own Koala expert panel that the model was too inaccurate to use for regulation, and that instead the priority should be to survey to identify extant Koala colonies for protection. When setting tree retention rates the EPA supported the advice of an agency Expert Fauna Panel that retention rates should be 15-25 feed trees/ha >25cm dbh, though instead the Forestry Corporation's retention of 5-10 feed trees/ha >25cm dbh was adopted. There can be no doubt that the new rules are grossly inadequate to mitigate impacts on Koalas and that numerous feed trees essential for Koala's survival will be taken for biomass.

3.2.3 Fires a gamechanger?

The 2019/20 bushfires had an immense impact on the forests of north-east NSW, burning 1.3 million ha of Public Lands and 1.1 million ha of private lands. Some 456,000 ha (54.4%) of State Forests was burnt, with 259,000 ha suffering significant canopy loss. The impacts were immense and will be long lasting, compounding impacts from logging. Millions of animals and millions of trees were killed. As climate heating progresses the risk of similar and more intense events is increasing.

The Koala was one of those species known to have been significantly affected by the 2018/19 wildfires, with 29.4% of modelled 'likely' Koala habitat in north-east NSW burnt and recorded population declines of 71-90% in burnt forests. Despite this the intent was to compound impacts by logging Koala habitat in burnt forests without undertaking surveys to identify and protect vital fire refugia.

The Hastings River Mouse is known to be one of those species worst affected by the 2019/20 wildfires, with 82% of known localities burnt. In Styx River SF logging continued in the only patch of occupied habitat that escaped burning, even after the Commonwealth recommended urgent surveys and protection of unburnt refuges. This displays contempt for the survival of one of our most endangered species.

The intensity and extent of the combined impacts of the 2019/20 drought and fires necessitates a long-term change in logging prescriptions to mitigate environmental impacts. Continuation of logging under the already inadequate CIFOA logging rules poses an extreme environmental risk. The expert advice obtained by the EPA advises they are inadequate "*to guarantee ecologically sustainable forest management and are likely to cause an ongoing decline and significant impact on biodiversity".* Obtaining biomass from State Forests is not ecologically sustainable and poses a significant environmental risk.

3.2.4 Forestry Criminality

The Forestry Corporation displays a reckless attitude towards compliance with its environmental obligations, meaning that timber taken has often been obtained illegally in contravention of the logging rules. Having a market for pulpwood will increase the impact of illegal logging by facilitating the felling of more large trees, the removal of more logs, more mechanical damage to understorey and retained trees, and more soil disturbance.

4 Transport

This is a very different proposal from what was originally proposed, rather than transporting most fuel by conveyors from 7 km away, the intent it to now transport huge volumes of green logging "residues" from thousands of sites to secondary processing facilities and then for hundreds of kilometres from those sites, and some forests, to Redbank. Then the residual ash and rejected timber is to be transported to some unknown disposal sites. There needs to be a comprehensive traffic assessment that accounts for all traffic movements, including CO2 emissions, identifies transport routes and traffic volumes, and identifies the impacts on rural roads, bridges and communities.

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1. Fuel

The original development approval (**DA183/1993**) was for a coal fired power station transporting most of its 700,000 tonnes of feedstock by a conveyor belt from a coal mine some 7 km away. Now the proposal is for a biomass fed power station transporting most of its 1,000,000 tonnes of feedstock by trucks from scattered sites in forests hundreds of kilometres away throughout NSW. It is not the same development and needs to be assessed as a new development rather than a modification.

The SEE states:

> The major features of the design of the Redbank Power Project include a nominal rating at Maximum Continuous Rating (MCR) of 146 megawatts (MWe) (gross) with an overload capacity of 151 MWe gross.
>
> The approval, as it stands, requires Redbank to source the majority of its fuel as coal tailings from Warkworth Mine located approximately 7km (via road) to the south of Redbank. The approval also allows for the use of road haulage based on certain upgrades to the road network being undertaken. These upgraded were completed prior to the 2001 start date.
>
> It is noted that previously fuel had been delivered to the site primarily via conveyor direct from Warkworth.
>
> The Redbank Power Plant is a coal powered plant containing a single steam driven turbo generator with a maximum capacity of 151 MW of electricity. Redbank differs from other Plants in that it utilises circulating fluidised bed technology which is capable of consuming a variety of fuels including Coal tailings and Biomass.
>
> The primary fuel (coal tailings) is delivered to the site via the conveyor system. Supplementary fuel is delivered via road transport when the conveyor is not available.
>
> The proposal involves modification of the existing consent to allow for the plant to utilise biomass fuel as an additional fuel source. This provides the opportunity for the proponents to generate

The Planning Report (URBIS 2021) states:

> The consent when read together with the referenced documents requires the Redbank Power Station (**Power Station**) operator to source the majority of its fuel as coal tailings from the Warkworth Mine located approximately 7km (via road) to the south of the site. The consent permits road haulage of fuel to the site based on certain upgrades to the road network being undertaken. These upgrades were completed prior to the operation of the Power Station commencing in 2001.
>
> When operational (between 2001 and 2014) the predominate fuel used was coal tailings which was delivered to the site primarily via conveyor direct from the Warkworth mine and run of mine coal which was used as a backup fuel. The conveyor which transported the fuel is still in-situ and available for the transport of coal based fuel as may be required.
>
> …
>
> The Power Station has been in care and maintenance mode since October 2014 and Verdant Energy are planning to restart the plant in 2021 drawing on either BDT and RoM coal or alternatively biomass.
>
> …
>
> The development as proposed to be modified will introduce biomass as a fuel source. This will comprise quality fuels that are considered residual materials in forestry operations, sawmilling and from urban sources (e.g., timber manufacturing) to provide a new sustainable fuel source for the power Station.
>
> …
>
> Investigations by BPPS have been performed to scope minor changes to the fuel delivery and handling systems with in the Power Station to enable the plant to receive biomass fuels that have been fully prepared, tested and validated for storage and use as an alternate and additional fuel in the plant.

The SEE proposes altering Condition 16 by the inclusion of the use of up to 100% biomass, while still pretending to use coal tailings:

> Proposed Condition 16 – Fuel Source
>
> At least the majority of the fuel burnt at the power plant shall be coal tailings and/or biomass, up to and including the potential use of 100% biomass in any one year, on a dry tonne basis. Coal Tailings derived from coal washery tailings shall be obtained directly from the Warkworth mine washery or indirectly from existing tailings storage dams on the Warkworth mine leases. Coal washery tailings are not to be obtained from mines other than Warkworth without the further approval of Council.
>
> Biomass fuel must be considered an Eligible Waste Fuel as defined by the EPA's Eligible Waste Fuel Guidelines and/or biomass fuel as otherwise approved or exempted for use by the EPA and/or such that it meets the EPA emissions requirements for the power plant as established or varied from time to time.

This claim that it still intends to use coal tailings seems to be a pretence. Elsewhere the SEE maintains the intent is to shift to 100% biomass with "Net Zero carbon dioxide emissions", for example on p21 stating "operating on 100% biomass". The Wilinson Murray air quality report clarifies the intent:

> Hunter Energy is proposing to operate Redbank on 100% biomass fuel to create a net zero emissions green baseload generator and lead Australia's efforts to reduce greenhouse gas (GHG) emissions.
>
> The ability to operate on coal, in accordance with the current approval, would be retained.

Similarly the Supply Chain Report (July 2021) states "*Verdant Energy are planning to restart the plant by using 100% Biomass*".

The SEE identifies that the proposal is to still generate up to 151 Megawatts (MW) of electricity, increasing input from 700,000t of coal tailings annually to 850,000t of dry biomass annually.

The SEE (p 26) notes that "Approximately 112 tonnes of biomass would be burned per hour, assuming a nominal fuel moisture content of 25%" and that:

> When in operation, the site generally operates 24 hours a day, 7 days per week. There are typically two shifts over this period, starting at 6 am and 6 pm.

This represents 981,120 tonnes of biomass per annum, even assuming the 850,000t refers to dry weight, the figures don't match. Basically it can be assumed, with 25% moisture content, that the proposal is to burn over a million tonnes per annum. A weight of 981,120 tonnes of biomass per annum would represent a 40% increase, which is not a minor variation.

It is apparent that contrary to a pretence that coal will still be a feedstock, the intent is to wholly change the fuel source to biomass. This ruse that coal may still be used is intended to be misleading in order to pretend it is just a variation to the original consent, which it clearly is not.

The intent is to increase volumes imported to the site from 700,000 tonnes to something like 981,120 tonnes per annum, a 40% increase, which is not a minor variation.

Whereas before the majority of the fuel was delivered to the site primarily via conveyor direct from the Warkworth mine less than 7 km away, now the intent is to deliver all the fuel to the site by trucks from up to 300km away which is not a minor variation.

The Supply Chain Report identifies that the intent is to "*establish centralised manufacturing facilities with in a 300km radius of the Power Station to process the materials to the required Redbank specification*".

The proposal is now to establish an unspecified number of secondary processing facilities to process unspecified volumes of biomass, at unspecified locations, for supply to Redbank. This is not a minor variation.

The Supply Chain Report identifies that Verdant Earth will also "*work directly with contractors of forestry operations to bulk haul biomass that meets specifications directly to the Redbank Power Station. In these cases, the woody biomass may be sized reduced and stockpiled at locations in the forest compartment*".

The proposal is also to woodchip some of the wood and stockpile it in the forest, which will significantly increase site impacts and increase fire threat. This is not a minor variation.

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*

1.1. Sources

While the SEE did not deal with sources for the biomass, the Supply Chain Report (July 2021) seeks to remedy that obvious failing. The Planning Report (URBIS 2021) refers to the Supply Chain Report as "Redbank QA/QC Supply Chain and Material Handling Report dated 9 August 2021", but the "Redbank Power Station QA/QC, Supply Chain and Material Handling" report provided with the exhibition documents is dated "Final report: 30 July 2021". The revised August report relied upon by the proponent has not been exhibited and thus the 30 July version is relied upon for this submission, and referred to as the Supply Chain Report herein.

The exhibited Supply Chain Report is an earlier version and apparently not that relied upon by the proponent.

The Supply Chain Report identifies that:

> 70% of the biomass sourced for the plant will be obtained from approved forestry residues, 15% from sawmill operations and 15% from uncontaminated wood wastes by weight.

In total 85% of the biomass relied upon is claimed to be sourced from forests, which equates to 722, 500 tonnes of dry biomass, with 599,000 coming directly from forests. Freshly cut trees have a moisture content of 39% (DPI 2017), so these volumes equate to 1,004,275 tonnes and 832,610 tonnes of green biomass respectively. It is assumed that the balance of 127,500 tonne of biomass will be dry.

The exhibited Supply Chain Report identifies a variety of potential biomass fuel sources, though it does not identify which of these, and what volumes, are to be used.

It is by no means clear what the sources proposed for forestry residues are. The Supply Chain Report (p.5) identifies that wood will be obtained from:

- clearing and thinning carried out in accordance with a private native forestry property vegetation plan
- Logging and thinning carried out in accordance with an integrated forestry operations approval

Other sources not listed, though presumably intended from mentions elsewhere (p6), include from hardwood plantations and clearing/thinning for fire breaks on State forests. It is unknown whether the intent is to include timber from pine plantations or logging on private lands.

The Supply Chain Report claims they "have signed MOU's to supply with eligible fuels" and have "identified and have had discussions with a 15-20 suppliers of woody biomass".

While there are claims of MOUs for unspecified volumes and claims of discussions with 15-20 suppliers, there is no indication of what volumes the proponent has commitments for, or where those volumes are to be sourced from.

It appears that the biomass to fuel Redbank is not going to come from public forests, as in response to questions in estimates, the Forestry Corporation made it clear that they have no intent to provide biomass to Redbank:

> ***Mr DAVID SHOEBRIDGE:*** *Is there any intention or is there any planning to provide biomass from the native forests?*
>
> ***Mr CHAUDHARY:*** *No.*
>
> ***Mr DAVID SHOEBRIDGE:*** *Regarding the proposed Redbank energy park in Singleton in the Hunter Valley, which is proposed to burn one million tonnes of native hardwood annually, do I understand that there is no current contract and no intention to have any of that come from public native forests?*
>
> ***Mr CHAUDHARY:*** *Yes. It will not be from public native forest.*

In response to questions in estimates, the EPA indicated that approval of sources from native forests would be very limited and that they had as yet held no discussions with Hunter Energy:

> *Ms MACKEY: The way the biomass operates is that they have explicit orders under our resource recovery orders, and it is clear what they can and cannot use in terms of what you are calling "offcuts". So I want to just go into a bit of detail around those offcuts. The offcuts that can be used from native forestry are those that have already been through the mill—for example, the sawdust, of which they have great piles. But it is not the offcuts. For example, if you go into a native forest—one of our State forests that has been harvested—you will see remnants of trees and the undergrowth that are left in the forest. They cannot take that and use that as part of that resource recovery order.*
> *…*
> *… Mr MATT KEAN: Can I just give you some comfort that New South Wales legislation does not permit logging native forests to produce wood for electricity generation? However, there are some specific exemptions for certain types of native vegetation and waste materials.*
>
> *… The Hon. MARK PEARSON: But the question is: Is it possible? We have just been given an assurance from Ms Mackey that there is no way that any of this biomass will be taken from forests but only from timber mills after logs have been taken and the so-called unwanted material comes off the logs. How is it possible for that to provide one million tonnes of biomass every year just to this one facility?*
>
> *Ms MACKEY: So in terms of Redbank there is a process that is underway at the moment that is going through the planning process, but there has been no application to the EPA around amending or*

> *seeking a different licence for that Redbank site. There would absolutely be due consideration to the current regulatory arrangements, including any resource recovery orders that we have relating to biomass as a part of that development project. It was at the stage before at the moment. We have had no engagement with Redbank.*

The Forestry Corporation recently told NSW parliament that Redbank's resources "*will not be from public native forest*" and the EPA implied that Redbank can only use sawmill residues, and have had no engagement with Redbank. The puts into question a large proportion of their potential resources.

Any assessment of potential fuels need to take into account other existing and potential commitments of that resource. There are existing export operations, composite timber manufacturers, landscapers and other users of the same resource. There are also a variety of other projects underway, for example the company Sweetman's Renewables is being touted as a potential supplier to Redbank, though it has recently announced other new deals for the same resources:

- a $15 million deal with Singapore's CAC-H_2 to construct the country's largest wood-fed hydrogen production plant, gasifying 30,000 tonnes of woodchips p/a to produce hydrogen, with biochar as a by-product. *https://www.pv-magazine-australia.com/2021/09/07/wood-fed-hydrogen-plant-to-be-built-in-nsw-in-15-million-singapore-deal/*
- A 20 year $US90 million deal with a Japanese conglomerate Sinanen Holdings to supply 60,000 tonnes of native forest woodchips per annum to four biomass power plants in Japan, at US$75 per tonne. *https://www.brisbanetimes.com.au/environment/conservation/renewable-energy-firm-backs-return-to-woodchip-exports-from-newcastle-20210908-p58pzk.html*

At the same time Cape Byron Power are increasing the volumes of wood being fed into their boilers at Broadwater and Condong, and the Condong Cogeneration Plant is currently preparing an EIS to obtain State Significant Development approval to permit the receipt, temporary storage & combustion of ~120,000 tpa of "recovered" timber fuel: *https://www.planningportal.nsw.gov.au/major-projects/project/41926*

The availability of potential woodchips is also dependent on the delivered costs, which are likely to make more remote sources economically unviable. For example DPI's (2017) North Coast Residues report gives weighted average delivered prices of $56/tonne of chip within 0-50km of Bulahdelah and $67/tonne for those within 100-150km.

There are considerable questions about the availability and sources of the one million tonnes of wood biomass per annum to feed into the boilers. Will low quality sawlogs be used to make up volumes? Will this proposal result in a massive increase in landclearing? Will they, like many similar plants overseas, be forced to burn more polluting materials (ie tyres, waste) in order to keep the boilers going? The proponent needs to clearly identify the actual availability and location of proposed feedstock.

1.1.1. Forestry Residues

The proposed sources of forestry residues is "*pulp wood logs and heads and off-cuts from clearing*" and "*trees cleared as a result of thinning*" from both public and private lands. Noting that it will be sourced from operations "*carried out in accordance with a private native forestry property vegetation plan or forestry operations carried out in accordance with an integrated forestry operations approval*".

The 2018 "Coastal Integrated Forestry Operations Approval – Protocols" (IFOA) defines a "pulpwood log" as:

> A log suitable for the manufacture of reconstituted products, including paper and panel board, and does not include timber suitable to be ***high quality large sawlogs***.

This is a broad categorisation as it allows any tree, or part thereof, to be classed as a pulplog as long as it does not meet the specifications for a high quality large sawlog :

> A log that is of a high quality and:
> (a) is at least 2.4 metres long; and
> (b) has a centre diameter under bark of 40 centimetres or more.

The IFOA notes:

> A ***harvesting operation*** must not be conducted for the primary purpose of producing ***low quality logs*** (including salvage and firewood), ***pulpwood logs*** or ***heads and offcuts***.

Though **thinning operations** are separately defined in a manner so broad as to allow almost anything: "*a type of **selective harvesting** resulting in the cutting and removal of trees to increase the distance between trees that have potential to yield high quality timber*".

Effectively any tree or part thereof that does not meet the definition of a high quality large sawlog may be classed as 'forestry residues' and removed for biomass fuel in the course of any logging operation, and may be the sole timber removed in thinning operations. These broad definitions leave it open for small and low quality sawlogs to be burnt, and for logging operations to be undertaken solely for pulplogs.

The only document cited in the Supply Chain Report that assesses the potential availability of forestry residues is DPI's (2017) North Coast Residues report. This identifies that the total volume of biomass available from public and private forests on the north coast as " close to one million tonnes", though warns these "are indicative only, and may vary considerably". It is important to recognise that this is wet tonnage, which translates into 648,500 dry tonnes, far less than proposed to be burnt by Redbank. There is no assessment of the volumes already committed to other users (such as Cape Byron Power, composite timber manufacturers, exporters, landscapers), or the significant proportion which falls outside the 300 km radius.

DPI's (2017) North Coast Residues report identifies for the North Coast the total of forestry residues available for biomass from public and private lands, native forests and plantations, as 1,084,494 wet tonnes (648,500 dry tonnes).

Estimate of logging residues (pulplogs) potentially available from north-east NSW. Adapted from Table 1.6 of DPI 2017, Forest harvest residues – summary (residues available for extraction)

Residue type	Wet tonnes	Dry tonnes, 0% moisture
Native public	399,958	247,974
Native private	392,655	243,446
Hardwood Plantation[1]	185,612	103,943
Softwood Plantation[1]	106,269	53,137
TOTAL	**1,084,494**	**648,500**

1: Assumes chipping on site.

It is important to recognise that the intent is not to take waste in the form of tree heads, branches, and stumps as often claimed, but rather in the form of logs that are easily handled. Though a pulplog market

does allow the felling of trees, and the removal of logs, that would otherwise be left. DPI's (2017) North Coast Residues report states:

> *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, helping mitigate impacts on biodiversity (Chapter 6) and future nutrition needs of the forests (Chapter 5).*

The only resource assessment relied upon is DPI's (2017) North Coast Residues report, which only identifies a total of 648,500 dry tonnes of forest and plantation residues (pulplogs) potentially being available across the whole of north-east NSW, without accounting for existing commitments and those resources outside the 300km limit identified for Redbank. This is around 400,000 dry tonnes from State Forests and plantations.

The DPI (2018) report 'NSW Regional Forest Agreements Assessment of matters pertaining to renewal of Regional Forest Agreements' identifies the average annual yields from north-east NSW's public forests over the period 2014-17 as 138,650 m^3 of large sawlogs, 49,185 m^3 of small logs and 21,397 m^3 of pulplogs

In 2018 the Forestry Corporation (2018) issued an Expression of Interest for 416,851 tonnes/yr of low quality sawlogs and residual logs from north east NSW's native forests and plantations, which they intended to be issued as 10 year WSAs in June 2018 (it is not known whether these new WSAs have already been issued). These volumes are in addition to 132,249 tonnes/yr of already committed low quality sawlogs.

In the EOI issued on 16 March 2018 the Forestry Corporation (2018) identify the total volumes in green metric tonnes as:

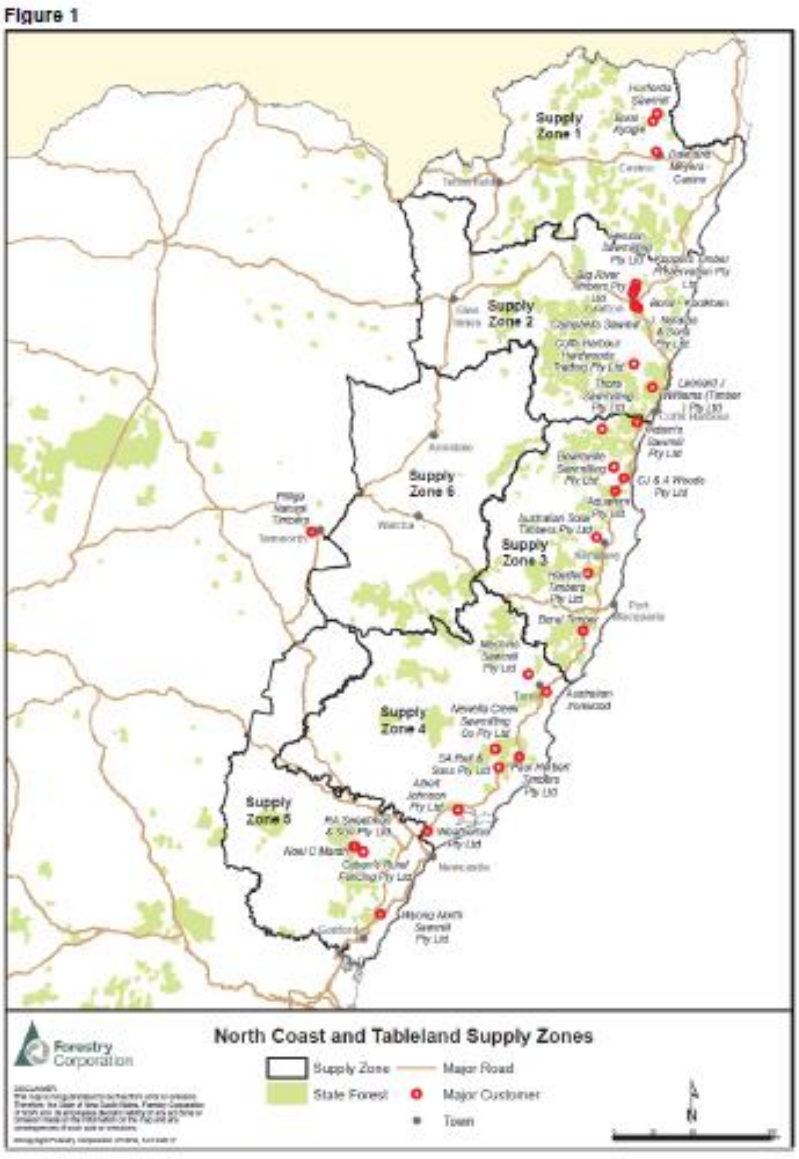
Timber Type	Volumes (GMT)
HQ Sawlogs committed	185000
Low Q Sawlogs committed	132249
Low Q Sawlogs uncommitted	95001
pulp/residue	321850

Forestry Corporation identified availability of products currently available from north-east NSW.
Note that the EPA 2017 note "*Salvage and pulp products are typically sold by weight, i.e. tonnes. The average conversion of m^3 to tonnes is 110%*". Though given other figures used by the Forestry Corporation the figures given here for HQ Sawlogs are assumed to be in m^3 for all HQL.

Supply Zone	Type	LQ Sawlog (EOI)	Pulp / Residue Logs (EOI)	LQ Sawlog Committed	HQ Log Committed
Supply Zone 1	Regrowth	2,633	14,850	13,567	18,000
	Plantation		50,000		
Supply Zone 2	Regrowth	26,332	49,500	27,668	60,000
	Plantation	12,508	43,400	10,692	
Supply Zone 3	Regrowth	39,498	61,500	32,502	80,000
	Plantation	2,057	68,200	13,443	
Supply Zone 4	Regrowth	2,263	8,250	22,487	15,000
	Plantation	1,481	16,800	319	

Supply Zone 5	Regrowth	658	1,100	2,642	2,000
	Plantation				
Supply Zone 6 (Walcha)	Regrowth	3,374	3,500	3,226	4,000
	Plantation				
Supply Zone 6 (Styx)	Regrowth	4,197	4,750	5,703	6,000
	Plantation				
Total	Regrowth	78,954	143,450	107,795	185,000
	Plantation	16,046	178,400	24,454	
	TOTAL	95,000	321,850	132,249	185,000

Data from the Forestry Corporation's (2018) EOI showing current commitments and available resources in tonnes per. annum. Note that the total volume of committed HQL is given as 185,000 m3/yr, and all plantation timber is identified as low quality sawlogs and residual logs despite 52,000 m^3 per annum of HQL (22%) being committed in extended WSAs modelled to come from plantations in the longer term.



Supply zones identified in the Forestry Corporation's 2018 EOI.

The proposal is based upon DPI's (2017) assessment that some 400,000 tonnes of green logging and plantation "residues" are available as pulplogs from State Forests in north-east NSW. Though the Forestry Corporation identify the total volumes (outside Supply Zone 1) as 257,000 green metric tonnes (GMT) of pulp/residue, 92,367 GMT of uncommitted low quality sawlogs and 118,682 GMT of low quality sawlogs already committed in Wood Supply Agreements. So the only way that 400,000 tonnes could be realised from these sources is by consigning all low quality sawlogs to pulpwood, as allowed for by the IFOA.

In 2018 the Forestry Corporation issued an Expression of Interest for 321,850 green metric tonnes of pulp/residue logs from north-east NSW's State Forests and plantations, which was claimed to be the total volume available. Of this, 64,850 tonnes was available in supply zone 1, largely outside the identified catchment area for Redbank, leaving 257,000 green tonnes, or 185,000 dry tonnes potentially available to Redbank. It is not known what proportion of this was subsequently allocated. The DPI (2017) estimates of pulpwood availability are apparently grossly inflated, and could only come close to being realised if all committed and uncommitted low quality sawlogs were reclassified as pulpwood. NEFA does not accept either the estimates relied upon or the reallocation of low quality sawlogs to pulpwood.

Since the 2018 yield assessments the 2019/20 wildfires caused significant death of, and damage to, trees across public and private lands, in both native forests and plantations. This has significantly reduced the availability of both forest residues and sawmill residues. The Forestry Corporation (2020) report '2019–20 Wildfires, NSW Coastal Hardwood Forests Sustainable Yield Review' undertook a preliminary desktop review of the likely impacts of the Black Summer wildfires on timber resources, noting:

> *Approximately 830,000 hectares of native State forest (44 per cent of the total area of native State forest in NSW) and around 62,000 hectares of timber plantations (24 per cent of the total State forest plantation area) were impacted by fire, with some RFA regions and sub-regions more affected than others. Within the North Coast RFA region, 49 per cent of the native forest area available for harvesting (referred to as net harvestable area or NHA) was impacted by fire. In the South Coast and Eden RFA areas, just over 80 per cent of native forest NHA was subject to fire.*

The Forestry Corporation estimate that there has been a significant loss of trees across at least a third of the north coast's State Forest, with a loss of 10-50% of large sawlog sized trees over 30 cm diameter at breast height, and 50-100% of smaller trees. Overall, across the north coast State Forests, the Forestry Corporation estimate there has been a loss of around 10% of sawlogs and 25% of smaller trees. This represents a significant loss of pulplogs.

NEFA is concerned that the assessment is preliminary, being based on landsat mapping and extrapolation from a small number of plots, without remeasuring any of their 659 field plots within the heavily burnt forests to obtain real data on impacts so that they can more accurately quantify impacts and future yields. Thus the actual impacts could be a lot worse than so far identified.

The 2019/20 wildfires resulted in widespread death and damage to trees, with a 25% loss of the smaller trees often used for pulplogs in north east NSW. A significant proportion of the volumes of pulplogs and sawmill residues identified in 2018 no longer exist. With climate heating causing an increase in the intensity and frequency of droughts and wildfires, this emphasises the folly of relying on what can be ephemeral resources.

The DPI (2017) estimates of pulpwood available from private properties is guesswork, with anticipated volumes reliant upon entering into agreements with thousands of private property owners, many who may

not want to. As identified by DPI (2017) "*the estimated quantities of residue available from private native forests come from several thousand individual suppliers*". As noted by DPI (2017):

> *The NSW North Coast has around 2.9 million hectares of private native forests spread across over eighty thousand individual properties. 2,745 properties covering over 400,000 hectares currently have an approved PVP plan to harvest native timber.*
> *…*
> *The estimated volume of residues generated from native forest harvesting on private properties is included in Table 1.3. The values were derived based on information from the surveys, current approved Property Vegetation Plans (PVP), forest type mapping of private properties and the residue to sawlog ratios developed from the public estate.*

The DPI (2017) estimates of volumes of pulplogs available from private properties are guess work, and realization of the claimed volumes would depend on reaching agreements with thousands of individual landowners, many of whom are unlikely to want to do so. Further to this, yields from private forests have been significantly reduced by the 2019/20 wildfires. It is pie in the sky.

The Supply Chain Report claims, without identifying any reference or basis, that:

> *There is a further estimated minimum two million tonnes of available residues per annum from harvesting operations of private native plantation operations that are otherwise left and burnt in mass in situ.*

The proponent makes no attempt to justify their claims of at least 2 million tonnes being available from private native plantations. Data on private plantation resources within 300 km of the site was not able to be readily obtained. Instead ABARES (2016) combined data for both public and private plantation pulplogs for the relevant regions was obtained: Australia's plantation log supply 2015–2059.

It is emphasised that these include plantations outside the proponent's supply area, that most of these volumes are from public lands (and therefore not included in the claimed source), and much of the volume is already committed.

For the North Coast region ABARES (2016) identifies:

> *Hardwood plantations are dispersed throughout the region. Softwood plantations tend to be concentrated in larger blocks, mostly north of Grafton.*
>
> *… Woodchips from harvesting and sawmilling residues are exported from the port at Brisbane.*
>
> *The hardwood pulplog volume is forecast at 520 000 cubic metres a year in the 2015–19 period and forecast to peak at 639 000 cubic metres a year in the 2030–34 period. … A small amount of softwood pulplog is forecast for this region.*

A significant proportion of this potential resource is on public lands and already accounted for by DPI (2017).

For the Northern Tablelands ABARES (2016) identifies that there are no appreciable volumes of hardwood plantation pulpwood, with 17,000 m3 of pine plantation pulplogs pa for the period 2020-4, and declining significantly thereafter.

For the Central Tablelands region ABARES (2016) identifies that there is no appreciable plantation hardwoods and "Softwood pulplog availability is forecast to average around 439 000 cubic metres per year

over the reporting period". It is noted that as well as "a particleboard and medium-density fibreboard facility in Oberon", "pulplogs are exported from Port Botany".

The claim that there is a "minimum two million tonnes of available residues per annum from harvesting operations of private native plantation operations that are otherwise left and burnt in mass in situ" are unsubstantiated and unbelievable.

The Supply Chain Report claims, without identifying any reference or basis, that:

> *Further residues are available to Verdant Earth and estimated at minimum 500,000 tonnes per annum through land clearance, bushfire zoning and other activities carried out in accordance with an integrated approval under the Forestry Act 2012*

It is perplexing as to where this is to be sourced from. It is assumed this timber is intended to be obtained from Crown land above and beyond the potential 400,000 tonnes obtainable from the whole of north-east NSW's State forests by DPI (2017). NEFA is not aware of any broadscale clearing of Crown Lands in addition to operations authorises under the Integrated Forestry Operations Approval that could account for these volumes.

It may be that this is a reference to the mechanical fuel load reduction trials undertaken on the Mid-North Coast of NSW by the NSW Forestry Corporation since 2016 which are yet to be reported on. Given the overwhelming evidence that logging, including thinning, increases fire severity any reliance upon such sources would have to be untenable. Aside from this, the community will never accept the logging of national parks for biomass under the guise of bushfire control.

Claims that an additional 500,000 tonnes per annum of biomass is available through land clearance, bushfire zoning etc under an integrated approval under the Forestry Act 2012 is unreferenced and untenable.

1.1.2. Sawmill Residues

Regarding sawmill residues DPI (2017) assess the milling waste to comprise sawdust, offcuts and rotten hearts. For their "Estimated Hardwood and softwood processing mill residue quantities available on the NSW North Coast", DPI present their assessments for overlapping hubs. Meaning that mills are being double counted, which precludes the identification of total wastes. The Supply Chain Report cites DPI's (2017) North Coast Residues report:

> *Sawmill residues (green) were estimated to range between 46,000 tonnes/year from around Bulahdelah to 118,000 tonnes/year for facilities around Kempsey (100 km radius). Green offcuts represented approximately 68% of the total volume of green residues produced.* [2]

They exclude the balance of the quoted paragraph which states:

> *Current markets for some of the green residues vary depending on location; the power/heat market is stronger further up North, whereas landscaping markets are strong for processors within 150km of Bulahdelah, especially those closer to Sydney.*

It is important to recognise that there are already a variety of markets for sawmill residues. DPI (2017) go on to state:

> *In many cases, at least part of the residue fractions are already committed to an existing market, such as horticultural applications, energy generation and as feedstock for pulp or engineered wood*

> *product manufacture. For the purposes of this study, we have assumed that all "dry" residues from the dressing of dry timber and green sawdust are already committed to stable markets. We have assumed all "green residues" to be potentially available to a bioenergy market.*
>
> *…*
>
> *The current markets for hardwood residues are very different between hubs (Figure 2.2). Intermediaries or "middle men" are dominant in the Grafton market but hardly feature in the Bulahdelah residue market. They also are likely to supply into power/ heat market, potentially accounting for the shown difference in the size of this market between Kempsey and Grafton, as Grafton is much closer to the Cape Byron Power owned Broadwater and Condong biomass electricity plants. Intermediaries dominate the sawdust market in Grafton, principally suppling animal bedding. Landscape markets are strong for processors within 150km of Bulahdelah, especially those closer to Sydney.*

In response to their own FAQ's DPI (2017) state:

> *6) Aren't sawmill residues largely utilised already?*
>
> *Yes – residues generated from "dry mill" processing are largely already committed, and to some extent a significant proportion of green residues as well.*

The way the data are presented by DPI (2017) precludes the identification of the total volume of sawmill wastes potentially available, most of which are already committed to other uses anyway.

2. Pollutants:

NEFA considers that the pretence that the development will result no emissions of CO_2 on site to be false and misleading. In reality it is expected that some 590,000 tonnes of carbon will be released on site each year by burning biomass to form 2.16 million tonnes of atmospheric CO_2. It is considered that the logging operations used to obtain this biomass will generate an additional 4.32 million tonnes of CO_2 from logged trees (including wood made into other products). In addition to this there will be significant damage to retained trees resulting in additional emissions and soil carbon will be significantly reduced. Logging machinery, post-logging burns, truck transport, and sawing, chipping and drying equipment will all add to CO_2 emissions. There needs to be some honest carbon accountancy.

The proposal will involve the stockpiling, transport and processing of massive volumes of woodchips, the burning of a million tonnes of woodchips and the storing, transport and disposal of a large volume of ash. Wood has very different characteristics to coal and will result in very different pollutants being blown into the air, washing into streams, and released through combustion. The release of these pollutants into the environment will affect human and environmental health in a very different way to coal pollutants, and thus requires a comprehensive assessment. The consideration of other pollutants is superficial and limited to pollutants within the stack, without considering compounds formed by the released pollutants mixing in the air, or pollutants within the ash residue.

2.1. Carbon Dioxide

The proponents effectively claim that they can burn 850,000 tonnes of wood without releasing any CO_2, not even at the site. To justify this they are using the accountancy trick that forest regeneration will over time take-up the carbon released during logging and in removed biomass. The flaws in this logic are that there will be an hiatus of decades for a logged site to stop loosing carbon and to become carbon neutral, then it will

take decades or centuries for regrowth to recapture carbon lost in harvesting. By which time climate heating will be so far out of control that many forest ecosystems will be in collapse and losing carbon.

Also it is intended to obtain resources from landclearing where regrowth will not be allowed, and by diverting waste wood from landfill where its carbon would remain buried for decades or centuries.

Burning wood is less efficient than coal, with substantially more CO_2 released to generate the same amount of energy as coal, and the forests ability to sequester carbon is curtailed. The highest carbon benefit is obtained from leaving the forest standing to go on sequestering ever increasing annual volumes of carbon as it matures, while using genuine renewables such as solar and wind to generate electricity.

The SEE (p11) states "This provides the opportunity for the proponents to generate electricity with Net Zero CO2 emissions", and on p21:

> Biomass is an approved fuel source pursuant to the Australian Renewable Energy Act and operating on 100% biomass, the plant will deliver Net Zero carbon dioxide emissions in line with the NSW aspirational aim for net zero emissions by 2050.

The Planning Report (URBIS 2021) states:

> 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.

The SEE (p28) summarises the Wilkinson Murray Air Quality Impact Assessment as finding"

> The estimated annual operational greenhouse gas emissions for Redbank, for both the approved and proposed fuels, are presented in ***Table 6***. The data indicate that the proposed use of biomass would result in a reduction in greenhouse gas emissions of approximately 98% compared to the approved fuel (coal tailings).

Parameter	Approved Fuel (coal)	Proposed fuel (biomass)
Energy content (GJ/t)	16.01	15.21
Consumption rate (t/h)	81.6	112.2
Annual consumption (t/y) [a]	652,800	897,600
GHG emissions (tCO_2-e/y)	**943,023**	**17,748**

a. 8000 operating hours per year

Table 6: Green House Gas Emission Assessment
Source: Wilkinson Murray (Air Quality Impact Assessment

The Wilkinson Murray report claims to have only assessed "Scope 1 – Direct (or point-source) emissions – emissions from sources owned or operated by the facility", deciding to ignore emissions associated with the extraction or transport of biomass or other goods, from secondary processing facilities, or workers transport.

Table 8-1 presents the Scope 1 emissions factors used in this assessment.

Table 8-1 Scope 1 Emission Factors (Solid Fuels)

Fuel Type	Energy Content (GJ/t)	Emission Factor (kg CO_{2-e}/GJ) [a]		
		CO_2	CH_4	N_2O
Green and air dried wood	15.21	0	0.1	1.2
Coal	16.01	90	0.03	0.2

a. relevant oxidation factors incorporated.

These fanciful figures are then used to claim:

Table 8-2 Estimated Annual Greenhouse Gas Emissions

Parameter	Approved Fuel (coal)	Proposed fuel (biomass)
Energy content (GJ/t)	16.01	15.21
Consumption rate (t/h)	81.6	112.2
Annual consumption (t/y) [a]	652,800	897,600
GHG emissions (tCO_{2-e}/y)	943,023	17,748

a. 8000 operating hours per year

A greenhouse gas assessment has been conducted for the Proposal. The estimated annual greenhouse gas emissions using biomass as a fuel are approximately 98% lower than those for the approved fuel.

The revised Air Quality Assessment still refuses to consider CO2 emissions from biomass, stating "emission factor for CO_2 from combustion of biogenic carbon fuels is taken as zero". This is a nonsense.

The SEE makes the misleading claim that asses the "emissions from sources owned or operated by the facility", yet it makes no attempt to identify or consider the site emissions of CO_2 from incineration of a million tons of biomass, rather pretending they don't exist. This is erroneous and misleading. The pretence that emissions will be compensated for by their uptake in regrowth somewhere off-site is irrelevant to site emissions, aside from the fact that it will take decades or centuries to be realised.

As identified previously, it is assumed that the 850,000 tonnes of biomass proposed to be burnt represents the dry weight. In total 85% of the biomass relied upon is claimed to be sourced from forests, which equates to 722, 500 tonnes of dry biomass, with 599,000 coming directly from forests. Freshly cut trees have a moisture content of 39% (DPI 2017), so these volumes equate to 1,004,275 tonnes and 832,610 tonnes of green biomass respectively. It is assumed that the balance of 127,500 tonne of biomass will be dry.

Generally half the green biomass will be carbon, with 1 million tonnes of green biomass comprised of 500,000 tonnes of carbon. The 127,500 tonne of dry biomass will represent some 89,000 tonnes of carbon. When combined with oxygen to form CO_2 this represents the release of 2.16 million tonnes of CO_2 every year at the site. This is without accounting for emissions from harvesting machinery, soils, forest residues (roots, stumps, branches, bark, leaves), pre and post harvesting burns, off-site processing (drying) and transport. In total CO_2 emissions associated with the development are likely to exceed 3 million tonnes per annum.

Contrary to claims, the burning of 850,000 tonnes of biomass on site is likely to result in annual emissions of some 2.16 million tonnes of CO_2 at the site. In addition to this there will be

significant CO_2 emissions associated with harvesting machinery, soil losses, remnant forest residues, off-site processing, transport and the like.

The Supply Chain Report claims:

> In the sustainable management of forests for wood and other products, the Forestry Corporation will maintain the carbon cycle and contribute to Australia's net emission reduction program by:
>
> - enabling captured carbon to be stored long term in harvested wood products
> - providing for further net atmospheric carbon capture in the growth of vegetation following wood harvest
> - reducing the potential for large intense wildfires, which generate greenhouse gases
> - maintaining or improving the productive capacity of the native and plantation forest estate, as the level of carbon sequestration is proportional to the vigour of the trees
> - seeking opportunities for harvesting waste and residues to be used as bio-fuels

The whole process generates CO2 that needs to be fully accounted for. As noted by the National Toxics Network (Bremmer 2016):

> It is not just the stack emissions from biomass plants that make biomass energy more polluting than fossil fuels. Life cycle assessments of biomass plants show that the energy used to grow plantation forests, including the energy used to harvest and transport the wood to the yard, the embedded energy in the pesticides applied to grow the plantations, the embedded energy in the material production processes, transportation and waste management disposal practices, all contribute GHG's to the atmosphere. The loss of carbon in the soil through intensive plantation and native forest logging is often unacknowledged in life cycle assessments.
>
> Proponents of biomass projects often argue that wood left to naturally decay in the forest contributes more to climate change than burning because of the release of methane, a more potent GHG, so that using this waste for energy provides a sustainable climate change and renewable energy solution. Once again these assumptions are inaccurate. Trees and logging wastes can take 10-30 years for 90% of the wood to decompose if not removed.[18] This slow decomposition allows some of the carbon to be retained and locked into the soil[19]. Conversely, when trees are burnt nearly all of the carbon is immediately emitted to the atmosphere.[20]
>
> Given that the majority of the earth's terrestrial carbon contained in our biosphere is in our soil - Soil Organic Carbon (SOC) - it is alarming to consider that up to 8% of carbon in soils is lost after logging through erosion, exposure of soils, and the accelerated decomposition of roots and branches etc.[21,22] In fact a replanted clear-felled plantation can give off more CO2 than it absorbs, even with fast growing trees, for up to 20 years due to the faster rate at which soil microbes work after logging.[23] By assessing biomass projects against the long term climate benefits that standing forests contribute globally, it can be demonstrated that biomass energy is not a credible solution to climate change and in fact is perversely driving us faster to dangerous tipping points such as melting ice sheets and sea level rise.

2.1.1. Is burning biomass less polluting than burning coal?

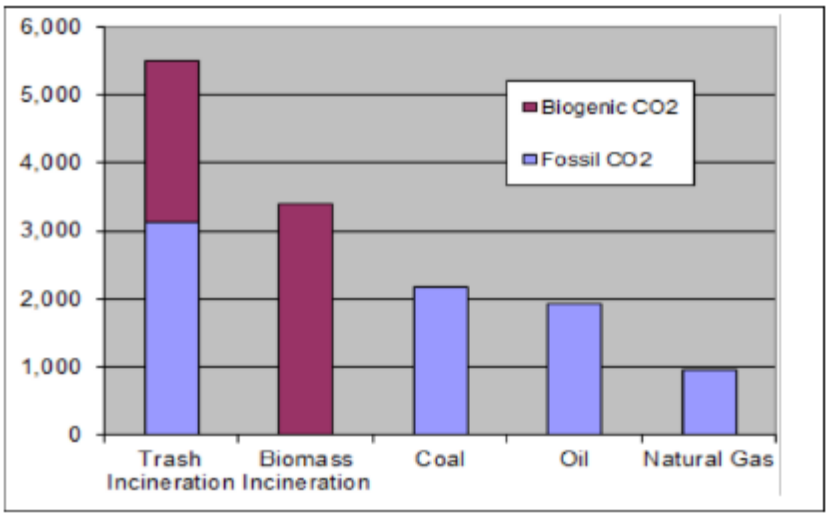
The Air Quality Impact Assessment identifies the $CO_{2\text{-}e}$ emissions from burning coal as 943,023 tonnes per annum, which compares to this assessment that burning 850,000 tonnes of biomass will result in the release of 2.16 million tonnes of CO_2 every year at the site. Even without accounting for off-site CO_2 releases this is a 230% increase in emissions.

A recent review by Chatham House concluded that since "*woody biomass is less energy dense than fossil fuels, and contains higher quantities of moisture and less hydrogen, at the point of combustion burning wood for energy usually emits more greenhouse gases per unit of energy produced than fossil fuels. Overall, while some instances of biomass energy use may result in lower lifecycle emissions than fossil fuels, in most circumstances, comparing technologies of similar ages, the use of woody biomass for energy will release higher levels of emissions than coal and considerably higher levels than gas*".

As noted by the National Toxics Network (Bremmer 2016):

> As USEPA data shows in Table 3 below, biomass energy emits 51% more CO2, 98% as much nitrous oxides and more fine particulates (PM 10 and PM 2.5) than coal.[17] Biomass incineration is second only to MSW incineration in terms of CO2 released per unit of energy exceeding all other current fossil fuel based energy power plants.

Table 3: CO2 emissions from U.S. electric power plants
NB carbon pollution per unit of energy produced (lbs/MWh



Norton *et. al.* (2019) reinforce that burning biomass releases more CO2 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 CO_2 emissions for the same energy output are higher (110 kg CO_2/GJ for solid biomass, 94.6–96 kg CO_2/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 CO_2 per kWh. The net effect of switching to biomass is thus usually to increase emissions and thus increase atmospheric levels of CO_2.

Contrary to the SEE's claims, the substitution of biomass for coal will dramatically increase the release of CO2 and a variety of other pollutants. The claim of carbon neutrality depends upon an assumption that the "residues" would have otherwise rotted and/or that the regrowing forests will regain the emitted carbon over time. Though this is not likely in any meaningful timeframe.

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 CO_2 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.*

This is reinforced by Norton et. al. (2019)

> 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 CO_2 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 CO_2 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 CO_2-intensive fossil fuel, the time to obtain a net reduction in atmospheric CO_2 can be decades; if it is replacing a less CO_2-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.

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.

It is evident that substituting wood biomass for coal will more than double site emissions of CO_2, with vast quantities emitted off-site.

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 CO2 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. The net carbon benefits of using a non-polluting energy source such as solar, and leaving the forest to age, needs consideration as an alternative in an EIS.

2.1.2. Does biomass removal increase logging intensity and tree removals?

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,*
>
> *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 pulpwood is a driver of increased logging intensity. For a long time the industry has claimed that they need to be able to log low quality trees for export woodchipping to make many logging operations economic. And a market for offcuts to make it economic to log low quality trees. For example McCormick (1995) states:

> *The export hardwood woodchip industry has enabled the production of sawlogs from native forests which were previously uneconomic on the basis of sawlog-only logging operations …Integrated logging operations have reduced the unit cost of harvesting sawlogs and the market for woodchips has enabled sawmillers to process lower grade sawlogs since the residues can be sold for export.*

The quick and high returns provided a major incentive for woodchipping, to the extent that sawntimber became a by-product of woodchips. By 2004, 80-90% of logs in Tasmania, Central Victoria, East Gippsland and southern NSW were chipped (Ajani 2007). In northern NSW sawntimber maintained a slim majority with 40-50% chipped (Ajani 2007).

While woodchips did not drive the industry in north-east NSW to the same extent as in southern Australia it did increase logging intensity. This is exemplified by the changes that occurred on public lands in north-east NSW when Sawmillers Exports stopped export woodchipping in 2013. Pulplog yields for the proceeding 4 years (2009-12) averaged 190,869 m^3 p.a., and for the subsequent 4 years (2014-17) 21,397 m^3 p.a., a drop of 89%. Pulplogs declined from being 47% of total timber yields down to 10%.

4 year averaged yields from State Forests in north-east NSW before and after export woodchipping ended in 2013 (adapted from DPI 2018 NSW Regional Forest Agreements Assessment of matters pertaining to renewal of Regional Forest Agreements)

Average Yields	Large Sawlogs	Small Sawlogs	Pulplogs	**Pulplog %**
2009-12	154,968	57,189	190,869	**47%**
2014-17	138,650	49,185	21,397	**10%**
Decline %			**89%**	

The Forestry Corporation has been trying to create a market for biomass since the collapse of Sawmillers Exports as a substitute for export woodchips. DPI (2017) consider that

> *The dramatic reduction in the demand for pulp logs in the region since 2013 has increased wastage and operational challenges (e.g. increased fuel loads); limited forest management options (by reducing thinning opportunities), and reduced profit margins*.
>
> *… The management of hardwood plantations has been constrained as silvicultural thinning has become largely uneconomic, and the profit margins for wood processors have reduced in the absence of an export woodchip market.*

To facilitate this they have zoned 140,000 ha of north east NSWs public forests to allow clearfelling and reduced tree retention requirements. Up until 2018 the Integrated Forestry Operations Approval (IFOA) only

permitted 2 logging regimes for public lands in north-east NSW: Single Tree Retention (STS) and Australian Group Selection (AGS). With STS the only logging regime practiced at that time. Under the then rules for STS, 60% of the basal area (area of the cross section of a tree trunk) of the trees in a harvesting area, including all trees under 20cm diameter (dbh), had to be left after a logging operation.

In a natural forest basal area can vary from as low as 18m^2 ha on a low productivity site, up to 47m^2 ha on a high quality site (Smith 2000), with up to 60m^2 on better quality sites. The NRC (2016) effectively identify the basal area range as 17-40m^2 per hectare, and identify the 60% retention requirement as equivalent to the retention of 10 to 24 m^2 per hectare. The classic study on Blackbutt Forests by Florence recommended retention of a minimum basal area of 22m^2 per hectare.

The new 2018 IFOA reduced the tree retention requirements for north east NSW in a variety of ways, including by establishing 3 zones where logging is primarily limited by basal area retention. These are:

- a 140,000ha North Coast Intensive Zone covering Coastal forests south from Grafton to Taree where there is no minimum basal area retention requirement
- a coastal "regrowth" zone with a requirement to retain a minimum basal area of 10m^2 per hectare, and
- an escarpment "non-regrowth" zone with a requirement to retain a minimum basal area of 12m^2 per hectare.

The Remake of the Coastal Integrated Forestry Operations Approvals Final Report Threatened Species Expert Panel Review, reports the EPA representative Brian Tolhurst (one of the 10 experts who answered questions) as stating:

> *Sustainable forest management requires maintenance of forest stand structure complexity and heterogeneity to allow for biodiversity conservation. This key point seems to have been given up on in this review process with harvesting practices proposed that will severely degrade these forests to an artificial and simplified arrangement with severely reduced and limited biodiversity values.*
>
> *I think this remake is an interventionist approach to remedy a situation that has evolved through poor and desperate practices adopted to meet an unsustainable wood supply agreement at significant expense to the environment and the people of NSW. Continuing down this path will have long term deleterious environmental outcomes for the public forests of NSW in order to limp across the line and meet the final years of the wood supply agreements. This will be entirely at the expense of these forests. Recovery to some level of 'natural' ecological function will be decades and centuries, possibly without many species that will not survive this current and ongoing impact.*
>
> *... The intensive harvesting has clearly moved the coastal state forests from being multiple use forests with significant biodiversity values to that of purely production forests more in line with plantations. I don't believe this is an appropriate outcome or use of these crown lands that was ever envisaged.*
>
> *... Removal of standing trees below a basal area of around 18 - 20m2/ha will reduce the structure of these native forests to such a simple form that the ecological processes will be severely diminished or non-functioning. Even in the best case scenario it will take many decades or even centuries of recovery for any level of native forest ecological function to be restored after this intensity and scale of impact.*
>
> *A typical healthily stocked Blackbutt forest could be expected to have a basal area of around 30 - 40 m2/ha. Currently under the IFOA a 40% removal would limit the minimum basal area retention of 18 m2/ha in the worst case scenario.*

For private forests the current Private Native Forestry Code of Practice for Northern NSW sivilcultural prescription for single tree selection is that it "*must not reduce the stand basal area below*" 12-14m^2/ha in forests <25m tall, and 16-18 m^2/ha in forests over 25m tall. The Draft Private Native Forestry Code of Practice, released in 2020, also proposes to increase allowable logging intensity, specifying "*Single tree selection and thinning operations must not reduce the stand basal area below 10m2/hectare across the harvested area*".

These increases in allowable logging intensities are directly aimed at increasing the volumes of small and defective trees that can be cut down and removed as low quality timber or pulplogs available for uses such as biomass. There is no doubt that a market for these trees is required to make their removal economic.

The NSW Government is reducing tree retention requirements to allow for increased tree removal for biomass. Creating a market for pulplogs facilitates increased tree removal and logging intensities. Meaning that without a market for biomass significantly more trees will be left standing to sequester carbon.

Where there is a market for pulplogs, such as created by this proposal, this will facilitate removal of live trees and parts of felled trees that would otherwise have been left in the forest. In many forests a scattering of trees will be retained.

NEFA is concerned that if this proposal is approved that it will increase logging intensity, the removal of live trees, and the removal of large logs, thereby increasing the volume of CO_2 released in logging operations.

It needs to be recognised that while harvesting for biomass will increase tree removal, a significant proportion of those additional trees (roots, stumps, offcuts, branches, leaves) will be left in the forest to rot or burn, and thus generate additional CO2 emissions.

2.1.3. What is the carbon cost of obtaining biomass for burning?

It is apparent that most of the accumulated carbon stored in any tree logged is relatively quickly released following logging, and the small proportion stored in products and landfill does not offset the lost carbon (Wardell-Johnson *et. al.* 2011, Dean *et. al.* 2012, Keith *et. al.* 2014b, Keith *et. al.* 2015, Keith *et. al.* 2017). Allowing for biomass to be burned increases the number of trees felled and increases the rapid release of carbon from wood residues. Keith *et. al.* (2017b) note:

> *In the context of carbon accounting, logging represents transfers of carbon stocks within the forest and production system. Biomass carbon is removed off-site and a proportion is stored in wood products and landfill. Carbon is emitted through combustion where the slash is burnt, as well as from decomposition of dead biomass from the slash remaining after harvesting and waste during processing. Carbon is sequestered in the regenerating forest.*

Where there is a biomass energy market, when a tree is logged most of its biomass is left behind in the forest to rot or burn, though larger logs and stumps may slowly decay over decades. Of the logs removed, half or more are likely to be converted into chips or pellets for burning. Of those logs utilised to create sawn products most is waste in the form of offcuts and sawdust, some of which may be used for a variety of purposes, including fuel. A significant proportion of the sawntimber will be used for short term products, with only a small proportion making it into longer-term storage in building or furniture. Once the

sawntimber has fulfilled its design life it may be burned or consigned to landfill. In landfill it may take decades or even centuries to decompose.

Keith *et. al.* (2014b) assessed the effects of logging on Mountain Ash forests in Victoria, demonstrating:

> *... that the total biomass carbon stock in logged forest was 55% of the stock in old growth forest. Total biomass included above- and below ground, living and dead. ... Reduction in carbon stock in logged forest was due to 66% of the initial biomass being made into products with short lifetimes (<3 years), and to the lower average age of logged forest (<50 years compared with >100 years in old growth forest). Only 4% of the initial carbon stock in the native forest was converted to sawn timber products with lifetimes of 30–90 years.*

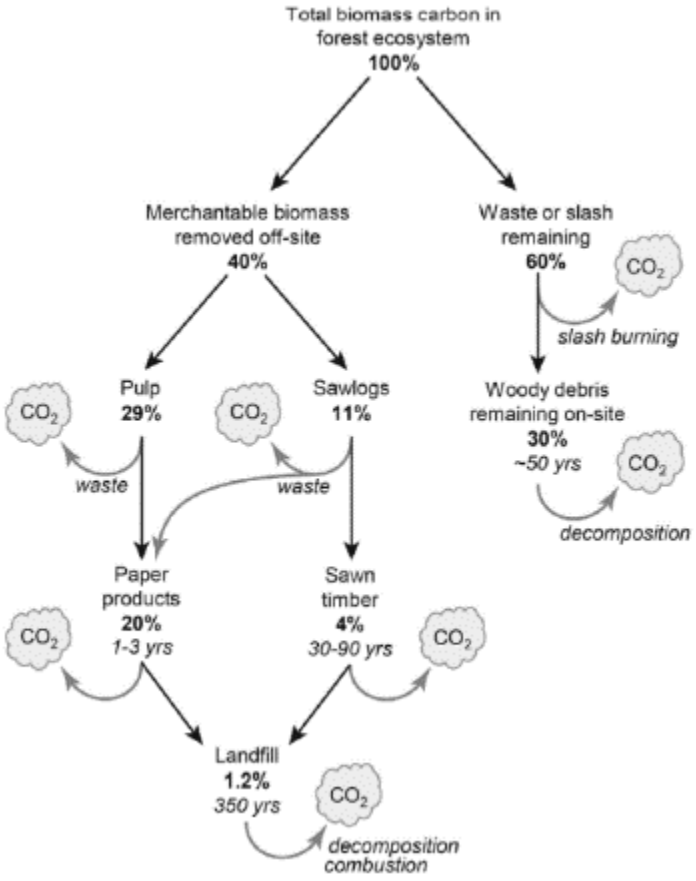


Fig. 8 from Keith *et. al.* (2014b). Transfer of biomass carbon during harvesting and processing of wood products. Numbers in bold represent the proportion of the total biomass carbon in the forest that remains in each component. Numbers in italics are the average lifetime of the carbon pool.

From their assessment of Above Ground Biomass (AGB) of commercial trees in south coast Spotted Gum forests Ximenes *et. al.* (2004) found "*When data from all sites were grouped, the total recovery to log products is 58.2%. The remaining biomass (41.8%) is left in the forest after harvesting as residue*". The above ground residue is comprised of tree heads (30.1%), logs, bark and stumps (4.6%). The bark component represented on average 7.2% of the total weight of commercial spotted gum trees, and thus 17.2% of AGB residues. Ximenes *et. al.* (2004) found AGB recovery variable between species, from 45.5% to 63.2% for other eucalypts.

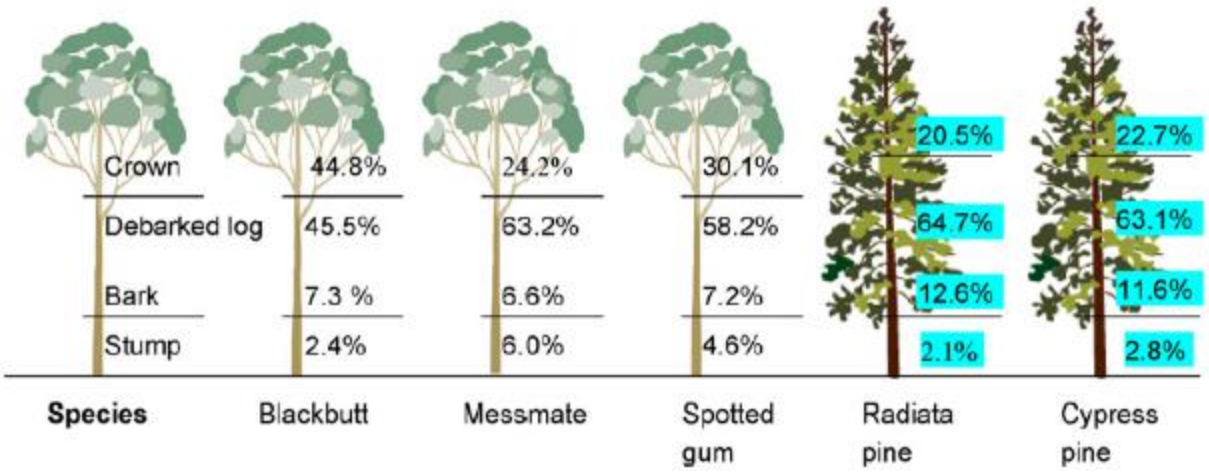


Fig. 3. From Ximenes 2008 showing Proportion of oven-dry biomass in the components of five tree species in Australia

Biomass removal is dependent on whether there is a pulplog market. Ximenes *et. al.* (2008) consider that recovery rates depend on whether pulpwood is taken, noting for example "*The proportion of AGB that was recovered in messmate commercial logs increased from 63 to 70% when pulpwood sourced from the crown was taken into account"*. Ximenes *et. al.* (2008) note "*Snowdon et al. (2000) estimated that when pulpwood is recovered in the harvesting of native forests, the proportion of AGB recovered in commercial logs may vary between 50 and 77%*".

It is important to recognise that the focus is on removing the larger logs that decay slower and provide the most important habitat.

Below ground biomass can be considered to be 25% of AGB based on the average root:shoot ratio for forests of 0.25 (Snowdon *et al.* 2000). Applying this factor to Ximenes *et. al.* (2004) to identify total biomass, suggests that the removal of log products is 43.6% of total forest biomass, which is similar to the 40% identified by Keith et. al. (2014b). So an assumption of 60% of total biomass being left in the forest after harvesting as residue is reasonable.

The dead wood (logs, branches and standing dead trees), including logging wastes, is termed Coarse Woody Debris (CWD). As noted by Mackensen *et. al.* (2011) CWD "is a substrate for detritivorous organisms, may act as a nursery site for tree regeneration, can store substantial amounts of nutrients and carbon and may be an important habitat component for many forest-dwelling species". Large CWD provides essential habitat for and array of invertebrates which in turn are essential food for a variety of frogs, lizards, mammals and birds. Hollows in large CWD also provide homes for many vertebrates.

DPI's (2017) North Coast Residues report states:

> *Forest residue or fallen coarse woody debris (CWD) encompasses a variety of woody material, including fallen logs, branches and twigs, stumps, roots and fragments of fallen trees[17]. Because of its many roles, CWD is considered a critical structural and functional feature of many ecosystems[18,19]. CWD provides habitat for many components of biodiversity as it provides foraging, nesting/breeding opportunities and regeneration niches[20].*

DPI's (2017) North Coast Residues report concluded:

> *Specific groups of fauna responded differently to log-level and site-level characteristics, however we found that logs were more likely to be visited by several different species when they contained a hollow, were larger and in a more decayed state. This suggests that CWD of this type should be retained or*

protected during harvesting operations, in addition to some portion of fresh CWD that over time will develop these characteristics.

Leaves, bark and small branches and rootlets will rapidly decompose, releasing their carbon in the process, though stumps, 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. These values clearly indicate that the IPCC default value of 10 years for the calculation of the complete mass loss of aboveground biomass following land-use change and forest harvesting (National Greenhouse Gas Inventory Committee 1997a, 1997b) is unrealistic.*

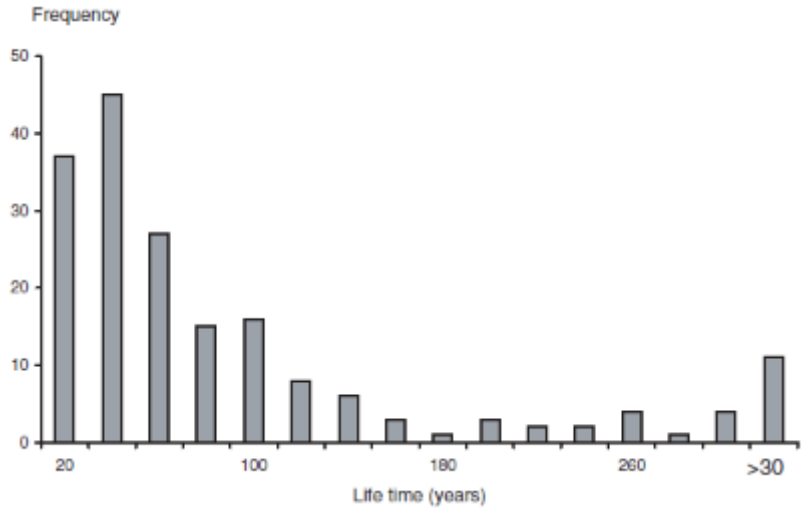


Fig. 4 from Mackensen *et. al.* (2011). Number of calculated coarse woody debris (CWD) lifetimes (*t*0.95)

)

For dry sclerophyll forests, Woldendorp *et. al*. (2002) identify the mean proportion of total above-ground biomass as forest floor CWD was approximately 18%, with a mean forest floor CWD of 50.9 t ha^{-1}, noting:

> *Forest management significantly affects the amount of CWD in a forest (Harmon and Hua, 1991) – while logging operations initially reduce the amount of standing biomass, logging residue left on site can increase biomass in the forest floor CWD pool (Harmon et al., 1986). However, by reducing standing biomass to a small fraction of the amount found in natural forest stands, there is a reduction in potential future volumes of forest floor CWD (Hodge and Peterken, 1998), and stag formation (Cline et al., 1980). ...*
>
> *... Typically, old growth forests contain the largest quantity of CWD, followed by young forests (when forest floor CWD is a relic of the previous stand), and with mature or intermediate forests containing the least (Spies et al., 1988; Sturtevant et al., 1997; Clark et al., 1998; and Spetich et al., 1999). The volume of standing dead wood, however, tends to be low in young forests (Sturtevant et al., 1997), and increases with forest age.*

When a tree is logged around 60% of its biomass, and therefore carbon, will remain in the forest as residues. It is important to recognise that large logs in a forest are essential habitat for a wide variety of fauna and may have an average lifetime of around 50 years, with some of their carbon

being added to soil carbon. Where there is a market for pulpwood it will increase the removal of larger logs that would otherwise be left to slowly decay. Over time logging will run down tree and log sizes.

With a market for pulplogs over half the biomass removed from the site in a logging operation is likely to be classed as pulplogs and thus end up as biomass, or similar short lived products.

For Mountain Ash forests Keith et. al. (2014b) identify 72.5% of the removed timber being allocated as pulpwood. For their Spotted Gum forests Ximenes *et. al.* (2004) identify that allocation of timber to pulpwood (and similar products) varied from 85-52% depending on site quality, with an average of 59%:

> *Pulp logs accounted for 55% of the total biomass in log products from spotted gum trees from all sites (Figure 20). The proportion of higher quality logs increased with an increase in site quality – from 15% at the LQS, to 35 and 48% at the MQS and HQS, respectively. (Figures 21-23). 'Other' logs included mostly log products used to produce firewood and round posts.*

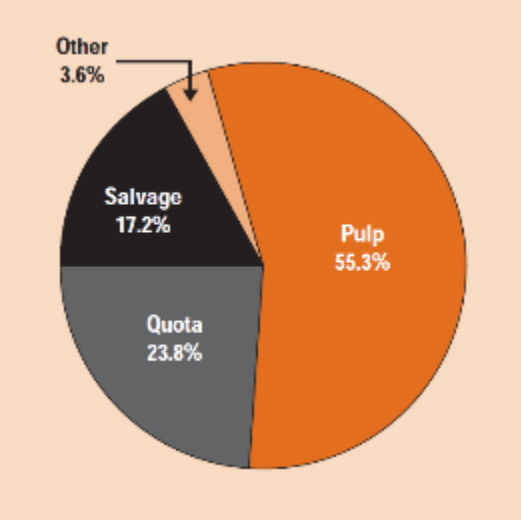


Figure from 20 from Ximenes *et. al.* (2004). Proportion of log products obtained after harvesting of spotted gum trees from all sites.

URS (2012) identify that NSW hardwood sawmills have recovery rates of 40.6%. The sawmill waste may be utilsed for a variety of uses such as landscaping, animal bedding or fuel where its carbon is rapidly released, though some may be utilised for composite timber products.

So at best, with a biomass market, of the logged trees 40% may be removed from the forest, of this 40% (16% of the trees) may be used for sawlogs, of this 40% (6.4% of the trees) may become sawntimber. At this stage 94% of the trees felled, and their carbon, are waste, though tree stumps, large roots and large logs may take decades to decompose. This low recovery is worse in some forests, and will get worse with repeated logging events.

Much of the sawn products from high quality logs will be further processed into floorboards and decking, resulting in further biomass losses, much of the salvage logs will have greater waste and be processed into products with short lives (such as pallets, garden stakes etc.). While some processed wood may end up stored in buildings or furniture for decades, ultimately most of it is either burned or consigned to landfill. Where landfill conditions are anaerobic very low rates of decomposition have been reported, meaning that timber consigned to landfill may result in long-term carbon storage. Keith *et. al.* (2015) note:

> *The scenario of maximising carbon storage in harvested forest systems relies on the longterm storage of waste material in landfill. Only a proportion of wood and paper products are transferred to landfill (0.44 to 0.95 depending on product type [35]), and of this amount, proportions of 0.23 for wood and 0.49 for paper products decompose (Table E in S2 Appendix). The proportion of the initial forest carbon stock that remains in long-term storage in landfill is less than 3%*

The sawntimber will have variable lifespans, some will have short lifespans (ie pallets, garden stakes) while some may be stored for decades in buildings. At the end of its useful life some may be burnt and some may end up in landfill. Because of the anaerobic conditions, timber in landfill may take decades or centuries to decompose. Redirection of timber from landfill to burning will immediately release its carbon.

In general, of the trees logged, pulpwood may comprise 24% of the biomass, sawmill residues 9.6% and sawntimber 6.4%. The Supply Chain Report identifies that 70% of the biomass sourced for the plant will be obtained from approved forestry residues, 15% from sawmill waste and 15% from wood wastes. If, for example, these proportions are applied to the logging biomass, then sources may comprise 100% of pulplogs, 54% of sawmill waste, and over time 80% of sawntimber.

Around a third of the biomass from a logging operation may end up being burnt for electricity, meaning that total tree carbon emissions associated with obtaining that biomass may be 3 times greater. In the case of this proposal that's a total of 6.5 million tonnes of CO_2 released from forest trees associated with obtaining the fuel for Redbank. What proportion of that can be attributed to biomass is a moot point, it can certainly be attributed to the logging operations used to source the biomass.

In addition to this there are significantly increased forest emissions resulting from incidental death and damage to retained trees and loss of soil carbon. There are also significant emissions associated with logging machinery, truck transport, and sawing, chipping and drying timber. And there is foregone carbon sequestration that is lost by killing the trees to obtain the biomass.

Carbon losses are not limited to logged trees, it is also released by trees killed or damaged during logging, released to the atmosphere in post logging burns, and transported offsite in streams by erosion. Losses of soil carbon can be significant and take decades to recover.

Logging significantly increases mortality of retained trees. After logging the retained trees are more vulnerable to windthrow and post-logging burning (Saunders 1979, Recher, Rohan-Jones and Smith 1980, Mackowski 1987, Smith and Lindenmayer 1988, Milledge, Palmer and Nelson 1991, Smith 1991a, Gibbons and Lindenmayer 2002). Gibbons and Lindenmayer (2002) note *"studies consistently show that the number of hollow-bearing trees that occurs on logged sites is negatively associated with the number of harvesting events*", and *"logging may result in a pulse of mortality among retained trees after each cutting event"*.

In Mountain Ash and Alpine Ash forests Gibbons and Lindenmayer (2002) identify that 18% of the total population of hollow-bearing trees collapsed over a 5 year period (3.6% per annum). Gibbons and Lindenmayer (2002) also report that *"14% and 37% of trees retained on logged sites were killed 2-5 years after low- and high-intensity slash burning respectively"*, and that the probability of a retained tree surviving after a single logging event was 0.63.

This problem is also recognised by the NSW Scientific Committee (2007):

> *Trees retained during harvest are susceptible to damage from logging operations and post-harvest burning, or can suffer poor health owing to changes in abiotic conditions (Gibbons and Lindenmayer*

2002). Consequently, retained trees are prone to early mortality, especially with repeated exposure to harvesting events over their lifespan

Cherry Tree State Forest (Pugh 2015) showing examples of widespread logging damage to retained trees resulting in increased carbon emissions and reduced carbon sequestration. LEFT: One of numerous marked habitat trees knocked by machinery when a snig track was created up to its base. RIGHT: One of many habitat trees obviously damaged by having trees dropped on it.

Cherry Tree State Forest (Pugh 2015) showing examples of widespread logging damage to trees marked for retention as future growers that are physically damaged and/or have debris piled around them, meaning they will soon die and add to CO2 emissions.

NEFA has found that prior to burning a significant proportion of trees required to be retained and protected are often damaged during logging, resulting in death, retarded growth, or premature mortality. As well as making them more susceptible to burning, this increases the release of CO_2 and decreases CO_2 sequestration. For example, in NEFA's audit of Cherry Tree State Forest (Pugh 2015) we focussed on undertaking a systematic audit of habitat trees (large hollow-bearing and recruitment trees) over a total of 50 hectares, finding that 22% of retained trees were illegally damaged by being sideswiped by machinery or carried logs, or by having trees dropped on them. In the NEFA (Pugh and Sparks 2016) Audit of Sugarloaf State Forest we again undertook a rapid systematic audit of 37ha for damage to habitat trees. In both areas we recorded a logging damage (to butt, trunk and canopy) rate of 1.5 habitat trees per hectare. Similar levels of damage were observed in smaller trees.

Logging, and post logging burns, also result in significant damage to retained trees. A significant proportion are killed or severely damaged, releasing their carbon or retarding carbon sequestration. Loss of large hollow-bearing trees, and potential recruits, have significant impacts on a large diversity of hollow-dependent and nectivorous fauna, as well as carbon stores.

Logging also results in significant losses of soil carbon which needs to be factored into carbon balances. From a study of Mountain Ash forests Bowd *et. al.* (2019) found that relative to unlogged forest, clearcut logging resulted in significantly lower levels of organic carbon in the lower 20–30 cm layer of soil, stating:

> *Logging impacts observed in this study were highly significant in both the short and midterm (8 and 34 years), and result from the high-intensity combination of physical disturbance (clearing of forest with machinery) and post-logging 'slash' burning (of remaining vegetation). These disturbances can expose the forest floor, compact the soil, volatilize soil nutrients and redistribute organic matter, resulting in the release of large amounts of CO_2 into the atmosphere (Fig. 4). These impacts can alter plant–soil–microbial dynamics and subsequently decomposition rates and carbon storage, and result in the leaching of dissolved organic carbon and nitrogen, and the depletion of base cations, reducing overall site productivity. Given the long-lasting impacts of fire, we suggest that the logging-related depletion of key soil measures may act as a precursor for longer-term, and potentially severe changes in soil composition.*

Similarly, for Mountain Ash forests Rab (1996) found:

> *... organic carbon and organic matter content in the topsoil and subsoil disturbed areas was significantly lower than that of the undisturbed areas. Mean organic carbon content in the topsoil and subsoil disturbed areas decreased by about 33% and 66% respectively compared with undisturbed areas.*

Soil carbon losses can offset carbon sequestration by regrowth for decades, before accounting for the loss of carbon in above ground biomass. From their review of plantations in eastern Australia, Turner *et. al.* (2005) found that plantations may reduce soil carbon for the whole rotation (up to 30 years), with overall biomass growth often not off-setting establishment losses for 5-10 years:

> *... after establishment, there are reduced inputs of carbon into the soil from prior vegetation or rapidly growing weeds, together with accelerated decomposition of soil organic matter as a result of disturbance, and this leads to a net loss of soil organic carbon. In some systems this loss of soil organic carbon is not balanced by carbon biomass sequestration until 5–10 years after establishment and on some sites, a reduction in soil organic carbon may remain until the end of the rotation.*

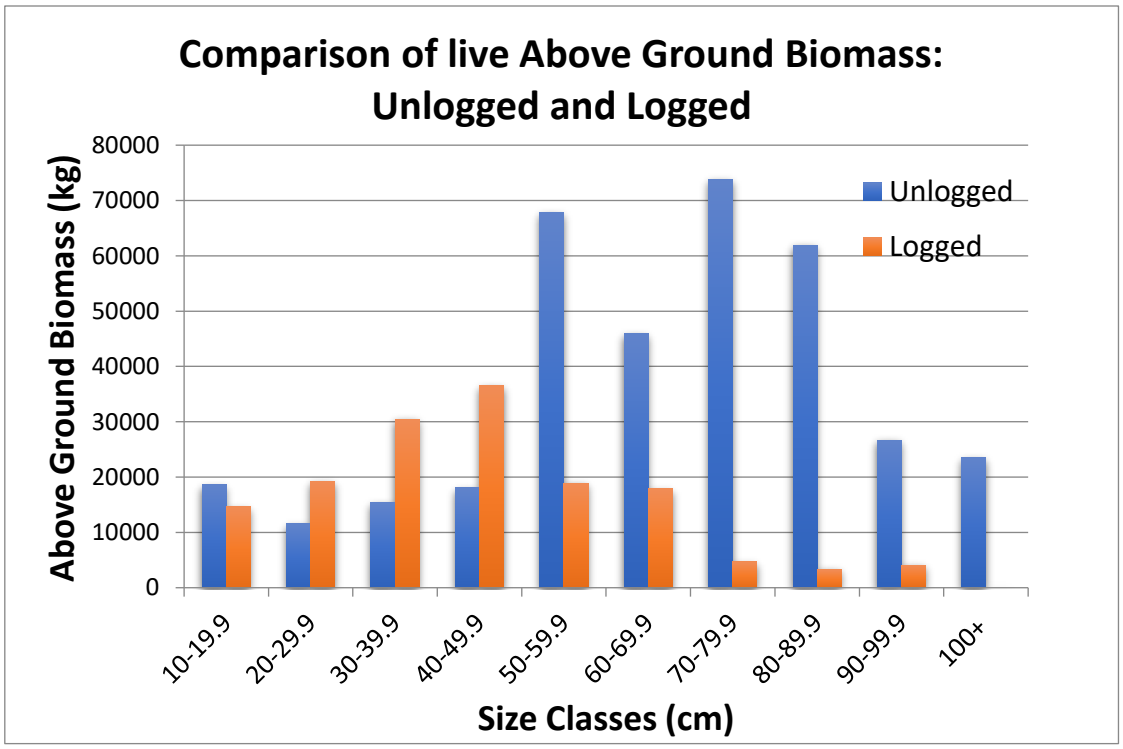
It is identified that regrowth forests (less than 15-30 years old) may be carbon sources due to lower leaf areas resulting in reduced sequestration and higher respiration from the residual carbon in soils and woody debris (Chen *et. al.* 2004, Luyssaert *et. al.* 2008). So it is evident that regrowth is unlikely to result in any

significant carbon increase between logging events as the volume increment will be small and offset by soil carbon losses.

Loss of soil carbon can be massive during logging and carbon deficits may persist for decades, offsetting carbon uptake by regenerating or planted trees for a long time.

Generally logged forests have lost around half of their stored carbon (Mackey *et. al.* 2008, Moomaw *et. al.* 2019, Pugh 2020). This lost carbon is recoverable over time if the forest is left to mature. Repeated logging maintains the deficit, and increases it over time as forests are increasingly converted to young regrowth and larger trees die. Carbon capture and storage is maximised by not relogging forests and allowing them to mature (see proforestation in next section).

Pugh (2020) assessed plots in (old) logged and unlogged Spotted Gum forest south of Casino and found an overall loss of 59% of live above ground biomass in (old) logged forests, which increased to 65% of biomass for trees above 30 cm dbh and to 84% of biomass for trees above 50 cm dbh. This equated to a loss of 134 tonnes of carbon per hectare, which would be recoverable over time if there was no further logging.



Comparison of Above Ground Biomass of logged and unlogged plots showing the dramatic reduction in the biomass of larger trees (from Pugh 2021).

	Aboveground biomass		Belowground biomass		Total biomass	
	Biomass (t/ha)	Carbon (tC/ha)	Biomass (t/ha)	Carbon (tC/ha)	Biomass (t/ha)	Carbon (tC/ha)
Unlogged	363	182	91	45	454	227
Logged	150	75	37	19	187	94
Reduction	214	107	54	27	267	134

Estimates of biomass and carbon volumes per hectare within the logged forests of the proposed Sandy Creek Koala Park, compared to an unlogged control site in Banyabba State Forest. Note that this excludes dead standing trees and logs, so is an under-estimation.

Pugh (2020) assessed that if the (old) logged forests remained unlogged they would sequester 1.73 tonnes of carbon per hectare per annum over 30 years, totalling 52 tonnes of carbon per hectare by 2050.

For Victorian Central Highlands forests Keith *et. al.* (2017b) found:

> *The difference in net change in carbon stock density between the area logged and the area unlogged but available for logging indicates the carbon sequestration potential, which was 2.98 tC ha^{-1} yr^{-1} averaged over 1990 – 2015*

In Australian forests Roxburgh *et.al.* (2006) found that following logging:

> *Model simulations predicted the recovery of an average site to take 53 years to reach 75% carrying capacity, and 152 years to reach 90% carrying capacity.*

Keith et. al. (2015) modelled logging and conservation scenarios of native forest management for mixed-eucalypt in New South Wales and Mountain Ash in Victoria, finding:

> *Total carbon stocks were lower in harvested forest than in conservation forest in both case studies over the 100-year simulation period. We tested a range of potential parameter values reported in the literature: none could increase the combined carbon stock in products, slash, landfill and substitution sufficiently to exceed the increase in carbon stock due to changing management of native forest to conservation.*
>
> *We have demonstrated that changing native forest management from commercial harvesting to conservation can make an important contribution to climate change mitigation. Throughout the 100 year simulation period, the net carbon stocks were higher in the conservation scenarios … than in the harvest scenarios …, with the difference representing the net abatement from conservation. An important attribute of the abatement from avoided native forest harvesting is its upfront profile: stopping harvesting results in an immediate and substantial reduction in net emissions relative to the reference case where commercial harvesting continues.*

By reducing the ages and sizes of trees, past logging has generally halved the carbon stored in forests. The lost carbon is recoverable over time if forests are left to mature. If they are now relogged this will further reduce the sizes of trees and the forest's carbon storage, and it will take many decades to regain what was lost. Regrowth will always lag well behind the growth that would have occurred had it not been logged.

2.1.4. Does logging reduce the potential for large intense wildfires, which generate greenhouse gases?

Logging makes forests more vulnerable to wildfires and increases their flammability by drying them, increasing fuel loads, promoting more flammable species, and changing forest structure. This includes increasing the risks of canopy fires by reducing canopy height, increasing tree density and increasing fuel connectivity from the ground into the canopy.

Lindenmayer *et. al.* (2009) note:

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

Conversion of natural multi-aged forests to predominately regrowth increases their vulnerability to burning by:

- increasing transpiration and loss of available soil moisture (Vertessy *et. al.* 1998)
- reducing canopy density, changing the microclimate and causing drying of understorey vegetation and the forest floor (Lindenmayer *et. al.* 2009)
- changing forest structure by creating a more horizontally and vertically continuous fuel layer - increasing shrub cover, increasing stocking densities, reducing inter crown spacing, reducing canopy base-height (Gill and Zylstra 2005, Lindenmayer *et. al.* 2009, Cohn *et. al.* 2011, Taylor *et. al.* 2014, Zylstra 2018, Cawson *et. al* 2018)
- natural self-thinning of post-fire regrowth creating large amounts of fine fuels from suppressed plants in the early stages of regrowth (Taylor *et. al.* 2014, Zylstra 2018),
- changing the understorey vegetation composition by opening the canopy and increasing disturbance adapted species (Gill and Zylstra 2005, Lindenmayer *et. al.* 2009, Zylstra 2018, Cawson *et. al* 2018)
- spreading lantana and increasing understorey flammability (Fensham 1994, Gill and Zylstra 2005, Murray *et. al.* 2013)
- logging slash fuelling fires (Lindenmayer *et. al.* 2009)

Forest canopies create their own microclimate by moderating temperature extremes and enhancing humidity. Davis *et. al.* (2019) found "*microclimate buffering was most strongly related to canopy cover*", while Kovács *et. al.* (2017) found "*The midstory and the shrub layer play key roles in maintaining the special microclimate of forests with continuous canopy-cover*".

Logging changes the structure of forests and thus increases ground temperatures and reduces humidity (Brosofske *et. al.* 1997, Chen *et. al.* 1999, Dan Moore *et. al.* 2005,), as identified by Chen *et. al.* (1999) "*Patches that have been recently disturbed by human-induced or natural processes tend to have higher daytime shortwave radiation, temperature, and wind speed than undisturbed patches; in addition, these variables show greater spatial and temporal variability*".

From their review of the effects of logging on riparian areas in America, primarily in catchments less than 100 ha in area or streams less than 2 to 3 m wide, Dan Moore *et. al.* (2005) concluded:

> *Forest harvesting can increase solar radiation in the riparian zone as well as wind speed and exposure to air advected from clearings, typically causing increases in summertime air, soil, and stream temperatures and decreases in relative humidity.*

They identify "*the magnitude of harvesting related changes in riparian microclimate will depend on the width of riparian buffers and how far edge effects extend into the buffer*", citing a variety of studies which show "*that much of the change in microclimate takes place within about one tree height (15 to 60 m) of the edge. Solar radiation, wind speed, and soil temperature adjust to interior forest conditions more rapidly than do air temperature and relative humidity*".

Stand age has a significant effect on hydrological processes in forests, with regrowth significantly increasing transpiration and rainfall interception by canopy trees, which in turn creates a drier microclimate and increases drying of soil and litter. This in turn influences litter decomposition and the build up of surface fuels.

Vertessy *et. al.* (1998) have attempted to quantify the different components of rainfall lost by evapo-transpiration, identifying them as: interception by the forest canopy and then evaporated back into the atmosphere; evaporation from leaf litter and soil surfaces; transpiration by overstorey vegetation; and transpiration by understorey vegetation. All of these have been measured as declining with increasing forest

maturity, with the exception of understorey transpiration which becomes more important as transpiration from the emergent eucalypts declines.

Rainfall interception is the fraction of gross rainfall caught by the forest canopy and evaporated back to the atmosphere. This is water lost to the understorey and groundwaters, as noted by Vertessy *et. al.* (1998):

> *rainfall interception rate rises to a peak of 25% at age 30 years, then declines slowly to about 15% by age 235 years. If we assume a mean annual rainfall of 1800mm for the mountain ash forest, stands aged 30 years intercept 190 mm more rainfall than old growth forest aged 240 years.*

Evaporation is also greater from soils and litter in regrowth forests.

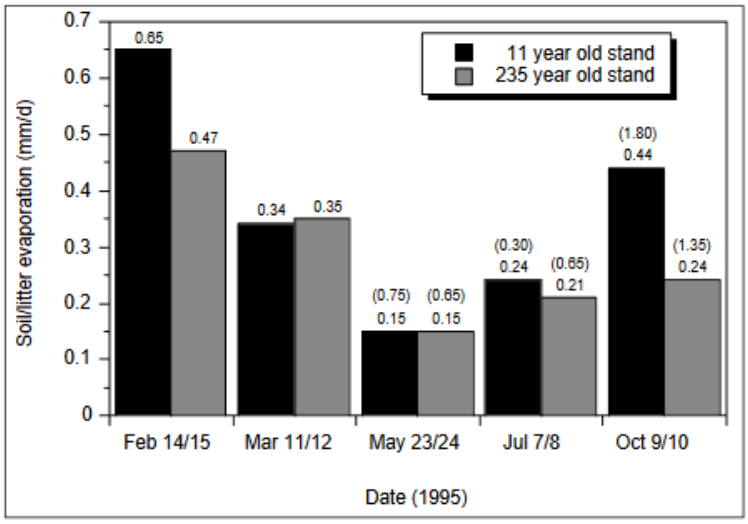
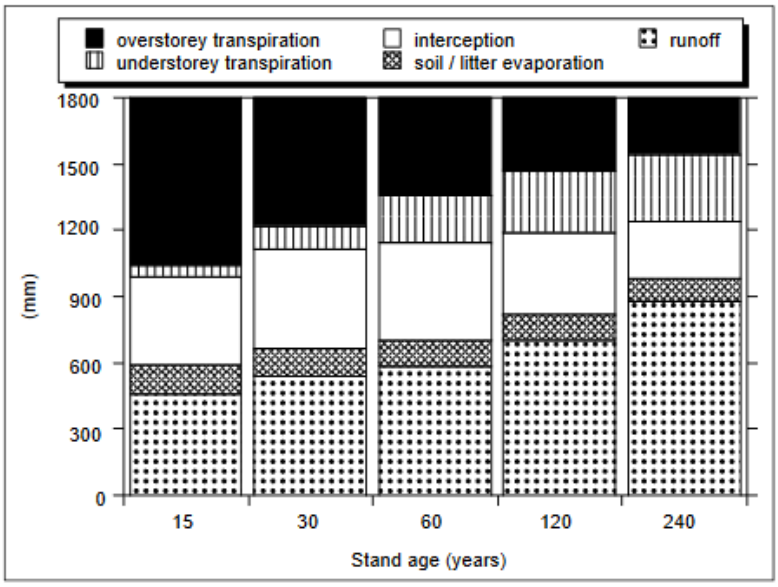


Figure 22 from Vertessy *et. al.* (1998): Comparison of soil/litter evaporation estimates beneath 11 and 235 year old mountain ash forest stands.

Reduction of oldgrowth forests to regrowth thus clearly dries out the forest and thereby increases the flammability of leaf litter.



Water balance for Mountain Ash forest stands of various ages, assuming annual rainfall of 1800 mm (Figure 24 from Vertessy et. al. 1998)

The reduced water yields particularly affect riparian areas and the availability of free water.

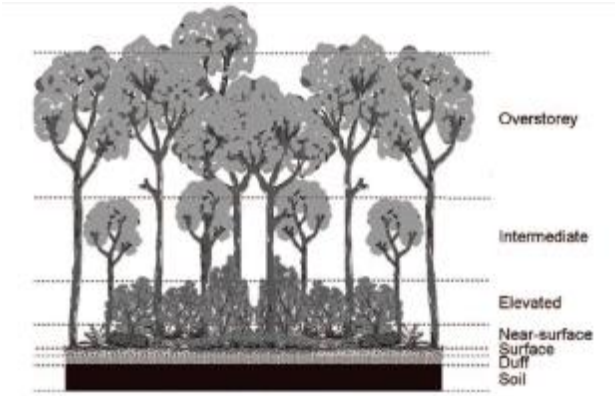


Figure 3.6 from Sullivan *et. al.* (2012) showing categories of forest fuel strata.

Flammability of surface fuels in forests is influenced by their nature and structure, though moisture content of living and dead fuels is the most fundamental constraint on biomass flammability. Forests which have denser canopies result in microclimates characterized by higher humidity, lower wind velocities, cooler temperatures, reduced evaporation and hence reduced fire risk compared to more open-canopied forests. From their comparisons of temperate rainforests and eucalypt forests, Clarke *et. al.* (2014) found "*there was no evidence of higher flammability of litter fuels or leaves from frequently burnt eucalypt forests compared with infrequently burnt rainforests*", concluding "*the manifest pyrogenicity of eucalypt forests is not due to natural selection for more flammable foliage, but better explained by differences in crown openness and associated microclimatic differences*".

Lindenmayer *et. al* (2009) observe "*logging in some moist forests in southeastern Australia has shifted the vegetation composition toward one more characteristic of drier forests that tend to be more fire prone*".

Forests can be separated into strata, with the surface fuels being primarily responsible for most of the fuel consumed and energy released by a fire, though it is the tall shrubs and regenerating trees of the elevated fuel layer that "*has a major influence on flame dimensions, particularly flame height*" and the development of crown fires (Sullivan *et. al.* 2012).

As forests age the gap between canopy and understorey plants and fuels develops, reducing stand flammability and the risk of canopy fires (Cohn *et. al.* 2011, Taylor *et. al.* 2014, Zylstra 2018). As identified by Zylstra (2018) eucalypt forests have evolved the ability to create mature environments that suppress the spread of fire. It is logical that as logging removes mature trees and promotes regrowth that it increases connectivity with ground fuels and therefore the risk of crown fires, though there is strong opposition to any suggestion that such fundamental changes in forest structure can influence crown fires (i.e. Attiwill *et. al.* 2014).

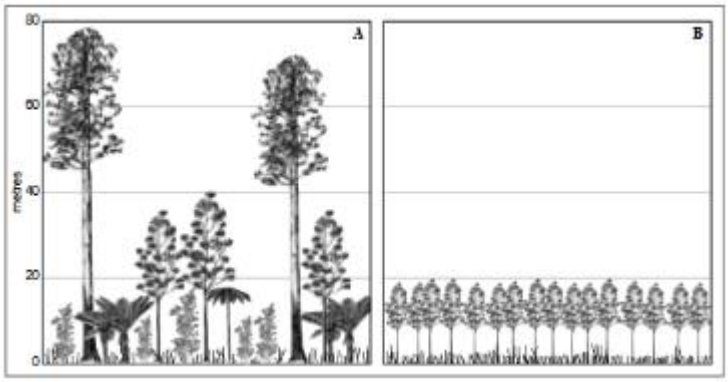


Figure 9 from Vertessy *et. al. 1998*: Comparison of forest structure in (A) old growth and (B) regrowth mountain ash stands. It beggars belief the anybody could deny that the reduced canopy height and increased canopy continuity in a drier regrowth forest is likely to result in increased crown fires.

From their studies of the 2009 Victorian fires Price and Bradstock (2012) concluded "*Probability of crown fires was higher in recently logged areas than in areas logged decades before*"

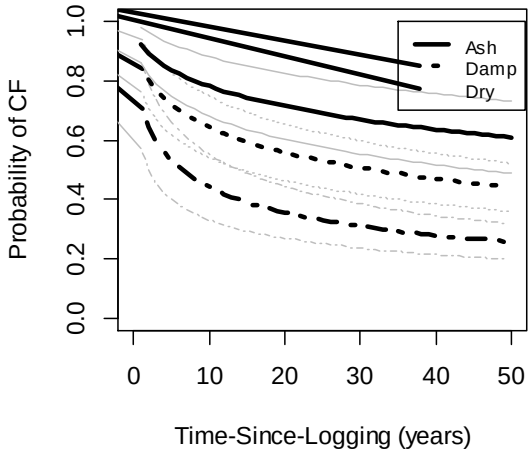
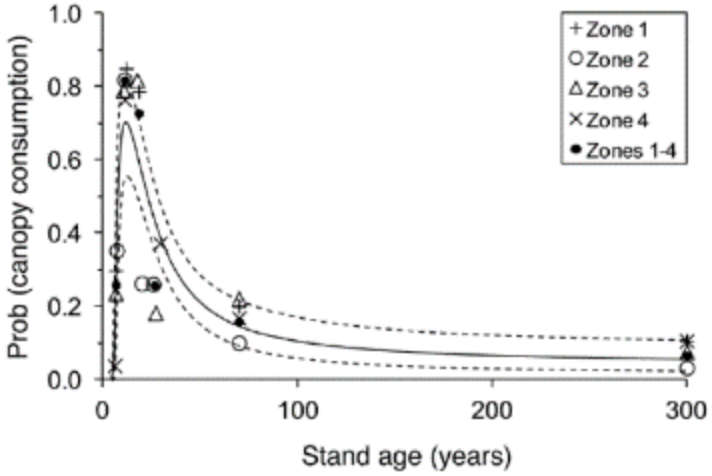


Figure 1 from Price & Bradstock (2012): Model predictions for crown fire (CF) against time-since-logging and forest type using the best model. In all cases, the models are for fire weather Moderate, slope = 0, topographic position = 50%, time-since-fire = 25 years, and aspect = East. Confidence limits for predictions for each forest type are shown.

Taylor *et. al.* (2014) assessed the impact of Victoria's 2009 wildfires on Mountain Ash forests, finding "*the probability of canopy consumption increased rapidly with age up to approximately 15 years ... In stands older than 15 years, the probability of canopy consumption decreased with age, such that it rarely occurred in stands aged around 300 years".* They note:

> *... a strong relationship between the age of a Mountain Ash forest and the severity of damage that the forest sustained from the fires under extreme weather conditions. Stands of Mountain Ash trees between the ages of 7 to 36 years mostly sustained canopy consumption and scorching, which are impacts resulting from high-severity fire. High-severity fire leading to canopy consumption almost never occurred in young stands (<7 years) and also was infrequent in older (>40 years) stands of Mountain Ash.*



Probability of canopy consumption versus stand age (Fig 7 from Taylor *et. al.* 2014)

From his study of 58 years of fires in the Australian Alps Zylstra (2018) found that "*forests were most likely to experience crown fire during their period of regeneration*", noting:

> *The strongest response was observed in tall, wet forests dominated by Ash-type eucalypts, where, despite a short period of low flammability following fire, post-disturbance stands have been more*

than eight times as likely to burn than have mature stands. The weakest feedbacks occurred in open forest, although post-disturbance forests were still 1.5 times as likely to burn as mature forests.

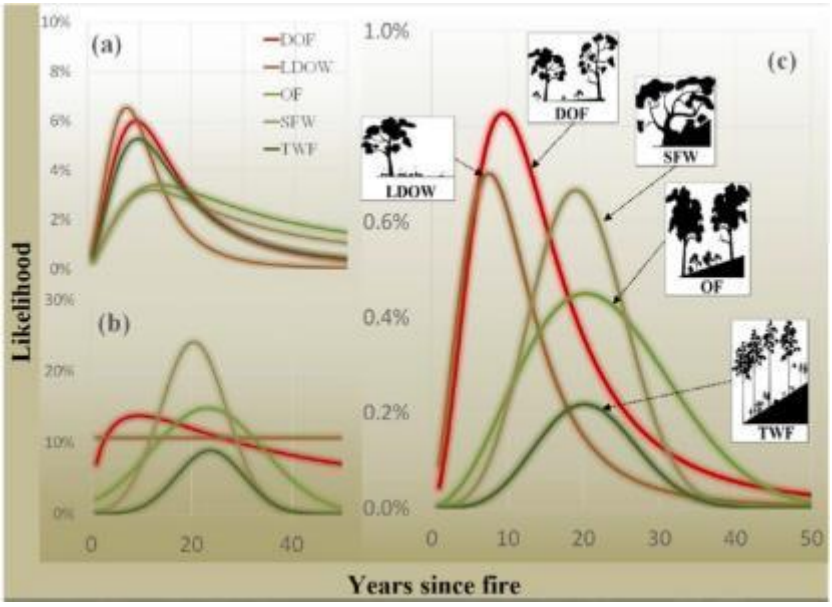


Figure 5 from Zylstra (2018). Flammability trends for each formation, where the *x*-axis gives years since the last fire, and the *y*-axis gives likelihood for (a) fire burning a point (L_f), (b) crown fire occurring if that point is burning (L_{cb}); and (c) crown fire occurring at any point (L_c). Labels refer to dry, open forest (DOF), low, dry open woodland (LDOW), open forest (OF), subalpine forest and woodland (SFW), tall, wet forest (TWF).

From their study of the 2019–2020 fires in northeastern Victoria, Lindenmayer et. al. (2021) found "fire severity was generally low in very young and very old forest and highest in stands that were 10–40 yr old … the tallest, oldest forests (100–300+ yr since previous major disturbance) burn at lowest severity". They postulated:

> *… it is possible that elevated fire severity in some forest types under particular fire weather conditions may be linked with several factors including (1) high stocking density of young stands (Blair et al. 2016); (2) high levels of self-thinning and selfpruning in rapidly growing stands of relatively young forest (10–40 yr old) (Cunningham 1960, Florence 1996) producing additional fine and medium fire fuels.; (3) the ongoing presence slash and debris remaining after previous logging and regeneration burning operations (Slijepcevic 2001); (4) the drying of soils following logging (Bowd et al. 2019) and generally reduced moisture levels associated with high levels of transpiration of young fast-growing trees (Vertessy et al. 2001); (5) the loss of mesic elements such as tree ferns in logged forests (Ough and Murphy 2004, Bowd et al. 2018); and (6) windspeeds that can be strongly affected by stand density (Tanskanen et al. 2005).*

After logging the large quantities of tree crowns, crushed plants and reject logs make the forest more vulnerable to burning, as noted by Lindenmayer *et. al.* (2009):

> *Large quantities of logging slash created by harvesting operations can sustain fires for longer than fuels in unlogged forest and also harbor fires when conditions are not suitable to facilitate flaming combustion or the spread of fire*

For Jarrah forests, Burrows *et. al.* (1995) identify that the severity of wildfires and damage to retained trees has increased since pre-European times which "*can be attributed largely to logging debris which ignites during summer wildfires*".

In the longer term weed invasion can also make the forest more vulnerable to burning. Lantana (*L. camara)* is the most widespread and successful weed throughout north-east NSW, benefitting from logging and other activities that open the forest canopy enough for it to thrive. Lantana now dominates the understorey in tens of thousands of hectares of northeast NSW‟s forests. Logging, fire and cattle grazing are significant contributors to the successful invasion of lantana (Gentle and Duggin 1997), and it in turn can increase the flammability of vegetation (Fensham *et. al*. 1994, Gill and Zylstra 2005, Berry *et. al* 2011, Murray *et. al.* 2013, Bowman *et. al.* 2014). Of the 79 species from dry sclerophyll forests tested by Murray *et. al.* (2013), lantana had the third shortest mean time to ignition for fresh leaves.

From their study of the Forty Mile Scrub National Park, Fensham *et. al*. (1994) found "*the proliferation of lantana results in the build up of heavy fuel loads across the boundary of dry rainforest and savanna woodland. Recent fires have killed the canopy trees in a large area of dry rainforest within the Park*". From their study of dry rainforests, Berry *et. al* (2011) concluded that *L camara* was less ignitable than native dry rainforest species, though:

> *Fuel bed depths, leaf litter depths, percentage cover by fuels and amount of medium size class fuels were higher in dry rainforest invaded by* L.camara *than in noninvaded forests. This suggests that the mechanism by which* L.camara *alters the fire regime in dry rainforest is by shifting the distribution of available fuels closer to the ground and providing a more continuous fuel layer in the understory*

The increasing dominance of forest understoreys by lantana in north-east NSW due to logging significantly increases forest's flammability and the wildfire threat.

Contrary to the pretence that logging reduces the potential for large intense wildfires, which generate greenhouse gases, the evidence is that it increases the flammability of forests, the intensity of fires, and therefore the generation of greenhouse gasses.

2.2. The importance of retaining forests to reduce atmospheric CO_2.

On the 26 February 2020 a number of Australia's leading scientists wrote an open letter to Australian parliaments calling for the immediate nationwide cessation of all native forest logging in response to the climate, fire, drought and biodiversity loss crises currently facing Australia

> *An open letter to the Parliament of Australia,*
>
> *Sadness at the losses from the fires sears our souls. Worse might lie in wait. We write to ask you to respond to the climate, fire, drought and biodiversity loss crises with an immediate nationwide cessation of all native forest logging.*
>
> *We need our forestry workers to be immediately redeployed to fire services support and national park management to help protect the forests and us from fire.*
>
> *Large, old-growth trees are important for carbon capture and storage and they keep on capturing carbon for their entire life. Logging increases fire hazard in the short term. Many native species rely on unlogged forests.*
>
> *Our timber needs can be met from existing plantations, with no need to log native forests. Native forest logging is heavily subsidised by our taxes, which can be better spent on fire mitigation.*
>
> *This is above politics –please show the leadership Australia desperately needs.*

Climate heating, native vegetation and bushfires are intimately linked in that they all affect each other through the carbon and water cycles and other interactions. As the climate heats and rainfall becomes more erratic extreme fire weather is becoming more frequent and intense. Droughts and heatwaves dry foliage and kill plants, while desiccating potential fuels, increasing the flammability of vegetation. Burning forests promotes more flammable vegetation while releasing stored carbon to accelerate climate heating.

Compounding these interactions are land clearing and logging. Clearing forests releases carbon, increases regional temperatures and reduces rainfalls, thereby increasing fire risk, which is worsened by fragmentation and edge effects. Logging forests releases carbon, dries and heats the microclimate, changes fuel arrays and increases the loss of water through transpiration to make forests more vulnerable to burning.

The climate is heating at an accelerating rate, and along with it the threat of catastrophic wildfires. While we urgently need to reduce our emissions to limit global heating, we can only keep global temperature rises to below 2°C if we increase removal of carbon from the atmosphere using *natural climate solutions*. The only realistic means of rapidly achieving carbon sequestration of the magnitude required is to protect native forests to allow them to realise their carbon carrying capacity.

Globally, terrestrial ecosystems currently remove an amount of atmospheric carbon equal to one-third of what humans emit from burning fossil fuels, which is about 9.4 GtC/y (10^9 metric tonnes carbon per year). (Moomaw *et. al.* 2019). Forests cover about 30% of the Earth's terrestrial surface and store around 90% of terrestrial vegetation carbon (Besnard *et. al.* 2018).

Loss of carbon from deforestation and degradation has contributed 35% of the accumulated anthropogenic carbon dioxide concentration in the atmosphere, and annually is around 10% of global anthropogenic emissions (Keith et. al. 2015). In Australia, an estimated 44% of the carbon stock in temperate forests has been released due to deforestation (Wardell-Johnson *et. al.* 2011), with stocks further reduced by around 50% in logged forests (Mackey *et. al.* 2008, Moomaw *et. al.* 2019).

The 2016 ratified Paris Climate Agreement declared a commitment to hold "the increase in the global average temperature to well below 2 °C above preindustrial levels" with a goal of limiting warming to 1.5°C. The Intergovernmental Panel on Climate Change (IPCC 2018), identifies that to achieve this the world needs to slow global emissions immediately and reach net zero carbon dioxide (CO_2) emissions by around 2050. Even then we need to remove copious quantities of carbon from the atmosphere. The IPCC (2018) identify:

> *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 $GtCO_2$ over the 21st century. CDR would be used to compensate for residual emissions and, in most cases, achieve net negative emissions to return global warming to 1.5°C following a peak (high confidence).*
>
> *...*
>
> *Model pathways that limit global warming to 1.5°C with no or limited overshoot project the conversion of 0.5–8 million km^2 of pasture and 0–5 million km^2 of non-pasture agricultural land for food and feed crops into 1–7 million km^2 for energy crops and a 1 million km^2 reduction to 10 million km^2 increase in forests by 2050 relative to 2010 (medium confidence). Land use transitions of similar magnitude can be observed in modelled 2°C pathways (medium confidence).*

Goldestein *et. al.* (2020) warn:

> *Given that emissions have not slowed since 2017, as of 2020, this carbon budget will be spent in approximately eight years at current emissions rates. Staying within this carbon budget will require a rapid phase-out of fossil fuels in all sectors as well as maintenance and enhancement of carbon stocks in natural ecosystems, all pursued urgently and in parallel.*

Limiting global warming below the 2°C threshold set by the Paris Climate Agreement is contingent upon both reducing emissions and removing greenhouse gases (GHGs) from the atmosphere. There has been considerable emphasis on failed mechanical schemes for increasing carbon capture and storage when for millions of years trees have effectively performed this function. There is growing recognition that we need to utilise natural climate solutions to have any chance of limiting global heating to below 2^{o}C. These include protecting remnant vegetation from further degradation, encouraging regrowth of natural ecosystems, widespread planting of trees. and restoring soil carbon on agricultural lands.

It has long been recognised that we need natural climate solutions (NCS) to have any chance of limiting the worst effects of climate change (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, Moomaw *et. al.* 2019, Goldestein *et. al.* 2020). As well as reducing atmospheric carbon, natural climate solutions have a multitude of environmental benefits including reducing flammability, enhancing rainfalls, reducing temperatures, enhancing streamflows (except for reforestation), protecting and enhancing natural habitats, restoring habitat linkages and improving soils.

Griscom *et. al.* (2017) calculate that natural climate solutions can provide 37% of cost-effective CO_2 mitigation needed through to 2030 for a >66% chance of holding warming to below 2°C, and 20% of cost-effective mitigation between now and 2050, further noting:

> *Thereafter, the proportion of total mitigation provided by NCS further declines as the proportion of necessary avoided fossil fuel emissions increases and as some NCS pathways saturate. Natural climate solutions are thus particularly important in the near term for our transition to a carbon neutral economy by the middle of this century.*

Griscom *et. al.* (2017) consider that "*Forest pathways offer over two thirds of cost-effective NCS mitigation needed to hold warming to below 2^{o}C and about half of low-cost mitigation opportunities pathway*".

Fargione *et. al.* (2018) quantified the potential of natural climate solutions to increase carbon storage and avoid greenhouse gas emissions in the United States, finding "*a maximum potential of 1.2 (0.9 to 1.6) Pg CO_2e year^{-1}, the equivalent of 21% of current net annual emissions of the United States*", and concluding *"The conservation, restoration, and improved management of lands in the United States represent a necessary and urgent component of efforts to stabilize the climate".* Their solutions include reforestation of marginal farmland, extending logging cycles, increasing soil carbon, and avoiding emissions. They found that reforestation has the single largest maximum mitigation potential, followed by extending logging cycles on private lands, stopping forest and grassland clearing, improving farming practices and soil carbon, and restoring wetlands.

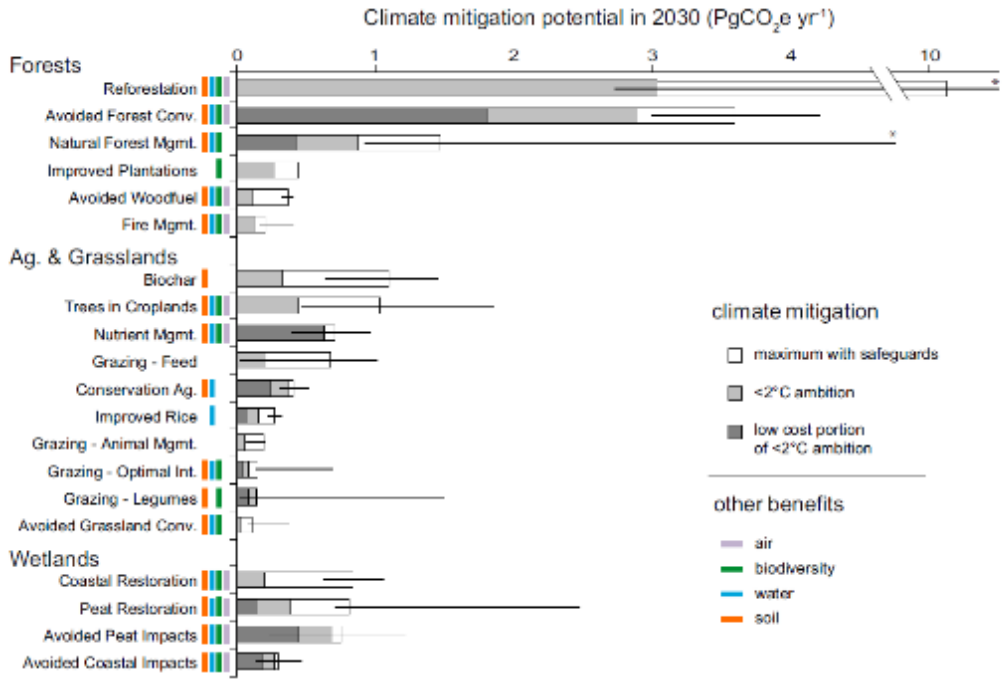


Fig. 1. from Griscom et. al. (2017): Climate mitigation potential of 20 natural pathways. We estimate maximum climate mitigation potential with safeguards for reference year 2030. Light gray portions of bars represent cost-effective mitigation levels assuming a global ambition to hold warming to <2 °C (<100 USD $MgCO_2e^{-1}$ y^{-1}). Dark gray portions of bars indicate low cost (<10 USD $MgCO_2e^{-1}$ y^{-1}) portions of <2 °C levels. Wider error bars indicate empirical estimates of 95% confidence intervals, while narrower error bars indicate estimates derived from expert elicitation. Ecosystem service benefits linked with each pathway are indicated by coloured bars for biodiversity, water (filtration and flood control), soil (enrichment), and air (filtration). Asterisks indicate truncated error bars.

The first step has to be to stop deforestation. Goldestein *et. al.* (2020) observe "*From 2000–2012, the aggregate of thousands of local decisions drove the loss of 2.3 million km^2 of forest cover worldwide. Human-driven loss was attributable primarily to agricultural expansion in tropical regions and to forestry in boreal and temperate regions*".

While reforestation has the highest potential carbon benefits if undertaken on a large scale, it requires an enormous amount of additional land, and will take some decades after establishment before the carbon sequestration benefits begin to manifest. As observed by Moomaw *et. al.* (2019) "*newly planted forests require many decades to a century before they sequester carbon dioxide rapidly*". We cannot remove sufficient carbon by growing young trees during the critical next decade.

By contrast there are vast areas of forest in various states of degradation and regrowth that have the potential to rapidly increase their carbon sequestration and storage just by stopping cutting them down. Moomaw *et. al.* (2019) consider:

> *... growing existing forests intact to their ecological potential – termed proforestation – is a more effective, immediate and low-cost approach that could be mobilized across suitable forests of all types. 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.*
>
> *Proforestation produces natural forests as maximal carbon sinks of diverse species (while supporting and accruing additional benefits of intact forests) and can reduce significantly and immediately the amount of forest carbon lost to non-essential management. Because existing trees are already*

> *growing, storing carbon, and sequestering more carbon more rapidly than newly planted and young trees (Harmon et al., 1990; Stephenson et al., 2014; Law et al., 2018; Leverett and Moomaw, 2019), proforestation is a near-term approach to sequestering additional atmospheric carbon: a significant increase in "negative emissions" is urgently needed to meet temperature limitation goals.*
>
> *Globally, existing forests only store approximately half of their potential due to past and present management (Erb et al, 2018), and many existing forests are capable of immediate and even more extensive growth for many decades (Lutz et al, 2018). During the timeframe while seedlings planted for afforestation and reforestation are growing (yet will never achieve the carbon density of an intact forest), proforestation is a safe, highly effective, immediate natural solution that does not rely on uncertain discounted future benefits inherent in other options.*
>
> *In sum, 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. Proforestation will increase biodiversity of species that are dependent on older and larger trees and intact forests and provide numerous additional and important ecosystem services (Lutz et al., 2018). Proforestation is a very low-cost option for increasing carbon sequestration that does not require additional land beyond what is already forested and provides new forest related jobs and opportunities along with a wide array of quantifiable ecosystem services, including human health.*

Moomaw et. al. (2019) "*conclude that protecting and stewarding intact diverse forests and practicing proforestation as a purposeful public policy on a large scale is a highly effective strategy for mitigating the dual crises in climate and biodiversity and ultimately serving the 'greatest good' in the United States and the rest of the world*".

Logging is the primary cause of carbon loss from forests, for example for the USA Moomaw et. al. (2019) consider "*Together, fires, drought, wind and pests account for ~12% of the carbon lost in the U.S.; forest conversion accounts for ~3% of carbon loss; and forest harvesting accounts for 85% of the carbon lost from forests each year*".

Houghton and Nassikas (2018) assessed the potential to take up the equivalent of 47% of global CO_2 emissions just by stopping clearing and degrading native vegetation, identifying "*the current gross carbon sink in forests recovering from harvests and abandoned agriculture to be -4.4 PgC/year, globally. The sink represents the potential for negative emissions if positive emissions from deforestation and wood harvest were eliminated*".

	Current average net emissions 2006–2015 (PgC/year)	Current average gross emissions 2006–2015 (PgC/year)	Net potential sink with a complete halt to deforestation and forest harvest 2016–2100 (PgC)
Temperate	−0.3	−1.1	−19
Tropics (Houghton & Nassikas, 2017) Simulation #2A	1.4	−0.5	−15
Tropics (with shifting cultivation) Simulation #2B	1.4	−3.3	−98
Global	1.1/1.1	−1.6/−4.4	−34/−117

Houghton and Nassikas (2018) conclude that:

> *... negative emissions are possible because ecosystems are below their natural carbon densities as a result of past land use. That is, potential negative emissions are directly coupled to past positive*

> *emissions. There is nothing magical about these negative emissions. They simply restore carbon lost previously. The corollaries of this conclusion are (i) that negative emissions will diminish as forests recover to their undisturbed state (negative emissions will only work for a few decades) and (ii) that much of that recovery will have occurred before 2100, according to these simulations.*

Sohngen and Sedjo (2004) cite one of their studies that "*showed that forests could account for approximately a third of total abatement over the next century*".

Trees are essential elements of the earth's carbon cycle, essential for mopping up excess atmospheric carbon and putting it out of harm's way. Trees continue to take up CO_2 and store exponentially increasing volumes of carbon in their wood and soils as they age. The older trees and forests are the more carbon they store making them vital components of the solution to rapidly escalating climate heating.

Because of their extent fires can release significant volumes of carbon, largely as CO_2, though this is primarily carbon sequestered in dead biomass and a portion of it may end up as char sequestered in alluvial deposits or soils if fires are not too frequent. Some trees may be killed, though the dead standing trees may slowly release their carbon over decades.

Logging is by far the biggest threat to terrestrial carbon stores. Cutting down and bulldozing trees releases their stored carbon, with at best a small fraction stored in timber products with a life of a few decades. Within our logged forests the volumes of carbon stored have been halved and continue to decline as retained old trees die out, logging intensifies and return times become more frequent.

A significant part of the solution to the climate crisis is to protect native forests from clearing and logging to allow them to regain their carbon carrying capacity. This will provide immediate results as growing trees take up and store ever increasing volumes of carbon as they age. We can take immediate and meaningful action on climate heating just by stopping logging of public native forests and offering incentives to private landholders to protect theirs.

Native forests play a crucial role in the storage of carbon and the sequestration of carbon dioxide from the atmosphere. Old growth forests are the most significant carbon storehouses, with most carbon stored in the oldest and biggest trees (Roxburgh *et.al.* 2006, Mackey *et. al.* 2008, Sillett *et.al* 2010, Dean *et. al.* 2012, Stephenson *et. al* 2014, Keith *et. al.* 2014b). Forests also remove carbon dioxide from the atmosphere and sequester it in live woody tissues and slowly decomposing organic matter in litter and soil. (Zhou *et. al.* 2006, Luyssaert *et. al.* 2008)

Forests accumulate carbon when their photosynthesis driven gross primary production (GPP), is greater than their carbon loss through ecosystem (plant and microbial) respiration (ER), giving them a positive net ecosystem production (NEP). These have diurnal variations, with photosynthesis dominant during the day and respiration at night.

With the urgent need to sequester carbon from the atmosphere we should be managing our forests as carbon sinks. As Mackey *et. al.* (2008) conclude;

> *The remaining intact natural forests constitute a significant standing stock of carbon that should be protected from carbon-emitting land-use activities. There is substantial potential for carbon sequestration in forest areas that have been logged commercially, if allowed to regrow undisturbed by further intensive human landuse activities*

2.3. Other pollutants.

The SEE (p26) identifies that the proposed burning of biomass will increase emissions of solid particles by 40% to 14 (mg/m3), Nitrogen oxides by 57% to 243 mg/m3, and elements or compounds containing antimony, arsenic, cadmium, lead or mercury by 187% to 0.046 mg/m3, though claims these are all "well below EPA limits".

The revised Air Quality Impact Assessment notes:

> The incremental PM_{10} concentrations for the furnace stack alone are lower for biomass compared to coal, however when fugitive emissions are included, the highest incremental 24-hour average PM_{10} concentration is 2.6 µg/m_3 for biomass and 1.0 µg/m_3 for coal. The highest incremental annual average PM_{10} concentration is 0.4 µg/m_3 for biomass and 0.1 µg/m_3 for coal. The incremental ground level $PM_{2.5}$ concentrations for the furnace stack alone are slightly higher for biomass compared to coal. When fugitive emissions are included, the highest incremental 24-hour average $PM_{2.5}$ concentration is 0.6 µg/m_3 for biomass and 0.3 µg/m_3 for coal. The highest incremental annual average $PM_{2.5}$ concentration is 0.1 µg/m_3 for biomass and 0.04 µg/m_3 for coal.

These claims require scrutiny, particularly as they are limited to pollutants just within the stack and therefore do not consider compounds formed outside the stack or the pollutants in the residue ash, as the National Toxics Network (Bremmer 2016) identifies:

> The Partnership for Policy Integrity (PFPI) report that a typical 50 megawatt biomass incinerator in the USA releases 230 tons of nitrogen oxides, 248 tons of carbon monoxide, 85 tons of particulate matter, 40 tons of volatile organic compounds, and 25 tons of hazardous air pollutants annually.[28] These pollutants are known to cause significant health impacts in the population and contribute to the formation of dangerous ozone.[29]
>
> The American Lung Association does not support biomass because of health concerns and state in their energy policy 2011:
>
> > *"The American Lung Association does not support biomass combustion for electricity production, a category that includes wood, wood products, agricultural residues or forest wastes, and potentially highly toxic feedstock's, such as construction and demolition waste. The combustion of fossil fuels and biomass in the residential, commercial and industrial sectors in the United States generates a significant share of the nation's air pollution, threatening the health and lives of millions of people, including those who are most vulnerable to harm.*
> >
> > *The American Lung Association supports programs and policies to encourage a transition from coal, oil, and biomass use in the residential and commercial sectors to cleaner alternatives. The American Lung Association strongly opposes the combustion of wood and other biomass sources at schools and institutions with vulnerable populations. The American Lung Association strongly supports policies that encourage a transition from coal, oil, and biomass use in the industrial sector to cleaner alternatives."*[30]
>
> In their 2010 NEPM review, the NEPC stated that there was no threshold for health effects associated with exposure to the criteria ambient air pollutants.[31] Given that ambient air pollutants emitted from biomass incinerators have non-threshold for effect and with a lack of compliance monitoring of the NEPMS in Australia, it is difficult to understand how regulatory authorities can justify the establishment of the biomass incinerator industry in Australia.
>
> Recent independent studies have shown just how ineffective the current NEPMs are at protecting public health. Associate Professor Adrian G Barnett, Queensland University of Technology, used the NEPM standards to predict the health impacts in major cities in Australia at levels just below the standards[32].

Evidence suggests current NEPM's are failing to protect health and pose significant cost burdens on our health system while our government delays action and drags its feet on policy reform. The absence of air toxics standards is indefensible while the government promotes the establishment of the biomass burning industry into Australia.

Biomass incineration releases significant amounts of particulates to the atmosphere through the combustion process. In addition particulates also form from emissions of sulphur dioxide, nitrogen oxides, ammonia, and volatile organic compounds in the condensate once they have left the filter systems and exited the stack.[33] PM 10, PM2.5, ultrafine and nano-particles pose the greatest risks to health.

The NEPC advise that there has been a substantial increase in studies demonstrating that exposure to particulates are linked to morbidity and mortality. Particulate exposure causes significant adverse impacts on the respiratory and cardiovascular systems such as reduced lung function, increased lung inflammation, increased respiratory disease, COPD and asthma, pulmonary injury and inflammation and is associated with adverse birth outcomes such as low birth weight and infant mortality.[34] Children, the elderly and those with compromised immune systems and pre-existing cardiovascular and respiratory disease are more vulnerable to the effects of particulate exposure.

Persistent Organic Pollutants (POPs) such as dioxins, are known to be emitted to the atmosphere from biomass incinerators including pyrolysis technologies[35]. Dioxins can be released at rates 7 times higher than coal, and 167 times higher if burning salt laden wood, like marine pilings.[36] Dioxins are highly toxic and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer.[37]

Trees absorb pollution from the atmosphere and therefore can release a range of dangerous substances such as lead, cadmium, copper, iron, zinc and mercury when burned or chipped. Wood from construction and demolition waste can increase the risk of dangerous pollutants due to the residues of glues, paint, plastics, chlorinated adhesives and formaldehyde resins. Wood may also be pre-treated with dioxin precursors like pentachlorophenol (PCP), copper, chrome and arsenic (CCA), and a variety of pesticides. US reports show that wood waste is difficult to separate and can result in up to 10% of the waste stream being contaminated even when sorted by hand. Contamination rates of 5% are enough for the ash from wood waste incinerators to be considered hazardous waste, and rates of 1-2% still result in significant toxic metal emissions.[38]

Dr. Ellen Moyer (http://www.huffingtonpost.com/ellen-moyer-phd/burning-trees-to-make-ele_b_1601275.html) considers:

> *As yet another consequence of their bottom-of-the-barrel efficiency, biomass incinerators (even after air pollution control equipment) release copious amounts of a wide array of air pollutants besides carbon dioxide, including particulates (soot), carbon monoxide, sulfur oxides, nitrogen oxides, heavy metals, volatile organic compounds, radionuclides, and dioxins. Biomass plant developers admit in their air permit applications that their projects will routinely emit air pollutants. Something they don't admit is that fuel pile fires are a common occurrence when fuel is stored uncovered outdoors, as is invariably the case due to the mammoth fuel quantities required. Fires often burn for weeks, with no emissions controls.*
>
> *Because routine biomass plant air emissions increase human morbidity and mortality by causing or exacerbating asthma, heart disease, and cancer, numerous medical societies have spoken out forcefully against biomass plants. For example, the Massachusetts Medical Society, with over 23,000 physicians and medical students, adopted a resolution that states that biomass power plants "pose an unacceptable risk to the public's health by increasing air pollution."*

Wielgosiński *et. al.* (2017) compared the emission of carbon monoxide (CO), nitrogen oxide (NO) and the sum of hydrocarbons (as total organic carbon – TOC) generated in the process of biomass combustion with coal, concluding "*In many cases the determined emission indicators for biomass combustion were higher than for hard coal".*

Ruscio et. al. (2016) found that fine ash emissions generated from biomass and coal combustion were significantly different, and that conventional particulate control devices have low collection efficiencies for the disproportionally higher emissions of submicron ash particles by biomass, concluding:

> *Comparisons show that combustion of some biomasses may generate disproportionally higher emissions of submicron ash particles than combustion of coals (0.03–1.1 versus 0.04–0.06 kg/GJ, respectively). The high submicron emissions of biomass are problematic, as conventional particulate control devices have low collection efficiencies for such small particles. Moreover, the chemical composition of submicron particles of biomass typically contain large amounts of alkalis (potassium and sodium), chlorine, sulfur and, often, phosphorous, whereas those collected from combustion of coal contain large amounts of silicon, aluminum, iron, and sulfur. The composition of biomass ashes renders them more amenable to deposition on furnace surfaces, as calculations based on published empirical surface deposition indices show. These calculations, as well as experiences elsewhere, indicate that the slagging and, particularly, the fouling deposition prospects of most biomasses are significantly higher than those of coals.*

The pollutants released from storage, processing, transport and burning of wood biomass are very different to coal, as such there needs to be a full and contemporary assessment of impacts on the receiving environment, air quality and the surrounding community.

2.3.1. Disposal of Ash

The Supply Chain Report notes:

> Burning waste woody biomass in the Redbank power station will produce a residual ash of approximately 3%-5% of the feedstock. Utilising the worst case scenario of 5% we have calculated that there will be a requirement to remove 134 tonnes of the ash per day or the equivalent of 3 transport loads.
> 112t/h x 24 hours = 2,688 tonnes per day
> 2688 x 5% = 134.4 tonnes

The Supply Chain Report states “the ash will be transported and used as a soil amendment in agriculture or forestry in accordance with *The Ash from Burning Biomass Exemption* 2014”. No contingencies are identified should sampling find the ash not comply with requirements.

The problem of the disposal of residues is not adequately considered, as the National Toxics Network (Bremmer 2016) identifies:

> Similar to the coal industry, biomass plants generate significant amounts of toxic ash. In the US a typical 50 MW biomass combustion electricity project generates about 29,000 tons of ash per year.[39] Depending on the fuel source biomass ash can contain significant quantities of heavy metals such as cadmium, mercury and lead. In the US reports have shown that mercury in the ash can be up to forty times the level found in the fuel.[40] Some reports also indicate ash from burning wood contains radioactive materials.[41] Given the hazardous nature of ash the handling, transportation and its potential uses require significant controls to protect worker and public health and environmental releases.

Dr. Ellen Moyer (http://www.huffingtonpost.com/ellen-moyer-phd/burning-trees-to-make-ele_b_1601275.html) considers:

> *Another dangerous byproduct that comes out the back end of a biomass plant is ash. A typical 50 megawatt biomass plant produces 1.5 tons of ash per hour. Ash from burning wood (even trees directly from the forest) contains dioxins and heavy metals such as arsenic. Another concern is radionuclides such as cesium-137 that are released from nuclear testing and accidents and are sequestered by trees and*

thus end up in the ash. Radionuclides and metals are released in air emissions or ash - those are the only two possibilities. Regulators turn a blind eye to radionuclides, however, and do not require testing for radionuclides. They likewise usually do not require testing for dioxin, a "known human carcinogen." Up to 80 percent of wood ash generated in northeastern U.S. is landspread on agricultural soils.

NEFA considers that there needs to be a full assessment of the pollutants in ash, identification of disposal sites, and an assessment of likely transfer of pollutants to surrounding environments by wind, runoff and leaching.

3. Environmental Impacts

The SEE (p15) claims "The impact of the development on the environment in regard to noise, ecology, hydrology and stormwater would not change". The SEE's Table 2 (p22) "assessment of the likely impact of the modification on both the natural and built environments" is limited to the impacts on the development site, while ignoring the offsite impacts.

It is by no means clear what the sources proposed for forestry residues are. The Supply Chain Report (p.5) identifies that wood will be obtained from:

- clearing and thinning carried out in accordance with a private native forestry property vegetation plan
- Logging and thinning carried out in accordance with an integrated forestry operations approval

Other sources not listed, though presumably intended from mentions elsewhere (p6), include from hardwood plantations and clearing/thinning for fire breaks on State forests. It is unknown whether the intent is to include timber from pine plantations or logging on private lands. The origin of the biomass is further confused given the Forestry Corporation's unequivocal commitment that the biomass "*will not be from public native forest"* (Section 1).

Logging and clearing operations occur over thousands of hectares of native forests inhabited by an abundant variety of native species, many of which are threatened by extinction. They involve removal of trees and shrubs used by a variety of species for food, nesting and denning, extensive soil disturbance resulting in erosion and stream pollution, reductions in carbon sequestration and storage, and changes in evapotranspiration affecting microclimates, air moisture, temperature and stream flows.

Eucalypt trees are long lived organisms, taking decades to begin to flower and seed, over a century to begin to develop the hollows required by a plethora of native species for denning and nesting, and have lifespans measured in centuries. They can grow to massive sizes and are not quickly replaced. Logging impacts are long-lasting, so they are compounded by repeat events, and combined with clearing have landscape scale impacts.

Management of clearing (see Section 3.1.1) and logging (see Section 3.1.2.) of private lands is poor and rapidly worsening, and the already poor constraints on logging of public lands have been seriously weakened in recent years, and then compromised by the 2019/20 wildfires (Section 3.3.).

It is clear that the logging of private native forests has no social licence. The unpublished Forestry and Wood Products' report "Community perceptions of Australia's forest, wood and paper industries: implications for social license to operate" surveyed 12,000 people from throughout Australia in 2016 and found.

- *Native forest logging was considered unacceptable by 65% of rural/regional and 70% of urban residents across Australia, and acceptable by 17% of rural and 10% of urban residents. Eleven per*

cent of rural/regional and 9% of urban residents found this neither acceptable or unacceptable, and 8% and 11% respectively were unsure whether it was acceptable.

- *45% felt the forest industry had negative impacts on attractiveness of the local landscape and only 22% that it had positive impacts; agriculture and tourism were viewed as having more positive impacts, and mining somewhat more negative impacts*
- *53% felt the industry impacted negatively on local traffic (and 16% positively); similar proportions reported negative impacts on traffic from tourism and mining activities, and 30% from agriculture*
- *58% felt the industry had negative impacts on local road quality while 16% felt it had positive impacts; mining was also viewed as having negative impacts, while agriculture and tourism were viewed as having slightly more positive impacts.*

The report concludes:

Views were very strong about unacceptability of native forest harvesting, with most of those who indicated it was unacceptable choosing the response of 'very unacceptable' rather than moderately or slightly unacceptable.

The activity of harvesting timber from native forests has very low levels of social license in Australia, both in regions where this activity occurs and in those where it doesn't. Even amongst the groups who have the highest levels of acceptance of this activity (farmers), and in the regions with highest acceptance (mostly those in which there is higher economic dependence on native forest logging), more people find this activity unacceptable than acceptable.

...

The activity of harvesting timber from native forests has very low levels of social license in Australia, both in regions where this activity occurs and in those where it doesn't. Even amongst the groups who have the highest levels of acceptance of this activity (farmers), and in the regions with highest acceptance (mostly those in which there is higher economic dependence on native forest logging), more people find this activity unacceptable than acceptable. The similarity of views about logging of native forest with views about mining activities suggests that it is viewed as an activity that is non-renewable or unsustainable, rather than as having some of the positive environmental attributes of actions such as establishing solar or wind farms. The strength of views of many people about native forest harvesting suggests potential that this activity is considered incompatible with values held by many people.

...

Native forest harvesting has very low social license, with very few people being at the 'acceptance' level. Many of those who do not find this activity acceptable are likely to be at the blocking or withheld level of social license, rather than the tolerance level, based on the strength of their negative response when asked about acceptability. Even amongst the groups and in the regions with the highest acceptance of this activity, less than 30% find it acceptable and the majority find it unacceptable. Planting trees on good agricultural land for wood and paper production, however, has higher levels of social license: 43% find timber plantations acceptable, and of the 29% who find it unacceptable most do not find it highly unacceptable (instead reporting slight or moderate unacceptability), indicating many are at the 'tolerance' level rather than withholding or blocking social license.

As demonstrated by the timber industry's own report, it is clear that logging of native forests, on both public and private lands is considered unacceptable by the vast majority of Australians and is thus is not in the public interest.

3.1. Private Forests

Logging and clearing are high impact activities with significant environmental impacts that deserve due consideration. Numerous activities with far smaller footprints and impacts require Development Applications (DAs) be submitted to Councils, including mapping of tree removal and ecosystems, site-specific flora and fauna surveys, and species impact statements. Most importantly they require public exhibition of proposals and reports, giving neighbours and the broader community a right to raise concerns and objections.

Under the Local Land Services Act, land clearing can be self-assessed and most is unexplained while logging only requires a desktop assessment of impacts, and neither require any notification of neighbours or give the public a right to object, critique claims or raise issues. Unlike with Development Applications, neither clearing or logging require any surveys to assess, identify and map the distribution of threatened species and ecosystems as part of an approval process. This includes Koalas. Intentional ignorance allows people to kill and maim threatened species in logging and land-clearing activities with impunity.

With most land-clearing "unexplained" it is obviously up to landowners to self-assess, with no environmental assessment requirements. Even when Local Land Services are involved, the Auditor General found clearing is "*not effectively regulated and managed*", being fraught with problems of weak processes, poor assessments, inadequate protection, limited monitoring and poor enforcement. With no pre-clearing survey requirements, the identification of "core Koala habitat" as category-2 sensitive regulated land appears to be the only constraint requiring Koalas to be considered, though, given the small areas mapped and the lax enforcement by LLS, this provides no substantial protection for Koala habitat. It is mostly a clearing free-for-all, including for Koala habitat. To compound current problems the NSW Government is intent on removing the inclusion of "core Koala habitat" in category-2 sensitive regulated land.

The Property Vegetation Plans seen have been simplistic desk-top assessments that rely on remotely mapped attributes (oldgrowth, rainforest, stream orders), with no ground surveys or assessments what-so-ever (unless a landowner challenges the oldgrowth or rainforest mapping). There is no on-ground assessment of biodiversity values. The EPA do not see it as their responsibility to identify localities of threatened species or ecosystems, and even when notified of their presence will not require landowners to look for them. Despite logging affecting large areas, the assessments are nowhere near the standard required for a Development Application.

While the PNF Code of Practice has numerous prescriptions for threatened species, there are no requirements to look before they log. With most landowners primarily interested in maximizing profits and contractors chasing dwindling sawlogs (Jamax Forest Solutions 2017), there is no incentive to look for threatened species that will require increased tree retentions, even if they had the expertise. As noted by Jamax Forest Solutions (2017) *"Whilst many PNF landowners are aware of PNF requirements, many still don't know or don't want to know"*, and the logging contractors *"generally only undertake a visual assessment of each property to determine if it is viable to harvest"*.

The extremely poor level of assessment is clearly illustrated by the treatment of Threatened/Endangered Ecological Communities (TECs, EECs). The Auditor General (2019) observed:

> *LLS has produced guidelines to assist regional service officers to determine the viability of TECs in the long term however they lack specific criteria and training to adequately guide such decisions.*
>
> *LLS staff in most regions have received some specific training in plant ecology, including the identification of plant community types, but limited training in identifying threatened ecological*

> *communities. Records provided indicate that staff in two of the larger regions have received little or no such formal training since the reforms were implemented in 2017.*

In relation to EEC's, Jamax Forest Solutions (2017) cite the following responses from contractors:

- *EPA not prepared to make a call and identify boundary in the field, leaving the decision to less qualified people (contractor/landowner). If you do get EPA out in the field, they have 3 different opinions/boundaries*
- *moving goalpost, previously an EEC would cut out if other species present, now can have a "sprinkle" of other species. Have to identify yourself but EPA won't commit to a decision on in/out, won't draw a line in the sand. But they will prosecute you if they think you got in a different location that where they would have put it.*
- *difficult to identify in the field and left solely with the landowner*
- *EEC goalposts keep changing - gone from limited number of species to anything is possible*
- *what's mapped isn't EEC in field;*

State and nationally listed Threatened Ecological Communities on private lands have not been mapped and agencies responsible for overseeing their protection do not have either the will or the expertise to identify them, preferring to leave it up to landholders to decide for themselves what to protect. If NEFA's experience from public lands is an indication, we expect that they are routinely cleared and logged.

The bipartisan inquiry **Koala populations and habitat in New South Wales** found:

> **Committee comment**
>
> **7.91 Based on the evidence received, the committee believes that the regulatory framework for private native forestry does not protect koala habitat on private land.** In fact, the 'number of quite stringent protections for koalas' that government witnesses asserted the PNF Code contains are weakened substantially, or indeed non-existent, when practically applied. **The committee finds it unacceptable that land identified as core koala habitat can be cleared because of departmental delays.**
>
> **7.92** The committee concludes that many of the issues with the Private Native Forestry Codes of Practice stem from their reliance on protections under SEPP 44. **Once again, the committee reiterates its disappointment at the systemic failure to approve koala plans of management under SEPP 44. Because of this failure, it is clear that protection of 'core koala habitat' under the Private Native Forestry Codes of Practice is not occurring as the NSW Government claims it is in its submission.**

Bellingen Shire Council (2021) consider:

> *It is our view that the current regulatory framework for clearing and forestry is not sufficiently robust to protect core koala habitat (or other important habitat) and the findings of three (3) recent reviews by the NSW Auditor General, the Natural Resources Commission and the NSW Parliamentary Inquiry into koalas support this position. The 2019 review by the Natural Resources Commission found that there had been a 13 fold increase in clearing rates attributable to the new legal framework governing clearing and that biodiversity in 9 out of 11 regions is now at risk.*

Lismore City Council (2021) consider:

> *The current mechanisms by which biodiversity values are assessed on private land when land use changes depend on what the particular changes are and whether they fall under the Environmental*

> *Planning and Assessment Act or the Local Land Services Act. The continued decline of koala populations, habitat loss and fragmentation suggest that these mechanisms have not been sufficiently effective.*

After considering the evidence, the bipartisan Parliamentary inquiry into Koala populations and habitat in New South Wales found "*that the regulatory framework for private native forestry does not protect koala habitat on private land*". This view that private lands are not adequately managed have been echoed by the NSW Auditor General, the Natural Resources Commission and numerous local Councils. Yet as illustrated by the 2020 Koala wars the Nationals are progressively implementing their agenda of removing regulation of, and constraints on, logging and clearing. They want a free-for-all on private lands and they are getting it.

The prime focus of the Koala wars was stopping core Koala Habitat identified in a Council Koala Plan of Management in accordance with a State Environmental Planning Policy (SEPP) from (a) being excluded from logging, and (b) requiring consent before it can be cleared. The Liberals had agreed to this in December 2019, 9 months previously, on the proviso that the Nationals come up with alternative protection for Koalas on private lands. The Nationals had put forward no alternatives, preferring to declare war on Koalas.

Under the National's brazen misinformation campaign on the SEPP the Liberals quickly surrendered, altering the SEPP to make it harder to identify core Koala habitat, while allowing the Nationals to put forward their own Local Land Services Amendment Bill – the Koala Kill Bill. While the Bill was dropped after being referred to a committee for review on the casting vote of Catherine Cusack, the Government is proceeding to implement its intent by other means.

Decisions will soon be made on the protection provided for Koalas in the final PNF Codes (to replace the prohibition on logging core Koala habitat) and how they intend to regulate clearing of Koala habitat under the LLS Act.

While the Koala Wars were meant to be all about the Koala SEPP, the Nationals used the resultant capitulation of the Liberal Party to stop "greenie councils" limiting land use activities. The Liberals agreed to remove Council's rights to regulate logging, with the intent to allow logging across all Council environmental zones. They are also seeking to extend this to cover clearing in environmental zones.

The NSW North Coast has around 2.8 million hectares of private native forests (DPI 2018), of which Council's Local Environment Plans prohibit logging of 167,217 ha (6%) and require development consent for 602,597 ha (25%). These protections will be over-ridden.

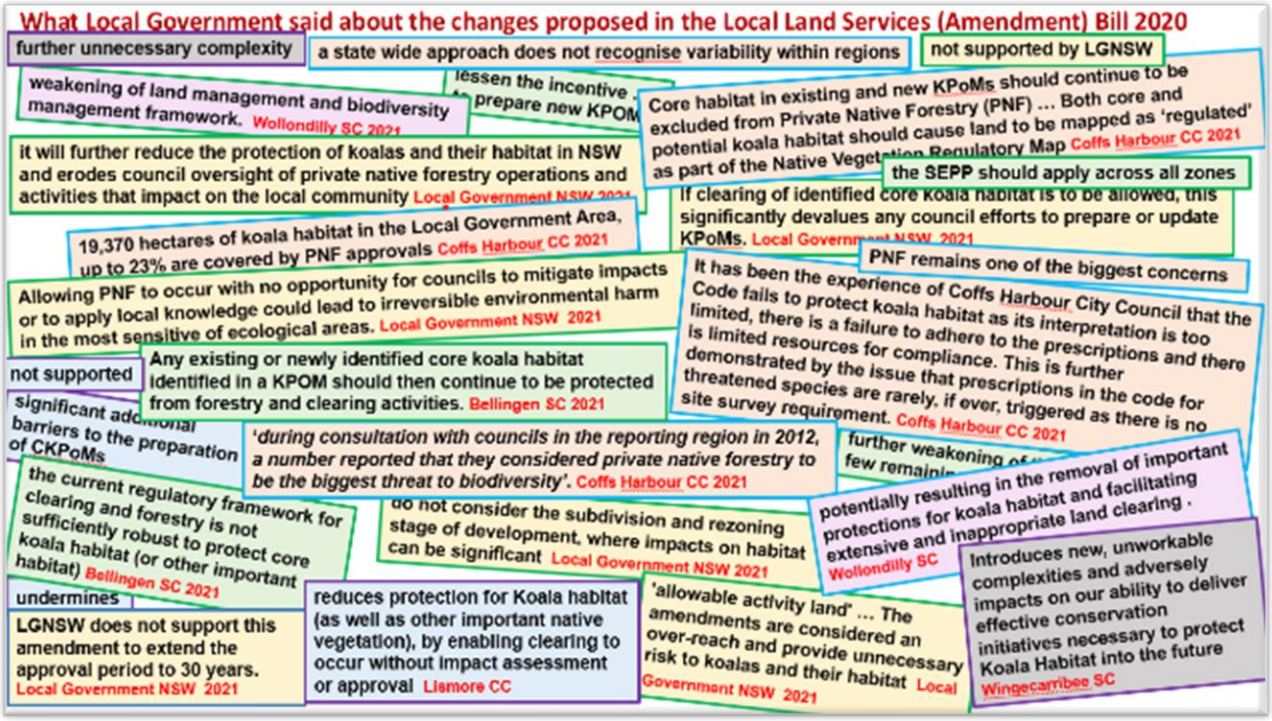
As an additional bonus, the Liberals intend removing Council's rights to create environmental zones, currently the Planning Minister is assuming their role though there are more draconian plans that will effectively stop environmental zones being created throughout NSW if adopted.

Many Councils reacted strongly to the Government's proposed gutting of logging and clearing constraints. Local Government NSW (2021) stating:

> *LGNSW's key concerns with the LLS Amendment Bill are as outlined previously in this submission and specifically that:*
>
> - *it will remove local councils' ability to assess private native forestry operations by removing the requirement for development consent and also removing the ability for councils to restrict forestry operations through other environmental planning instruments. Private native forestry operations can change traffic conditions and impact on local roads, generate noise and local amenity issues. Councils*

need to know where PNF sites are being approved in relation to other planning overlays, and where and when active operations will occur in order to ensure impacts on the community are minimised.

- *allowable activities (such as clearing) will be permissible on allowable activity land, including land zoned for environmental protection, without approval, therefore removing councils' assessment and authorisation provisions.*
- *it will prevent the inclusion of core koala habitat as identified by an approved Koala Plan of Management (KPoM) from being designated as category 2 regulated land under the LLS Act (and therefore allow land clearing of core koala habitat in rural areas). If clearing of identified core koala habitat is to be allowed, this significantly devalues any council efforts to prepare or update KPoMs.*



Wollondilly Shire Council (2021) submitted:

> *… the changes proposed by the Local Land Services Ament Bill (LLS Bill) are viewed as potentially resulting in the removal of important protections for koala habitat and facilitating extensive and inappropriate land clearing. The proposed changes are also viewed as having wider significant adverse implications for the protection of the biodiversity aesthetic and cultural values of Wollondilly.*
>
> *… Council has strong concerns over the intent of the LLS Bill, which will incorporate the assessment of vegetation clearance on land that is zoned Environment Protection into the Land Management Code.*

Bellingen Shire Council (2021) submitted:

> *The remaining parts of the Bill, which are geared towards ''decoupling'' all forestry and clearing provisions from the NSW land use planning framework is also of significant concern to Council. This would mean, for example, that forestry and clearing operations could now be permitted to occur in the E2 (Environmental Conservation) Zone. The NSW Government describes this zone as follows.*
>
> > *''This zone is generally intended to protect land that has high conservation values outside the national parks and nature reserve system.''*

> *In Bellingen Shire this has been primarily applied to land that contains an identified ''Endangered Ecological Community'', and ''forestry'' is currently a prohibited land use in view of these values. The proposed Bill would mean that any such prohibitions are no longer recognised, nor any requirements for development consent that may currently exist, or be proposed, in the Councils Local Environmental Plan.*
>
> *These reforms are highly significant and would render Councils mute in terms of the ability to have any say in the way in which clearing or forestry land uses are permitted to occur in rural and environmental zones within their own local government areas. They act to render the planning intent of a local government area redundant (as expressed through the adoption of environmental zones within a publicly exhibited and legally adopted LEP), without any form of consultation with the community that it effects.*

Port Macquarie-Hastings Council (2021) submitted:

> *Dual consent for Private Native Forestry (PNF) should be a matter for each Council to consider via Local Environmental Plans. Of particular concern is the impact on land zoned Zone E2 Environmental Conservation and Zone E3 Environmental Management where allowing PNF to occur is contrary to the zone objectives. Forestry is currently prohibited on E-Zoned lands under Port Macquarie-Hastings Council LEP 2011.*
> *…*
> *The option for Councils to continue to require consent for vegetation removal in environmental zones via the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 should be retained.*

Lismore City Council (2021) submitted:

> *Overall the Bill reduces protection for Koala habitat (as well as other important native vegetation), by enabling clearing to occur without impact assessment or approval. This is at a time when koala populations are known to be at serious risk. The 2019 Upper House Inquiry gathered considerable scientific evidence and community representation, leading it to conclude that existing protections are not adequate and that the koala is seriously threatened. This situation has been further exacerbated by the impact of the widespread and severe bushfires of 2019/20. Survival and recovery of the species from its current extinction trajectory requires stronger, not weaker, protections.*
> *…*
> *The proposed Bill is inconsistent with the recommendations of the 2019 Upper House Inquiry, and undermines the ability of Councils to protect koalas and their habitat. It expands the circumstances in which clearing can occur without assessment or approval, thereby enabling further removal and fragmentation of habitat. It also considerably increases the potential for pre-emptive clearing for future development under the guise of agricultural activities. There are currently inadequate resources available for investigation and prosecution of these types of breaches.*

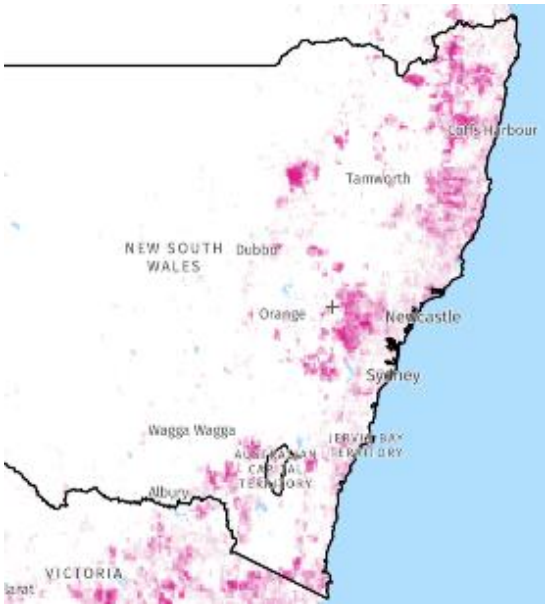
Local Governments have made it clear that the proposed changes identified by the NSW Government remove important protections for koala habitat and disenfranchise local Government's regulation of logging and clearing activities, while facilitating extensive and inappropriate land clearing and logging.

3.1.1. Land clearing free-for-all.

The WWF report *Deforestation Fronts: Drivers and Responses in a Changing World* (Pacheco *et. al.* 2021) identifies 24 "active deforestation fronts" worldwide, identifying eastern Australia as number 14 of the

major deforestation fronts due to cattle ranching and large scale logging, and as the only developed country on the list.

WWF (2021) Deforestation Front.



Global Forest Watch (2021), forest loss

In the forward Marco Lambertini, Director General of WWF International states:

> *Yet forests today are in crisis, devastated by fires, converted and degraded for agriculture, for fuel and for timber. The mismanagement of the world's forests is ramping up carbon emissions, ravaging biodiversity, destroying vital ecosystems, and affecting the livelihoods and wellbeing of local communities as well as societies globally. And the situation is getting worse. The world's current unsustainable food systems mean that instead of repurposing degraded land for sustainable agricultural use, forests, savannahs and grasslands continue to be destroyed.*
>
> *…*
>
> *We know what has to be done: protect critical biodiversity areas and sustainably manage forests, halt deforestation and restore forest landscapes, recognize and protect the tenure rights of indigenous peoples and local communities, support local people to build sustainable livelihoods, enhance landscape governance, and transform our economies, food and financial systems to better account for the value of nature. …*
>
> *Let's use this crisis as a wake-up call to halt nature loss, and safeguard forests, one of our world's most precious resources.*

WWF (Pacheco *et. al.* 2021) note in relation to eastern Australia *"Vegetation laws are governments' preferred approach to reduce deforestation but have had a chequered history and are now universally weaker than they were in the mid-2000s"*.

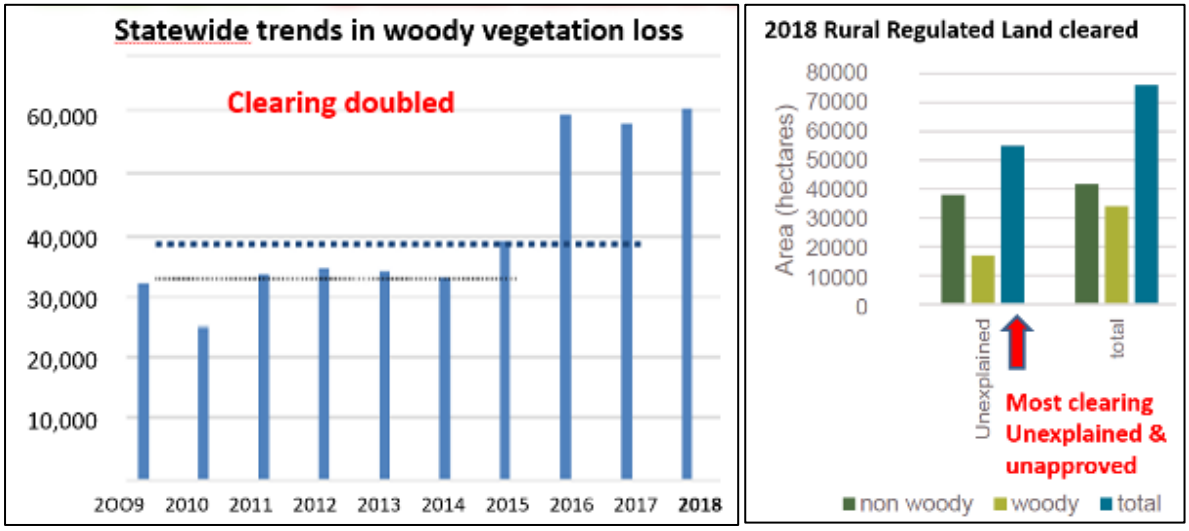
The recently released Global Forest Watch identifies:

> *In 2010, **New South Wales** had **11.8Mha** of natural forest, extending over **15%** of its land area. In **2019**, it lost **910kha** of natural forest, equivalent to **247Mt** of CO_2 of emissions.*
>
> *From **2001** to **2019**, **New South Wales** lost **1.66Mha** of tree cover, equivalent to a **13%** decrease in tree cover since **2000**, and **441Mt** of CO_2 emissions.*

The June 2019 Auditor General report on Managing Native Vegetation found that "*The clearing of native vegetation on rural land is not effectively regulated and managed*", being fraught with problems of weak

processes, poor assessments, inadequate protection, limited monitoring and poor enforcement. Leading her to conclude (in part):

> ***The clearing of native vegetation on rural land is not effectively regulated and managed because the processes in place to support the regulatory framework are weak. There is no evidence-based assurance that clearing of native vegetation is being carried out in accordance with approvals. Responses to incidents of unlawful clearing are slow, with few tangible outcomes. Enforcement action is rarely taken against landholders who unlawfully clear native vegetation.***
>
> ***The rules around land clearing may not be responding adequately to environmental risks.***
>
> *The Code, which contains conditions under which the thinning or clearing of native vegetation can be approved on regulated land, is intended to allow landholders to improve productivity while responding to environmental risks. That said, it may not be achieving this balance. For example, the Code allows some native species to be treated as 'invasive' when they may not be invading an area, provides little protection for groundcover and limited management requirements for set asides. There is also limited ability under the Code to reject applications for higher risk clearing proposals.*



Graphs adapted from DPIE **Woody vegetation change, Statewide Landcover and Tree Study (SLATS) for 2018**

Land clearing in NSW has developed into a free-for-all since the rules were changed in 2016. In 2018 clearing of woody vegetation doubled to 60,800 ha and 72% of the 75,000 ha of Rural Regulated Land cleared was described as "unexplained".

The Natural Resources Commission's belatedly released July 2019 report on land clearing gives another damning assessment of NSW's land clearing free-for-all, revealing that the *"average annual area approved pre-reform"* was 2,703 ha/annum, with this increasing by 14 times to 37,745 ha from June 2018 to May 2019. This is excluding unapproved clearing and "invasive native species", with over 140,000 ha approved for clearing in 2018/19 under the guise of 'invasive native species'. The NRC note "*Widespread use of Part 3 of the Code – which relates to thinning – poses a risk to biodiversity state-wide*", and the Auditor General (2019) concludes *"the Code allows some native species to be treated as 'invasive' when they may not be invading an area"".*

The refusal by the NSW Government to punish illegal clearing, and the allowance of "self-assessable" clearing has led to most land clearing being "unexplained". The NSW Government has no idea of what is going on, and the lack of enforcement has resulted in a free-for-all mentality. The Natural Resources Commission (2019) considered "*Compliance frameworks are inadequate and high rates of unexplained clearing pose a major risk*", noting:

> *However, the available data indicate that there is a major risk from unexplained clearing. Based on total area, the area of unexplained clearing identified in the first five months of the reform alone (7,100 hectares) exceeded the annual pre-reform average (6,350 hectares). Extrapolating this to an annual figure indicates that the trigger would be exceeded significantly. Further, when the proportion of unexplained to approved clearing is considered, nearly 60 percent of the total area cleared under the reforms is unexplained, which is of concern. The Commission notes that not all unexplained clearing is necessarily unlawful clearing but data were not available to indicate the proportion of unexplained clearing that is found to be unlawful.*
>
> *Maintaining biodiversity values under the reforms relies on landholders complying with the Code and a key measure of the reforms' success is a reduction in the amount of unlawful clearing. The available data indicate that there is a major risk from unexplained clearing or that systems for monitoring unexplained clearing are inadequate.*

The Auditor General (2019) commented:

> ***There are significant delays in identifying unlawful clearing and few penalties imposed.***
>
> *Unexplained land clearing can take over two years to identify and analyse, making it difficult to minimise environmental harm or gather evidence to prosecute unlawful clearing. Despite around 1,000 instances of unexplained clearing identified by OEH and over 500 reports to the environmental hotline each year, with around 300 investigations in progress at any one time, there are only two to three prosecutions, three to five remediation orders and around ten penalty notices issued each year for unlawful clearing. Further, OEH is yet to commence any prosecutions under the current legislation which commenced in August 2017.*

The principal measure relied upon to mitigate clearing impacts are requirements to permanently protect part of the land in set asides, NRC (2019) identified that "*when all certifications and notifications for approval are considered*" (aside from "invasive species") "*less than 54 percent of the state-wide area approved to be cleared (45,553 hectares) was set aside*", noting:

> *The two LLS regions where the set aside areas were lowest relative to the area approved to be cleared were Central Tablelands (which had 1,404 hectares approved to be cleared and 35 hectares or 2.5 percent set aside) and Northern Tablelands (which had 6,915 hectares approved to be cleared and 453 hectares or 6.5 percent set aside). Additionally, North Coast, North West and South East had set aside areas that were less than 20 percent of the area approved to be cleared.*

The Auditor General (2019) further concluding:

> ***There are processes in place for approving land clearing but there is limited follow-up to ensure approvals are complied with.***
>
> *…*
>
> *There is limited follow-up or capacity to gauge whether landholders are complying with the conditions of approvals and effectively managing areas of their land that have been set aside for conservation (i.e. 'set asides'). …*

Allowing significant areas to be cleared while setting aside parts of the area is not redressing biodiversity and habitat loss, it is just facilitating it. There is still a net loss no matter how much is set aside.

A publicly available Native Vegetation Regulatory Map was a key component of the Government's vegetation reforms intended to provide landholders and regulators with clarity and certainty about what management activities they can undertake on land. The NRC (2019) noted "*the lack of a public map is likely to impact on outcomes related to landholder clarity and certainty, reduces opportunities to improve the map and increases the risk of unlawful clearing*". The Auditor General (2019) commenting:

> ***The release of the Native Vegetation Regulatory (NVR) map has been delayed, limiting landholders' ability to determine if their plans for clearing are lawful.***
>
> *… However, in November 2016 the then Minister for Primary Industries advised Parliament that the two largest land categories of the NVR map will not come into effect until the relevant Ministers are satisfied stakeholders have sufficient confidence in the maps' accuracy. Not releasing the map has made it harder for landholders to identify the portions of their land that are regulated and ensure they comply with land clearing rules. …*

While the mapping has been available for years the NSW Government still refuses to release it. The LLS website accessed on 1 February 2021 still relies on a "transitional" regulatory map, stating:

> ***Transitional Native Vegetation Regulatory Map currently in force***
>
> *On commencement of Part 5A of the Local Land Services Act 2013 (LLS Act) in August 2017, a transitional Native Vegetation Regulatory Map (NVR Map) was published for use during the transitional period. The transitional NVR Map does not include all categories defined in the legislation. …*
>
> *During the 'transitional period', landholders are responsible for determining the categorisation of their land in accordance with section 60F of the* Local Land Services Act 2013 *(LLS Act).*

The Land Management (Native Vegetation) Code 2018 specifies "*Clearing is not authorised by this Code if the person who carries out the clearing harms an animal that is a threatened species and that person knew that the clearing was likely to harm the animal*". With no requirements to look for threatened species before clearing, this clause is testimony to the scam "What you don't know won't hurt you", allowing people to blindly bulldoze the home of threatened species.

The most recent windback was the September 2021 release of the Government's land clearing tool to allow landholders to clear within 25m of property boundaries, irrespective of environmental impacts, without needing approval, which prompted a number of ecologists to state:

> *This is poor environmental policy that lacks apparent consideration or justification of its potentially substantial ecological costs. It also gravely undermines the NSW government's recent announcement of a plan for "zero extinction" within the state's national parks, as the success of protected reserves for conservation is greatly enhanced by connection with surrounding "off-reserve" habitat.*

Bellingen Shire Council (2021) was one of the numerous voices raised against the environmental folly of this policy:

> *Council accepts that there is a need to properly plan for the future impacts of bushfires, however broad-brush approaches such as this are not supported. In areas like Bellingen Shire with both sensitive vegetation and many small lots (and therefore many boundaries), this impact could have a disastrous impact on the koala population.*

Landclearing in NSW is literally out of control, with 72% of landclearing "unexplained", the Natural Resources Commission considering "*unexplained clearing pose a major risk*", the Auditor General finding landclearing "is not effectively regulated and managed, and the NSW Government intent on further weakening existing constraints. Landclearing permanently removes forests, their carbon sequestration ability, and the habitat they provide, while releasing large volumes of CO_2 into the atmosphere. Creating a market for biomass will provide a financial incentive to reward and encourage landclearing.

3.1.2. The PNF Code of Practice

The Private Native Forestry Code was introduced by the NSW Government in August 2007 and sets the minimum operating standards for harvesting in private native forests. These were made as a Regulation under the Native Vegetation Act 2003, with four Codes of Practice for separate geographic regions. Under the Code, broadscale clearing for the purpose of private native forestry is taken to be "sustainable" and "improve or maintain" environmental outcomes (even when it causes extensive environmental degradation) if:

- it complies with the requirements of the PNF Code, and
- any area cleared in accordance with the Code is allowed to regenerate and is not subsequently cleared.

Under the Native Vegetation Act 2003, harvesting and associated forestry operations conducted for the purposes of PNF require an approved PNF Property Vegetation Plan (PNF PVP). PNF operations under a PNF PVP must be conducted in accordance with the PNF Code of Practice (PNF Code). The PNF Code has been granted biodiversity certification under the Biodiversity Conservation Act. This means that once a PVP has been approved, landholders do not need to separately apply for a licence under the BC Act as threatened species are taken to have been adequately dealt with.

No further assessment is required over the life of the plan and only the PNF Code current when the approval was granted needs to be complied with. There is no need to consider additional information, or even to apply improved species prescriptions or species information when PNF Codes are updated. This is contrary to the principles of Ecologically Sustainable Forest Management and requirements for adaptive management. Theoretically they are meant to be monitoring their activities, review the outcomes, and change their procedures to improve outcomes. But they don't look, don't monitor, and only weaken logging rules.

This rorting is most obvious with core Koala habitat identified in KPoMs, as any "core Koala habitat" identified after a PVP is approved does not need to be excluded from logging, even though the PNF Code current at the time required "core Koala habitat" to be excluded from logging. The Koala Inquiry reported 200 properties in KPoM certified core Koala habitat that have pre-existing logging approvals, which therefore approve the continued logging of mapped core Koala habitat as if it had never been identified.

These approvals currently last for 15 years, though the LLS Amendment Act proposed extending this to 30 years. It is outrageous that these superficial 15 year PNF PVPs do not need to be updated when additional information comes to light, or that updated logging rules aren't automatically applied. The idea of not ensuring there is a new and hopefully professional assessment, along with an exemption from having to comply with new logging rules, for 15 years is bad enough, the idea of extending this to 30 years is outrageous.

Coffs Harbour City Council (2021) note:

> *The current approval period of 15 years already means that the impact and legacy of these approvals cannot be underestimated. In sensitive environments an approval without further analysis for 15 years is already inappropriate. This is demonstrated by survey work and assessments older than 5 years being deemed, in general, to be time damaged in evaluations undertaken under the Biodiversity Conservation Act 2016. As such Council does not support extending the approval period to 30 years.*

Ballina Shire Council (2021) consider:

> *Extension of licences from 15 years to 30 years has considerable impact given existing shortfalls in adequately of assessing impacts and managing and monitoring Private Native Forestry impacts.*
> *…*
> *The SoE report specifically highlighted that Ballina and several other Northern NSW councils should have no new PNF operations approved (Page 48). Within such sensitive environments, an approval without further analysis for 15 years, let alone 30 years is considered to be inappropriate especially in an environment where biodiversity values can change (e.g. long term approvals do not take into account impacts associated with new threats or emerging ecological issues such as population deciles that may occur in future).*

The NSW Government has proposed extending PNF approvals from 15 to 30 years, thereby entrenching the problem that logging operations only need to comply with the Codes applicable at the time of approval. Meaning that when additional information comes to light, or logging rules are updated, they don't need to be applied. This is contrary to ESFM's basic principle of adaptive management.

The folly of not adapting logging to meet changed conditions is exemplified by the Local Land Services' refusal to follow the EPA's example and modify logging practices in burnt forests to minimise additional impacts. The EPA recognise *"The Coastal Integrated Forestry Operation Approvals (IFOA) was not designed to moderate the environmental risks associated with harvesting in landscapes that have been so extensively and severely impacted by fire"*. Given the EPA's acknowledgement that the IFOA is no longer fit-for-purpose, they state "*This has required the EPA to issue additional site-specific conditions that tailor protections for the specific circumstances of these burnt forests*".

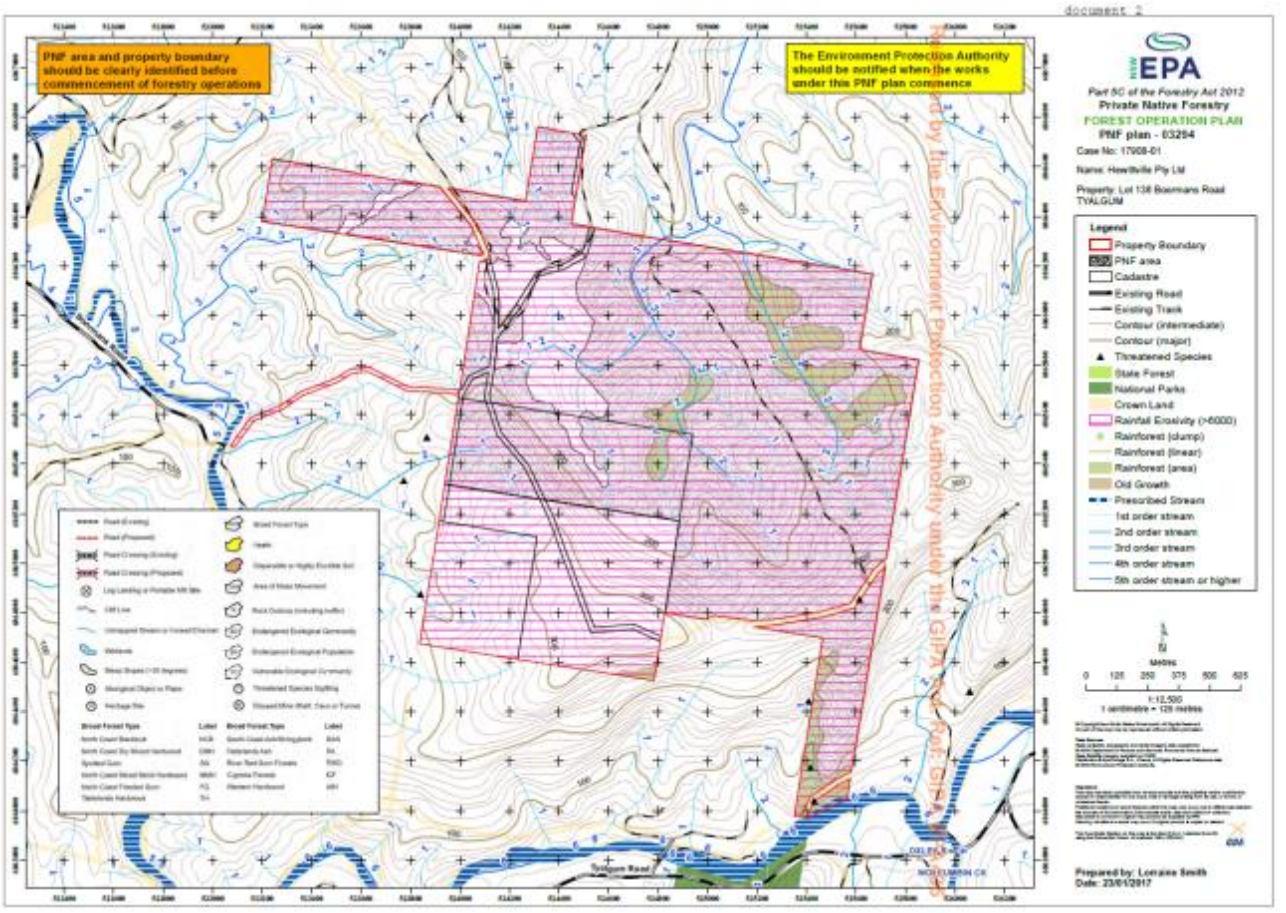
In the Black Summer bushfires over 45% of north coast PNF areas were burnt, though the PNF rules have no contingencies for fires, and there has been no changes to the logging rules to reduce impacts on burnt forests or streams. For example, the identification of evidence of species requiring prescriptions is greatly reduced following the fires, threatened herbs and shrubs were incinerated and scats burnt meaning they were less likely to be encountered after the fires as it would take some time for herbs and shrubs to resprout or scats to accumulate (such as "*koala faecal pellet (scat)")*, yet the LLS couldn't care less.

The Commonwealth and State assessments of the fires, along with the EPA's expert advice, was widely circulated and available to the LLS. The LLS's Managing a Private Native Forestry area after a bushfire urges some caution, though requires no additional protections. This exemplifies the contempt shown by the LLS for minimising the environmental impacts of logging on burnt private lands.

Despite the overwhelming evidence of significant impacts on species, ecosystems, soils and streams from the Black Summer bushfires, and the expert advices to take additional measures to mitigate impacts (such as protecting unburnt refugia), the Local Land Services did nothing to mitigate impacts. It was business as usual. The failure of LLS to increase prescriptions for burnt forests to mitigate the greatly increased impacts of Private Native Forestry on soils, streams, ecosystems and species (including Koalas) exemplifies the parlous state of regulation of private lands in NSW.

The PNF PVP process is just a simplistic desk-top approval that does little to redress environmental constraints. Those observed by NEFA simply show CRA mapped rainforest and oldgrowth (except where it has been remapped by OEH) and stream orders. These are mapped data requiring no ground truthing, except where the land-owner requests deletions. There is no on-ground environmental assessment or

surveys for threatened species. They do nothing to identify the presence of Koalas or potential Koala habitat. They are token superficial assessments.



Forest Operation Plan (obtained under GI(PA) request) for a property at Tyalgum. Note that the only identified features are vegetation extent, mapped rainforest and stream orders. It is a token plan. It is revealing that while the key claims to identify Endangered Ecological Communities it fails to recognise that the rainforest is the Endangered Ecological Community Lowland Rainforest, which is likely to be more extensive than mapped. Also the key claims to identify proposed roads, proposed road crossings, log landings, broad forest types, Aboriginal objects or places, Heritage sites, areas of mass movement, dispersible or highly erodible soils, rock outcrops, threatened species records etc, though none are shown. It's not that they don't occur, but rather that the EPA didn't bother to identify them, even those readily identifiable from existing information. It is a total failure of process that even proposed roads and creek crossings are not identified, which had significant consequences. Similarly Tweed Shire Council's Environmental Zones are not delineated, which also had significant consequences. It is no wonder that the EPA want to keep their inept shoddy plans secret.

The PNF code does have a limited number of logging exclusions. As detailed in NEFA's submission to the Koala Inquiry:

> *The glimpses we have had of the regulator's performance since 2007 reveal numerous transgressions including approving thousands of hectares of core Koala habitat identified in a KPoM for logging, wrongly remapping thousands of hectares of oldgrowth for logging, wrongly remapping critically endangered lowland rainforest for roading, and turning a blind eye while roads were pushed through exclusion areas for Koalas and threatened plants.*

The principal mapped vegetation exclusions are rainforest and oldgrowth forest, based on mapping undertaken in 1997 as part of the Comprehensive Regional Assessment. Under DECCW's Old Growth and

Rainforest Private Native Forestry assessment protocols a private landowner can a request a review of oldgrowth and rainforest as mapped in the CRA.

The oldgrowth and rainforest review process is only aimed at deleting areas that don't match EPA/LLS's mapping criteria, and does not allow for areas meeting the criteria to be added – meaning that unidentified oldgrowth and rainforest can be logged. As noted by Ballina Shire Council (2020): "*the process to refine the mapping appears to be driven by the applicant, should they disagree with the extent of excluded area on their property. Conversely, there is no process to identify areas that are missed or have incorrect line work by the regional scaled map"*.

According to NRC (2018), landholder initiated reassessments of mapped as old growth forest in 667 cases resulting in a 65 percent reduction in the area of mapped old growth forest (from 45,000 hectares down to 16,000 hectares), and a 23 percent reduction in the mapped area of rainforest (from 18,000 hectares to 14,000 hectares). The deleted oldgrowth and rainforest has been made available for logging in numerous 15 year Property Vegetation Management Plans, that can't be reviewed.

A 2010 internal review of DECCW's (now OEH) methodology for remapping oldgrowth forest found it was fundamentally flawed and that a significant amount of the mapped oldgrowth was being wrongly deleted. Webster (2010) found that *"the protocol implementation is working very well for rainforest"*, but that implementation for *"old-growth is highly variable and problematic and has apparently resulted in some areas of old-growth being potentially available for harvest"*. Transect assessments resulted in PNF old-growth classification in 4 out of 5 areas that were not correctly identified by DECCW assessments as being old-growth, 80% of the time OEH were getting it wrong. Extensive areas of oldgrowth were wrongly deleted and made available for logging.

Though aside from their failure to accurately apply their methodology, the more fundamental problem was that they had tightened the decision rules for mapping oldgrowth (i.e. reducing the regrowth threshold from less than 30% to less than 10%) and were applying rules developed for 1:25,000 aerial photographs to higher resolution imagery. The high-resolution ADS40 imagery now being used allows for greater visibility of under-canopy trees, and thus far more regrowth trees are visible than is the case with 1:25,000 aerial photos. It is plainly wrong to use decision rules developed for 1:25,000 aerial photos for very different imagery that allows a higher proportion of regrowth to be viewed. New mapping rules need to be developed specifically for ADS40 imagery that allows for a higher threshold for regrowth.

On behalf of NCC, John Edwards and myself attended an EPA workshop on oldgrowth delineation in the Private Native Forestry PVP process on 22 November 2012. It was aimed at showcasing how OEH had improved their oldgrowth field assessments, though it revealed a fundamentally flawed field assessment process that was strongly criticised by all stakeholders, as well as ongoing mapping problems. OEH had still not rectified the manifest deficiencies in their remapping.

It was alarming that OEH's Science Division (SD) were refusing to map oldgrowth of species not displaying senescent characteristics typical of Blackbutt. I reported to the EPA (Pugh 2012):

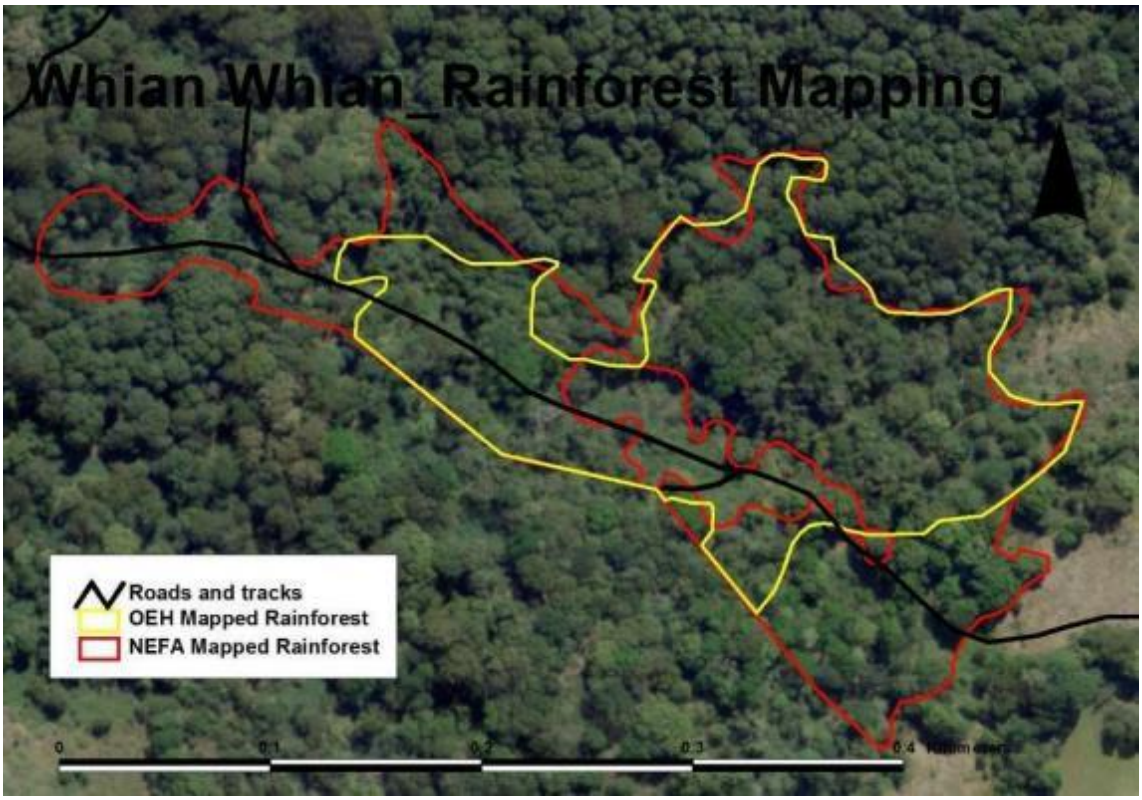
> *Growth-staging is based on the typical growth stages of Blackbutt and the presence of dead branches and uneven crowns in senescent trees. These are what are used to define oldgrowth trees and thus oldgrowth forests. These characteristics are shown to varying degrees by eucalypts, but not by non-eucalypts such as Brush Box, Turpentine and some Angophoras. This has been identified as a key issue for over 20 years in the north-east forests. Despite this, SD still had no decision rules for identifying oldgrowth stands of these forest types. ...*
>
> *...*

> *Given that SD have no decision for forest types showing atypical growth forms there are real concerns that significant stands of oldgrowth forests, particularly those dominated by Brush Box and Turpentine, are being missed. It was recommended that decision rules to delineate the oldgrowth stage for these species be developed urgently.*

It is reprehensible that the current rules still do not allow for species not displaying obvious signs of senescence in their canopies, meaning that their oldgrowth stage is not discernable using the method applied. This was the reason that the CRA adopted different API decision rules for different interpretability classes (which OEH seem not to understand). The refusal to rectify the decision rules all these years later displays a high level of antipathy towards protecting oldgrowth forest.

On the field inspection it was also concerning that "*The selection of field transects and plots for verification is extremely problematic as they are chosen subjectively and in at least one case (if not both) plots were located outside the mapped polygon. The assessment of significant disturbance appeared to have been wrongly assessed on one of the three plots inspected within mapped oldgrowth and another was dubious. Based on the small sample reviewed it is not considered that field verification is undertaken in a rigorous or objective manner*".

As an example of the rainforest remapping process, at Whian Whian in 2013 (Pugh 2014) NEFA found the that OEH had remapped obvious Critically Endangered Lowland Rainforest of Subtropical Australia (listed and mapped under the *Environment Protection and Biodiversity Conservation Act 1999)* as either cleared land or part of the logging area. In May 2012 as part of the preparation of the PVP, the OEH, at the request of the EPA and Forestry Corporation, reviewed the rainforest mapping. In this process they redrew the rainforest boundary. The 4.9 hectares of rainforest mapped on the property in the stand along the road, was remapped as 3.3ha by OEH, with 2.5 ha deleted and 0.9ha added by an extension of the boundary to the north. The deleted rainforest was reassigned either to the loggable area or as cleared land.



Mapping by OEH and NEFA overlaid on aerial photo, note the south eastern patch classed as "cleared" by OEH and the central lantana dominated area classed as non-rainforest by NEFA.

We presented the EPA with detailed mapping (and results of ground surveys) that showed the blatant errors, with the egregious result of remapping Critically Endangered rainforest as either cleared or for logging for the life of the PNF PVP. The EPA refused to investigate our well documented complaint, or provide us with any documents on their remapping process under a GI(PA) Act request.

Examples of Lowland Subtropical rainforest at Whian Whian remapped by OEH as either cleared land (right) or assigned to the logging area (left).

The veil of secrecy surrounding private property logging hinders public accountability and encourages lax enforcement by captured regulatory agencies.

NEFA considers that a large proportion of the 29,000 ha of mapped oldgrowth and 4,000 ha of mapped rainforest deleted by OEH (by 2018) has been erroneously remapped and made available for logging. While oldgrowth and rainforest were originally mapped in a process involving oversight by all stakeholders, the remapping is undertaken in a secretive process using different decision rules and methods. Even with the new rules an internal review found that oldgrowth was being erroneously deleted, and NEFA have documented a case where Critically Endangered Lowland Rainforest of Subtropical Australia was remapped as either cleared land or part of the logging area. The deleted oldgrowth and rainforest is now potentially available as fuel for Redbank.

As of 13 January 2020 there was 467,341 ha approved for PNF in NSW, with 95% of this on the north coast. The NSW Government found that on the North Coast there is a significant overlap between highly suitable koala habitat and PNF forests with high timber values, with "highly suitable koala habitat" comprising:

- 55% of areas with very high timber values

- 38% of areas with high timber values

It is a safe bet that no effort has been made to identify the presence of Koalas in the majority of these operations, and that nothing is being done to protect where they occur.

The PNF Code of Practice is the regulatory mechanism that is meant to protect attributes such as soils and threatened species. There is nothing in the EPA's guidelines relating to Private Native Forestry that require surveys for any threatened species. Rather the species-specific protections identified in the code only apply to a 'known record' on Wildlife Atlas or 'site evidence' where a landowner may incidentally come across evidence of a threatened species and report it.

For koalas, the specific provisions for the PNF Code of Practice are:

(a) Forest operations are not permitted within any area identified as 'core koala habitat' within the meaning of State Environmental Planning Policy No. 44 – Koala Habitat Protection

(b) Any tree containing a koala, or any tree beneath which 20 or more koala faecal pellets (scats) are found (or one or more koala faecal pellets in Koala Management Area 5) must be retained, and an exclusion zone of 20 metres (50 metres in Koala Management Area 5) must be implemented around each retained tree.

(c) Where there is a record of a koala within an area of forest operations or within 500 metres of an area of forest operations or a koala faecal pellet (scat) is found beneath the canopy of any primary or secondary koala food tree (see Table I below), the following must apply:

(i) A minimum of 10 primary koala food trees and 5 secondary koala food trees must be retained per hectare of net harvesting area (not including other exclusion or buffer zones), where available.

(ii) These trees should preferably be spread evenly across the net harvesting area, have leafy, broad crowns and be in a range of size classes with a minimum of 30 centimetres diameter at breast height over bark.

(iii) Damage to retained trees must be minimised by directional felling techniques.

(iv) Post-harvest burns must minimise damage to the trunks and foliage of retained trees.

Clause (a) is next to useless in most areas as LLS maintain that only 4,960 ha of "core Koala habitat" has been identified in three Comprehensive Koala Plans of Management approved over the past 25 years, and that there are 200 pre-existing PVPs that over-ride its mapping as core Koala habitat. DPIE have a different interpretation of "core Koala habitat, claiming a total area of 15,809 ha identified in 5 CPoMs, and while 6,922 ha of this is claimed to be mapped as Sensitive Regulated Land (with urban and environmental zones excluded), the LLS doesn't accept it for regulation of PNF.

Clauses (b) and (c), like all species specific provisions in the PNF Code of Practice, are triggered by either a 'known record' of a koala in the Atlas of NSW Wildlife or 'site evidence' of the presence of koalas found by the landholder and/or a logging contractor. There is nothing in the EPA's guidelines relating to Private Native Forestry that require surveys for any threatened species. There are very few records in the Atlas of NSW Wildlife for private lands and no incentives for landowners or contractors to look for or report the presence of Koalas.

Most PNF logging operations are undertaken in areas where there have been no surveys for threatened species and thus there are no "known" records. Therefore the reliance is on incidental "site evidence" which is unlikely to be accidentally found for most threatened species, and even where evidence (such as quoll or

Koala scats) may be found and identified by an experienced person, the landowner or contractor have a clear financial incentive not to admit to it. This means that while the PNF code has many potentially useful prescriptions for threatened species they are practically useless.

In their submission to PNF, Ballina Shire Council (2020) observe:

> *In respect to threatened entities, the code of practice is highly reliant on records submitted into NSW BioNet. This is not suitably reflective of the likely presence of threatened species in forested areas that are utilised for PNF or the impact of habitat loss on flora and fauna resulting from PNF operations.*
>
> *The application process should require site specific threatened species surveys pertinent to contemporary data, literature and methodology. Ecological assessment should be required to have regard for landscape and cumulative impacts associated with PNF.*
> *…*
> *Many of the ecological prescriptions listed in Appendix A rely on a specific record within the forest operation to trigger exclusions, buffers or directives for harvesting. However, as previously noted in the above comments, there is no requirement to undertake surveys. It is unlikely that habitat, sightings and indications of occurrences for many (if not all threatened species) are being observed to subsequently trigger the appropriate prescriptions. For example, observation of koala scats is unlikely if no specific search is carried out.*

In their submission to the Koala Inquiry, Bellingen Shire Council (2021) consider:

> *… the current Code of Practice for Private Native Forestry presents as inadequate as a protection for koala habitat. The prescriptions in the Code for threatened species are rarely, if ever triggered because there is no site survey requirement, and it relies on either the identification of core koala habitat in an adopted KPOM or a record in BioNet. Even if a prescription is triggered for koalas, the Code of Practice can also still actually allow for the logging of koala habitat trees that have up to 19 scats underneath them.*
> *…*
> *… it is considered important that the assessment of biodiversity values takes place by appropriately qualified persons, including systematic on-ground surveys to properly understand impacts. Any increased reliance upon desk-top style assessments, or self-assessment of impact by persons unqualified in ecology is of concern in that it risks missing important information and makes no further contribution to the knowledge base (eg: BioNet records) that is referred to when applying things such as desktop threatened species prescriptions.*

Coffs Harbour City Council (2021) state:

> *It has been the experience of Coffs Harbour City Council that the Code fails to protect koala habitat as its interpretation is too limited, there is a failure to adhere to the prescriptions and there is limited resources for compliance. This is further demonstrated by the issue that prescriptions in the code for threatened species are rarely, if ever, triggered as there is no site survey requirement. The reliance on adopted KPoM 'core habitat' or a record in BioNet is not an effective mechanism to demonstrate threatened species presence/absence and is not accepted in applications for vegetation removal of a similar scale such as through development applications or planning proposals. Site surveys should be required prior to PNF approvals.*
> *…*
> *The 2016 Regional State of the Environment Report for the North Coast Region of New South Wales also noted that 'during consultation with councils in the reporting region in 2012, a number reported*

> *that they considered private native forestry to be the biggest threat to biodiversity'. With additional issues relating to PNF being raised in 2016 including, 'Approvals being issued on land designated as koala habitat' and 'Failure to adhere to the PNF Code of Practice'. Council urges the inquiry to recommend that core habitat in existing and new KPoMs continue to be excluded from PNF and that additional resources are made available for compliance of PNF and unauthorised vegetation removal more generally.*

Port Macquarie-Hastings Council (2021) similarly consider:

> *Site surveys should be required prior to PNF approvals. This survey methodology should be comprehensive and using the same methodology as would be required for Development Consent under the EP&A Act.*

As detailed in NEFA's submission to the Koala Inquiry, NEFA have undertaken brief fauna surveys of 2 active PNF operations in the northern rivers, revealing the unrecorded presence of Marbled Frogmouth, Masked Owl, Koalas and various threatened plants on both properties, with the addition of Alberts Lyrebird, Pouched Frog and Sooty Owl on one property. The significance of this is that all these species had specific habitat retention requirements in the PNF Code that were required to mitigate logging impacts (such as wider stream buffers, increased tree retention and exclusion areas), that weren't applied until NEFA identified their presence.

At Tyalgum (see NEFA's submission to the Koala Inquiry,: 2.2.1. Private Case Study 2: Tyalgum private forestry) NEFA identified 2 Koala High Use Trees (trees with 20 or more Koala scats beneath them). NEFA and the community also identified the Vulnerable Marbled Frogmouth, Masked Owl, and Durobby (*Syzygium moorei*), and the Endangered Green-leaved rose walnut (*Endiandra muelleri* subsp.*bracteata*). Even then the EPA refused to undertake, or require, surveys to identify other occurrences of these threatened species for application of required prescriptions.

At Whian Whian in 2013 (Pugh 2014), where private land was being logged by the Forestry Corporation, NEFA and the community did manage to undertake more thorough surveys. Over the course of events NEFA found and reported a total of 16 Koala high use trees and Community Surveys found an additional 10 Koala high use trees with limited searching, bringing the total to 26 such trees in an area where the Forestry Corporation had only identified 2. The PNF Code required 20m buffers around all such trees.

The surveys also found the Marbled Frogmouth, Sooty Owl, Masked Owl, Alberts Lyrebird and Pouched Frog; the Endangered plants *Endiandra muelleri* ssp. *Bracteata* and *Marsdenia longiloba;* and the Vulnerable plants *Corokia whiteana*, *Hicksbeachia pinnatifolia* and *Tinospora tinosporoides*, none of which had been identified by the Forestry Corporation. A total of 8 Koala high use trees (and numerous threatened plants) were found to have had roads and tracks constructed within 20m of them contrary to the PNF Code. It took immense community effort and angst to get Koalas, and other species, the protection they were entitled to, and even then the EPA identified roading into 12 exclusion areas after they had been identified.

Regrettably it is clear that for Koalas both the Conservation and Management Strategy and NSW Recovery Plan requirements relating to identifying and protecting important habitat areas, identifying improved and standardised survey methods, and monitoring and reviewing the effectiveness of mitigation measures, are not being complied with on private lands

While the PNF logging Code does have a variety of prescriptions to protect habitat or habitat attributes around known records of threatened species, there are few existing records for private land and no requirement to look for them prior to logging. This means that in practice no specific mitigation measures are applied for most threatened plants and animals, even where the need

for mitigation actions are recognised. PNF is a threat to a multitude of threatened plants and animals.

3.2. Public forestry

In 2018 the NSW Government adopted a new Coastal Integrated Forestry Operations Approval (CIFOA) that combined the four IFOAs into one, covering all native forests on State forests in eastern NSW. For north-east NSW these new logging rules doubled allowable logging intensities, zoned 140,000 ha for clearfelling, more than doubled the off-take of small and defective trees, reduced buffers on headwater streams from 10m to 5m, removed protection for most threatened species, halved proposed tree retention for Koalas, and removed protection for most mature trees.

In adopting the new CIFOA logging rules for public lands the NSW Government has significantly eroded environmental protections and abandoned any pretence that logging is ecologically sustainable.

For north-east NSW the 1999 IFOA allowed two forms of logging: Single Tree Retention (STS) and Australian Group Selection (AGS), though by 2018 STS was the only legal logging regime being practiced. The legal requirements for Single Tree Selection required 60% of the basal area (area of the cross section of a tree trunk) of the trees in a harvesting area, including all trees under 20cm diameter, to be left after a logging operation. In practice the Forestry Corporation had been removing 80-90% of the basal area under the guise of STS, while dismissing the EPA's objections.

NEFA had been complaining about this for years, leading the EPA (2016), on behalf of the Environment Minister, to admit this *"is not consistent with the definition and intent of STS (Single Tree Selection) in the Integrated Forestry Operations Approval (IFOA) as well as FCNSW's own silvicultural guidelines*." Despite its illegality and the EPA's objections, the NRC (2016) considered that as the Forestry Corporation have been practicing "Regeneration Single Tree Selection" since 2007 they would adopt this as **Current harvesting practice** to reference proposed changes against.

In the new CIFOA there was a specific focus on removing protections for mature trees and increasing logging intensity. The CIFOA established 3 zones where tree removal in logging areas is limited by basal area retention:

- a 140,000ha North Coast Intensive Zone covering coastal forests south from Grafton to Taree where there is no minimum basal area retention.
- a coastal "regrowth" zone with a minimum basal area retention of $10m^2$ ha and,
- an escarpment "non-regrowth" zone with a minimum basal area retention of $12m^2$ ha

The consequences of the reduction in basal area are discussed in 2.1.2., and the removal of most protection for mature trees in 3.2.1.

The EPA (NRC 2016) recommended basal area retention of 12 and $14m^2$ ha for the "regrowth" and "non-regrowth" zones respectively, though they were over-ridden by the Natural Resources Commission (2016).

The Remake of the Coastal Integrated Forestry Operations Approvals Final Report Threatened Species Expert Panel Review reports the EPA representative Brian Tolhurst (one of the 10 experts who answered questions) as stating:

> *Sustainable forest management requires maintenance of forest stand structure complexity and heterogeneity to allow for biodiversity conservation. This key point seems to have been given up on in*

this review process with harvesting practices proposed that will severely degrade these forests to an artificial and simplified arrangement with severely reduced and limited biodiversity values.

I think this remake is an interventionist approach to remedy a situation that has evolved through poor and desperate practices adopted to meet an unsustainable wood supply agreement at significant expense to the environment and the people of NSW. Continuing down this path will have long term deleterious environmental outcomes for the public forests of NSW in order to limp across the line and meet the final years of the wood supply agreements. This will be entirely at the expense of these forests. Recovery to some level of 'natural' ecological function will be decades and centuries, possibly without many species that will not survive this current and ongoing impact.

... The intensive harvesting has clearly moved the coastal state forests from being multiple use forests with significant biodiversity values to that of purely production forests more in line with plantations. I don't believe this is an appropriate outcome or use of these crown lands that was ever envisaged.

... Removal of standing trees below a basal area of around 18 - 20m2/ha will reduce the structure of these native forests to such a simple form that the ecological processes will be severely diminished or non-functioning. Even in the best case scenario it will take many decades or even centuries of recovery for any level of native forest ecological function to be restored after this intensity and scale of impact.

A typical healthily stocked Blackbutt forest could be expected to have a basal area of around 30 - 40 m2/ha. Currently under the IFOA a 40% removal would limit the minimum basal area retention of 18 m2/ha in the worst case scenario

The new CIFOA logging rules have allowed a major intensification of logging throughout north-east NSW's public forests, with a 140,000ha North Coast Intensive Zone allowing clearfelling, and minimal tree retention elsewhere. Without requirements for retention of mature trees, those old trees left in logging areas will quickly succumb to old age, logging injuries and fire, converting native forests into pseudo plantations of regrowth. To achieve the increased logging intensity the Forestry Corporation needs a market for pulpwood, the intent is to use biomass logging to convert "*multiple use forests with significant biodiversity values to that of purely production forests more in line with plantations".* The environmental impacts will be massive.

The previous Threatened Species Licences for Upper North East (UNE), Lower North East (LNE), Southern and Eden IFOAs identified 87 species and populations of animals that required surveys and the implementation of species specific protections. For 18 birds and 6 bats protection was limited to nests/roosts when found. For the remaining 63 species and populations with species specific prescriptions, the new CIFOA retained the currrent protection for 14, significantly reduced protection for 26, and removed the species-specific protection for 23. For most threatened animals this includes removing all exclusion zones identified in surveys over the past 20 years and making them available for logging.

The previous Threatened Species Licences for Upper North East (UNE), Lower North East (LNE), Southern and Eden IFOAs identified 428 threatened plant species or distinct populations that required pre-logging surveys and the implementation of prescriptions if found. An "*integral part of the licence*" was for pre-logging and pre-roading surveys and compartment mark-up surveys for threatened plants to be undertaken by suitably experienced and trained people, with minimum survey effort and required surveyor experience specified. Under the new CIFOA pre-logging surveys are now only required for 17 species in limited areas. Protection

was removed from 76% of threatened plants, leaving some 102 species requiring some form of protection, though often reduced.

Under the new logging rules most pre-logging survey requirements and most species-specific protections for threatened species were removed or reduced, leaving most threatened plants and animals with no or less protection from logging. The intensification of logging involving biomass removal leaves these now unprotected species particularly vulnerable.

Headwater streams are of overwhelming importance for catchment health as this is where most of the interaction between the terrestrial and aquatic realms occurs. It is along the smallest streams and drainage lines where most of the interaction between terrestrial and aquatic environments occurs. Small headwater streams generally drain catchments smaller than two square kilometres and can constitute over 75% of the stream length in a drainage basin (Barmuta *et. al.* 2009).

The science is that we should be establishing buffers at least 30m wide around these headwater streams. For example:

- Munks (1996) recommended minimum buffer widths of 30-50m for small streams with a catchment of 50 to 100 ha and 30m for small streams, tributaries, gully and drainage lines which only carry surface water during periods of heavy rainfall.
- Croke and Hairsine (1995) recommended "Minimum Streamside Reserve and Filter Strip Widths according to stream type", with 20m buffers for temporary (1 in 5 yr flow) streams and 30m buffers for small streams with a catchment less than 100 ha.
- Hansen *et. al.* (2010) identified various riparian buffers for different purposes, ranging from 30-60m to improve water quality, up to 40-100m to Improve in-stream biodiversity.

In the CIFOA remake there was a focus on reducing protected riparian habitat, primarily to allow access to the resources in riparian areas that had been protected for decades. There was no science involved. Essentially the CIFOA reduced buffers on headwater streams from an already inadequate 10m down to 5m, and removed or reduced the requirements for increased protection of riparian habitat for 17 threatened animal species.

The Remake of the Coastal Integrated Forestry Operations Approvals Final Report Threatened Species Expert Panel Review reports all experts who commented as opposing the opening up of riparian areas protected for the past 20 years for logging. For example Brad Law, DPI Forestry, stated:

> *"In some areas where areas once mapped as riparian buffers are no longer identified then there would be a loss of habitat protected for the past 20 year period. Given the intensity of operations over the last 10 years, it would be important to try to ensure these areas remain protected"*

The EPA representative Brian Tolhurst stated:

> *"No further loss or impact on the retained riparian areas that have been protected to date under the existing rule set should occur. The expert panel agreed that these areas were the few areas seen on the site visit that still retained habitat elements and the diversity, form and structure of a native forest.*
>
> *...*
>
> *I am not convinced that the proposed riparian buffers are adequate for ecological protection of these features. The widths seem to have been generated to deliver no net loss of available harvestable area rather than driven by an appropriate buffer for the size/importance of the feature".*

The new CIFOA logging rules reduced buffers on headwater streams from 10m down to 5m contrary to the scientific advice that they should be at least 30m, removed existing increased

riparian exclusions established around records of 17 threatened species, and removed protection for riparian areas that had existed for over 20 years against the explicit advice of the agency Threatened Species Expert Panel. There can be no doubt that a biomass market will increase the intensity and extent of logging in these sensitive riparian areas, and will have significant environmental impacts.

The EPA makes much of the pretence that to compensate for the multiple reductions in prescriptions there will be additional requirements to permanently protect 10 to 13% of the loggable area. These include areas that would otherwise have been required to be retained such as unmapped rocky outcrops, cliffs, heath and scrub, wetlands, as well as "carry-over" exclusion areas, and habitat trees. As noted by the EPA "*it is anticipated most wildlife clumps will be made up of 'carry over exclusion zone' – being large exclusion zones previously applied for koalas, squirrel gliders and phascogales or the specified habitat features".* So they are not really intended to protect anything additional.

The biggest problem is that these compensatory areas are left up to the whim of the Forestry Corporation to select, without any requirements to survey for areas of particular biological importance. They are effectively being allowed to decide a mini reserve system based on their resource imperatives. Where they have a choice, they are often chosing areas that are unloggable or have the least resources, which often have minimal conservation values. In NEFA's audit of Myrtle State Forest we found "*to satisfy retention requirements for Wildlife Habitat Clumps the Forestry Corporation are protecting some of the most heavily burnt forests, with many dead trees, despite their relatively low wildlife values*".

Myrtle SF (Pugh 2020) example of an area that the Forestry Corporation chose to protect in perpetuity as a Wildlife Habitat Clump under the CIFOA, primarily because most of the trees were dead. When reported to the EPA they said they would do nothing to ensure a more effective selection.

Ecologist David Milledge inspected the above area, noting:

> *The selection of this area as WHC appears to be completely contrary to the intent of the protocol and is unlikely to provide any of the habitat attributes the protocol was designed to protect, even providing it remains relatively undisturbed, for one to two decades or more. With regard to hollow-bearing trees, this is unlikely to be achieved for a minimum 100 years.*

In his review of current logging prescriptions for the EPA, Smith (2020) notes:

This review concluded that, particularly in the context of the 2019/20 wildfires, the standard conditions (CIFOA 2018) fail to guarantee ecologically sustainable forest management and are likely to cause an ongoing decline and significant impact on biodiversity, inconsistent with the requirements of the Environment Protection and Biodiversity Conservation Act 1999 and the NSW Forestry Act 2012.

The key reasons for concluding that standard CIFOA conditions are inadequate and that timber harvesting and fire will have a significant impact on biodiversity are as follows:

1) There is no mandatory provision to identify, map and protect fire refuges in net harvest areas (areas of unburnt and lightly burnt forests or with a low probability of future fire) for sufficient length of time (20 - >120 years) necessary for biodiversity recovery after fire and logging.

2) The harvesting intensity limits (including the basal area retention requirements for selective harvesting which are largely met by habitat tree protections alone) effectively allow intensive harvesting or clear felling on short rotations in the net harvest area which will permanently eliminate late stage forest dependent fauna from the net harvest area over time.

3) There are no effective requirements for protection and recruitment of a minimum area and percentage of late stage (uneven-aged and old growth) forest and its dependent fauna within compartments or across landscapes to mitigate the losses from timber harvesting (such areas could be substantially coincident with fire refuges).

4) The current size, area and pattern of retained unlogged Environmentally Sensitive Areas (ESAs) within compartments and across landscapes is not adequate to provide the suitable habitat, corridor links, or unlogged and/or unburnt forest patches of sufficient size (20 - >100 ha.) to sustain viable populations of vulnerable and threatened late stage dependent fauna like Greater Glider and Yellow-bellied Glider.

Ecologically sustainable forest management requires that species are retained throughout their natural range, and not just in public national parks and nature reserves, in order to maintain genetic diversity and the capacity for continued evolution. Current evidence indicates that fire and logging is causing progressive declines in the population size and abundance of sensitive and threatened species like the Greater Glider and Yellow-bellied Glider leaving local populations in state forest isolated and vulnerable to genetic drift and extinction (Lumsden et al 2013, Lindenmayer and Sato 2018).

The new CIFOA pretends to compensate for the increased logging intensity, removal of most protection for mature trees, the removal of most pre-logging survey requirements for threatened species, and the removal of exclusions or modified logging around records of threatened species, by requiring that the Forestry Corporation choose 10-13% of the net logging area be protected in perpetuity. Though as surveys for threatened species are no longer required, and the Forestry Corporation are primarily concerned with limiting resource losses, the areas chosen are insufficient and often inappropriate to mitigate logging impacts on threatened species.

3.2.1. Large old trees

It is the bigger and older trees that provide resources in the abundance required by numerous animals. It may take a tree one or two decades before they begin to flower and set seed, which they produce in increasing abundance as they mature. Numerous species of invertebrates, many birds, and a variety of mammals feed on these flowers and seeds. As they mature their trunks and leaves also exude a variety of sweet substances used by many species. Invertebrates harbour within their rough and shedding bark where they are eagerly sought out for food. Yellow-bellied and Squirrel Gliders chew channels through their bark to tap trees for sap. As the trunks and branches thicken the trees provide more stable nesting and roosting sites, while enabling Koalas to hug them on hot days to keep cool.

Once a eucalypt tree is over 120-180 years old they may start to develop hollows in their branches and trunks. In NSW at least 46 mammals, 81 birds, 31 reptiles and 16 frogs, are reliant on tree hollows for shelter and nests. As the trees get bigger so do their hollows, and it may not be until they are over 220 years old that they develop hollows big enough for the largest species. Most eucalypts may only live for 300-500 years, though some are reputed to live for over 1,000 years.

Seventy species (28%) of vertebrates use hollows in north-east NSW (Gibbons & Lindenmayer 2002). The loss of the hollows provided by large old trees has been identified as a primary threat to a variety of priority species in north east NSW (Environment Australia 1999, Appendix 1); 4 mammals (non-flying), 20 bats, 3 birds, 2 frogs, 3 reptiles and 4 snakes. The large hollows essential for large hollow-dependent animals, such as the threatened Powerful Owl, Masked Owl, Barking Owl, Greater Glider, Yellow-bellied Glider, and Glossy-black Cockatoo, are provided by trees over 200 years old.

Gibbons and Lindenmayer (2002) documented that relatively undisturbed temperate and sub-tropical eucalypt forests contain 13–27 hollow-bearing trees per hectare. Only some hollows have appropriate entrance sizes and depths for fauna, with only 43-57% of hollows found to be used by fauna, and 49-57% of hollow-bearing trees used (Gibbons and Lindenmayer 2002). Based on their estimates Gibbons & Lindenmayer (2002) assumed that *"hollow-bearing trees in forests are likely to be occupied at a rate of around 6-15 per hectare".*

The NSW Scientific Committee (2007) has identified *Loss of Hollow-bearing Trees* as a Key Threatening Process. The maintenance of large old hollow-bearing trees in perpetuity is the single most important requirement for the survival of the numerous animal species that rely on their hollows for denning, nesting or roosting**.** To maintain continuity of supply of these resources by such long lived organisms it is essential to ensure that there are enough small hollow-bearing trees to replace the large hollow-bearing trees when they die, and enough strong and health mature trees to develop into the hollow-bearing trees of the future.

As noted by Gibbons and Lindenmayer (2002):

> *Hollow-bearing eucalypts are extremely long-lived 'organisms'. Eucalypts typically have a life span of 300-500 years, and dead trees may provide hollows for a further 100 years. The age at which they 'reproduce' hollows (typically 150-250 years) represents one of the slowest 'reproductive cycles' for any organism. Failure to replace hollow-bearing trees as they are lost will result in prolonged temporal gaps in the resource that will not only reduce the area of suitable habitat for hollow-using fauna, but could also fragment populations of species unable to occupy areas lacking hollows. The dispersal of hollow using species also will be impaired".*

In logged forests old hollow-bearing trees are a declining resource, there are not enough homes to satisfy demand.

Tree hollows are used by seventy species (28%) of vertebrates in north-east NSW, providing essential roost, den and nest sites for many of these. The large hollows necessary for larger species such as Powerful Owl, Masked Owl, Barking Owl, Greater Glider, Yellow-bellied Glider, and Glossy-black Cockatoo are only provided by trees over 200 years old. It is essential to retain those hollow-bearing trees remaining, and enough of the next largest trees so that they are able to develop into the hollow-bearing trees of the future.

Larger trees also produce more nectar, a key food that many vertebrate species depend on. Eucalypt species can produce copious nectar though most flower unreliably, often at intervals of several years, so nectarivorous species need to be able to track nectar across the landscape or switch to other foods when nectar is in short supply. The erratic production of nectar is likely to become more so in the future as climate heating gathers momentum, as stated by Butt *et. al.* (2015) "*as a consequence of the increasing incidence of droughts and heat waves, the net quantity of nectar at flower, stand and landscape scales may be reduced, and its temporal variability increased*".

Older trees produce significantly more flowers and nectar than young trees and thus are of particular importance to fauna relying on these food sources. For Mountain Ash trees Ashton (1975) found "*The mature forest produced 2.15-15.5 times as many flowers as the pole stage trees, and 1.5-10 times as many as the spar stage forest".* From her study of the flowering phenology displayed by seven Eucalyptus species in a Box-Ironbark forest, Wilson (2003) found *"trees in size - classes >40 cm flowered more frequently, for a greater duration, more intensely and had greater indices of floral resource abundance than trees < 40 cm DBH"*.

For Spotted Gum forest in southern NSW Law and Chidel (2007, 2008, 2009) found large trees (>40cm dbh) carried 3,600 flowers compared to 816 flowers on medium trees and 283 flowers on small trees (<25cm dbh), noting "*mature forest produced almost 10 times as much sugar per ha as recently logged forest, with regrowth being intermediate*" And for Grey Ironbark *Eucalyptus paniculata* forests large trees carried 12,555 flowers compared to ,1024 flowers on medium trees and 686 flowers on small trees, noting "*old regrowth forest (232 g sugar per night per 0.2 ha) produced just over 7 times the sugar of recently logged forest (32 g), while regrowth forest was intermediate (91 g)*."

As well as producing more flowers larger trees also tend to flower more often (Law *et. al.* 2000, Law and Chidel 2007), for example Law *et. al.* (2000) found that large Spotted Gum *Corymbia variegata* flowered every 2.3 years whereas medium sized trees flowered every 5.9 years.

The abundance of flowers provided by trees directly affects their suitability for foraging by numerous animals. Mature and older trees have been significantly diminished across these forests, and along with them the abundance and reliability of nectar essential to maintain resident and seasonal populations of nectar feeders.

The Regent Honeyeater and Swift Parrot are two key species that depend upon nectar. Researchers at Australia's Threatened Species Recovery Hub (Geyle *et. al.* 2018) recently identified that the Regent Honeyeater and Swift Parrot have a 57% chance of extinction and a 31% chance of extinction respectively within the next 20 years, ranking them the 7th and 13th most threatened birds in Australia.

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act. The 2016 National Recovery Plan for the Regent Honeyeater identifies "*It is important to identify and retain trees that produce relatively high levels of nectar. In some areas where there has been a history of removal of large trees, regent honeyeaters often select the largest available trees of the 'key' species".* John Gould (cited by Crates 2018) stated *"Although it is very generally distributed, it's presence appears to be dependent upon the state of the*

Eucalypti, upon whose blossoms the bird mainly depends for subsistence; and it is, consequently, only to be found in any particular locality during the season when those trees are in full bloom. It generally resorts to the loftiest and most fully-flowered trees".

The Recovery Plan identifies key feed tree species for the Regent Honeyeater as including Swamp Mahogany *Eucalyptus robusta,* and Spotted Gum *Corymbia macula,* noting "*Mature, large individual trees tend to be more important as they are more productive, particularly on highly fertile sites and in riparian areas (Webster & Menkhorst 1992; Oliver 2000). Trees in such areas tend to grow larger (Soderquist & MacNally 2000) and produce more flowers (Wilson & Bennett 1999)*".

The Swift Parrot *Lathamus discolor* is listed as 'Endangered' under the EPBC Act. The 2011 National Recovery Plan for the Swift Parrot identifies the loss of mature trees and the abundance of nectar they provide as a major threat, noting:

> *Based on current knowledge of the ecology and distribution of the Swift Parrot the persistence of this species is mainly threatened by loss and alteration of habitat from forestry activities including firewood harvesting, clearing for residential, agricultural and industrial developments, attrition of old growth trees in the agricultural landscape, suppression of forest regeneration, and frequent fire. The species is also threatened by the effects of climate change, food and nest source competition, flight collision hazards, psittacine beak and feather disease, and illegal capture and trade.*
>
> *Forestry activities, including firewood harvesting result in the loss and alteration of nesting and foraging habitat throughout the Swift Parrot's range ... The harvesting of mature box-ironbark woodlands of central Victoria and coastal forests of New South Wales for forestry reduces the suitability of these habitats for this species by removing mature trees which are preferred by Swift Parrots for foraging and that provide more reliable, as well as greater quantity and quality of food resources than younger trees (Wilson and Bennett 1999; Kennedy and Overs 2001; Kennedy and Tzaros 2005)*

The Recovery Plan identifies "*Swift Parrots have been found to preferentially forage in large, mature trees (Kennedy 2000; Kennedy and Overs 2001; Kennedy and Tzaros 2005) that provide more reliable foraging resources than younger trees".* Brereton *et. al*. (2004) found:

> *Swift Parrots showed a clear preference for larger Blue-gum trees: Blue-gum trees in which Swift Parrots foraged were ~40% larger than surrounding (non-forage) trees, while the size-class distribution of forage trees was significantly skewed towards larger tree-size compared with surrounding non-forage trees. The mean flowering intensity of forage trees was also significantly greater than the mean flowering intensity of non-forage trees. Both flowering frequency and flowering intensity increased with tree size, although there was a trend for both flowering frequency and intensity to decline in the largest tree size-classes.*

Yellow-bellied Glider and Squirrel Glider are two marsupials that have a high reliance upon older trees for the abundance of nectar and other resources they provide, particularly tree sap.

Eyre and Smith (1997) found that Yellow-bellied Gliders preferred forests containing gum-barked and winter flowering species, and that within these forests they were "*more abundant in the more productive forests with relatively high densities of ironbark and gum-barked species > 50 cm diameter*". Wormington *et. al.* (2002) found that "*the density of hollow-bearing trees >50 cm dbh, tree height and increased length of time since the last logging contributed to the presence of yellow-bellied gliders*".

Kavanagh (1987) found that Yellow-bellied Gliders primarily selected trees of certain species and secondarily trees of larger size for foraging, with 92% of trees used for foraging over 60 cm dbh and 58% over 80 cm dbh. Kavanagh (1987) found that larger trees provide a variety of resources:

> *Tree size. The size of trees used by foraging animals was influenced by the type of substrate being exploited (Fig. 5). Gliders were observed licking flowers mainly in medium to large trees, and licking honeydew from the branches of some very large trees. Large trees (> 80 cm DBH) were important as a source of sap: the diameters of important sap-site trees in the study area ranged from 56 to 164 cm in E. viminalis (mean ~SD1,10 t 31.3 cm, n = lo), and from 74 to 143 cm in E. fastigata (105 k21.2 cm, n = 14). Decorticating bark provided a foraging substrate which gliders utilised from trees of a wide range of size, and was the only substrate to be exploited from small (<40 cm DBH) trees.*

Kavanagh (1987) concluded:

> *The gliders in my study area selected the trees with the greatest number of flowers in which to forage for nectar; these would have been the older trees, because mature trees (c.200 years old) produce 2.2-15.5 times as many flowers as pole stage trees (c.25 years old).*
> *The importance of manna, lerp and honeydew as food for forest vertebrates has only recently been appreciated ... The gliders obtained them from large trees.*
> *...*
> *These results suggest that mature forests which provide sufficient diversity of the favoured eucalypt species will be the habitats with the highest concentration of yellow-bellied gliders.*

There is abundant evidence that larger trees provide more nectar in more years than smaller trees and that consequently larger trees provide essential resources for nectarivores such as Regent Honeyeater, Swift Parrot, Yellow-bellied Glider and Squirrel Glider. Retention of mature trees of key nectar species is essential to minimise impacts of logging on nectarivores.

Mackowski (1988) found that the trees tapped for sap by Yellow-bellied Gliders in northern NSW had a mean diameter (dbh) of 65.6 cm and *"a minimum dbhob of about 30 cm"*. Similarly in south-east Queensland Eyre and Goldingay (2005) found "*Of the tree species used for sap feeding by gliders, trees >40 cm in diameter at breast height (DBH) were used more than would be expected on the basis of their abundance in the forest*". They also found *" An increase in the basal area of cut stumps and dead trees in the forest stand was related to an increase in the number of sap trees observed that more trees were tapped for sap"*, considering:

> *This is thought to be due to reduced availability of other foraging resources. ...In southern Queensland, this basal area threshold is equivalent to 9 trees ha^{-1} in the 61–80-cm DBH class, or 17 trees ha^{-1} in the 41–60-cm DBH class, which in general (based on regional-scale data) approximates 25–35% removal of the original tree basal area, or 20–30% removal of the overstorey canopy. This could lead to a decrease in potential foraging substrates, such as decorticating bark (for arthropod searching) and flower cover (for nectar and pollen feeding), necessitating a heavier reliance upon sap trees in glider diet to maintain energy requirements".*

As exemplified by Koala, many species prefer larger trees for reasons not associated with hollows or nectar. Many studies have identified Koalas preference for larger trees (Hindell and Lee 1987, Lunney *et. al.* 1991, Sullivan *et. al.* 2002, Moore *et. al.* 2004b, Smith 2004, Moore and Foley 2005, EPA 2016). Tree size has been found to be the most significant variable after tree species in a number of studies, though this seems to be often ignored or downplayed for resource and political reasons.

The relationship between tree trunk diameter and foliage weight is logarithmic (Hindell and Lee 1987). From their 10 year study on Phillip Island, Moore and Foley (2005) found that koalas used trees that were on average significantly larger than expected, which they considered "*represent larger food patches and account for a greater proportion of the foliar biomass available to koalas*".

From their study near Melbourne, aside from tree species Hindell and Lee (1987*)* only found a significant correlation with the relative proportion of large trees in each species, stating *"Our data also showed that*

koalas favoured large trees and forest in which large trees were most abundant, and also showed that large trees occurred where the tree density was lowest. This preference for large trees did not change with season and appeared to be independent of species", and consider:

> *There was a significant correlation between density of koalas and three of the structural components, the most significant of which was the negative relationship with tree density and small trees (7-19 m high). Thus the blocks with the highest densities of Koalas were those characterised by low tree densities and large trees.*

Size class	*Males*	*Females*	*Non-breeding females*	*Breeding females*	*TOTALS*
0-50	*8.0*	*0.5*	*0.6*	*0.0*	*0.6*
51-100	*2.2*	*0.9*	*1.0*	*0.5*	*1.5*
101-150	*5.2*	*5.5*	*5.8*	*3.8*	*5.5*
151-200	*10.8*	*11.5*	*10.7*	*16.0*	*11.1*
201-250	*17.7*	*17.0*	*17.7*	*13.4*	*16.7*
251-300	*21.2*	*26.3*	*25.2*	*32.1*	*24.1*
301-1100	*41.9*	*38.0*	*34.2*	*39.0*	*40.4*

Table 8(b) from Hindell and Lee (1987): Preference indices of Koalas for each size class of tree (expressed in estimated dry weight of foliage, in kilograms) - by sex and female breeding state.

Hindell and Lee (1987) consider:

> *While the leaves of large trees may have different nutritional properties to the leaves of small trees, it seems more likely that large trees are chosen for some other reason. Large trees have more foliage and consequently may reduce the frequency with which koalas need to move between trees. However, koalas generally move two or three times a night, regardless of the size of the trees they are using (M.Hindell, personal observation). Alternatively, large trees may provide more shelter and greater security from predators. Koalas have few means of escaping adverse weather but sometimes seek out dense foliage such as clumps of mistletoe, and these are most frequent in large trees.*

Handasyde and Martin (1991) comment:

> *There is no scientific evidence that Koalas favour disturbed habitat or prefer to feed in eucalypt regrowth forest. The contrary is true. In all of the wild populations we have studied in the past 15 years, the animals have preferred to feed in large mature trees. In our experience koalas rarely feed in saplings or regrowth. When they do, it is usually when mature trees are scarce and the animals are nutritionally stressed.*

Sullivan *et. al.* (2002) note "*Our data suggest that about 100 m^2 (Table 4) is a threshold above which tree use by koalas changes in comparison to trees with smaller canopy areas. On average, the length of tree visitation increases with an increase in tree girth, and this might be an attempt to reduce the energetic cost of moving between trees*"

From their study of Tallowwood in north-east NSW, Moore *et. al.* (2004b) found that tree diameter at breast height (dbh) was one of the best explanatory variables for the presence of koala pellets at a site, finding "*koala pellets were more common under larger, less chemically defended trees*" and noting "*It is well known that free-ranging koalas prefer larger trees*".

In his investigations of Koalas in Pine Creek State Forest near Coffs Harbour, Smith (2004) "*identified forest structure to be a key predictor of koala scat density after food tree species and diversity*", noting:

> *... The number of trees with scats was significantly correlated with the number of stems in the medium to large size classes (50-60 cm, 60-70 cm and 70-80 cm, Table 2).*

> *Scats occurred more than expected at the base of trees over 30 cm dbh. Significant discrepancies (Chi-square test P< 0.05) were apparent in the 40-50 cm and 10-20 cm dbh classes with the larger stems favoured and the smaller stems avoided. Stems of 60-70, 70-80 and 80-100 were also associated with scats more than expected but these differences could not be statistically validated because of small samples sizes.*

In her study of Koalas on St. Bees Island (near Mackay) Ellis (2009) found:

> *E. tereticornis tree girth was significantly correlated with the number of times that koalas were observed in a tree (r=0.121, n=1,754, p<0.001). ... Eucalyptus used only one time have a significantly smaller girth than those used on more than one occasion (133.5±3.0 vs. 114.6±1.6 cm; t=5.577, p<0.001).*
>
> *...*
>
> *Our findings provide some indication that frequency of feeding tree use by koalas is related to tree girth, but a threshold tree size might be responsible for guiding koala foraging patterns.*

The NSW Recovery Plan for the Koala (DECCW 2008) identifies that Koalas have been found to have a preference for larger mature trees of specific species, stating:

> *Smith and Andrews (1997) found that koala activity was greater in structurally diverse forest with the majority of trees 50–80 cm diameter at breast height (dbh). White (1999) found that koalas preferentially utilise trees between 25.5–80 cm dbh, with under-utilisation of trees less than 25.5 cm dbh. Lunney et al. (2000a) found that the koalas in the Coffs Harbour area favoured trees of 50–60 cm dbh and greater than 120 cm dbh".*

As part of a project to map Koala habitat, the EPA (2016) assessed the relationship between Koalas and key variables in 4 State Forests in north-east NSW known to have significant Koala populations. The found usage of preferred species increasing linearly with tree size, noting "*the data demonstrates a strong positive relationship between size class and activity, with highest activity in the largest size class*", concluding that for Koalas:

> *Limited areas of higher koala activity corresponded with; a higher abundance and diversity of local koala feed trees, trees and forest structure of a more mature size class (>30 centimetres and mature forest structure), and areas of least disturbance.*

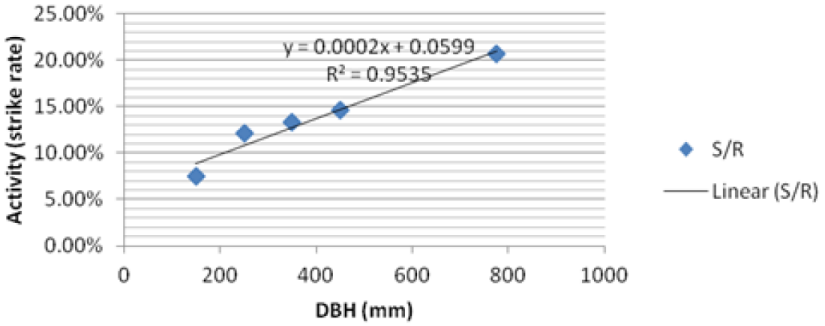


Figure 5 from EPA 2016: Size class of grey box versus scat strike rate

It is evident that a variety of animals rely upon larger trees for other food resources, such as Yellow-bellied Glider and Squirrel Glider for sap and Koalas for forage. We still don't know enough about most species' habitat needs to fully appreciate this reliance, though a precautionary approach necessitates increased protection of mature trees.

The previous 1999 Threatened Species Licence under the IFOA had a variety of requirements for retention of a minimum of 5-8 hollow-bearing trees per hectare, or however many were left. For each hollow-bearing

tree they also required retention of the largest healthy mature tree in its vicinity as a potential recruitment tree (R trees) capable of developing hollows in the future to replace the hollow-bearing tree when it died.

The revised 2018 IFOA requires the retention of 8 hollow-bearing trees per hectare where they remain, along with all "giant trees". The requirement to protect Recruitment Trees has been removed.

The Remake of the Coastal Integrated Forestry Operations Approvals Final Report Threatened Species Expert Panel Review reports the EPA representative Brian Tolhurst as stating:

> *All trees greater than or equal to 100 cm dbh should be retained and protected as a matter of urgency. Not only do these provide the best opportunity to develop the large hollows required by many species they also provide more flowers, fruit, nectar and seed along with nesting opportunities for large birds such as raptors. At this stage of the harvesting cycles across coastal NSW all remaining large trees are part of a limited resource and are critical for many threatened species and populations to survive. There is known clear deficit of hollow bearing trees in the forested coastal landscapes of NSW.*

Towards the end of their negotiations over the CIFOA the EPA were holding out for "giant trees" to be defined as a "*Minimum 135 centimetres blackbutt, Minimum 120 centimetres all other species*". The NRC (2016) again sided with the Forestry Corporation and over-rode the EPA. The outcome is that 'Giant Trees' "means a live tree with a diameter at stump height over bark (DSHOB) of 160 centimetres or greater if Blackbutt or Alpine Ash, or 140 centimetres or greater for other species.

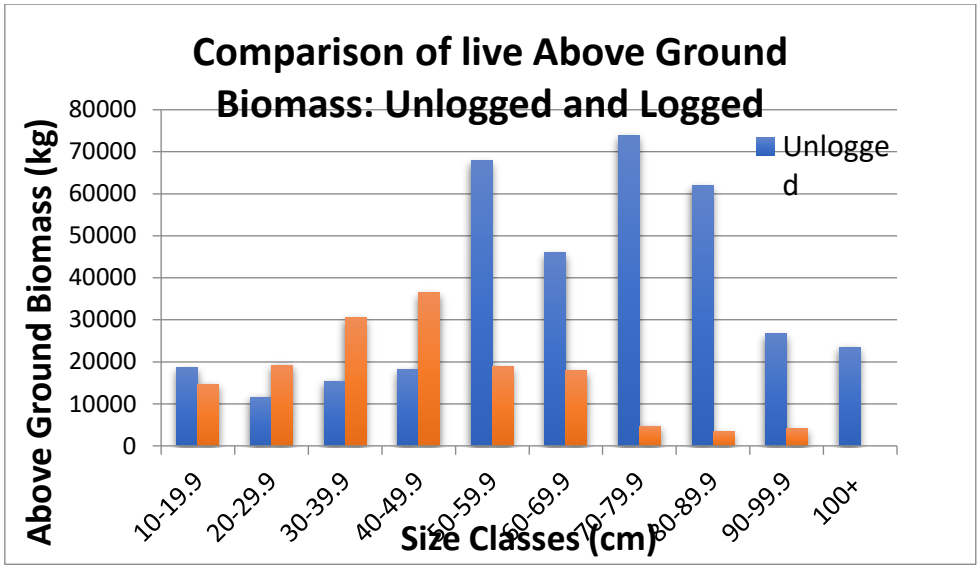
The effective outcome is that giant eucalypts will only require extra protection in high productivity forests that have not already been heavily logged or subject to Timber Stand Improvement. In most forests trees surplus to H tree retention requirements will be below Forestry Corporation's unrealistically high threshold. Smith (1999) identified the averaged structure of natural native forests according to tree size class and site productivity in eastern NSW (Table 1).

Table 1. Smith (1999) Number of stems (all species) per hectare and stand basal area (square metres per hectare) in increasing diameter classes in unlogged or "old-logged" forests.

Productivity Class	20-39 cm dbh	40-59 cm dbh	60-79cm dbh	80-99 cm dbh	>100 cm dbh	Stand Basal Area
1 low	69	24	10.8	2.5	-	18
2 low-mod	80	50	16.7	6	1.3	26
3 mod-high	87	57.4	31.6	11.5	5	43
4 high	64	44.7	14.3	7.6	11.9	47

1. Shading depicts where significant numbers of hollows with an entrance >10 cm diameter and estimated depth >25 cm were recorded.
2. Size classes are based upon diameter at breast height (dbh).

Most forests subject to repeated logging have already had the numbers of hollow bearing trees and giant trees reduced below 8 per hectare. For example in a comparison of medium site quality logged and unlogged Spotted Gum forests south of Casino, Pugh (2020) found that there was only an average of 1.7 trees/ha larger than a metre diameter (and none larger than 1.4 m) in unlogged forest, with none larger than a metre in logged forest. Trees with large hollows had been reduced from 18.3 trees/ha down to 0.3 trees/ha, a 98.4% reduction in these vital resources. Higher site quality forests can have more large trees, though the magnitude of their depletion is similar. Any giant trees remaining are vital resources that should be protected.



Comparison of Above Ground Biomass of logged and unlogged plots showing the dramatic reduction in the biomass of larger trees.

The new CIFOA has ignored the recommendations by one of the Threatened Species Expert Panel to retain all trees greater than or equal to 100 cm dbh, and the EPA's compromise of all trees over 120-135 cm dbh was over-ridden, instead the Government opted for the Forestry Corporation's limit of 140-160 cm dbh. It is those trees over 80-100 cm diameter that are of the utmost importance to the survival of a plethora of native species, and are thus essential to reduce logging impacts upon them. Allowing more of these giant trees to be logged significantly increases logging impacts.

A key requirement is to retain enough of the next largest trees capable of developing hollows to replace the retained hollow-bearing trees as they die. These are termed recruitment trees. The requirement to retain recruitment (R) trees has been removed in the 2018 CIFOA. As the EPA well knew, the removal of protection for Recruitment trees means that there will be no trees left to develop hollows in the future as those retained in logging areas succumb to old age, or more likely damage in the logging operations, and die.

Tree marked as "R" (Recruitment) tree in Braemar SF before the adoption of the new CIFOA, then cancelled so it can be logged. In this case 26 Koala scats were found under this Grey Gum, showing it is a significant feed tree.

To maintain habitat trees in perpetuity there is a necessity to account for natural and logging/burning induced tree-deaths when prescribing retention rates for both hollow-bearing trees and recruitments sufficient to maintain the prescribed number of hollow-bearing trees over long time frames (Recher, Rohan-Jones and Smith 1980, Mackowski 1984, 1987, Recher 1991, Scotts 1991, Traill 1991, Gibbons *et. al.* 2010, McLean *et. al.* 2015). In natural forest there is a self thinning process that results in significant mortality as trees mature (Mackowski 1987, Smith 1999). Though there is also a high likelihood of mortality due to other factors. As noted by Mackowski (1987 p124) *"the frequent occurrence of fire in this site height blackbutt forest precludes a 100% chance of survival - a proportion will be damaged, or weakened, or burnt down by each fire. These trees are also subject to the risk of lightning and windstorm damage."*

To account for mortality over time there is a necessity to retain progressively increasing numbers of trees in smaller age classes.

COASTAL BLACKBUTT RETENTION RATES REQUIRED TO MAINTAIN 10 HABITAT TREES PER TWO HECTARES IN PERPETUITY. The assumption is made that there will be 50% mortality of recruitment trees every 80 years. Adapted from Mackowski 1987.

Diameter (dbhob) cm.	Age yrs	Time-span in size class yrs	Mackowski's requirements for 3 Habitat Trees per Hectare over 100cm	Requirements to retain 10 Hollow-bearing Trees per Two Hectares
20-60	16-68	52	11.5	38.3
60-100	68-144	76	4	13.3
100-140[A]	144-224	80	2	6.6
140-180[B]	224-304	80	1	3.3

A - stage at which hollows suitable for small wildlife form.
B - stage at which hollows suitable for large wildlife form.

Lindenmayer *et. al.* (2014) recognise that:

> *... drivers of large old tree loss can create a "temporary extinction," that is, a prolonged period between the loss of existing large old trees and the recruitment of new ones (Gibbons et al. 2010b). The length of a temporary extinction may vary (e.g., 50 to 300+ years) ... Temporary extinction has the potential to drive species strongly dependent on large old trees to permanent local or even global extinction. In other cases, existing large old trees may be doomed to eventual extinction because the animals that dispersed their seeds have disappeared".*

Lindenmayer *et. al.* (2014) warn "*Existing policies are failing. New polices and management actions are required to conserve existing large old trees, provide for their recruitment, and maintain an age structure for tree populations that ensures a perpetual supply of large old trees thereby sustaining the critical functional properties that such trees provide. Without urgent action this iconic growth stage and the biota and ecological functions associated with it are in danger of being seriously depleted or even lost in many ecosystems*".

Lindenmayer *et. al.* (2014) consider "*A critical step in large old tree management is to stop felling them where they persist and begin restoring populations where they have been depleted*".

Hollow-bearing trees, and with them hollow-dependent species, have already been decimated within these forests. The problems such fauna are facing is expected to exponentially worsen as the few remaining large old hollow-bearing trees die-out without replacement trees being available. The full ramifications of irreversible changes already set in place will take a century or more to become fully manifest as the few retained hollow-bearing trees die with even fewer replacements available. A "temporary extinction," due to

a prolonged period between the loss of existing large old trees and the recruitment of new ones is inevitable under current management. The few patches from which logging is excluded will do little to ameliorate this.

The ongoing decline in Hollow-bearing Trees is a common problem across south east Australia's public forests, in part because of the failure to retain adequate numbers of recruitment trees. As well as the obvious necessity of retaining recruitment (R) trees as the replacement hollow-bearing trees of the future, it was also evident that more than one recruit needs to be retained for each hollow-bearing tree to account for natural and logging induced mortality over time. For example Gibbons *et. al.* (2010, What strategies are effective for perpetuating structures provided by old trees in harvested forests? A case study on trees with hollows in south-eastern Australia) found:

> *We predicted that, under existing practice, only 35–79% of the intended numbers of hollow-bearing trees will be perpetuated. In a sensitivity analysis we found that 75% of the variation in predicted numbers of trees with hollows over multiple harvesting rotations could be explained by the number of recruitment trees retained for each hollow-bearing tree, the rate of mortality among retained trees, the length of the harvesting rotation and the rate at which trees developed hollows. Our results indicated that trees with hollows can only be perpetuated in harvested stands over multiple harvesting rotations if ≥2 recruitment trees are retained for each hollow-bearing tree and measures are employed to minimise mortality among all retained trees.*

This is reflected in McLean *et. al.* (Forest Ecology and Management 341 (2015) 37-44) conclusions for the Dorrigo area that:

> *Logging intensity was negatively correlated with tree diameter at breast height (DBH), and the density of both hollow-bearing trees and hollows. Losses of hollow-bearing trees and hollows occurred through an interaction between logging intensity and fire frequency, resulting in an absence of recruitment of hollow trees. ... We recommend additional hollow recruitment trees be retained on logged sites in the future if no net losses of hollows are to occur in the future, or for wider unlogged buffers to be established adjacent to the cutting area.*

Mature trees are vital to retain as recruitment trees, as well as for their abundant nectar, seed and invertebrates, and for a variety of other resources not provided by young trees. As well as the requirement to retain only one mature recruitment (R) tree for every hollow-bearing (H) tree (up to a maximum of 5), until late 2018 the logging rules for public forestry (Threatened Species Licence) included a variety of overlapping requirements for the retention of mature trees, that were required to be marked in the field:

- 3 eucalypt feed trees (mature or late mature high nectar producing eucalypt species) per hectare.
- 5 eucalypt feed trees per hectare in compartments with nectivorous Swift Parrot, Regent Honeyeater or Black-chinned Honeyeater records (in lieu of surveys, FCNSW often applied the prescription to modelled habitat).
- 15 mature to late mature feed trees (smooth barked eucalypts shedding bark in long strips) for foraging within a 100 metres radius of each retained Yellow-bellied Glider sap feed tree, observation or den site record, and 200 metres radius of a Yellow-bellied Glider call detection record.
- 4 rough-barked trees (mature to senescent) per ha for foraging by Brush-tailed Phascogales in compartments with records or modelled habitat - in lieu of 20ha exclusion areas around records.
- 75% of mature individuals of each species of *Banksia integrifolia*, *Melaleuca quinquenervia*, *Grevillea robusta* and *Callistemon viminalis* within modelled habitat of Common Blossom Bat.

There was also a requirement to retain 5 Koala feed trees per hectare in “intermediate” Koala habitat, though despite it being recognised that these should be mature trees over 30cm diameter the licence set no

size limit, as there is usually an abundance of very small trees these were usually taken to satisfy this requirement. NEFA also found that in practice these additional requirements for retention of mature trees were often ignored.

The Forestry Corporation have repeatedly refused to retain the large healthy mature trees required to satisfy their legal obligations (see 3.2.4). After the EPA made the retention of habitat trees a compliance priority in 2013, the EPA and NEFA found that the Forestry Corporation still regularly failed to retain the large healthy mature trees required as recruitment trees, instead choosing small defective trees that were often damaged during logging. Despite this being one of the most frequent breaches found, the EPA refused to do more than issue one Warning Letter after another, refusing to take stronger action.. This made no difference as the breaches continued. The Forestry Corporation apparently had no intention of complying, presumably because trees capable of qualifying as large high quality sawlogs (with a centre diameter >40cm) needed to satisfy Wood Supply Agreements were becoming increasing scarce, and therefore the retention of sound healthy mature trees for wildlife was in direct conflict with their resource imperatives.

The EPA sought to resolve this in the new CIFOA by removing all requirements to retain mature trees. After exhibition they reinstated a requirement to protect 5 nectar feed trees/ha in compartments within 2km of existing records of Swift Parrot and Regent Honeyeater, which encompasses 16,856 ha (3.2%) of the general purpose logging area (FMZ4) in north-east NSW. By NEFA's estimation the CIFOA removed required protections from some 2-2.5 million mature habitat trees.

In his report for the EPA, Smith (2020) notes:

> *Current limits to selective logging allow forests to be intensively logged and effectively clear felled with retention of scattered habitat trees because basal area retention limits are too low (10-12 m2/ha.) and there is no requirement to focus retention on large and medium sized trees to maintain forest structure.*
> …
> *This report also recommends that the intensity of so called selective harvesting in all Dry Sclerophyll Forest types be reduced significantly by increasing minimum tree basal area limits and minimum medium and large tree stocking limits, to ensure that populations of threatened and sensitive fauna such as Koalas and Greater Gliders are maintained at close to normal densities within the net harvest area consistent with principles and requirements for ecologically sustainable harvesting required under Regional Forest Agreements and the Forestry Act 2012*

The 2018 CIFOA removes protection for most mature trees, most significantly those previously required to be retained as recruitment hollow-bearing trees and nectar feed trees. There is no longer an intent to maintain hollow-bearing trees in perpetuity in logging areas, which also means the hollow-dependent animals that rely upon them. The removal of protection for most mature trees is a significant blow to the numerous animals that rely upon them for critical resources, whether it is a Koala relying on them for browse, birds searching decorticating bark for invertebrates, gliders tapping them for sap, or one of the many who depend on their abundant nectar. This has greatly amplified logging impacts on a broad range of forest species. The creation of a market for defective mature and old trees, or parts of them, will facilitate their removal.

3.2.2. Koalas

The 1999 Threatened Species Licence required that in compartments which contain preferred forest types, marking-up must be conducted as part of mark-up surveys at least 300 metres in advance of harvesting

operations, with primary browse trees inspected at ten metre intervals with **thorough** searches around the base of trees for Koala scats (faecal pellets).

W*here Koala scats were detected under two of any ten consecutive trees the compartment was identified as* an "intermediate use area" and 10 Koala feed trees/2ha were required to be retained. Where a high use tree (with >20 scats) was found AND scats found under 3 trees on a transect, a 20m buffer was applied and it was called a "Koala high use area", within which logging was prohibited.

Since the first Threatened Species Licence was introduced in 1997 there has been a ongoing refusal on behalf of the Forestry Corporation to thoroughly search for Koala scats. This went on for 15 years while the EPA (and their predecessors) turned a blind eye, until NEFA exposed the failure to search for Koala scats and the logging of Koala High Use areas at Royal Camp State Forest in 2012.

In 2012 when the Forestry Corporation were two-thirds through logging 3 compartments in Royal Camp State Forest, a limited survey by NEFA identified a Koala High Use Area (HUA) actively being logged, with four others proposed for logging. We went public and forced the logging to stop with both the EPA and Forestry Corporation confirming the Koala HUAs we had identified and the EPA identifying that 61 trees had been logged and 405m of snig tracks constructed within the Koala HUA. Logging resumed nearby a few days later and NEFA again identified that a Koala HUA had been logged, the EPA confirmed that 7 trees were logged and 230m of snig tracks constructed within this Koala HUA. Logging continued and NEFA again identified a Koala HUA was logged - the EPA failed to investigate. Numerous other breaches were reported to the EPA, most of which they refused to investigate. The EPA issued the Forestry Corporation with 3 fines, totalling $900 for just the first Koala HUA.

When the Forestry Corporation proposed to start logging another part of the forest in 2013 where they said there were "nil" Koalas, a brief survey by NEFA identified 2 Koala HUAs in the proposed logging area, finding more on later occasions.

For a brief period after Royal Camp the EPA attempted to make the Forestry Corporation undertake thorough scat searches, though quickly succumbed to Forestry Corporation pressure and abandoned any meaningful attempts to enforce compliance. Koalas were identified as one of the EPA's Cross-tenure environmental compliance priorities for 2014–15 and 2015-16. For "*Protecting koalas and their habitat*" the action proposed was "*Assess compliance with Integrated Forestry Operations Approval (IFOA) and PNF Code requirements relating to protecting koalas and their habitat*".

As a consequence of Royal Camp the EPA began to audit Koala scat searches in the Lower North East, identifying that the Forestry Corporation had not undertaken thorough searches for Koala scats ahead of logging in Wang Waulk State Forest (from an assessment of just 12 trees) and Bulahdelah State Forest (from an assessment of just 9 trees). The response to the EPA's draft findings the Forestry Corporation (2013) admitted inadequate mark-up but refused to accept the need to thoroughly search for Koala scats, responding:

> *FCNSW cannot accept the detail and method associated with the specific allegations relating to ... retained koala feed trees. The link the EPA has made between tree marking and searching is not contained in the licence. The EPA's approach to searching for koala scats is not specified in the licence. The very nature of both the koala mark-up technique and star-search technique is subjective and inevitably different results may be expected on a particular day of searching, let alone results from surveys on different days, weeks or months.*

After their initial flurry with Wang Wauk and Bulahdelah State Forests the EPA don't appear to have attempted any further compliance action. We have consistently found in our audits that since then the Forestry Corporation are routinely failing to thoroughly search for Koalas elsewhere (i.e. Whian Whian,

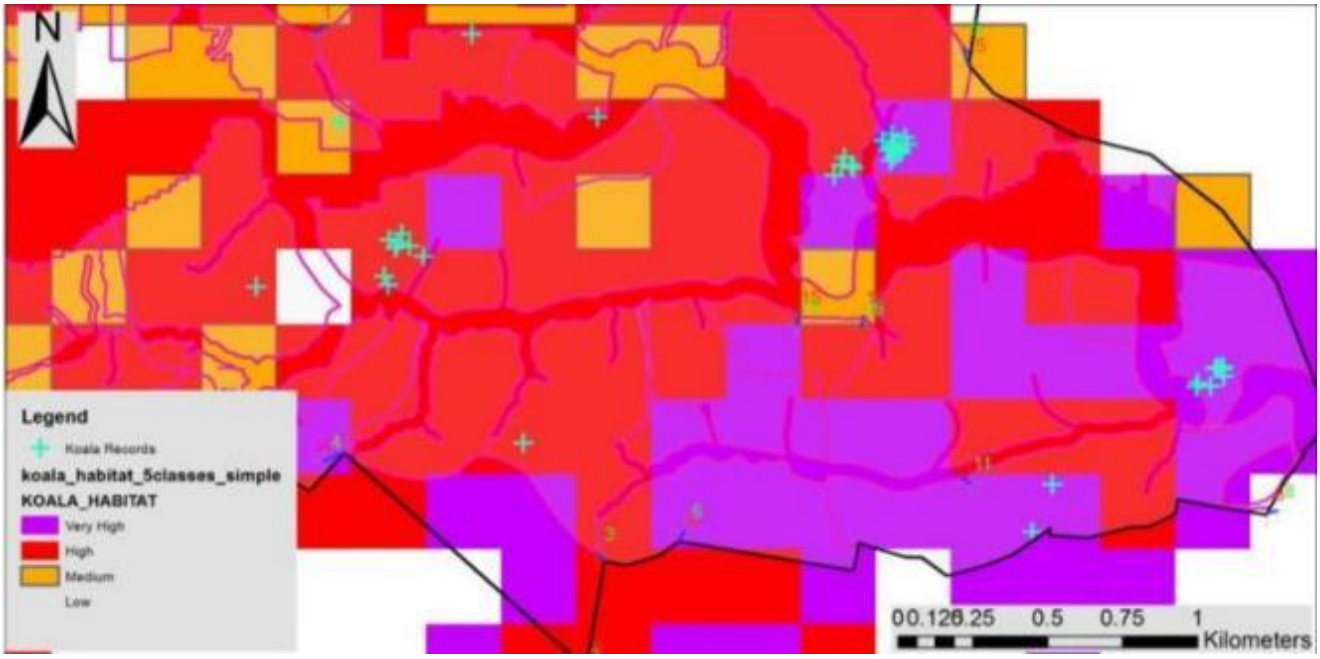
Richmond Range SF, Cherry Tree SF, Sugarloaf SF - see NEFA audits). The EPA dismiss all our complaints, often without even investigating them.

The EPA seem to have totally given up in 2015, For example a review of the 8 proactive audits undertaken by the EPA in the UNE in 2015 found the EPA didn't identify any breaches for not undertaking Koala scat searches, though they started the year documenting that across 3 operations they inspected 3.32 ha and saw no evidence of Koala scat searches, with the 21 Tallowwood assessed showing no signs of being searched. Despite still theoretically still being a compliance priority, after May 2015 the EPA stopped identifying the area assessed for Koala searches and stopped identifying whether individual feed trees had evidence of searching, simply saying that they were not able to determine whether searches had been undertaken or not.

In NEFA's review Clearing Koalas Away (Pugh 2017) of DPI's Koala Habitat model an analysis of State Forests Biodata (from Wildlife Atlas) over the years 1997-2016, limited to high quality and very high quality habitat as mapped by DPI, revealed an annual average of 9.6 Koala observations, the hearing of an annual average of 3.6 calls and the finding of 74.6 trees with Koala scats under them each year, despite requirements for extensive surveys. This is an extremely low strike rate for what is meant to be some of the best habitat left for Koalas in New South Wales.

From a review of harvesting plans current at that time, NEFA found:

> *In current logging operations there are 2 Koala High Use Areas: one 0.5ha in size in very high quality habitat in Bagawa SF (cmpt. 780), and one 0.7ha in size in moderate quality habitat in Wang Waulk SF (cmpt. 118). So of the 4,669ha of high quality habitat in compartments currently being logged only 0.5ha is identified in harvesting plans to be protected.*
>
> *The reason that so little is protected is twofold, firstly because the EPA have set unrealistically high scat detection thresholds and miniscule buffers in the licence, and secondarily because the Forestry Corporation refuse to undertake the legally required "thorough" searches necessary to find sufficient scats to trigger protection. The EPA know that the Forestry Corporation are not undertaking thorough, if any, searches though refuse to take action.*



Example of "regeneration" STS of high quality Koala Habitat in Cairncross SF, undertaken in 2012-13 (from Pugh 2017). There are 40 Koala records in this limited area dating back to 1980, with numerous records in 2011, 2012 and 2013 as it was being cleared. It is astounding that such obviously important Koala habitat was allowed to be virtually clearfelled. Even if no Koala High Use Areas were identified, the area qualified as an Intermediate Use area, with the intensive logging clearly illustrating the ineffectiveness of the current prescription.

It is apparent that very few Koala High Use Areas have been identified. The Natural Resources Commission (2016) identify that "*Around 200 hectares of koala high use area has been protected over the past 15 years and tree retention requirements have been triggered on around 33 percent of compartments (130,000 hectares)*". NEFA accepts that the relatively low identification of Koala High Use Areas partially reflects the collapse of Koala populations on the north coast, though considers it also reflects the ongoing refusal by the Forestry Corporation to thoroughly search for Koala scats ahead of logging.

In 2017 the Office of Environment and Heritage (OEH) analysed Koala records *"to delineate highly significant local scale areas of koala occupancy currently known for protection",* which they term Koala Hubs. A review of gross logging disturbances from satellite images (Pugh 2019) identified that the Forestry Corporation logged 2,546 ha of Koala Hubs from 2015-2018, with some 430 ha of Koala hubs logged since they were identified. This means that over those 4 years 21% of the loggable area of Koala Hubs within native forests on State Forests had been logged.

After 1997 the Forestry Corporation were required to undertake thorough searches for Koala scats to identify Koala High Use Areas to exclude from logging and intermediate habitat where 5 feed trees/ha were required to be retained. The Forestry Corporation refused to undertake thorough surveys, only identifying an average of 74.6 trees with Koala scats under them, and some 13ha of Koala High Use Areas, each year – despite logging tens of thousands of hectares of high quality Koala habitat. After NEFA caught the Forestry Corporation illegally logging Koala High Use Areas in 2012, the EPA briefly tried to enforce compliance, though quickly gave up and decided to abandon survey requirements.

Given the Forestry Corporation's refusal to undertake the thorough searches necessary to identify Koala High Use Areas for protection, for the CIFOA the EPA recklessly pursued their intent to get rid of the requirements to search for, identify and protect Koala High Use Areas, contrary to the advice of their own

Koala expert panel (EPA 2016) that "*the primary intent and focus should be to identify the location, distribution and extent of areas that are supporting extant/resident koala populations*". The EPA ignored our requests for Koala surveys to be undertaken by independent experts.

The EPA's (2014) aim was to get rid of most species specific prescriptions for threatened species and focus on a landscape based approach to reduce *"the need to locate threatened species through costly surveys".* They go so far as to assert that *"The government considers that relying on record-based triggers for species protection is an unnecessary risk to most threatened species"*. The absurdity of this claim is astounding.

The EPA (2014b) told the General Purpose Standing Committee No. 5 'Inquiry into the performance of the NSW Environment Protection Authority':

> ***Core koala habitat mapping***
> *The EPA is mapping core koala habitat so that it can be protected at the landscape level. This is intended to replace the existing presence/absence triggers and is a far more effective way of ensuring koalas and their habitat are protected.*
> ***Regulatory improvements to ensure koala protection***
> *As part of the proposed consolidated Coastal IFOA, the EPA and Forestry Corporation have committed to moving to regional koala habitat mapping. As noted above, the EPA has commenced broad-scale mapping of koala habitat. The outcome of this mapping project will be used to inform appropriate conditions, including exclusion zones, the protection of feed trees and other alternative provisions in the consolidated Coastal IFOA.*

In 2016 the EPA undertook a project overseen by an expert panel (including Andrew Smith, Rod Kavanagh and Steve Phillips) to review various approaches to map potential Koala habitat, with extensive groundwork to test the mapping. The project found that neither modelling nor ecosystem mapping were accurate enough to identify the "*occurrence of feed trees and therefore habitat class at the level of detail required for management in state forests*", with the panel unanimously agreeing that "*the primary intent and focus should be to identify the location, distribution and extent of areas that are supporting extant/resident koala populations*".

In his review of the EPA's (2016) Pilot Mapping Project, Smith (2015) stated:

> *It is currently uncertain whether current koala conservation protocols are sufficiently precautionary to protect koalas under modern harvesting methods. There have been no conclusive scientific studies of the impacts of modern harvesting methods on koalas. The simplest and most cost effective way of addressing this problem would be to re-survey all sites with koalas that have been subject to pre-logging surveys during the past 18 years and use the data to identify any effects of changes in forest structure, food tree abundance and logging disturbance.*
> *...*
> *Based on current knowledge, any precautionary Conservation Protocols applied to potential koala habitat in crown and private forests would need to mimic the effects of past low intensity harvesting practices. This primarily involves limiting the basal areas of stems removed across a range of size classes. Guidelines for achieving basal area limited harvesting been applied for many years to regulate private forestry operations on privately owned Protected Lands (Smith 2001,2010, copy supplied). These guidelines may serve as a useful basis for revision and wider application of existing koala Conservation Protocols*

In his review of the EPA's (2016) Pilot Mapping Project, Phillips (2015) stated:

> *Because of the need to incorporate koala socio-biology and disturbance history as fundamental considerations there is little value in relying on categorisation of koala habitat alone to inform management in areas subject to logging.*
> *...*

> *In my experience it suits Government for timber harvesting approvals and processes to remain obfuscatory, when there is no reason that they should be. How could such matters be addressed / overcome? Transparency of process along with acceptance and application of best practice techniques (as opposed to trying to reinvent the wheel with no axle to place it on).*
> *...*
> *note that the question of what is being protected has also been raised. I would have thought that this was a question that should not have required an answer when surely the most important thing to protect are remaining areas of habitat that are currently supporting resident koala populations. This consideration remains independent of the issue of habitat quality and so should be the primary objective of management.*

Without any attempt to review the status of Koalas on State Forests, and despite evidence that Koala populations are crashing under Forestry Corporation mismanagement (EPA 2016), and despite clear expert advice that their proposed approach will not be effective, the EPA continued to develop their flawed model and remained intent on implementing the Forestry Corporation's position of removing the need for scat searches and the protection for core Koala habitat on public lands.

Despite the conclusion from their study that modelling is too inaccurate for regulation at the scale of individual logging operations, the EPA funded DPI Forestry (Law *et. al.* 2017) to complete their model, despite its being considered inaccurate by the expert panel. This model was intersected with an OEH (2016) likelihood model to identify high/high, moderate/high and moderate/moderate quality Koala habitat.

Because of differences between the EPA and Forestry Corporation the Natural Resources Commission (2016) was directed to resolve a prescription based on a "*modest increase in tree retention rates aim to minimise impacts on wood supply to best possible extent while recognising Government's policy initiatives and targeted investment in Koalas as an iconic species (**no net change to wood supply**)*".

The EPA (NRC 2016) proposed a retention rate of "*25 trees per hectare in High/high quality habitat, 20 trees per hectare in High/moderate quality habitat, and 15 trees per hectare in Moderate/moderate quality habitat*". The NRC over-rode the EPA to support a retention rate proposed by the Forestry Corporation specifying "*10 healthy trees per hectare with cell based application in High/high quality habitat, 5 trees per hectare with compartment wide application in High/moderate or moderate/moderate cells over 25 percent or more of compartmen*t".

Under the new prescriptions Koala browse trees are required to be greater than 20 cm diameter at breast height (DBH) (30cm DBH outside the north coast). The EPA (NRC 2016) proposed that "*retain trees with minimum 25 centimetre diameter DBHOB, prioritising primary browse species, then secondary browse species:*". The NRC over-rode the EPA to support the Forestry Corporation, deciding "*retain trees with minimum 20 centimetre diameter DBHOB, retaining trees where available with 50 percent primary browse species*".

The outcome is a map of very restricted highest quality Koala habitat and a broad map of compartments with more than 25% "moderate" quality Koala habitat. In the high quality habitat the requirement is to retain up to 10 browse trees >20cm DBH per hectare in the vicinity, and in moderate quality habitat the proposed requirement is to retain up to 5 browse trees >20cm DBH per hectare.

Under the new Koala prescription the area of State Forests for which 10 trees/ha >20 cm dbh will need to be retained is just 36,152ha (out of almost a million ha) and the area where 5/ha will need to be retained is 212,073 ha. Requirements under the 1999 IFOA for 5/ha Koala feed trees in intermediate use habitat was already triggered on around 33% of compartments (NRC 2016), so overall tree retention will be lower.

In their submission to the new logging rules, the Office of Environment and Heritage (2018) complained that the new Koala feed tree retention rates are less than half the number and of a smaller size than proposed by the Expert Fauna Panel, concluding that the increased logging intensity proposed under the new rules is expected to impact Koalas through diminished feed and shelter tree resources:

> *Koalas are selective both in their choice of food tree species and in their choice of individual trees. The scientific basis for proposed tree retention rates in the Draft Coastal IFOA is not clear, and the rates are less than half those originally proposed by the Expert Fauna Panel.*
>
> *While Koalas will use small trees, research has shown that they selectively prefer larger trees. In our experience, the proposed minimum tree retention size of 20cm dbh will be inadequate to support koala populations and should be increased to a minimum of 30cm dbh. Many Koala food trees are also desired timber species, so there is a high likelihood that larger trees will be favoured for harvesting, leaving small retained trees subject to the elevated mortality rates experienced in exposed, intensively-logged coupes.*
>
> *Koalas require large areas of connected habitat for long-term viability. The increased logging intensity proposed under the draft Coastal IFOA is expected to impact Koalas through diminished feed and shelter tree resources. Animals will need to spend more time traversing the ground as they move between suitable trees that remain, which is likely to increase koala mortality.*

It is evident that the EPA list of feed species fails to include numerous browse species. This means that where there are less than 5 or 10 browse trees per hectare, alternative unlisted browse trees are allowed to be logged rather than retained. Some 43% of the mapped high quality Koala habitat on State Forests is within the North Coast Intensive zone and thus intended for clearfelling. Illegal logging in these forests over the past decade has focussed on replacing Koala feed trees with Blackbutt, so there will be few listed feed trees left.

For the CIFOA the Government adopted a model to identify two classes of Koala habitat, with requirements to retain 5 feed trees/ha >20cm dbh in one and 10/ha in the other. In adopting this they ignored the advice of their own Koala expert panel that the model was too inaccurate to use for regulation, and that instead the priority should be to survey to identify extant Koala colonies for protection. When setting tree retention rates the EPA supported the advice of an agency Expert Fauna Panel that retention rates should be 15-25 feed trees/ha >25cm dbh, though instead the Forestry Corporation's retention of 5-10 feed trees/ha >25cm dbh was adopted. There can be no doubt that the new rules are grossly inadequate to mitigate impacts on Koalas and that numerous feed trees essential for Koala's survival will be taken for biomass.

3.2.3. Fires a gamechanger?

The 'Black Summer' fires that ravished north-east NSW's forests in 2019/20 were of unprecedented scale and intensity, the burning of half the native vegetation and habitats has had massive impacts on north-east NSW's ecosystems, plants and animal populations. A variety of populations and species are likely to have been so significantly affected that they are at imminent risk of extinction. Others have been shoved further down that path.

There can be no doubt that a multitude of wildlife died in those fires, from the invertebrate world of the leaf litter to up to Koalas in the tree tops. The fires were of unprecedented proportions, in north-east NSW burning out half the forests, including a contiguous 1.9 million hectares from Tenterfield on the tablelands to Iluka on the coast and from near Bonalbo in the upper Clarence River down to near Gloucester on the

Manning River. Within the burnt grounds it was so dry that fires burnt through riparian vegetation and rainforests, the usual refuges for many species.

The fires were superimposed on an existing fire regime, with many areas burnt just a year or two ago burnt again, and occurred during an extreme drought when the forest was exceptionally dry and stressed. The drought continued after the fires, compounding impacts and hindering recovery.

What is most concerning is that droughts, heatwaves and wildfires will all increase in frequency and intensity as the world continues to heat. Meaning that drought and wildfire events like 2019/20 will become more frequent and intense, with each fire compounding the impacts of the previous one. These fires will be superimposed over logging disturbances, amplifying logging impacts while logging amplifies wildfire impacts.

In summary comparison of GEEBAM v2 fire mapping with other data for north-east NSW shows the fires burnt:

- 1,324,772ha of Public Lands (54.2% of burn) and 1,118,659ha of Private Lands
- 868,714 ha (59%) of National Parks, with 517,802 ha suffering significant (full or partial) canopy loss. This includes 180,295 ha (58.3%) of the NSW section of the Gondwana Rainforests of Australia World Heritage area, including some 26,283 ha (24.4%) of World Heritage listed rainforest.
- 456,058 ha (54.4%) of State Forests, with 259,293 ha suffering significant canopy loss. This includes 16,000 hectares (43%) of Pine Plantations, most of which burnt intensively, rendering them useless for future production.
- Some 160,000 ha (34.7%) of rainforest, with 124,494 ha (78% of burnt rf) suffering significant canopy loss
- 851,847 ha (66%) of mapped oldgrowth forest, with 420,257 ha suffering significant canopy loss
- 322,191 (29.4%) of Koala Habitat Suitability Model (north-east NSW) classes 4&5, with 196,663 ha suffering significant canopy loss. (Note this is limited to the north-east NSW bioregion)

The 2019/20 bushfires had an immense impact on the forests of north-east NSW, burning 1.3 million ha of Public Lands and 1.1 million ha of private lands. Some 456,000 ha (54.4%) of State Forests was burnt, with 259,000 ha suffering significant canopy loss. The impacts were immense and will be long lasting, compounding impacts from logging. Millions of animals and millions of trees were killed. As climate heating progresses the risk of similar and more intense events is increasing.

On 11 February and 14 March 2020 the Department of Agriculture, Water and the Environment released reports on the impacts of the Black Summer bushfires impacts on threatened species, based on expert advice with input from representatives from Queensland, NSW, Victorian, SA and WA state governments; and the Office of the Threatened Species Commissioner. These were just 2 of a variety of reports released by Governments that identified significant impacts and the need for specific mitigation measures.

The DAWE March 2020 report "Rapid analysis of impacts of the 2019-20 fires on animal species, and prioritization of species for management response" notes:

> *The 2019-20 bushfires have had severe impacts on many animal species. The fires have covered an unusually large spatial extent, and in many areas they have burnt with unusually high intensity. Some species were considered threatened before the fires, and the fires have now likely brought them even closer to extinction. Many other fire-affected animal species were considered secure and not threatened before the fires, but have now lost much of their habitat and may be imperiled. To*

> *support recovery of these species, conservation action will be needed for many species, at many sites, and such informed management will be carried out by a wide range of government agencies, non-government conservation organisations, university researchers, community groups and the public. However, some species are in need of more urgent help than others.*
>
> *The revised provisional list therefore comprises 119 species (23 reptile species, 16 frog species, 17 bird species, 20 mammal species, 5 invertebrates, 22 crayfish and 16 fish) that are identified as having the highest priority for management intervention.*

Of these 119 fauna species, 60 species occur in north-east NSW. The Commonwealth identified the highest priority actions for all species as protecting unburnt habitat patches and carrying out rapid ground assessments of remnant populations.

In their simplistic assessment the NSW Government identified Pugh's frog, Hastings River Mouse, Brush-tailed rock-wallaby, Parma wallaby, Yellow-bellied glider, New England Tree Frog, and Davie's Tree Frog as having more than half their known localities burnt. NSW's preliminary assessment identified 19 of north-east NSW's threatened plants that had more than 90% of their localities burnt, with another 27 as having more than 50% burnt.

North-east NSW is one of the Koalas remaining strongholds, though the Black Summer fires took a heavy toll on many significant populations, killing thousands of Koalas and leaving many more sick, dehydrated and starving. While overall 29.4% of modelled 'likely' Koala habitat burnt in the recent fires, many populations had 73-90% of their likely Koala habitat burnt and may consequently be in imminent danger of collapse. Extinction is the end result of the cumulative loss of populations, it is essential we address the extinction crisis at the population level.

Koalas are particularly vulnerable to wildfires due to their tendency to climb higher into the canopy. As larger trees are targeted for logging, resulting in smaller trees, more contiguous canopies and increased connectivity between ground and canopy fuels, this leaves less refuges for Koala to escape fires. Koalas also clearly prefer larger trees for feeding and roosting. At the same time as their survival is being challenged by increasing wildfires it is also threatened by the accompanying droughts and heatwaves. Koalas west of the Great Dividing Range have been some of the early victims of climate heating, in the 1990's the Pilliga was found to be a stronghold for NSW's Koalas, though by 2014 there had been an 80% drop in occupancy, and now there may be none left.

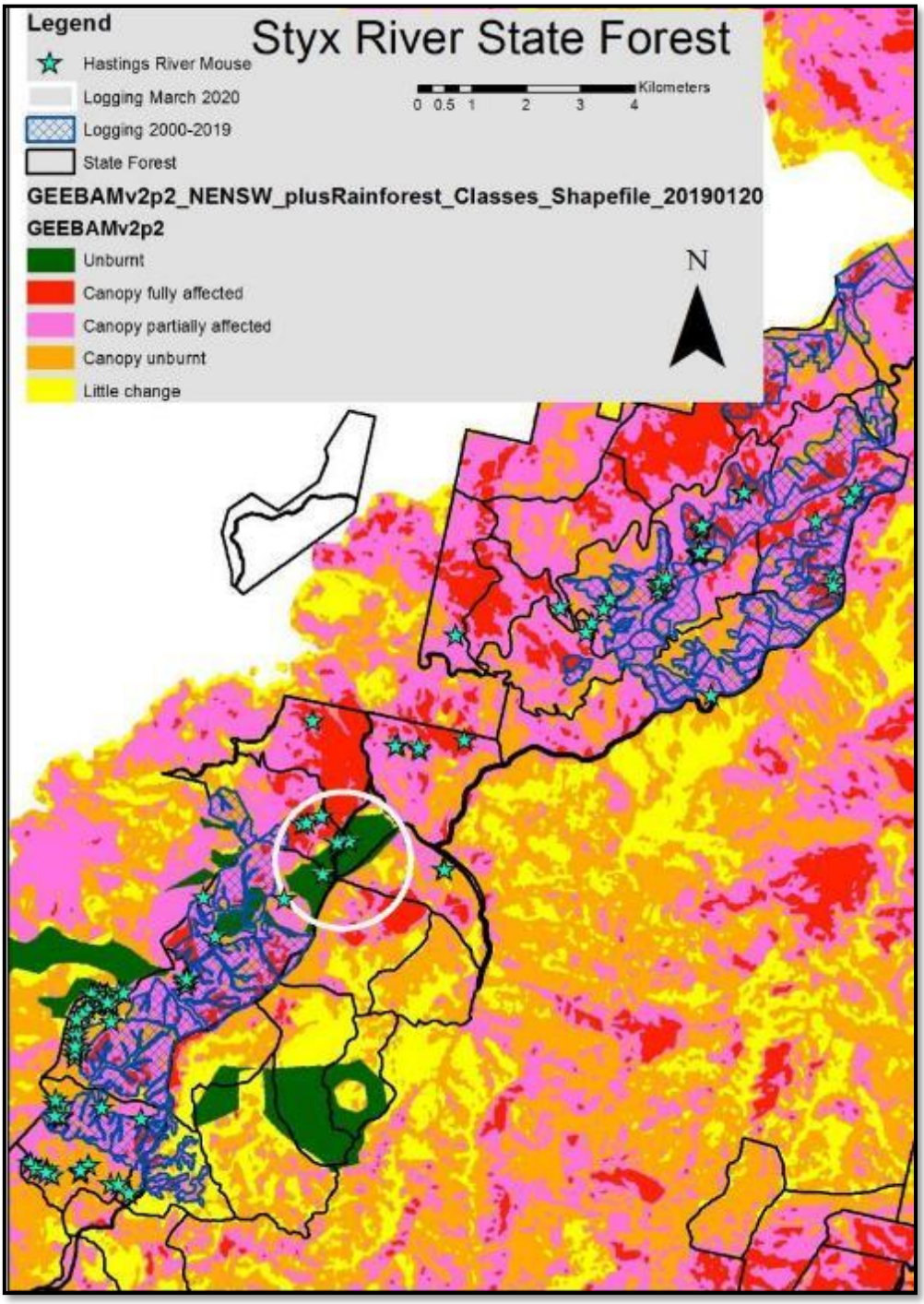
Phillips (2020) assessment of burnt forests for WWF found an average 71% decline in Koalas in burnt forests. Within the proposed Sandy Creek Koala Park NEFA found that most Koalas were lost from heavily burnt forests, with an initial loss of around half the Koalas in partially burnt forests increasing to a 60-90% loss over the next 3 months due to the continuing drought, giving an overall loss of 84-96% of Koalas from burnt forests.

At the Banyabba ARKS population level 83% of 'likely' Koala habitat burnt, yet despite the increased vulnerability of Koalas, the Forestry Corporation continued with plans to log their habitat (i.e. at Myrtle SF, Pugh 2020a, 2020b).

The Koala was one of those species known to have been significantly affected by the 2018/19 wildfires, with 29.4% of modelled 'likely' Koala habitat in north-east NSW burnt and recorded population declines of 71-90% in burnt forests. Despite this the intent was to compound impacts by logging Koala habitat in burnt forests without undertaking surveys to identify and protect vital fire refugia.

North-east NSW is also the national stronghold for the Endangered Hastings River Mouse. It is one of those species worst affected by the 2019 fires in Australia. While there is a debate about long-term impacts, it is a species that is known and agreed to be significantly affected in the short-term by burning and logging.

Fire burnt into Styx River State Forest in mid November and by late December 2019 78-89% of the forest had burnt, of the 198 locations in Styx River SF identified for Hastings River Mouse only 5 (2.5%) escaped burning, with some 95% of potential habitat burnt.



Map showing Hastings River Mouse records, canopy loss from 2019 fire, and logging 2011-March 2019 (note later logging records not available), with the unburnt patch logged in late February 2020 indicated.

Logging continued after the fire in Styx River State Forest, at some stage intentionally focussing logging into the remaining unburnt stand where the 5 Hastings River Mice had been found.

In their 28 January 2020 belated 'immediate' response the NSW Department of Planning, Infrastructure and Environment identified the Hastings River Mouse as the third most fire impacted threatened animal in NSW with 82% of its known localities burnt.

On 11 February the Commonwealth's Wildlife and Threatened Species Bushfire Recovery Expert Panel identified the Hastings River Mouse as one of 113 animals nationally in most urgent need of emergency action over the coming weeks and months. It was the mammal with the second highest vulnerability for fire and post-fire mortality and one of the highest priorities for urgent management intervention:

> *Two priority actions should be carried out for all high priority species: 1) Rapid on-ground surveys to establish extent of population loss and provide a baseline for ongoing monitoring. 2) Protecting unburnt areas within or adjacent to recently burnt ground that provide refuge, as well as unburnt areas that are not adjacent to burnt areas, especially from extensive, intense fire.*

Contrary to this advice the Forestry Corporation continued to log the only unburnt patch of occupied Hastings River Mouse habitat known in Styx River State Forest. It is astounding that the Environment Protection Authority allowed this to continue from mid-November 2019 until completed in mid-March, weeks after conservationists went public in the beginning of March 2020.

The Hastings River Mouse is known to be one of those species worst affected by the 2019/20 wildfires, with 82% of known localities burnt. In Styx River SF logging continued in the only patch of occupied habitat that escaped burning, even after the Commonwealth recommended urgent surveys and protection of unburnt refuges. This displays contempt for the survival of one of our most endangered species.

Eventually the EPA was forced to react to the immense environmental impacts of the Black Summer bushfires on State Forests, the EPA obtained its own expert advice and on 3 March 2020 issued Site Specific Operating Conditions for a suite of compartments across north-east NSW. To mitigate high risks the EPA used expert advice to identify requirements for significant changes to logging rules, including: protecting unburnt areas, prohibiting intensive logging in burnt areas, protecting all hollow-bearing trees, protecting additional feed trees, excluding logging from slopes >20^{o}, and expanding riparian exclusion zones. Though they still did not require surveys to identify fire refugia or key fauna habitats.

While the Forestry Corporation initially agreed to these changes for burnt forests, they soon began to object to the reductions in trees they could take. After prolonged dispute with the EPA, on 10 February 2021 the Forestry Corporation advised the EPA that they would be returning to regular operations under the Coastal IFOA (CIFOA) in South Coast, Eden and Tumut for the coming period, while the Natural Resources Commission (NRC) carry out their assessment of post fire harvesting. The Forestry Corporation said that they would apply their own additional prescriptions to mitigate impacts, though these would not be legally enforceable. The EPA considers "*the threat of the twin impacts of fire and post-fire harvesting demands very careful management*", with the EPA website stating:

> *The EPA advised against FCNSW's proposal, on the basis that additional site-specific operating conditions have been essential to ensuring harvesting activities in fire-impacted forests are carried out in an ecologically sustainable manner, and therefore meet the requirements of the* Forestry Act 2012*, the CIFOA and relevant Regional Forest Agreements*

To obtain expert advice, the EPA engaged Dr. Andrew Smith (2020) to prepare 'Review of CIFOA Mitigation Conditions for Timber Harvesting in Burnt Landscapes', which advises in part:

None of these additional conditions for the burnt areas are likely to mitigate fire and logging impacts or have substantive biodiversity benefits because the time frame (12 months) of application for all but the latter (retention of all tree hollows) is too short.

This means that SSOC for fire affected landscapes would need to remain in place permanently or for minimum periods of around 20-60 years in DSF and much longer (40->120 years) in WSF in order for biodiversity to recover from the 2019/20 fires …

The scale of FCNSW operations in State Forests and extent and severity of the 2019/20 wildfires have the potential to cause a combined adverse impact on biodiversity of considerable magnitude. A potential impact of this size merits an environmental impact assessment of the highest scope, rigour and calibre. … In short it risks causing a real and substantive decline in biodiversity and local threatened species extinction across coastal NSW and provides no justification for moving beyond the Precautionary Principle. Failure to monitor harvesting impacts over the past 20 years, in conjunction with the severity of the 2019/20 fires, has necessitated the adoption of new and expanded precautionary standards for mitigating logging impacts in fire affected landscapes.

…

In general, FCNSW (2020a) erroneously assumes that impacts of timber harvesting and wildfire on threatened species and biodiversity can be addressed by continuation of current practice and increased retention of a few small scattered habitat clumps within the net harvested area. An overly simplistic approach that appears to have been justified on the basis of unvalidated, unproven, theoretical retention harvesting concepts (Gustafsson et al 2012) of sustainable forestry derived primarily for northern hemisphere forests with little or no relevance or transferability to Australia. FCNSW has failed to demonstrate and is unable to conclude, that normal CIFOA timber harvesting practices will not have a significant impact on biodiversity in burnt areas. Under these circumstances it would be appropriate to apply new highly precautionary measures to limit harvesting extent and intensity in burnt areas to prevent environmental harm and limit the risk of serious or irreversible damage to threatened species and biodiversity.

Smith (2020) makes a variety of recommendations including:

1) That timber harvesting be excluded from all mapped unburnt and lightly burnt forests within state forests for a minimum period of 20 years.

2) That all timber harvesting be limited to a maximum average 50% of compartment area (with a maximum of 75% within individual compartments) and maximum 50% of the total local landscape Area.

The intensity and extent of the combined impacts of the 2019/20 drought and fires necessitates a long-term change in logging prescriptions to mitigate environmental impacts. Continuation of logging under the already inadequate CIFOA logging rules poses an extreme environmental risk. The expert advice obtained by the EPA advises they are inadequate "*to guarantee ecologically sustainable forest management and are likely to cause an ongoing decline and significant impact on biodiversity".* Obtaining biomass from State Forests is not ecologically sustainable and poses a significant environmental risk.

3.2.4. Forestry Criminality

The Forestry Corporation have a long history of criminality. For decades NEFA have exposed cases of illegal logging on State Forests, though they continue unabated. We have only audited a miniscule portion of

logging operations in any year and yet we invariably find numerous breaches of the logging laws, showing that at a landscape scale they are extensive and are having a major impact above and beyond what is allowed. This means that a significant portion of the trees they sell have been obtained illegally at significant environmental cost.

Since NEFA's formation in 1989 we have exposed innumerable cases of logging occurring in places from which it was expressly excluded and trees being taken that were required to be retained, meaning large volumes of wood that has been sold has been obtained illegally. We have also exposed innumerable cases of failures to apply erosion controls, failure to protect stream buffers, illegal roading, intrusions into protected areas, damage to threatened plants and damage to retained trees - greatly increasing environmental impacts.

Only a few representative examples of the Forestry Corporation's illegal activities are presented here to illustrate the types of breaches, their scale and their persistence over decades.

In 1990 NEFA presented evidence to the Land and Environment Court (Corkill vs Forestry Commission of NSW, 1990) that in North Washpool the Forestry Corporation were logging rainforest that had been expressly protected in an Environmental Impact Statement (EIS), logging compartments they had not prepared the required harvesting plans for, logging well in excess of the 50% canopy retention required by the EIS, not retaining 100m buffers free from logging along roads as required by the EIS, and not implementing the required erosion mitigation conditions.

In his judgement on 29 October, granting an injunction preventing further works in North Washpool, Justice Hemmings commented:

> *... Regrettably, there is conceded to be a history of departure by the Commission from not only its own approvals in the logging of this area, but apparently a continuous avoidance of the obligations imposed by the E.P.&A.Act. In such circumstances, it is difficult to have confidence that, unless restrained, the Commission will observe its statutory duties.*

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COURT CONDEMNS ILLEGAL LOGGING

Logging of the North Washpool area had been banned because the Forestry Commission could not be trusted, the Land and Environment Court heard yesterday.

Justice Noel Hemmings said in granting an injunction against logging in Washpool and Billinudgel State forests that preserve rainforest logging and roadwork by the Forestry Commission contained apparent serious breaches of the Environmental Planning and Assessment (EPA) Act.

Conservationists from the North-East Forest Alliance sought the injunction until a full hearing next year and claims that rare and endangered flora and fauna species could be threatened by the logging.

The conservationists also claimed EPA regulations had been breached by the Forestry Commission in North Washpool, and that alternative sig supplies to North Washpool were available for mills at Casino, Bonalbo and Grafton.

Conservationist Mr John Corkill, who brought the action, said later at a Press conference at Parliament House that the State Cabinet, in approving the logging, had been deceived by the Forestry Commission.

Tragedy

While the commission described yesterday's decision as disappointing, it denied that the EPA Act had been intentionally breached.

Yet forest industry spokesman Mr Col Barber described the proceedings as a tragedy for the workers and families in the North Coast who depended on logging.

Justice Hemmings said in his decision the Forestry Commission had shown "continual avoidance of the EPA Act".

Commitments by the Forestry Commission that it would log hardwood only from a 926-ha area known as compartment 695 in the North Washpool area also could not be guaranteed.

He said that unless restrained by the injunction, the Forestry Commission could depart from this agreement.

Outside the court, Mr Corkill, Sydney co-ordinator for the North-East Forest Alliance, condemned the Forestry Commission, saying Justice Hemmings' decision justified protest at North Washpool by conservationists.

Mr Corkill also supported Justice Hemmings' rejection of Forestry Commission claims that failure to allow North Washpool logging in the next six months could affect the commission's planning and ability to supply logs to the industry.

"The commission argued complete cessation could cause more hardship to the commission and contractors. Such hardship arguments are unsatisfactory and unconvincing to say the least," Justice Hemmings said.

Mr Barber, the head of the NSW Forest Products Association, said the Forestry Commission had deceived the industry about the annual availability of

● Continued Page 3

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Airport soil samples taken — Page 3

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In her assessment of prior criminality by the Forestry Corporation Justice Pepper (Director-General, Department of Environment, Climate Change and Water v Forestry Commission of New South Wales [2011] NSWLEC 102) took into account their prior convictions "*and enforcement action against the Forestry Commission*", for which she only considered the Penalty Infringement Notices (PINs) issued. Pepper (2011) notes " *The Forestry Commission has not admitted guilt in relation to any of these PINs*", concluding:

> *However, in my view, the number of convictions suggests either a pattern of continuing disobedience in respect of environmental laws generally or, at the very least, a cavalier attitude to compliance with such laws.*
>
> *... Given the number of offences the Forestry Commission has been convicted of and in light of the additional enforcement notices issued against it, I find that the Forestry Commission's conduct does manifest a reckless attitude towards compliance with its environmental obligations ...*

After 2009 NEFA focussed on undertaking annual audits of Forestry Corporation logging operations, usually for 2 days, with the audit reports sent to the EPA, and where appropriate Fisheries NSW. See: https://www.nefa.org.au/audits. Of the 9 audits authored by Dailan Pugh on public land for NEFA between 2009 and 2015, the EPA and Fisheries confirmed 463 offences, issuing Official Cautions or Warnings for 68 offenses and Penalty Notices with fines for 12 offences.

OFFENCES	Yabbra 2009	Girard 2010	Doubleduke 2010	Wedding Bells 2011	Styx River 2012	Royal Camp 2012	Koreelah 2013	Richmond Range 2014	Cherry Tree 2015	TOTALS
Penalty Notices	6	1				3			2	12
Cautions/warnings	4	8	2	40		5			9	68
Proven offenses	21	15	15	40	3	10	4	3	352	463
Rehabilitation	yes	yes		yes				yes	yes	5

Outcomes from audits undertaken by Dailan Pugh for NEFA, 2009-15.

Penalty Notices issued as a result of the above 9 audits are were:

- Logging 3ha mapped rainforest 1x$300
- Logging and roading a number of wetlands 2X$300
- Failure to search for Koala scats 1x$300
- Logging and Roading Koala High Use Area 2x$300
- Failure to mark and protect 11 Yellow-bellied Glider sap-feed trees and 15 feed trees around each 1x$300
- Damage to 2 vulnerable Onion Cedar (26 affected) 2x$1000
- Forestry operations in some 20ha of buffers of unmapped streams 3x$500

NEFA has been repeatedly frustrated by the EPA's and Fisheries refusal to identify the scale of the offences occurring because they group breaches of the same category into a single breach, for example in Yabbra State Forest there were some 20ha that required protection within 10m buffers on numerous "unmapped" streams, though the boundaries were not marked and hundreds of trees within the exclusions were logged, yet Fisheries NSW only undertook an afternoon inspection (for others offences as well), did not bother to assess the extent of the offences or their impacts, and only recorded it as 2 offences with a $500 fine issued for each. We have often found that the regulators do not bother to investigate the extent or scale of offences, preferring just to record them as single breaches.

Many of the most egregious offences NEFA identify go unassessed and/or unreported by the EPA. This is best demonstrated by two examples of logging Endangered Ecological Communities (EECs) that NEFA reported and that the EPA maintained they were investigating with a view to taking legal action, though in the end there was not even a reprimand. These are the most serious offences as they are breaches of Section 118A of the National Parks and Wildlife Act 1974.

The Endangered Ecological Community (EEC) *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion* was gazetted as an Endangered Ecological Community on the 17 December 2004. It covers parts of the floodplains of the Clarence and Richmond Rivers. After assessments by a number of botanists, NEFA complained about logging of this EEC in Compartments 145 and 146 of Doubleduke State Forest (Pugh 2010a, 2010b). In response to our complaints in October 2011 the Chief Executive Officer of the Office of Environment and Heritage commenced legal proceedings against the Forestry Corporation of NSW for logging 120 mature trees in 7.5 ha of the EEC in contravention of section 118A(2) of the *National Parks and Wildlife Act 1974*. In July 2012 the EPA withdrew from its prosecution of Forests NSW, claiming this was because *"Forests NSW evidence raised questions about the interpretability of the soil related component of the NSW Scientific Committee's determination".*

This area of the EEC Subtropical Coastal Floodplain Forest was logged in 2010 in Doubleduke SF but has been omitted from Forestry Corporation logging data.

As an outcome of that failed case, and other instances of logging of EECs, the EPA resolved to map EECs. with funding from the Environmental Trust. Key dates are the gazettal of Subtropical Coastal Floodplain Forest as an Endangered Ecological Community in December 2004 and its mapping being completed by June 2016. Comparison with Forestry Corporation logging history maps covering from July 2000 until March 2019, shows 1,646 ha of the mapped Subtropical Coastal Floodplain Forest as having been logged over that time. Since its gazettal in December 2004, 1,269 hectares (11.5%) of this EEC is mapped as logged, with at least 21 ha logged since the EPA's mapping.

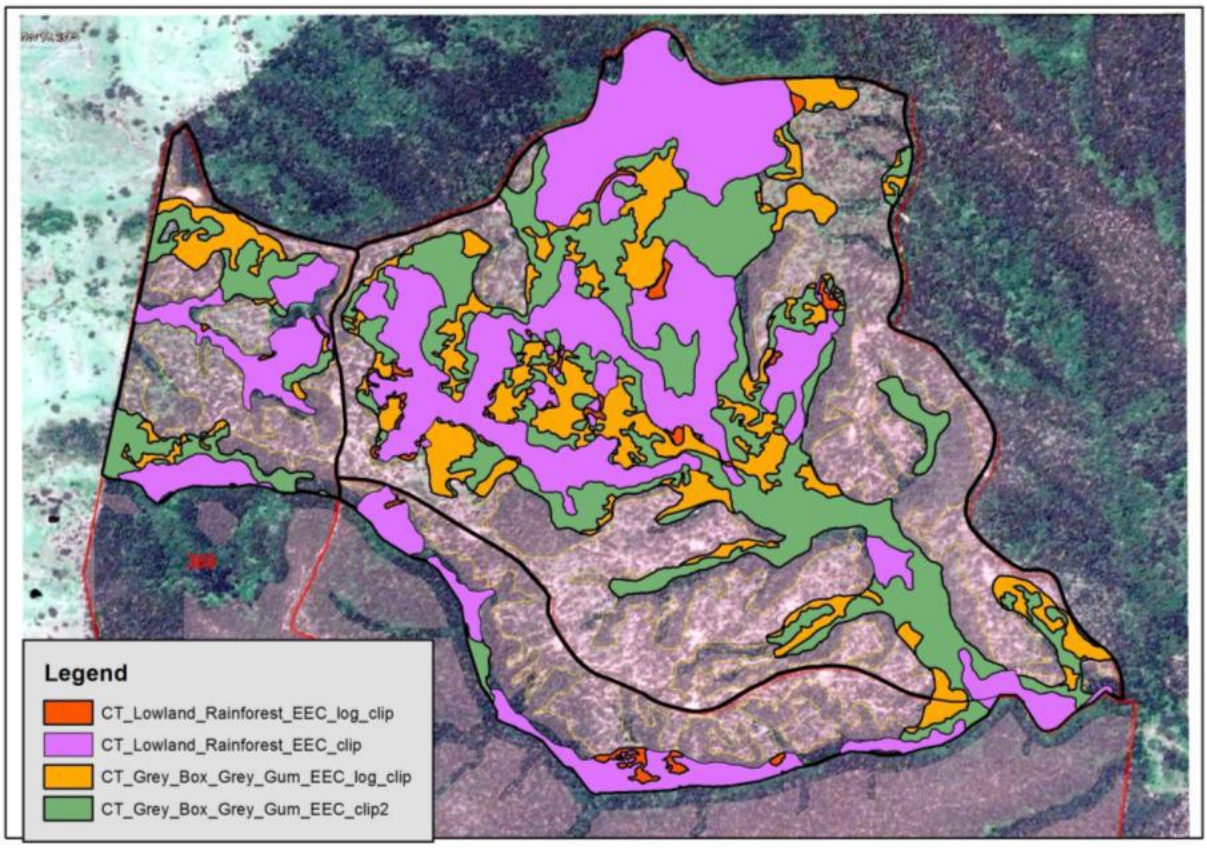
Subtropical Coastal Floodplain Forest	Area (ha)
TOTAL AREA	11,070
Logged July 2000-2004	377
Logged 2005-2011	1,111
Logged 2012-2016	137
Logged 2017-March 2019,	21

TOTAL LOGGED	1,646

Logging of the EEC Subtropical Coastal Floodplain Forest since its gazettal in 2004 and mapping in 2016.

Comparison of Forestry Corporation mapping of logging with the EEC mapping for Doubleduke State Forest shows 44 ha of the EEC Subtropical Coastal Floodplain Forest complaint area as being logged in 2010-2011. An additional area of 1.75 ha of this EEC identified as logged by NEFA is confirmed as this EEC, though erroneously omitted from Forestry Corporation's logging maps. In response to NEFA's complaint the EPA took no legal action what-so-ever, not even a Warning Letter. The Forestry Corporation got away scot free, and went on logging the EEC, albeit at a reduced rate.

In 2015 NEFA complained that that the Forestry Corporation had illegally constructed 6 logging tracks through, and undertaken logging in, the EEC Lowland Subtropical Rainforest in our audit of Cherry Tree State Forest (Pugh 2015). In the process causing significant damage, including to the Vulnerable Onion Cedar. The Forestry Corporation's Harvesting Plan claimed that the Endangered Ecological Community (EEC) Lowland Rainforest was "*unlikely to be present*", yet their own botanist had previously mapped it as an EEC. When the EPA (Michael Hood 21 December 2016) provided their "final" response to our Cherry Tree audit they deferred a decision on the EEC Lowland Subtropical Rainforest, claiming to us that they were considering prosecution.



This map shows the areas of the Endangered Ecological Communities Lowland Rainforest and Grey-Box Grey Gum Wet Sclerophyll Forest (mapped by the EPA) subject to intensive logging (red and orange respectively) in Cherry Tree SF which the EPA refused to acknowledge or take any regulatory action on. It shows the EPA (2016) mapping of EECs with heavily logged areas of each EEC as identified in NEFA's review from Google Earth 11/18/2015. The Google Earth landsat images are relatively low resolution and thus only identify gross disturbances, generally in excess of 50% canopy removal where bare soil is visible, so logging disturbance is far more widespread than mapped.

At the time it was being logged the EPA and Forestry Corporation were undertaking a joint project to map a number of EECs on State Forests. When NEFA obtained the mapping we undertook a review (Trashing Endangered Ecological Communities in Cherry Tree State Forest, 2017) comparing the EPA's EEC mapping

with Google Earth landsat imagery taken post logging to assess gross disturbance to the mapped EECs. This process identified 4.5 ha of the mapped Endangered Ecological Community (EEC) Lowland Subtropical Rainforest was affected by 33 roading and logging incursions, and that there was an extensive area of the EEC Grey Box-Grey Gum Wet Sclerophyll Forest logged. Over 50ha of the EEC Grey Box-Grey Gum Wet Sclerophyll Forest was heavily logged (>50% canopy removal and bared ground) with up to another 40ha subject to logging operations.

The EPA refused to pursue the logging of the Grey Box-Grey Gum Wet Sclerophyll Forest because of an agreement they had with the Forestry Corporation not to use the mapping retrospectively – despite most of the breaches we had earlier identified being within it. Even though the EEC Lowland Subtropical Rainforest had been previously mapped by the Forestry Corporation, had been explicitly identified by a botanist we engaged, and had been reconfirmed in the EPA's joint mapping with the Forestry Corporation, the EPA took no legal action what-so-ever on the grounds they couldn't prove beyond reasonable doubt that it was an EEC. Not even a Warning Letter was issued for roading and logging in over 94.5 ha of 2 EECs.

The failure to provide the required legal protection for Hollow-bearing (H) and Recruitment (R) trees has been the most widespread and persistent breaches identified by both NEFA and the EPA, with significant proportions of trees required to be protected being logged and damaged. As a result of NEFA's complaints, the EPA made habitat trees a compliance priority in 2013. From then until the rules were changed in 2018 to remove protection for R trees, the EPA found that poor selection and retention of habit trees is the most frequent and widespread breach of the Threatened Species Licence. For example from an audit of 6 forests in the Upper North East in 2013/14 the EPA (Gregory Abood, 13 August 2014) once again found that the Forestry Corporation were logging the larger trees legally required to be retained as R trees:

> **Key Audit Findings**
>
> **Recruitment – failure to select trees most likely to provide hollow bearing resource continuity**
>
> EPA audits found a common trend that appropriate recruitment trees were not retained in accordance with the Threatened Species Licence (TSL) requirements. For example, in Dalmorton State Forest, trees were felled belonging to a cohort of trees with the largest diameter at breast height over bark (dbhob) contrary to the TSL requirements. For example, of the required ten recruitment trees (2 hectare assessment area) 6 trees from the cohort of trees with the largest dbhob were felled. Stumps of 85; 78; 78; 70; 66; 60 cm DBHOB (6 trees) were all belonging to a cohort of trees with the largest dbhob compared to the R trees retained in the assessed area being 83; 76; 60; 57; 54; 51; 51; 51; 51; 49; 49; 46; 46; 42.5; 36. Most notably, differences in trees removed versus those retained ranged up to 49cm (i.e. R tree 36cm vs stump 85cm at 1.3m). The EPA audit recorded clear examples of non-compliances with trees felled within 10m of marked and retained R trees including a Spotted Gum 46cm R tree and four adjacent Spotted Gum trees felled 75cm, 71cm, 60cm, 58cm DBHOB. Similar findings were recorded at Kangaroo River State Forest with for example an 81cm DBHOB tree felled and the largest R tree retained was 62cm and smallest R tree 46cm DBHOB (in the assessed area). Trees belonging to a cohort of trees with the largest dbhob were felled.
>
> Proper selection is critical to achieve compliance and the intent of the condition. The retention of recruitment trees that belong to a cohort of trees with the largest DBHOB is important. Larger size class trees maintain biodiversity, diversity of forest structure and form, forest health and the productive capacity of these forest ecosystems. Larger size class trees are more likely ensure continuity of hollow bearing forest resources. Continuity of these resources is the key to sustain biodiversity elements of ecologically sustainable forest management (ESFM). Removing the next largest size class increases the risk of a hollow bearing resource gap in time. A future resource gap would acutely impact on biodiversity. The presence, abundance and size of hollows are positively correlated with tree basal diameter, which is an index of age. As such, tree dbhob is, in turn, a strong predictor of occupancy by vertebrate fauna and is the primary reason why largest diameter is stated within the TSL conditions. Harvesting trees that belong to a cohort of trees with the largest dbhob will impact on the capacity of this forest ecosystem to function in the future.

For these breaches they just required an Action Plan. Similarly in the EPA's 6 proactive audits undertaken in the Upper North East region in 2015 they assessed a total of just 7.9ha for habitat tree retention, with just 43 H trees and 51 R trees assessed, and yet identified 36 breaches. This is 4.6 breaches per hectare. If this is extrapolated across the thousands of hectares being logged each year the scale of the illegality can be imagined. For these widespread and frequent breaches the only regulatory action the EPA took was to require 11 Action Plans, time after time as the breaches continued unabated.

In NEFA's audit of Cherry Tree State Forest (Pugh 2015) we focussed on undertaking a systematic audit of habitat trees, recording their locations with a GPS and providing photographs of them, assessing a total of 50 hectares, and by extrapolation across the whole logging area, concluding:

- *In the order of 2,000 (44%) of the habitat trees required to be protected were logged, in contravention of TSL 5.6 (d)(i), (e), and 6.9 (d).*
- *There have been over 1,600 breaches of habitat tree selection and retention requirements for trees that were retained across the logging area, in contravention of TSL 5.6 (a) (i), (ii), (d)(ii), (e) (i), (iii), (iv), and (h) (i), (ii).*
- *Of the marked H trees, 10% were considered inappropriate selections due to their small size, suppression and lack of hollows, in contravention of TSL 5.6 (a) (i), and (d)(ii).*
- *Of the marked R trees, 63% were considered to be inappropriate selections due to pre-existing damage, being suppressed, or being too small, in contravention of TSL 5.6 (a)(ii), and (e)(i),(iii),(iv).*
- *Of the marked habitat (H&R) trees, 22% were physically damaged in the logging operation, with some 520 habitat trees likely to have suffered significant physical damage, in contravention of TSL 5.6 (h)(i), and*
- *Of the marked habitat (H&R) trees, 38% had debris left around them, with some 680 habitat trees likely to have had debris left around them, in contravention of 5.6 (h)(ii).*

When the EPA (Michael Hood 21 December 2016) provided their "final" response to our Cherry Tree audit they identified a shortfall in the retention of 172 hollow-bearing (H) trees in just one compartment, meaning that by their estimation up to 172 H trees had been illegally logged in that compartment. Though this was only reported as one breach and the only legal action was an Official Caution. The EPA also considered "Selection of R trees" was non-compliant, though provided no details, with regulatory action limited to an Official Caution and a requested an Action Plan.

The EPA deferred their consideration of damage to habitat trees, telling us they were considering legal action and even requested high resolution images of all the habitat tree breaches we had identified. They strung us along for almost a year before telling us (Michael Hood,1 December 2017) that they would take no regulatory action at all. The EPA did not visit the trees identified by NEFA, though themselves identified 22 trees with crown damage, 51 trees with butt damage and 49 trees with excessive debris around them, all legal breaches, but then refused to take any regulatory action on the grounds that they could not "*prove beyond reasonable doubt that each individual instance of damage or debris was as a result of an action by those undertaking the harvesting operation*", claiming it could be argued "*that the damage was caused by some other means*".

In this area of Cherry Tree SF 4 hollow-bearing (H) and one Recruitment (R) habitat tree had their crowns knocked out by having trees felled on them, with damage to their trunks and piles of debris left around all 10 habitat trees in the vicinity, ready for cremation. Despite the stumps, bulldozer tracks and sawn-off logging debris, the EPA claimed that it

could not be proven that logging was responsible. One selected R tree had pre-existing severe trunk damage, and one H tree was very small, with a diameter of only 38cm - next to a 105cm diameter stump.

Marked H and R trees next to logging tracks with recent injuries obviously caused by machinery that the EPA claimed could not be proven to be due to the logging.

Given this lack of enforcement it is no wonder that when NEFA next undertook a rapid systematic audit of 37ha (Pugh and Sparks 2016, Audit of Sugarloaf State Forest) we documented inadequate tree retention, 25 hollow-bearing trees (H) and 26 marked recruitment (R) trees that had been damaged, 4 hollow bearing trees that had been logged, excessive debris left around 6 H trees and 10 R trees, and 32 marked recruitment (R) trees that failed to satisfy the selection criteria. A similar level of damage that we reported for Cherry Tree SF.

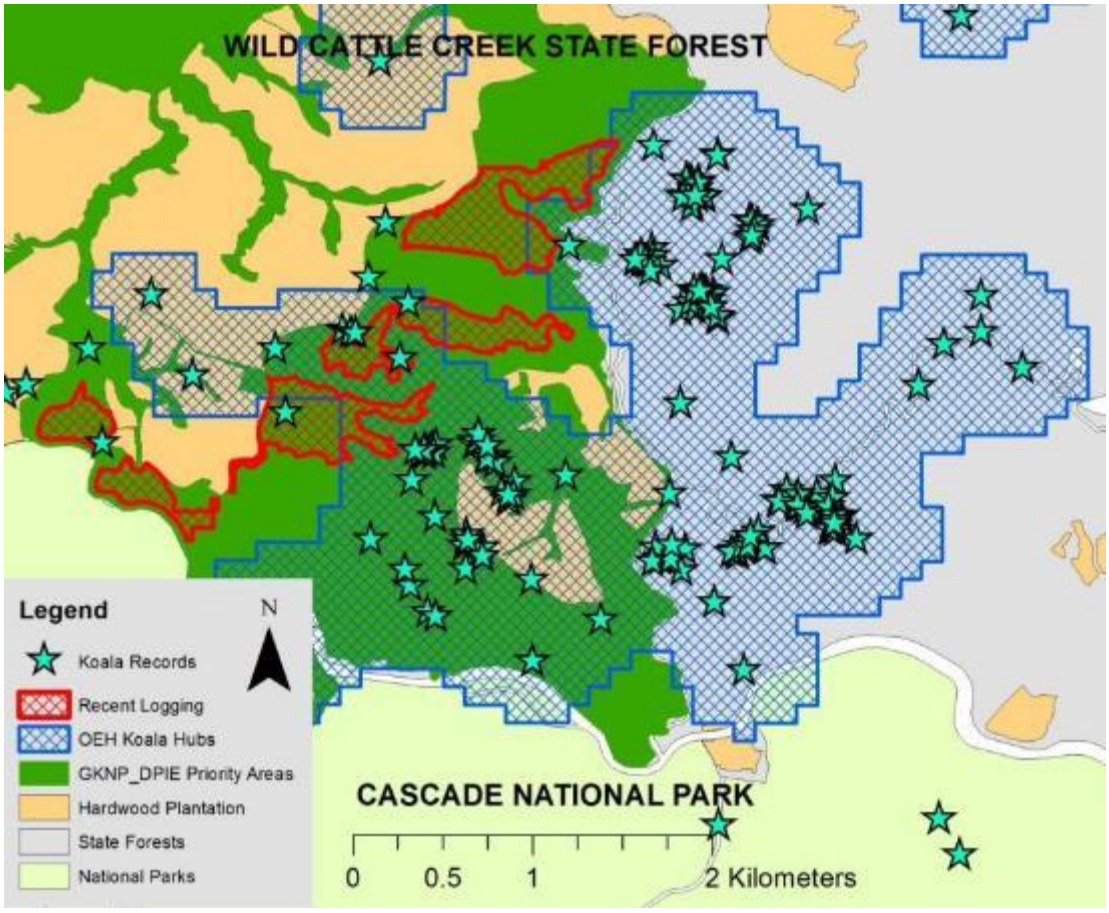
The EPA (Bryce Gorham, 19 October 2018) confirmed logging of unspecified numbers of H trees required to be retained, 17 cases of damage to the butt or crowns of marked H trees, 1 case of marked H tree not satisfying requirements, 2 cases of excessive debris around H trees, 20 cases damage to the butt or crowns of marked R trees, 26 cases of marked R trees not satisfying requirements, and 4 cases of excessive debris around R trees. Despite the abundant evidence that the Forestry Corporation are serial offenders and have been illegally removing and damaging trees in every operation for years, the EPA just issued another ineffective Warning Letter. Subsequent audits kept finding the same problems.

NEFA have not had the opportunity to assess compliance under the new logging rules, with only one brief assessment of an operation in Wild Cattle Creek State Forest. The new rules no longer require retention of Recruitment (R) trees, and the requirements to minimise damage to hollow-bearing (H) and "giant" trees have been significantly relaxed. Never-the-less our brief assessment shows that the Forestry Corporation are continuing business as usual by logging "giant" trees required for retention and recklessly damaging H trees and Koala feed trees.

On the 9 July 2020 the EPA found 2 giant trees >140 cm illegally cut down in Wild Cattle Creek State Forest, they then allowed logging to continue for another 9 days before issuing a 40 day Stop Work Order on the Forestry Corporation when logging was almost complete. On the afternoon of 28 July 2020 NEFA undertook a brief audit of part of the logging area, finding 12 legal breaches:

- 2 'giant trees' illegally felled
- 4 giant 'hollow-bearing trees' recklessly damaged by machinery and tree felling
- 6 marked small tallowwood Koala Feed Trees recklessly and significantly damaged

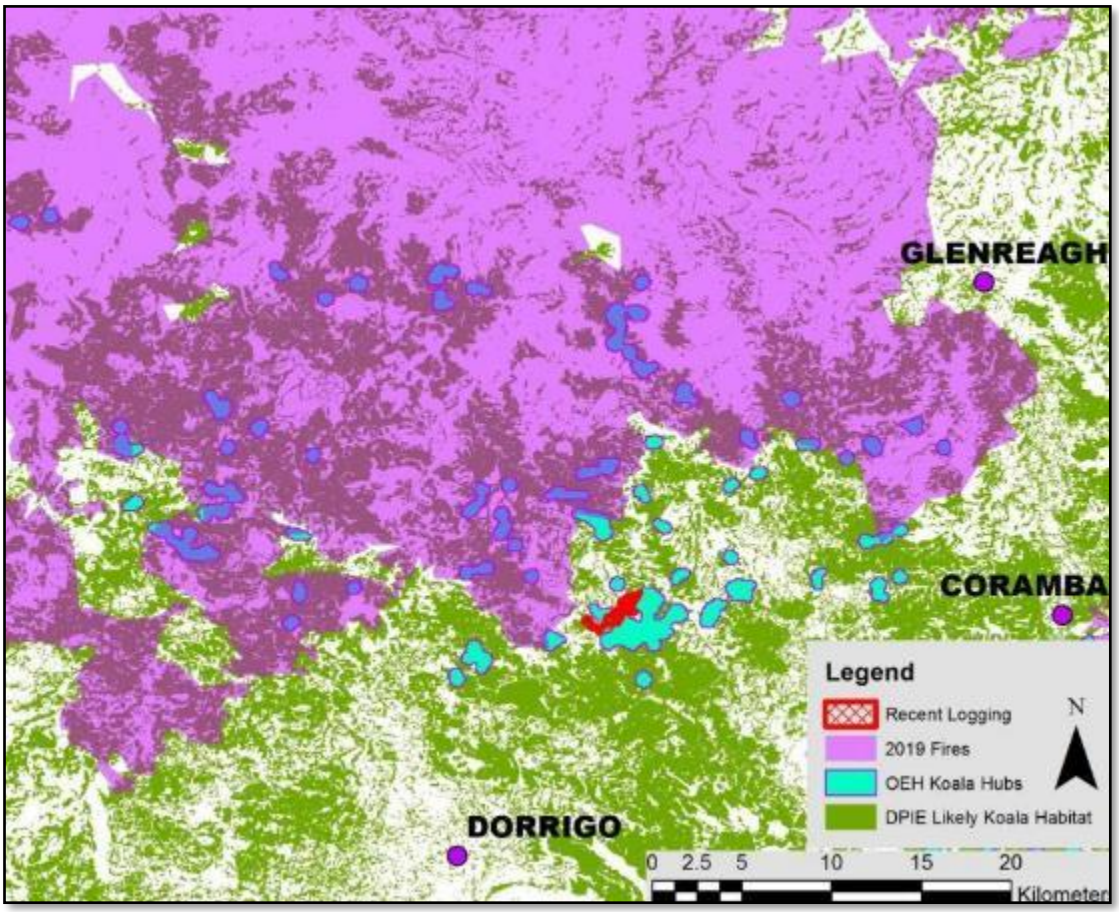
These showed that breaches are more widespread and significant than identified by the EPA, and also raises questions as to how many occurred after the EPA's first inspection. Though equally worrying is that this shows that, despite a major wind-back of environmental regulatory requirements, the Forestry Corporation has maintained its "*reckless attitude towards compliance with its environmental obligations*".



The logging areas occur on the edge of the largest patch of Koala Hubs (*clusters of resident populations*) on the Dorrigo Plateau. They are within the DPIE 2019 Wild Cattle Creek Koala Focus Area recommended as part of the Great Koala National Park.

It is of particular concern that the logging occurred in an area identified as being of outstanding value for Koalas. In 2017 the Office of Environment and Heritage identified these forests as part of the largest Koala Hub on the Dorrigo Plateau, hubs being "*areas of currently known significant koala occupancy that indicate clusters of resident populations*". Then in 2019 DPIE acknowledged the significance of these forests by identifying them as part of the Wild Cattle Creek Koala Focus Area, part of the 10 priority areas of State Forests that could be protected as part of the Great Koala National Park to "*provide a feasible and strategic balance between increasing protections for koalas, while minimising impact to forestry operations*".

It is also part of the forests on the Dorrigo Plateau that escaped burning in the 2019/20 wildfires, that so severely decimated Koala populations.



Affects of 2019 wildfires (purple overlay) on DPIE 'Likely Koala Habitat' (green) and OEH 'Koala Hubs' (aqua) on Dorrigo Plateau, in relation to recent logging (red) of the largest Koala Hub on the plateau.'

Wild Cattle Creek SF. TOP and Middle LEFT Giant Sydney Blue Gums (152.5 cm and 149.5 cm DSHOB**) found felled, with the top one left where it fell. Middle RIGHT Giant hollow-bearing Sydney Blue Gum (157.5 cm DBH) with trunk and root damage. Bottom LEFT Giant hollow-bearing Tallowwood (145 cm), had a machine drive around its base, causing significant visible root/base damage. Bottom RIGHT one of 6 Tallowwood marked for retention as Koala feed trees that were badly injured (likely mortally).**

It is apparent that after the devastating 2019/20 wildfires the Forestry Corporation logged an unburnt refuge recognised as being of exceptional importance for Koalas in a manner that caused reckless damage in contravention of the CIFOA.

The Forestry Corporation displays a reckless attitude towards compliance with its environmental obligations, meaning that timber taken has often been obtained illegally in contravention of the logging rules. Having a market for pulpwood will increase the impact of illegal logging by facilitating the felling of more large trees, the removal of more logs, more mechanical damage to understorey and retained trees, and more soil disturbance.

4. Transport

The SEE (p16) tries to downplay the significance of transport changes by claiming "*the delivery of fuel would require on average 70 trips, which is well within the existing consent which provided for up to 100 trips*", conveniently ignoring that most fuel was brought in by conveyor belts rather than trucks. Though the SEE (p19) does admit the proposal will increase the vehicle movements to/from the site.

The Traffic Impact Assessment is limited to an assessment of trucks delivering biomass, noting:

> As part of the scope of this report, the forecast operation heavy vehicle traffic generation is 140 movements per day (1 truck equals 1 in movement plus 1 exit movement, equalling 2 movements).

The SEE (p 26) notes that "Approximately 112 tonnes of biomass would be burned per hour", with the plant operating 24 hours per day this is 38.4 tonnes per truck.

The Supply Chain Report claims biomass will be imported using "*predominantly B Double rated semi-trailer configurations averaging a payload of 42-44 tonnes per load*".

The Supply Chain Report notes:

> *As discussed, feedstock processing facilities will be strategically positioned within the supply chain. These sites will process the feedstock to the specification required by Redbank and as defined under our Specific Resource Recovery Order post approval.*
> *Redbank will engage a fleet of B double configured semi-trailers; a combination of company owned and subcontract driver will be engaged to transport the required feedstock to Redbank site.*

The traffic impact assessment only considers impacts accessing the powerplant while ignoring the broader traffic impacts resultant from obtaining and transporting the biomass. The SEE Section 6.2 summarises traffic impacts, noting:

> The sourcing of biomass fuel from sites other than Warkworth mine, will require road haulage to Redbank Power Station. As part of the scope of this report, it was forecasted that 140 movements (70 trips) per day (1 truck trip equals 1 entry movement plus 1 exit movement, equalling 2 movements), would be needed to haul the required biomass.
>
> It is proposed that biomass would be transported via road (primarily using B-Double trucks). It

While previously most coal was brought in by conveyor belt from nearby mines, this proposal is to truck in timber from up to 300km away. This is a whole new ball game, which requires assessment. Firstly there will be significant machinery movements associated with the logging operations, then logs will be trucked to processing facilities (including facilities for drying and processing fuel for Redbank), then partially dried woodchips/pellets will be trucked to Redbank, and then finally residual ash will be trucked from Redbank to disposal sites.

It is claimed that there will be 70 deliveries each day, for 365 days a year, which totals 25,550 deliveries a year to Redbank. This is a total of 51,100 truck movements a year. Though there has been no assessment of

the trucking of green residues to secondary processing facilities, including the locality of those facilities, the truck types used and the routes that will be used.

The Supply Chain Report identified "there will be a requirement to remove 134 tonnes of the ash per day or the equivalent of 3 transport loads". This is an additional 6 truck movements per day, travelling on unidentified routes to unidentified disposal sites

This is a very different proposal from what was originally proposed, rather than transporting most fuel by conveyors from 7 km away, the intent it to now transport huge volumes of green logging "residues" from thousands of sites to secondary processing facilities and then for hundreds of kilometres from those sites, and some forests, to Redbank. Then the residual ash and rejected timber is to be transported to some unknown disposal sites. There needs to be a comprehensive traffic assessment that accounts for all traffic movements, including CO2 emissions, identifies transport routes and traffic volumes, and identifies the impacts on rural roads, bridges and communities.

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