# North East Forest Alliance Submission to: Draft Private Native Forestry Codes of Practice

Dailan Pugh, May 2020

The Local Land Service have simply adopted the same fundamentally flawed Private Native Forestry (PNF) Codes as developed by the EPA without fixing the manifest deficiencies, and instead weakened them further by increasing logging intensity and reducing retention requirements for hollow-bearing trees. The LLS have demonstrated that they have contempt for the principles of Ecologically Sustainable Forest Management, particularly incorporating public participation into decision-making processes.

**On behalf of NEFA I wasted considerable time on a submission to the PNF Review. It is evident that there was not a single positive change to the PNF Code as a result of our submission. The LLS are deaf to the evidence we present because their 'consultation' is a tick-a-box sham. I have again wasted my time making a submission because I consider it important that such opportunities be taken, irrespective of the outcome, though I have only focussed on a few of the multitude of issues and species so as not to waste too much time.**

Since the PNF Review over half north-east NSW's forests were ravished by the 2019-20 'black summer' wildfires, decimating populations of numerous threatened species, while the burning of riparian buffers and loss of ground cover have significantly increased stream pollution. It is apparent that the LLS's only reaction has been to increase logging intensity and reduce protection for the hollow-bearing trees which suffered high mortality in the fires. It is contemptible that the LLS has made no attempt what-so-ever to account for the necessity to increase protections in burnt landscapes. With intense fires becoming more frequent, the LLS's refusal to increase mitigation measures in burnt forests displays their contempt for ESFM.

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"*. So they have at least increased prescriptions in burnt forests. 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*".

**Not only have the LLS done nothing for fire effected wildlife in the recent fires, they don't intend to do anything in future fires. Such fire events will become more frequent and intense into the future. It is grossly irresponsible for the LLS not to recognise the compounding impacts of wildfire on the environmental impacts of logging and include contingency measures into the PNF Code.**

In the January 2019 'North East Forest Alliance Submission to Private Native Forestry Review' we commented:

> *This submission is made in the expectation that the Government will ignore our concerns (as they did with our RFA and IFOA submissions) due to their obsession with weakening and removing the grossly inadequate constraints on logging of private forests in NSW. There is no genuine commitment to Ecologically Sustainable Forest Management, it has become a meaningless platitude.*

As expected our suggestions to rectify any of the manifest deficiencies in the PNF Code were ignored and thus our efforts were in vain. Another sham process of community consultation. Another waste of community time as all the concerns we raised were simply dismissed without consideration.

The claim is made that the intent is to "*Support a socially ... sustainable forest industry in line with ecologically sustainable forest management*" and "*Enhancing ... community acceptance of the PNF industry*".

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.*
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> *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.*
>
> *...*
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> *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.*

This perception exists because it is a rapacious industry overseen by blind bureaucracies who just perpetuate and compound concerns by lack of meaningful constraints and poor regulation. The NSW Government agencies refuse to recognise and accept community concerns, instead labelling them as "*negative views", "misguided hyperbole" and "fake news", as* demonstrated by the NSW Department of Primary Industries (2018):

*The suggestion of government 'promotion of private native forestry' is a call to counter the negative views, 'fake news' and around sustainable native forestry, and promote the industry and timber products as a sustainable, ecologically beneficial and a carbon neutral material the public should use above all others.*

Social licence is something that needs to be earned, it can't be manufactured by a public relations campaign while the root causes are ignored, and often exasperated by further weakening of rules and regulations. One of the most basic problems is the secrecy and lack of public accountability for PNF. It is exempt from all the rules and public accountability applying to other developments on private lands.

The current secrecy surrounding PNF approvals are contrary to the one of the basic principles of ESFM that supposedly underpinning the new Forestry Act "*(b) ensuring public participation, provision of information, accountability and transparency in relation to the carrying out of forestry operations"*. This secrecy has the perverse consequences of undermining the ESFM principle of *c) providing incentives for voluntary compliance, capacity building and adoption of best-practice standards*, as the only accountability is to the EPA and not affected communities.

The RFA definition of ESFM elaborates:

**Principle 2 Ensure public participation, access to information, accountability and transparency in the delivery of ESFM.**

- Ensure public participation in decision-making processes at local, regional and State and Federal levels.
- Ensure comprehensive, timely and reasonable public access to information.
- Ensure transparency, openness and accountability in decision making processes and performance.

It is clear from our experience that any claims that Private Native Forestry is adequately or competently regulated or that the PNF code achieves the principles of ESFM are plainly false. The minimum standards established by the PNF Code are too minimal to achieve ESFM, this is most apparent by their failure to provide any meaningful protection for threatened species or Endangered Ecological Communities.

By ignoring <u>all</u> the suggested solutions to manifest deficiencies identified by NEFA in our Submission to the Private Native Forestry Review, the Local Land Services have proven that they are just another supposed regulator captured by the logging industry, who refuse to listen to community concerns and have no commitment to Ecologically Sustainable Forest Management.

The LLS seem hell-bent on undermining the little community acceptance that remains for PNF and increasing community antagonism to what is clearly an unsustainable, rapacious and environmentally destructive industry.

**The LLS have failed their duty of care. As the LLS have again proven they cannot be trusted it is recommended that to improve regulation and community acceptance that Private Native Forestry should require a Development Application like all other large developments to ensure full environmental assessments and to give the local community a chance to raise their concerns and have them listened to.**

## Contents

# 1. PLANNING

The PNF planning process is a sham. Apparently either a Forest Operation Plan must be prepared *"in an approved form"* (2.1) or a Forest Stewardship Plan (2.2) prepared by the Local Land Services (or maybe both are required), though the "*landholder may amend*" whichever it is "*at any time*", with the only exception being "*a contemporary description of the pre-harvest forest condition*". This variable plan is the plan you have when you don't have a plan.

Everything else is open to change - if they contravene a requirement they can just change the plan. Further to this, there is little the regulator can do as monitoring activities undertaken in PNF Plan areas "*can only occur with the written consent of the landholder*".

At least now the landholder is required to notify the LLS before they start logging or after they finish, though there is apparently no requirement to notify them if it is suspended, even if for years. This still precludes LLS knowing when an operation is underway so that they can at least inspect it at appropriate times.

**At the very least any logging plan must be approved by Local Land Services, including any variations, before logging. It is ludicrous to allow landholders to vary plans at their whim with no accountability. At least with a DA the proposal has to be adhered to and cannot be altered without a Section 96 variation.**

**Landowners should be required to notify LLS if logging is suspended for more than a month and notified before it restarts to enable EPA to undertake timely site visits.**

## 1.1. IDENTIFYING AND PROTECTING ECOSYSTEMS

Similarly there are requirements to protect rainforest and oldgrowth as mapped in the 1998 Comprehensive Regional Assessment, though it is open for LLS to amend the mapping using rorted decision rules. The OEH unit, now incorporated into DPIE, have changed the decision rules for mapping oldgrowth and rainforest (ie effectively excluding Brush Box, which can be over 1,000 years old), and have already wrongly remapped numerous areas of both oldgrowth and rainforest for logging.

**There needs to be an independent expert review of the criteria and methodology for remapping rainforest and oldgrowth forest in a transparent and open process involving conservation groups. Both need 50m buffers.**

There are also requirements to protect Threatened Ecological Communities, though only those identified by LLS. These are not mapped and the EPA have previously proven that they were both incapable of, and unwilling to, identify them, even going so far as to wrongly delete mapped nationally endangered lowland rainforest. The LLS have similarly demonstrated they are incompetent for this task, with the Auditor General in 2019 finding *LLS staff do not have expertise to identify Threatened Ecological Communities.*

**As had to be done on public lands to stop their logging, there has to be expert mapping of Threatened Ecological Communities across private lands. At the very least LLS should be required to map them as part of the preparation of a property plan.**

Wetlands, heathlands and rock outcrops, along with 20m buffers, are also required to be protected, though similarly these have been found to be poorly identified in the past with qualifying areas and buffers frequently logged. There can be no guarantee that they will be protected in logging operations unless LLS put significant resources into mapping them.

**LLS needs to ensure that accurate mapping of wetlands, heathlands and rock outcrops is undertaken as part of the logging plan.**

The preparation of a Property Vegetation Plan should be regarded as an opportunity to undertake a full assessment of all environmental values and constraints, including undertaking surveys for threatened species, as well as identifying all potential management options. It is the opportunity for landowners to learn about the values of their properties, management options and opportunities for funding assistance.

NEFA considers that the first step in the preparation of a PVP and FOP should be the mapping of areas of environmental significance (i.e. rainforest, oldgrowth, Endangered Ecological Communities, wetlands, stream buffers, rock outcrops, caves and mines, areas of potential Aboriginal significance, heritage items), as well as environmental constraints (steep slopes, areas of mass movement, erodible soils, weed infestations, dieback etc). This needs to be undertaken using both available data, Aerial Photographic Interpretation, and site assessments. It is essential that this include targeted surveys for relevant species requiring prescriptions.

It is also important that it identifies areas proposed for logging, areas for rehabilitation, proposed roads, stream crossings, log dumps and the like.

The current simplistic desk-top process that only identifies mapped streams, oldgrowth and rainforest (i.e. see the FOP in 3.2) is next to useless as it provides no information on most of the values requiring protection. While such a simplistic assessment may help the EPA pretend they have done something it does not satisfy requirements, and does not help the landowner appreciate what it is they are meant to protect and why.

This needs to be a genuine attempt to assist the landowner to identify all areas and species of environmental significance. It needs to be part of a learning process for the landowner that delivers real outcomes. It is no wonder that after the current shoddy assessments that Jamax Forest Solutions (2017) found "*Even though 73% of PNF landowners already have a PNF PVP through the NSW EPA before they meet a harvesting contractor, 78% of landowners understand very little (0-20%) about the PNF requirements".*

NEFA considers that forests have numerous non timber values, such as flora and fauna habitat, carbon sequestration and storage, attracting rainfall, regulating stream flows, recreation and spiritual values, that should be considered as part of any assessment of forests. Any fair-dinkum assessment should consider these vales and identify all opportunities for landholders, not just forestry, such as conservation covenants, funding for bush rehabilitation, funding for habitat protection (i.e. core Koala habitat), biobanking, stewardship payments, and the potential for carbon credits for avoided emissions. The Government needs to consider stewardship payments and assistance for the protection of high conservation value areas.

**It is considered that preparation of a Property Vegetation Plan should require a full assessment of all environmental values and constraints, including surveys for threatened species, as well as all potential management options, not just forestry, including funding for bush regeneration, assistance with habitat protection (i.e. core Koala habitat), stewardship payments, biobanking opportunities, funding for avoided carbon emissions, etc. The preparation of a PVP should be treated as an opportunity to inform land owners of the values of their properties and the range of management options, rather than a shoddy desk-top review aimed at promoting the single use of logging.**

### 1.1.1. Rainforest

The arrival of Europeans resulted in extensive clearing and degradation of the surviving rainforests. Widespread logging changed their structure, dried them out and increased their flammability. Decades later many stands are still struggling to recover.

The relatively small remnants left are packed with survivors from the ancient forests. Rainforests now cover only about 0.25 per cent of Australia, yet they contain about half of our plant species and a third of our mammals and birds.

The exceptional importance of NSW's rainforests is recognised by parts being created as the Gondwana Rainforests of Australia World Heritage Area.

Rainforest's resilience to fire is primarily due their dense canopies maintaining a moister microclimate. Last year was Australia's hottest and driest year on record, resulting in north-east NSW's rainforests becoming unusually dry and flammable.

**Burnt Rainforest at Tooloom National Park**

The NSW Government's mapping of fire extent and canopy scorch (GEEBAM v2) shows that some 160,000 hectares (35%) of north-east NSW's 462,000 ha of rainforests were burnt last fire season. For this assessment reliance is placed on DPIE's GEEBAM v2 that is adapted specifically to account for rainforest, rather than the more recent and grossly erroneous FESM v2 mapping (see below). This was clipped with CRAFTI mapped rainforest for north-east NSW, north from the Hunter River. Based on this and my limited ground truthing:

- 34,000 ha of rainforest has had its 'canopy fully affected', with the understorey fully burnt and the loss of most canopy trees.

- 91,000 ha has had its understorey extensively burnt, with the bases of many trees damaged (which is likely to cause ongoing fungal problems and mortality), and 'partial' canopy loss.
- 47,000 ha has been variably burnt, with some areas unburnt and other areas with extensive understorey burning and damage to the bases of many trees, and some loss of canopy trees. For the purpose of this preliminary review it is assumed that 36,000 ha may have burnt.

It is frightening that with only one degree of global heating over a third of these priceless relicts burnt in one year. Across the fire-grounds most leaf litter, logs and understorey plants were burnt, along with their inhabitants. Many tree bases were damaged. Even riparian areas burnt.

Most worrying is the significant loss of large canopy trees, hundreds of years old, across 125,000 ha of rainforests. Those areas heavily burnt will struggle to regenerate. Some stands are unlikely to ever recover, further diminishing our rainforest heritage.

From her investigations of burnt Tasmanian rainforests, Barker (1990) concluded "*The results suggest that burnt rainforest would be very susceptible to further fires because of the dense cover of highly flammable non-rainforest species present*".

A 1989 study (Bennett and Cassells 1989) of rainforest patches in the Apsley-Macleay Gorges found that the effects of fire were likely responsible for restricting their extent, and that "*the majority, just over three quarters of the total area of rainforest, is highly prone to fire*", noting that an expert workshop:

> *... considered that "unmanaged" fire was indeed a significant factor controlling the distribution of dry rainforest in the Gorges. It was also concluded that dry rainforest expansion would be promoted with a reduction or total cessation of burning.*

The size of rainforest patches is an indicator of their vulnerability to fire. Bennett and Cassells (1989) note:

> *The configuration of patches (i.e., their shape, size and area perimeter ratio) is thought to be the primary variable influencing their fire susceptibility. For example, it appears that the significance of and potential for fire damage was greater for the smaller and more linear shaped dry rainforest patches and less for the larger, more compact patches. Furthermore, the greater distance of boundary relative to the patch area (characteristic of the smaller, linear shaped patches and reflected in the measurement of their area: perimeter ratio) ensure that potential fire impacts would be significant to the integrity and continued existence of the patch as a whole. The protective nature of the rainforest microclimate is less well developed in these patches and would be likely to break-down more rapidly than in the larger, compact patches with high area : perimeter ratios.*
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> *The current configuration of a patch may, in addition to indicating its current fire susceptibility, also reflect the past impact of fire. Indeed, patch configuration may largely be the result of fire superimposed on other controlling factors, including edaphic and topographic condition*

With climate heating increasing droughts, temperatures, heatwaves and extreme fire weather, many of our relictual rainforests are under a looming threat to their continued existence.

Some 230,000 ha within 100m of rainforest stands also burnt. These encompass vital buffers, characteristically with an overstorey of eucalypts and an understorey of hardier rainforest species.

These transition zones are essential to maintain rainforest microclimates, reduce fire threat, and provide complementary habitat and resources for some species. Their degradation increases the drying of rainforests and vulnerability to the next fire.

**Given the role of logging in increasing forest flammability, including by facilitating lantana invasion, it is essential that as a minimum 50m buffers are placed around all rainforests from which logging is excluded. Such buffers should be a focus for lantana control and the removal of debris from previous logging.**

### 1.1.2. Oldgrowth

As identified in NEFA's submission on the PNF review, we have no confidence in the remapping process for oldgrowth forest on private lands. As expected the LLS has simply ignored our concerns. They are reiterated herein.

**It is outrageous that the PNF criteria for remapping oldgrowth does not recognise that some forest types (particularly those dominated by Brush Box, Turpentine and some Angophoras) do not typically have senescent crowns (i.e. dead branches) when they reach ecological maturity. The exclusion of ecologically mature stands of such forest types from being identified as oldgrowth forest is a deliberate contravention of the national criteria. Similarly the application of criteria developed for application to 1:25,000 aerial photographs to ADS40 imagery where more regrowth is visible is an intentional rorting of the methodology.**

**There needs to be an independent and open expert process to review mapping criteria for oldgrowth forests taking into account the extent to which mature trees of different species display senescence and the increased visibility of regrowth trees with improved imagery. Given the evidence of incorrect re-mapping the LLS also needs to review the accuracy of current mapping.**

The National Forest Policy (1992) required that "*relevant State agencies will, as a matter of high priority, undertake assessments of forests for conservation values, including old-growth values*" and that a " *comprehensive, adequate and representative reservation system to protect old-growth forest and wilderness values will be in place by the end of 1995*". The NFPS defines old-growth forest as:

> *Forest that is ecologically mature and has been subjected to negligible unnatural disturbance such as logging, roading and clearing. The definition focuses on forest in which the upper stratum or overstorey is in the late mature to over mature growth phases.*

The national forest reserve criteria (JANIS 1997) adopt the operational definition:

> *Old-growth forest is ecologically mature forest where the effects of disturbances are now negligible.*
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> *In applying this interpretation to a forest ecosystem within a region, the following principles will apply:*
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> - *Ecological maturity is defined by the characteristics of the older growth stages*
> - *If data are available on the structural, floristic, and functional qualities that would be expected to characterise an ecologically mature forest ecosystem, these data should be used in the assessment of the significance of disturbance effects.*

- *Negligible disturbance effects will be evident in most forests by a significant proportion of trees with age - related features and a species composition characteristic of the ecologically mature forest ecosystem.*

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. 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.

NEFA considered that by then over 8 thousand hectares of mapped oldgrowth forest were likely to have been remapped as not being oldgrowth, and thus been made available for logging, in numerous 15 year Property Vegetation Management Plans. The reviewer hoped that improved imagery and hardware, combined with fieldwork, and regular peer review would increase the accuracy and reliability of DECCWs remapping.

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. ...*
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> *...*
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> *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 disgusting that the current rules still do not allow for species not displaying obvious signs of senescence in their canopies. 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*".

It also needs to be recognised that the decision rules relating to >10% senescence and <10% regrowth (tA and tB) were specifically derived for attributes visible on the 1:25,000 'wet film' aerial photographs available at that time. 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.

The mapping unit of OEH has also come under strong criticism internally and externally for its secrecy and unreliable vegetation mapping (Campbell 2012, Hunter 2016, Benson 2016). Given their history, unreliability and unaccountability, NEFA has no confidence in the OEH remapping of oldgrowth forest or rainforest.

### 1.1.3. Lantana Invasion and Dieback

In keeping with its "rigorous" nature of the PNF Code, over half of "plots" are required to be "stocked" with something (no details specified yet, maybe cattle?) within 2 years of logging.

**Within 2 years of logging over 90% of plots should be required to have adequate regeneration to restore the original tree canopy.**

In keeping with the principles of ESFM landholders "may" manage pests and weeds. Even if the forest is on its last legs due to lantana and dieback there is no requirement to do anything. This lackadaisical approach is the antithesis of ESFM.

**There must be a requirement to identify areas badly affected by weeds and dieback as part of the logging plan, along with explicit details of how those areas will be rehabilitated and minimum regeneration standards.**

Lantana 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. The NSW Scientific Committee has listed the 'Invasion, establishment and spread of Lantana (*Lantana camara* L. *sens. lat*)' as a Key Threatening Process, noting *"There is a strong correlation between Lantana establishment and disturbance ..., with critical factors being disturbance-mediated increases in light and available soil nutrients".*

Logging, fire and cattle grazing are significant contributors to the successful invasion of lantana (Gentle and Duggin 1997, Raizada and Raghubanshi 2010), 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). Gentle and Duggin (1997) concluded "*The effects of biomass reduction and soil disturbance associated with fire and cattle grazing are significant in the successful invasion of* L. Camara". This is supported by Wardell-Johnson et. al. (2006): "*the proliferation of dominant understorey weeds, such as Lantana (Lantana camara), in the north-eastern region of NSW has largely been attributed to the disturbance caused by logging and associated activities".*

The evidence is clear that by opening up the overstorey and disturbing the understorey logging can facilitate the invasion and spread of lantana and thereby initiate and promote Bell Miner Associated Dieback (BMAD). Logging's legacy lasts well after the harvest, with

lantana and BMAD still present and expanding in National Parks where logging was stopped over 20 years ago.


**Severe BMAD affected forest in Donaldson SF (note the obvious dead trees), 9 years after "restoration" works.**

Bell Miner Associated Dieback (BMAD) is spreading through our forests as a consequence of logging opening the canopy and promoting understorey dominance by lantana. It is principally a problem of wet forests and gullies, though is increasingly affecting surrounding forests subject to lantana invasion. For over two decades the Forestry Corporation have intentionally procrastinated over the causes and management of BMAD so that they can go on logging affected and susceptible stands.

The “moist hardwood” forests have long been recognised as a management problem due to difficulty in achieving regeneration of the eucalypt component following logging as a result of competition from rainforest elements or weeds (e.g. van Loon 1966, Forestry Commission 1982, King 1985). The NSW Forestry Commission (1982) notes *“The Moist Coastal Hardwood types can be among the most difficult in the state to regenerate successfully. The dense rainforest understorey precludes hardwood regeneration without major disturbance; some of the most important species are relatively slow growing in their younger stages; weed growth after disturbance can be prolific and vigorous.”* The more developed the rainforest component, the harder it is to achieve eucalypt regeneration (i.e. Forestry Commission 1982).

State Forests (1995) identified moist hardwood forests as 'Potentially High Yielding, Difficult to Manage Forest', one of three categories (along with 'Low Wood-Yield Forest' and 'Geographically Remote Forest') for consideration for exclusion from the core productive forest estate on the basis that:

> *"Under the current restrictions that apply to logging intensity, many past and current areas of potentially high wood productivity such as moist hardwood and rainforest ecotone forest cannot be satisfactorily regenerated back to the same stand level of sclerophyll species following logging. Generally, the light logging practised in these forests has the*

*effect of promoting either the mesophyll (rainforest) component or a viney, weedy component. Either way, the effect is one of reducing the sclerophyll component and lowering commercial productivity."*

The NSW Scientific Committee's (2008) final determination for listing 'Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners' as a Key Threatening Process notes that:

> *Broad-scale canopy dieback associated with psyllids and Bell Miners usually occurs in disturbed landscapes, and involves interactions between habitat fragmentation, logging, nutrient enrichment, altered fire regimes and weed-invasion (Wardell-Johnson et al. 2006). ... Over-abundant psyllid populations and Bell Miner colonies tend to be initiated in sites with high soil moisture and suitable tree species where tree canopy cover has been reduced by 35 – 65 % and which contain a dense understorey, often of Lantana camara.*

Stone et. al. (1995) found that *"The vast majority of plots (97%) had been exposed to some degree of logging and were on their second or third rotations ... A possible long-term explanation of why the dieback problem may be increasing, is that the proportion of moist sclerophyll forest being exposed to selective logging is increasing throughout the State."*

Wardell-Johnson *et. al*. (2006) identify that many authors who have studied BMAD have identified logging as a cause, noting:

> *Hence, logging operations may be both implicated in the development of BMAD, and affected by changes in yield induced by BMAD. Nevertheless, the literature remains very limited concerning the impacts of logging and associated disturbance on the initiation or development of BMAD.*

Based on her research for the Forestry Corporation and review of the literature, Stone (1999) put forward a conceptual model for BMAD identifying logging as a primary cause:

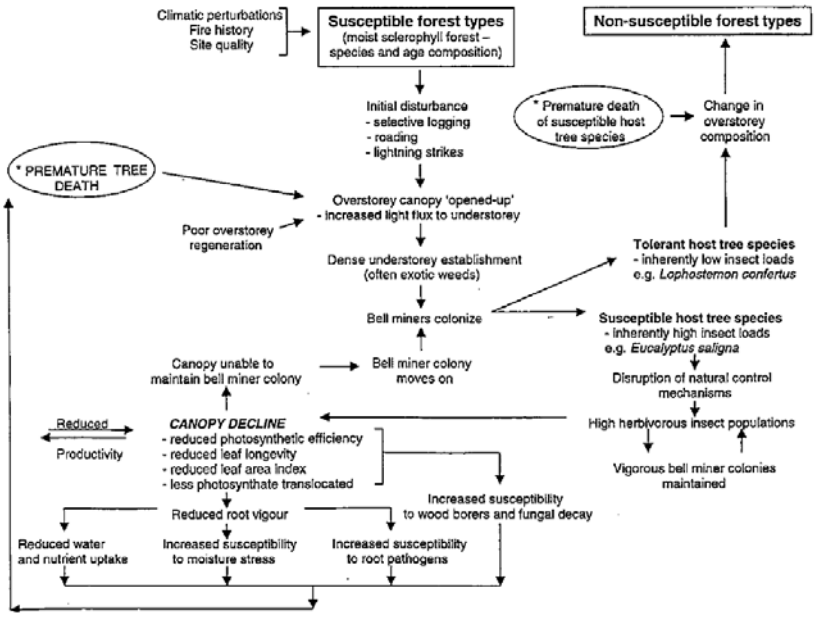
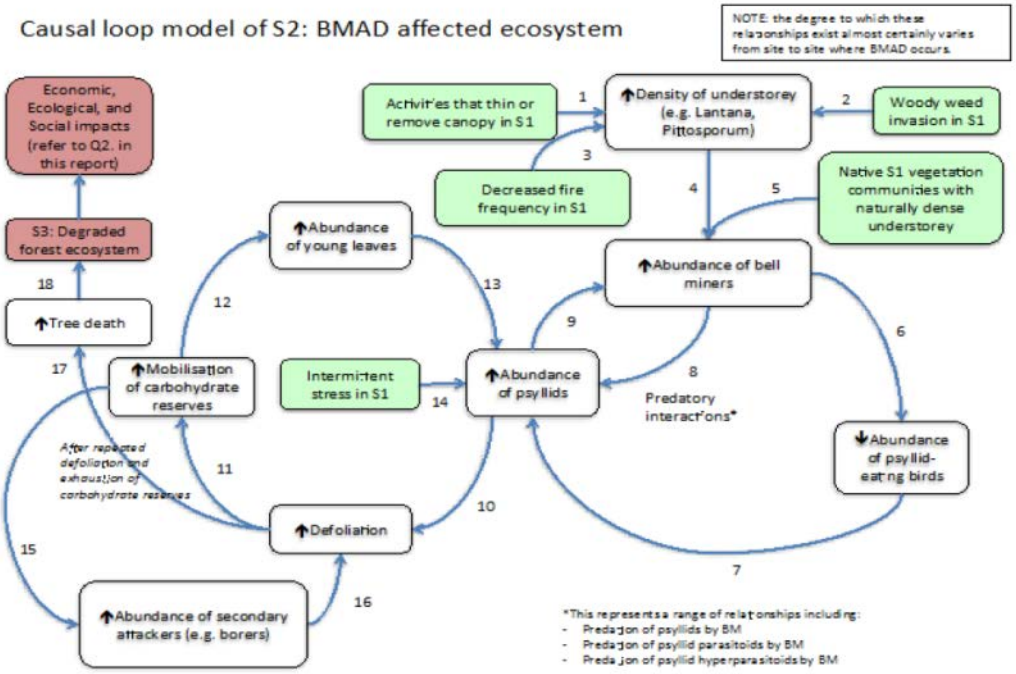



**Figure 1.** A conceptual model illustrating possible relationships and several feedback loops between processes which may contribute to canopy dieback associated with bell miners in moist eucalypt forests.

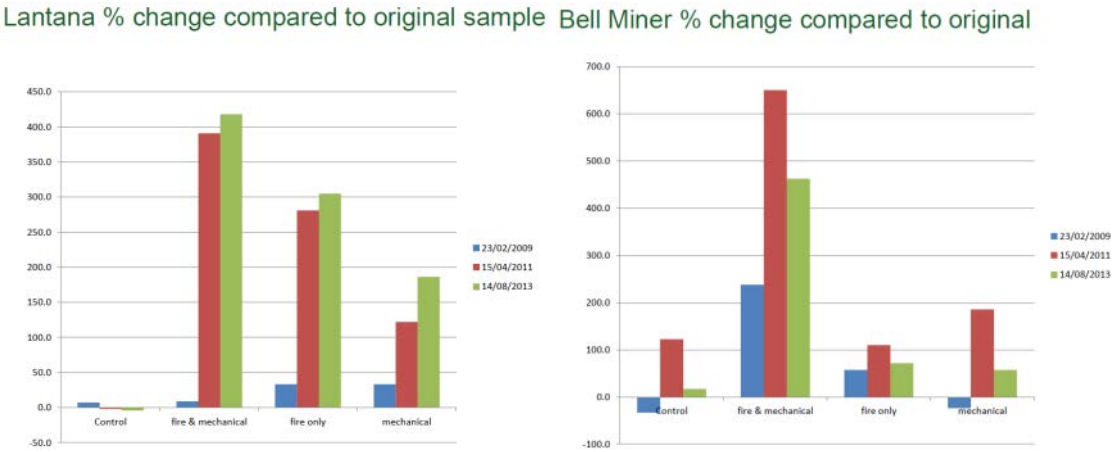
NSW DPI recently completed another literature review of the causes of BMAD (Silver and Carnegie 2017). They derived yet another conceptual model, which yet again identifies "activities that thin or remove canopy" as the primary cause of BMAD.




Under the auspices of the Bell Miner Associated Dieback Working Group the then State Forests established management "trials" of BMAD in compartments Donaldson State Forest in 2005 and Mt Lindesay State Forest in 2007, utilising some $117,000 of Environmental Trust monies, with 120 monitoring plots established and commitments to 15 years monitoring. Only the initial 2 years results for Mount Lindesay were written up by the Forestry Corporation (St.Clair 2010), and it was only because of NEFA's complaints about the lack of monitoring and reporting (i.e. Pugh 2014) that the Forestry Corporation (2015) was forced to collate at least some results (though only a brief PowerPoint presentation), claiming many of the records were missing.

**ABOVE Photos of BMAD in Donaldson SF taken in May 2014.**

It is no surprise that the Forestry Corporation tried to suppress the results (and still tries to) as the Donaldson Trials clearly show that the use of mechanical and fire treatments together resulted in 420% increases in lantana and 460% increases in Bell Miners after 8 years (FCNSW 2015), and the Mt. Lindesay trials found that logging increased lantana 145% and Bell Miners 104%, after 6 years (averaged across all plots, including those not affected by BMAD).




**The Forestry Corporation (2015) results for Donaldson State Forest.**

**Logging of BMAD affected forests in Yabbra State Forest in 2009.**

It is recognised that stress may be a factor involved in the proliferation of BMAD and that BMAD becomes worse during periods of low rainfall (i.e. Stone 2005, Jurskis and Walmsley 2012, Silver and Carnegie 2017). This suggests that global warming, with its increasing temperatures, skyrocketing evaporation and intensifying droughts is likely to be a major contributor to increasing BMAD.

The latest subjective aerial mapping of BMAD (undertaken from 2015-17) (Silver and Carnegie 2017, and subsequent updates) is claimed to have covered some 1,250,000 hectares of forest north from Taree, with 44,777ha of BMAD mapped. Comprised of 17,005ha on State Forest, 12,822ha on National Park, 1,540 on Crown Land, 12,885ha on private property and 525ha on plantations.

One problem is that comparison with 2004 mapping of the western Border Ranges undertaken by the same mapper using similar methods identified very different results, with

only a 13% overlap between the two mappings. This and other evidence suggests that the 2017 mapping has grossly under estimated BMAD extent, by some 40% if the 2004 mapping has any credibility.

There has also been no recent BMAD mapping south from Taree. yet past mapping has identified significant areas of BMAD in that region, it would be reasonable to assume that a third of BMAD occurs south of Taree. Given these considerations it is reasonable to assume that there are over 100,000 ha of BMAD affected forests in north-east NSW.

NEFA's extensive experience with BMAD leaves us in no doubt that logging and associated disturbances are the principal factor responsible for the alarming spread of BMAD through our forests. The solution to BMAD is to stop logging affected and susceptible forests and to rehabilitate affected areas to reduce their suitability for Bell Miners.

The solution to BMAD is to remove the lantana (or other low dense vegetation) component, thereby removing the habitat favoured by Bell Miners and allowing for regeneration.

Stone (2005) states:

> *If bell miners are responsible for a breakdown in the top-down processes maintaining the insect herbivore populations at non-damaging levels, then management options could concentrate on reducing or removing at least one of the habitat factors favoured by bell miners.*

Wardell-Johnson et. al. (2006) concluded:

> *...It may be appropriate for management to prevent the creation of habitat that is preferred by the Bell miner, as such habitat will also facilitate the primary cause of eucalypt dieback. However, to attempt such management intervention in isolation from an understanding of both the processes and the behaviour of Bell miners under different levels of disturbance may compound the problem.*

From his work in Donaldson and elsewhere in the region, Mews (2008) observed *"It is apparent that there is reluctance by NSW government to deal with this phenomenon and to recognise the linkages between BMAD and poor management practices".* He concluded:

> *There is evidence that bottom up factors such as soil nutrients, physical and structural properties play an important role in allowing or encouraging BMAD to occur and these processes. However it will most likely be easier to influence populations of* M. melanophrys *in most cases by physical manipulation of their habitat rather than the soil directly"*.

**Given the abundant evidence that logging is the primary cause of Bell Miner Associated Dieback, and that re-logging affected forests makes it worse, it is well past time that the logging of BMAD affected and susceptible forests is stopped and the process of restoration begun.**

# 2. LOGGING INTENSITY AND TREE RETENTION

Maintaining, or restoring, a multi-age forest that provides the full range of age classes, along with the understorey attributes, that characterise the natural ecosystem is the basic requirement to be able to claim ecologically sustainable forestry. Having the full range of tree age classes is the only way to provide the range of resources that the full diversity of fauna rely upon.

Because there is effectively no protection for threatened species, reliance has to be placed upon silvicultural prescriptions to provide essential resources for fauna across the net logging area. In the absence of records for threatened species, the only measures applied are basal area retention, retention of some oldgrowth trees, retention of a mature recruitment tree for each hollow-bearing tree and the retention of nectar feed trees of any size.

The sivilcultural prescription for single tree selection is to *"not reduce the stand basal area below 10m2/hectare across the harvested area"*. This is a massive reduction from the 12-14$m^2$/ha previously required for forests <25m tall, and 16-18 $m^2$/ha for forests over 25m tall.

**Reducing the minimum basal area retention requirements down to 10$m^2$ per hectare is outrageous and allows for far too intensive logging, at the very least the minimum basal area retentions from the previous PNF Code must be reinstated.**

For clearfelling the sum of canopy openings must at no time exceed 20% of the net harvestable area, with widths of openings less than two tree heights, though there is no minimum time between clearing, meaning that effectively 20% could be clearfelled every few years.

**Clearfelling must not be allowed.**

Forests are naturally multi-aged, in general they are composed of individuals or cohorts from a range of age classes resulting from past disturbances. These regeneration cohorts can result from past disturbances, such as wildfires, and go through a self-thinning process as they age. Forests are thus naturally multi-aged.

Mackowski (1987) and Smith (1999) provide evidence that in natural forests there is a natural mortality rate in the order of 50% of trees between each age class, with mortality rates increasing with age and increasing due to declining site quality. This means that in a natural forest, in order to retain one tree in an age class, there is a need to retain at least twice as many trees in the next youngest age class. Mackowski's (1987) assessment was that Blackbutt forests had a 50% mortality between 80 year age classes.

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).

These generalised stand descriptions are indicative and do vary, particularly in the tall wet forests with rainforest understories where major disturbances are rare events. For example data for high productivity oldgrowth on the Richmond Range (Table 2) show a similar distribution of stockings by age classes, though with more individuals in the 60-99 cm size classes and correspondingly less in the 40-59 cm size class.

**Table 2. Stocking of diameter classes in predominately oldgrowth forest in the Duck Creek area on the Richmond Range (from State Forests' Urbenville EIS)**

| Productivity Class | 40-59 | 60-79 | 80-99 | >100 |
|---|---|---|---|---|
| **4 high** | 26.8 | 18 | 19.2 | 12 |

To obtain a reference sample of unlogged Spotted Gum forest, NEFA measured 2 transects comprising 12x500m$^2$ plots in CRAFTI mapped oldgrowth forest in Banyabba State Forest. Their basal areas varied from 34.4 - 47 m$^2$/ha, giving a combined average of 40.7 m$^2$/ha. Individual plots recorded up to 57 m$^2$/ha.

**Summary of plot results for unlogged forest in Banyabba State Forest**

| | **Trees per hectare (by DBH classes in cm)** | | | | | | | **Basal Area** |
|---|---|---|---|---|---|---|---|---|
| | 10-19.9 | 20-29.9 | 30-44.9 | 45-59.9 | 60-79.9 | 80+ | TOTALS | m$^2$/ha |
| **Banyabba 1** | 326.6 | 50 | 23.3 | 43.3 | 26.7 | 10 | 480 | 34.4 |
| **Banyabba 2** | 223.3 | 33.3 | 33.3 | 46.7 | 36.7 | 20 | 393.3 | 47.0 |
| **AVERAGE** | 275.0 | 41.7 | 28.3 | 45.0 | 31.7 | 15.0 | 436.7 | 40.7 |

NEFA also sampled plots in logged Spotted Gum forests to assess current structure. In Braemar State Forest 29x475.3m$^2$ plots on four sites were assessed, 14x500m$^2$ plots at 2 sites in Royal Camp State Forest, 9x500m$^2$ plots in Carwong State Forest, 12x500m$^2$ plots at 2 sites in Ellangowan State Forest, and 11x500m$^2$ plots on land Forestry Corporation bought for pine plantations adjacent to Royal Camp SF, giving an assessed area of 36,784m$^2$, with 1,337 trees measured on 75 plots.

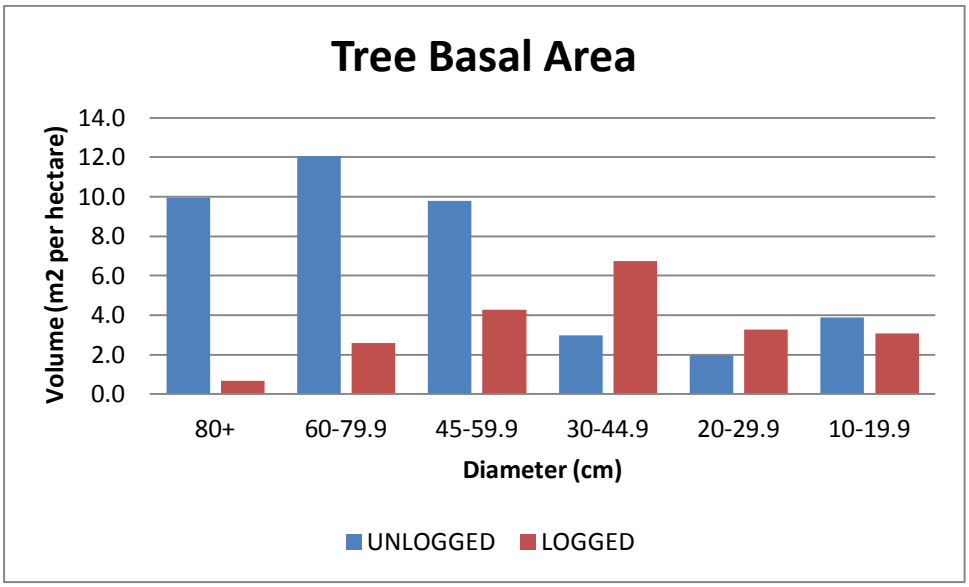
**Summary of plot results for proposed Sandy Creek Koala Park**

| | **Trees per hectare (by DBH classes in cm)** | | | | | | **Basal Area** |
|---|---|---|---|---|---|---|---|
| **STATE FORESTS** | **10-19.9** | **20-29.9** | **30-44.9** | **45-59.9** | **60+** | **TOTALS** | **m2/ha** |
| **Braemar** | 226.4 | 65.3 | 68.9 | 27.6 | 7.3 | 395.4 | 21.7 |
| **Royal Camp** | 230.0 | 84.3 | 65.7 | 10.0 | 4.3 | 394.3 | 18.5 |
| **Carwong** | 177.8 | 57.8 | 51.1 | 17.8 | 22.2 | 326.7 | 21.9 |
| **Ellangowan** | 128.3 | 68.3 | 60 | 15 | 8.3 | 280 | 19.0 |
| **Plantation Purchase** | 173.3 | 70 | 58.3 | 26.7 | 6.7 | 335 | 19.9 |
| **AVERAGES** | **187.2** | **69.1** | **60.8** | **19.4** | **9.7** | **346.3** | **20.2** |

Our structural plots indicate that there has been an overall decline of 25% of the number of trees over 30 cm dbh due to logging over the past century, with 79% of trees over 60cm dbh

and 57% of trees 45-60 cm dbh removed. NEFA identified a reduction in basal area from 40.7 $m^2$ per hectare down to 20.2 $m^2$. Halving of the biomass is part of the cost of a hundred years of logging, and can be costed as both the value of timber lost and the volume of carbon released to the atmosphere from the biomass and the soils.

Based on these data the unlogged forest has twice the basal area of the logged forests. The increased basal area of the small tree size of 10-19.9 cm dbh in the unlogged forest is primarily due to a high number of Forest oaks. The starkest difference is in trees greater than 45cm dbh, which is not surprising as these constitute the sought-after large high quality sawlogs. The logged forests have an average basal area of trees >45cm dbh of 7.6 $m^2$/ha, compared to a basal area of 31.8 $m^2$/ha in the unlogged forests, which is 4.2 times as much.




Comparison of basal area according to size class between logged and unlogged forests.

The difference between logged and unlogged stands is even starker when converted into biomass:

| | 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 | 372 | 186 | 93 | 47 | 465 | 233 |
| Logged | 157 | 78 | 39 | 20 | 196 | 98 |
| Reduction | 215 | 108 | 54 | 27 | 269 | 135 |

**It is clear that even with a basal area retention of around 20 $m^2$/ha the tree size classes, timber volumes, biomass and carbon storage in the forest have been dramatically reduced.**

**A reduction in retention to 10 $m^2$/ha is not by any measure sustainable, and is yet another undermining of the concept of ESFM that will greatly increase environmental impacts, particularly on wildlife habitat. In keeping with the LLS's lack of any environmental credibility, there is no increase in species/habitat specific protection to counteract the increased impacts of reduced tree retention on threatened species.**

The sustainable use of forests outside the reserve system that are identified as appropriate for timber production requires a whole new management model. The management model

has to be predicated on the maintenance and restoration of an uneven-aged structure throughout native forests used for timber production.

Attiwill *et. al.* (1996) recommended:

> *"Promotion of the north-east forests as a region for production of high value-added specialty hardwood products (poles, beams, floorboards, kiln dried furniture timber, and timbers of large size and strength) and biodiversity conservation, by management under low cost, low intensity (less than 35% canopy removal) selection logging techniques and discouragement of management for low-value products including scantling (housing frame), woodchips, and wood fibre."*

Smith (2000) goes to great lengths to outline the requirements for a sustainable silvicultural system. He considers that maintenance of uneven-aged forest structure with regrowth, mature and senescent elements is the best way to optimize both wood production and non-wood production objectives simultaneously. He notes:

> *"By maintaining an uneven-aged structure it is possible to sustain wood production and biodiversity values concurrently in the one stand. Biodiversity values are optimized with a higher proportion of senescent stems while wood production is optimized with a higher proportion of mature stems. A balance between biodiversity and wood production objectives is achieved by retaining a small percentage of senescent stems and selecting a minimum stocking of mature stems of high quality to grow into large stems (>70cm) in the late mature stage. Maintenance of uneven-aged structure in combination with low intensity (partial) logging enables most forest fauna species to persist within logged forests (Dunning and Smith 1986, Kavanagh and Webb 1998).*

Florence (1996) notes:

> *"Certainly, the uneven-aged forest offers the best scope for taking into account within the one stand, a range of management objectives. …A greater emphasis on the environmental factor would characterise a more intensive approach to selection practice. Such an approach would require a good ecological appreciation of species patterns and biological process in the forest, seek to achieve near-full production on all sites, and maintain diversity in the composition and structure of the forest.*
>
> *"There will be those who will argue that the concept of intensive selection silviculture in this way is too divorced from the present reality, the priorities of the State, financial constraints, and the availability of experienced field foresters. Nevertheless, thinking on the future of the forests should not be constrained by immediate demands on the forest and current management philosophies. State policies, management objectives and priorities may change as the forests become an increasingly valuable environmental resource, generating a professional responsibility to keep them in near peak silvicultural condition. Moreover, the forests are rich in species providing fine timbers offering combinations of strength, durability and attractiveness. If there are, as expected, higher value markets for them in the future, both domestic and export, the case for more intensive forms of uneven-aged forest management will become stronger."*

Butcher (1994) also recognised the need for maintenance of forest structure as a measure of sustainability:

> *"ESD (1991) supports these needs in stating that* '…to ensure that there is a constant supply of the largest-sized trees required … it is necessary to develop a desired age or size class structure.' (p.38) and 'Monitoring of the forest, and particularly comparison of actual forest structure with predicted structure, is an essential part of sustainable yield management.' *(p.39).*

*"Sustainable yield is therefore more critically related to sustaining a forest structure capable of supplying logs and other values than to the actual continuity of production flows. For example it is critical to continue to grow trees into the mature size classes if large diameter logs or trees with hollows are required, hence there need to be age classes continually contributing to provide the necessary perpetuation. This is most critical for those age/size classes which are hardest to replace, the large mature/senescent forest, or the climax community in a successional forest. Therefore to provide future communities with options forests at the regional level must still contain an appropriate proportion of these components."*

Smith (2000) establishes a baseline using data from unlogged or lightly logged stands (see Table 1), and then identifies retention rates that "*closely mimic patterns of natural disturbance",* according to percentages of regrowth, mature and hollow bearing size classes. Smith (1999) recommended minimum stocking levels for each size class at the following levels:

- *40% of the unlogged average stocking for mature (merchantable) size classes;*
- *50% of the average unlogged basal area for senescent tree size classes most likely to contain tree hollows or a minimum of five trees in the two median habitat tree size classes;*
- *70% (dry forest) to 100% (wet forest) of the unlogged stocking of small diameter stems.*

His retention rates are based upon size classes of trees and basal areas, varied according to four broad productivity classes. This methodology is aimed at managing forests primarily for the highest value large sawlogs.

Smith's retention rates are similar but lower than Curtin's idealised stocking for Blackbutt forest (Florence 1996), and as noted by Florence (2001, pers. comm.) "*is more or less consistent with the optimum stocking for a mixed species blackbutt forest as described by M.R. Jacobs in Growth Habits of the Eucalypts'"*. It is worth noting that Blackbutt is generally considered an "intolerant" species and thus requires less overstorey for successful regeneration than "tolerant" species.

**Table 3. Smith's (2000) proposed minimum retention rates (stems per hectare). Note that basal areas are for trees over 20cm dbh):**

| Productivity Class | Min Stocking 20-39 cm | Min Stocking 40-59 cm | Min Stocking 60-79cm | Min Stocking 80-99 cm | Min Stocking >100 cm | Minimum Basal Area |
|---|---|---|---|---|---|---|
| 1 | 50 | 12.5 | 4 | 2 | | 11 |
| 2 | 60 | 25 | 5 | 2.5 | 1 | 16 |
| 3 | 80 | 30 | 8 | 3 | 2.5 | 23 |
| 4 | 60 | 35 | 10 | 4 | 4 | 28 |

Smith (2000) also requires that canopy gaps do not exceed 25m diameter.

**Table 4. Curtin's idealised stocking for Blackbutt forest (from Florence 1996).**

| Productivity Class | Min Stocking 20-39 cm | Min Stocking 40-59 cm | Min Stocking 60-79 cm | Min stocking 80-99 cm | Min Stocking >100 cm | Minimum Basal Area |
|---|---|---|---|---|---|---|
| 3? | 67 | 31 | 14 | 7 | - | 22 |

It needs to be recognised that unlike the situation where Curtin and Jacobs were developing their retention rates, there are now requirements to incorporate other values into forest management. It is apparent that from a purely timber production standpoint that Smith's retention rates are close to optimum. There is a concern that from a wildlife standpoint they

are already sub-optimal, though they have the advantage of providing a retained framework for forests which is essential to support those trees needed to be retained for fauna in perpetuity.

Establishing minimum retention standards for each size class encourages the return of multi-aged stands over time. For example, in a stand dominated by 20-39 cm trees the land manager can remove a large number of these for timber, while still retaining some to grow into the next size class. Once they have grown sufficiently, they can again remove most of these while still being required to retain some to grow into the next size class, and so on. The end result is enhanced biodiversity values while still allowing for timber production.

In his advice to the Richmond Regional Vegetation Management Committee, Florence (2001) states:

> *Any regulatory process for uneven-aged forest must express silvicultural objectives, for example*
>
> 1) *to maintain a structurally diverse forest with trees through a range of size classes, including those trees needed to meet standards set for wildlife habitat, food and recruitment trees; and*
> 2) *to progressively improve the productive condition of the forest (consistent with ESFM principles) by*
>    - i) *retaining trees with good growth potential through the range of tree sizes and*
>    - ii) *ensuring regeneration is able to develop through the growth stages to maturity by creating canopy openings of an appropriate size.*

## 2.1. OLDGROWTH AND HOLLOW DEPENDANT SPECIES

**It is outrageous that the LLS have reduced requirements for retention of 10 live hollow bearing trees per hectare down to just 8 per hectare. Given the widespread depletion of old trees, including in the recent wildfires, all trees over 80cm diameter (dbh) must be protected.**

**There is still a requirement to protect a recruitment tree for every hollow-bearing tree, though these all need to be in the nett logging area, and to provide a reasonable chance of succession at least 2 recruitment trees need to be retained for every hollow-bearing tree to allow for ongoing mortality.**

The PNF Code still has a requirement to retain 10 hollow bearing trees per 2 hectares, where available, though this protection has be reduced by now allowing 2 of these to be dead. Previously it was explicitly stated " ***Dead standing*** *trees cannot be counted as hollow bearing trees*".

The Commonwealth's list of 119 priority species includes the hollow-dependant species Yellow-bellied Glider *Petaurus australis* Greater Glider, *Petauroides volans* South-eastern Glossy Black-Cockatoo *Calyptorhynchus lathami lathami,* Red-browed Treecreeper *Climacteris erythrops.* These are just a few of the hollow-dependant animals badly affected by the fires.

Once trees are over a century old they begin to develop hollows in their branches and trunks that provide essential homes for a multitude of Australian animals. Old trees have already been severely depleted by logging, wildfire, prescribed burning and drought.

Fires progressively eat away at the bases of old trees until they collapse, and old trees are often targeted for removal in wildfire control. Every fire removes more of our already depleted old hollow-bearing trees, and the homes they provide.

Across north-east NSW 851,847 ha (66%) of mapped oldgrowth forest was burnt last season, with 420,257 ha suffering significant canopy loss. The wildfires that ripped through north-east NSW's forests occurred when plants were stressed and leaf litter and logs unusually dry, making older trees with butt or root damage from logging or previous fires extremely vulnerable. There has been a significant loss of large old-growth trees across all fire grounds, from within oldgrowth stands and amongst the scattered survivors in logged forests. Given the accumulated damage to their bases over the centuries they are particularly vulnerable to being burnt out. At Terania Creek I observed numerous huge Brush Box, likely over a thousand years old, burnt out and collapsed.

There are numerous species occurring in north-east NSW that depend upon the large hollows provided by old eucalypts for nesting or denning. Before European intervention it has been estimated these forests had 13–27 hollow-bearing trees per hectare (Gibbons and Lindenmayer 2002). They have been subject to widespread clearing, and for years those not logged were ring-barked in the coastal forests to make way for regrowth. It is only in the past 20 years that logging prescriptions have required the retention of around 5 hollow-bearing trees per hectare, by then there weren't that many left in extensive areas.

Retaining the remaining hollow-bearing trees is essential for maintaining remaining breeding populations of hollow-dependent species in the forests. 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 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 new 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".*

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) 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 across north-east NSW's forests. The problems such fauna are facing is expected to exponentially worsen as the few remaining large old hollow-bearing trees (in both forests and pastoral lands) 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. 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.

Under the IFOA up until 2018 there were requirements to retain up to 5 hollow-bearing trees per hectare, with increases up to 8 per hectare near owls. The rules used to be to retain one of the next largest trees as recruitment trees for each hollow-bearing tree (up to a maximum of 5), as these are essential to replace hollow-bearing trees as they die. Under the new IFOA there are no requirements to retain any recruitment trees.

Logging results in significant damage to retained trees, which is compounded by fires, resulting in increased mortality of both hollow-bearing and recruitment trees. Tree retention requirements were a prescription for reducing hollow-bearing trees over time. This problem was compounded the Forestry Corporation's systematic failure to retain the large healthy trees required as recruitment trees. From a study of the effects of logging and fire on hollow-bearing trees on the Dorrigo, Guy Fawkes and Chaelundi plateaux, McLean *et. al.* (2015) concluded:

> *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. However in unlogged forest, fire was positively correlated to the density of hollows. Under a regime of frequent fire, in areas that have had some degree of logging activity, a net loss of hollows may occur. 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.*

Hollow-bearing trees are in decline across the landscape as they succumb to logging, burning, drought, and sometimes old age. There are even less big sturdy trees left to replace them as the next generation of hollow-bearing trees as these are the targets of logging operations, it will be a long time before regrowth will develop hollows again.

The fire control activities included widespread felling of mature and oldgrowth trees along roads and tracks after the fire on the spurious grounds of safety. This included the felling of numerous trees that represented no threat to property or road users. The fires were taken as an opportunity, for a variety of motivations, to cut down trees without environmental assessment in a landscape that had lost a significant proportion of essential hollow-bearing trees.


**Large mature trees with no significant fire damage cut down in a post-fire spree along the Summerland Way and other roads after the fire. These posed no threat of collapsing.**


**Left a mature tree and right a hollow-bearing oldgrowth tree, neither of which had structural damage because of the fire, or posed a risk, that were cut down in the Tooloom National Park World Heritage Area.**

**The wildfires have caused a major landscape wide reduction in big old trees, along with the hollows vital as homes for so many animals, by being killed in the fires, cleared in firebreaks and extensive felling post-fire. Nesting boxes are of some benefit, but the long-term solution has to be increasing the availability of natural hollows by allowing mature trees to age and decay gracefully rather than cutting them down. There needs to be a moratorium placed on logging any trees over 80 cm diameter while the impacts of the fires on hollow-dependent species are assessed, this would greatly assist the Commonwealth's priority species Yellow-bellied Glider, Greater Glider, South-eastern Glossy Black-Cockatoo, and Red-browed Treecreeper.**

## 2.2. NECTIVOROUS SPECIES

There is still a requirement to retain 6 nectar feed trees per 2 hectares where available, though once again there are no size limits - anything goes.

**Given that nectar yields increase exponentially with tree size It is absurd to not require a minimum size for eucalypt feed trees (even a seedling is allowable), all trees retained as nectar feed trees must be selected from the largest healthy trees available.**

**Given the likely loss of half the already critical nectar resources provided by mature trees due to fires across north-east NSW, and the time it will take for surviving trees to recover, it is essential that all mature eucalypt feed trees (across both burnt and unburnt forests) are excluded from logging as an emergency measure to stem the loss of nectar and the species that depend upon it.**

**The PNF Code requires increasing retention of eucalypt feed trees to 5 per-hectare "in areas" (?) where the Critically Endangered Regent Honeyeater and Endangered Swift**

**Parrot have been recorded. though has no requirement to look for them. Surely at least 5 mature feed trees per hectare should be retained in modelled habitat unless the landholder proves through appropriate surveys that they are not present.**

**The LLSs contempt for the survival of the Critically Endangered Regent Honeyeater and Endangered Swift Parrot, and all nectavores, is palpable. You should be ashamed of yourselves.**

**The increasing starvation of Flying Foxes caused by clearing and cutting-down their eucalypt feed trees has the effect of increasingly forcing them to move into towns for food. This increases conflicts with residents, and increases the chances of viruses being transmitted via domesticated animals to humans.**

Eucalypt species can produce copious nectar though most flower unreliably, often at intervals of several years, so nectivorous species need to be able to track nectar across the landscape or switch to other foods when nectar is in short supply.

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 flowering of trees and abundance of nectar is directly affected by rainfall over the previous 6 months (Hawkins 2017), reducing in droughts and following bushfires (Law *et. al.* 2000, Law and Chidel 2009, Moore *et. al.* 2016). 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*".

Researchers at Australia's Threatened Species Recovery Hub (Geyle *et. al.* 2018) recently identified that the Regent Honeyeater has 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 Endangered Swift Parrot *Lathamus discolor* had 53% of its modelled habitat in north-east NSW burnt last season, and it can be expected that most of its nectar resources were consumed over that area, with the surviving trees expected to have reduced flowering and

nectar for years to come. This is a major impact on the winter flowering resource for a nectarivore. 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)*

With half north-east NSW's forests burnt, there has been a significant loss of eucalypt flowers, with most of the surviving key nectar trees unlikely to recover for years. Many eucalypts don't flower until they are over 20 years old, and the abundance of flowers increases rapidly with age. It is the mature eucalypts that provide the abundance of nectar necessary for the survival of some of our most threatened species, from flying foxes to winter migrants, such as the critically endangered Swift Parrot and Regent Honeyeater.

Flying foxes are another key nectar feeding species, Ebby (1999) considers:

> *... more reliable resources are produced in lowland coastal woodlands in northern New South Wales and in southern Queensland dominated by E. tereticornis, E. robusta, M . quinquenervia and Banksia integrifolia (Clemson 1985; Pressey and Griffith 1992). In approximately 30% of years the only significant winter foraging resources available in New South Wales occur in coastal woodlands at low elevations and large numbers of flying-foxes congregate in these areas, as illustrated by this study. Grey-headed Flying foxes are known to migrate from camps many hundreds of kilometres away to utilize these winter resources (Ehy 1991).*
>
> *Grey-headed Flying-foxes are additionally impacted by incremental reductions in food availability throughout their range as a result of forest clearing and degradation, forestry practices, eucalypt dieback, drought, fire and the vulnerability of nectar flow to fluctuations in temperature and rainfall".*

Even before the fires got out of control in 2019 there were reports of flying foxes starving to death (in addition to mass deaths from heatwaves in previous years), an indication of the dire straits of many nectarivore, due to the combined effects of clearing and logging removing older trees, and the drought. Burning has compounded these problems by consuming buds and flowers, and will retard flowering for years to come. This is in addition to the loss of numerous large trees by being burnt down in fires, apparent mortality of many standing trees (pers. obs.), and the cutting down of numerous mature and hollow-bearing trees as fire control measures (both during and after the fires).

Landclearing and logging have significantly reduced the availability of nectar. Starving flying foxes demonstrate that the drought was already having a critical impact on flowering before the fires, and their subsequent retreat to unburnt areas illustrates the dramatic impact of the wildfires on nectarivorous species.

The increasing starvation of Flying Foxes caused by clearing and cutting-down their eucalypt feed trees has the effect of increasingly forcing them to move into towns for food. This increases conflicts with residents, and increases the chances of viruses being transmitted via domesticated animals to humans.

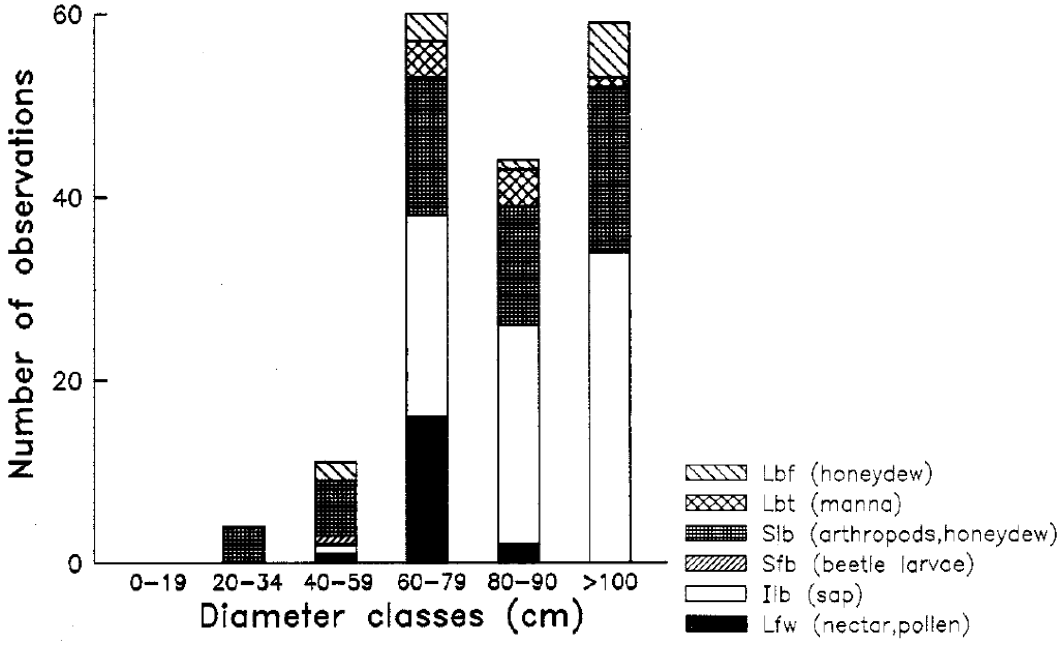
Yellow-bellied Glider and Squirrel Glider are two marsupials that have a high reliance upon older trees for the abundance of nectar and other resources they provide.

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.*

**Diameter classes of trees in which the different foraging behaviours of yellow-bellied gliders were observed (from Kavanagh 1987).**




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.*

The loss of nectar due to the fires affects many species that rely upon nectar as part of their diet, for example nectar and pollen were particularly important for Squirrel Gliders during winter and early spring (Sharpe and Goldingay 1998), with their populations varying with the number of flowering trees, and susceptible to crashing when key nectar trees fail to flower. From their study of Squirrel Gliders in Victoria, Holland et. al. (2007) concluded:

*The high density of large trees is a critical element of habitat quality. Not only were large trees preferentially selected for foraging, they also provide gliders with hollows for nesting (van der Ree 2000). Retention of large trees should therefore be a priority, and lack of regeneration is of serious concern, with trees not being replaced as they senesce.*

Until 2018 the IFOA covering State Forests required the retention of 3 mature eucalypts per hectare of species known to produce copious nectar as "eucalypt feed trees". This retention increased to 5 'eucalypt feed trees' per hectare in compartments with nectarivorous Swift Parrot, Regent Honeyeater or Black-chinned Honeyeater records, and was often adopted as the default in lieu of surveys in potential habitat. The new IFOA initially removed any need to retain eucalypt feed trees, though they changed this to the retention of 5 nectar trees per hectare within 2km of an existing record of Swift Parrot or Regent Honeyeater (given the limited records this will have little effect).

The PNF Code echoes this with a record of a Swift Parrot or Regent Honeyeater "*in an area of forest operations*" requiring "*At least ten eucalypt feed trees ... must be retained within every two hectares of the net harvest area*". Though the LLS didn't need to bother scrapping these prescriptions as they are a sham designed to pretend that something is being done when in reality without any survey requirements they are unlikely to ever be triggered, even when the species is present. Neither is there any definition as to what "*an area*" is, it could be anything you want it to be.

At least when the EPA had a similar requirement for public lands they required Forestry Corporation to survey in modelled habitat, or to retain 5 "*mature or late mature individuals*" per hectare in lieu of surveys. The LLS have no survey requirements or size requirements for retained nectar feed trees, effectively allowing seedlings to be retained.

The LLSs contempt for the survival of the Critically Endangered Regent Honeyeater and Endangered Swift Parrot, and all nectavores, is palpable. You should be ashamed of yourselves.

Law and Chidel (2007) found that while in good years eucalypts can produce a surplus of nectar, in poor years the limited nectar was rapidly consumed, leading them to observe "*Depletion of nectar in poor flowering years justifies management prescriptions that retain mature trees of locally important flowering species (currently six per ha) in the areas zoned for logging. The fact that total sugar content tends to be higher in lower slope areas (e.g. riparian zones) is also important in ameliorating logging impacts*".

# 3. THREATENED SPECIES

**While there are a variety of prescriptions required to be applied to mitigate impacts of PNF on threatened species they are only required to be applied to known records. There are few records of threatened species on private lands and no requirements to undertake pre-logging surveys, which means that in practice the locations of threatened species are rarely identified and the prescriptions rarely applied.**

**The PNF Code is a scam because there is effectively no protection for threatened species applied in the vast majority of PNF operations. There can be no doubt that the LLS's refusal to require surveys for threatened species, and thus protection for them. is intentional. Their contempt for threatened species is disgusting.**

**Prescriptions intended to reduce impacts on threatened species have been theoretically applied on public lands for over 20 years and on private lands for 12 years, yet there has never been any attempt to assess their effectiveness. This is a fundamental breach of 'adaptive management', one of the core principles of ESFM. Though the effectiveness of the species specific prescriptions is probably a moot point because the obvious intent is to not trigger them.**

**From the partial monitoring of a few plant species (without prescriptions) it is evident that even under controlled conditions logging results in significant impacts on threatened plants. A precautionary approach would require that logging exclusion zones are placed around all threatened plant species potentially vulnerable to the range of impacts associated with logging (i.e. physical damage, soil disturbance, microclimate changes, hydrological changes, burning, weed invasion, logging dieback), with logging only allowed after independent trials have proven that logging impacts can be appropriately controlled. Though this requires pre-logging surveys by competent botanists.**

**Not only have the LLS done nothing for fire effected wildlife in the recent fires, they don't intend to do anything in future fires. Such fire events will become more frequent and intense into the future due to climate heating. It is grossly irresponsible for the LLS not to recognise the compounding impacts of wildfire on wildlife and include contingency measures into the PNF Code.**

There Is a requirement for plans to include "recorded locations of any threatened populations or threatened ecological communities listed under the schedules of the Biodiversity Conservation Act 2016 and species in the Listed Species Ecological Prescriptions set out in Appendix A". 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.

Appendix A has species specific prescriptions for a large variety of threatened plants and animals, though there are few existing records on private lands and no survey requirements. This means that threatened species and ecosystems are usually provided with no protection what-so-ever in private forestry. If you don't look you don't find, if you don't find you don't protect. Excusing logging operations on private lands from any obligations for threatened species or ecosystems under the EPBC Act, with virtually nothing done to mitigate impacts on them, is the single biggest rort of the North East NSW Regional Forest Agreement.

At Whian Whian in 2013 the Forestry Corporation refused to accept site evidence as constituting a record (see NEFA submission to the PNF Review). In this latest version it has

been clarified that prescriptions are meant to apply to both records and site evidence, though as most of the species specific prescriptions still only refer to records it leaves their application ambiguous. **To overcome this problem this needs to be clarified in the glossary by defining 'record' to include 'site evidence'.**

The species prescriptions are theoretically better than what are applied to State Forests. For example the Koala prescription requires protection of 20m around Koala trees, and the retention of 15 Koala feed trees per hectare in the logging area. Though any site evidence of Koalas should trigger the prescription.

Though there is no requirement to look before they log. If you don't look you don't find and if you don't find you don't protect. There are few records for private lands so there is no protection for most threatened species.

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.

The LLS's failure to provide any actual protection for threatened species is deliberate. Excusing logging operations on private lands from any obligations for threatened species or ecosystems under the EPBC Act, with virtually nothing done to mitigate impacts on them, is the single biggest rort of the North East NSW Regional Forest Agreement.

Clear examples of the failure to identify threatened species in PNF operations are provided in the Case Studies 3.1, 3.2 and 3.3 in NEFA's PNF Review submission, the summary in Section 1.2 of that submission is relied upon for this submission.

**There has to be requirements for pre-logging surveys for threatened species using specified methodologies as part of the planning process for the prescriptions to be meaningful. Without surveys there is effectively no protection for threatened species which is the LLS's deliberate intent.**

The fundamental question is whether, if applied, a prescription for a threatened species is effective in reducing logging impacts to an insignificant level, or even whether it has any beneficial effects. As with public lands, the NPWS, DLWC and EPA have been applying prescriptions for threatened species in a haphazard way since the inception of the Endangered Fauna (Interim Protection) Act 1991 on the premise that the prescriptions would avoid "a significant effect". Though, as far as we are aware, there has never been any attempt to assess the effectiveness of prescriptions - the agencies just don't care.

Adaptive Management is a key requirement of ESFM, most Recovery Plans and Conservation Advices, and Forestry management plans yet it is not applied in practice. From well before the RFA, and repeatedly since, NEFA have been asking for Government agencies to monitor the effectiveness of prescriptions intended to reduce environmental harm. This has been a requirement of numerous recovery plans, including the Northern Rivers Regional Biodiversity Management Plan (a national multi-species Recovery Plan), which has an action

> *7.1.5. Develop appropriate criteria and indicators to review the effectiveness of threatened species protection measures currently employed in public and private native forestry activities. Strengthen threatened species protection measures where they are shown to be inadequate.*

The principle of monitoring a prescription and then using the results of that monitoring to improve the prescription is called adaptive management and is a basic tenet of ESFM. For example ESFM Principle 5 requires that "*ESFM would utilise the concept of adaptive management and continuous improvement based on best science and expert advice and targeted research on critical gaps in knowledge, monitoring or evaluation*".

Section 1.2 of NEFA's PNF Review submission details the only monitoring we are aware of for threatened plants, which is relied upon for this submission The examples for State Forests shows that over 20 years of the Threatened Species Licence the impacts of logging were only monitored and reported on for 5 species. Even then the monitoring was not commenced until long after the TSL came into effect, and often not reported on until years later. Even under the controlled monitoring programs, where monitored species were identified and presumably avoided, in all cases significant damage to the threatened species was recorded. Only one monitoring report for each species was undertaken, often despite claims that monitoring would be ongoing and the need to better identify the significance of impacts. Despite the monitoring finding significant impacts, prescriptions requiring buffers around plants were not adopted until 2018, often over a decade after significant impacts were identified, with indiscriminate logging allowed in the interim.

Since the PNF review over half north-east NSW's forests were burnt in the 2019-20 'black summer' though this event and the impact on wildlife seems to have escaped LLS's attention. It is apparent that the LLS's only reaction has been to increase logging intensity and reduce protection for the hollow-bearing trees which suffered high mortality in the fires.

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"*. So they have at least increased prescriptions in burnt forests. 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*".

Not only have the LLS done nothing for fire effected wildlife in the recent fires, they don't intend to do anything in future fires. Such fire events will become more frequent and intense into the future. It is grossly irresponsible for the LLS not to recognise the compounding impacts of wildfire on wildlife and include contingency measures into the PNF Code.

## 3.1. HASTINGS RIVER MOUSE

**The Hastings River Mouse is a nationally Endangered species, which had 82% of its know localities burnt in the 2019-20 fires, and for which the Commonwealth recommended protecting unburnt habitat and undertaking surveys. The Recovery Plan requires surveys , protection of habitat and buffers. Despite this the LLS effectively requires nothing to be done for this species, there is no requirement to survey, and in the unlikely event that one is accidently found the prescription required is not compliant with the Recovery Plan and has been found to be inadequate, even before the fires. This example clearly displays the contempt that LLS has for the survival of threatened species, particularly after the fires.**

**The LLS's PNF Code has no requirements for surveys to identify localities of Hastings River Mouse. There is modelled habitat identified that the LLS could require be protected unless adequate surveys show that the Hastings River Mouse is not present. This would be a responsible approach rather than the reckless abandonment of threatened species.**

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.

In 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.

The Expert Panel identified *'protecting unburnt areas within or adjacent to recently burnt ground that provide refuges*' as '*essential*'. The other essential action is to undertake surveys to identify how badly the Hastings River Mouse was affected by the fires before blundering about in its severely degraded habitat.

The Hastings River Mouse lives in dry sclerophyll forests that are naturally subject to infrequent burning events. There is conflicting evidence about the longer term effects of fire and logging, though there is agreement that they are adversely affected for some time following intense or frequent fires, as well as logging.

With 82% of its known localities burnt the Hastings River Mouse is one of the endangered species most severely impacted by the recent fires in Australia.

The PNF Code makes no allowance for the significant impacts of the fires. Its prescription has been found to be inadequate even without the compounding fire impacts. For private properties all modelled habitat should be immediately placed under moratorium while an effective prescription is developed.

The 2005 Recovery Plan for the Hastings River Mouse (Pseudomys oralis) includes as "Appendix 3. Interim Hastings River Mouse Management Guidelines":

> *Timber Harvesting*
>
> *Surveys: Pre-logging habitat and population surveys (Appendixes 1 & 2) should be carried out by the relevant agencies in areas not covered by the Integrated Forestry Operations Approvals for the Upper North East and Lower North East Regions.*
>
> *Timber Harvesting: Timber harvesting and associated activities should be excluded from areas of medium to high quality Hastings River Mouse habitat.*
>
> *Within a 200 m buffer around medium to high quality Hastings River Mouse habitat and mapped Hastings River Mouse corridors the following should apply:*
>
> - *if the area is unlogged or has not been logged since 1950 it will remain unlogged;*
> - *in other areas a minimum of six mature trees with basal hollows, or trees likely to develop basal hollows, per hectare will be retained; all burning will be excluded; and no fire wood collection should occur within 200 m of a known Hastings River Mouse population.*

For State Forests the Recovery Plan notes:

> *Specific prescriptions for the Hastings River Mouse state that where there is a record of the species in a compartment or within 800 m outside the boundary of the compartment the following must apply:*
>
> *a) Within 800 m of a record of the Hastings River Mouse, 'specified forestry activities' as defined in the IFOA, are prohibited from all areas assessed as moderate or high suitability Hastings River Mouse habitat.*
>
> *b) An exclusion zone of at least 200 m radius must be implemented around all records of the Hastings River Mouse.*

*The prescriptions dictate how targeted surveys for the Hastings River Mouse and habitat suitability assessments must be conducted. Hastings River Mouse microhabitat models (Smith & Quin 1997) used to determine the level of habitat suitability are included in the prescriptions (See Appendix 1).*

*There are potential threats from logging to Hastings River Mouse sites on private property. Issues relating to timber harvesting include road construction, use of heavy machinery, timber removal and burning to stimulate regeneration and limit wildfires (Smith et al. 1994).*

*Many of the identified threats to the Hastings River Mouse are intrinsically linked and the magnitude of the effect of one threat is often related to the presence or absence of other threatening processes*

The Private Native Forestry Code of Practice for Northern NSW contravenes the National Recovery Plan by not requiring pre-logging surveys, and not requiring identification and protection of medium to high quality Hastings River Mouse habitat. All that it requires is:

*Where there is a Hastings River mouse record within the area of forest operations or within 200 metres of the area of forest operations, the following must apply:*
*(a) An exclusion zone with a 200-metre radius (about 12.5 hectares) must be identified, centred on the location of the record, within which the following additional prescriptions must be implemented:*
*(i) No forest operations or removal of understorey plants or groundcover are permitted.*
*(ii) No post-harvest burning is permitted.*
*(iii) Disturbance to any seepage areas within or adjacent to the exclusion zone, as well as to ground logs, rocks and litter, must be minimised.*

The Recovery Plan (DECCW 2005) identifies that "*Eight percent of known Hastings River Mouse sites are located on private land. There is a high probability that additional populations are located on private land*". There are likely to be significant populations on freehold land as 21% of high quality habitat is modelled on freehold land.

The prescription applied to forestry operations on freehold land are a sham. Contrary to the Recovery Plan, the Private Native Forestry Code of Practice for Northern NSW ignores modelled habitat for this species and requires that a 200m exclusion area must be established around any known records. Because there are no requirements for surveys to locate this species (even in modelled habitat), and it is unlikely they will have been previously recorded on most private property sites where it occurs, this prescription will have absolutely no effect on most logging operations undertaken within occupied Hastings River Mouse habitat on private land.

In recent years the Forestry Corporation has done most research on Hastings River Mouse and because of their vested interest their dubious assessments are targeted at trying to show that logging is benign or even necessary. If many of the claims are accepted it is hard to fathom how such species survived until the loggers arrived.

Habitat alteration and fragmentation of Hastings River Mouse habitat is predominantly a result of frequent fire, forestry activities, clearing activities, grazing and weed infestation (DECCW 2005).

The Recovery Plan for the Hastings River Mouse (Pseudomys oralis) notes:

*High frequency fire is listed as a KTP under the TSC Act and is considered to be a threat to the Hastings River Mouse. Burning at intervals of less than five years is common in grassy open forests in northern NSW to promote pasture development and as a management tool to reduce the risk of wildfire. Frequent fire can simplify*

*and alter understorey composition towards a proliferation of fire-dependent species (S. Townley pers. comm.). Pre- and post-logging burning to promote eucalypt regeneration adversely impacts on the Hastings River Mouse through the removal of shelter provided by hollow logs. Fire also removes critical resources such as food and nesting sites and increases exposure to predation. ...*

*No experimental work on the response of the Hastings River Mouse to fire regimes is known. Current information is based on captures within sites that have been burnt by wildfires or by leaseholders for stock grazing. Thirteen individuals were captured at Boundary Creek in Forestland State Forest in 1986. The site was subsequently burnt by wildfire and three trapping surveys over eight years post-fire failed to trap any Hastings River Mouse. However, some 16 years later the Hastings River Mouse was captured in the area during 2001-2002. At Werrikimbe National Park three trapping surveys of a previously known Hastings River Mouse site have failed to locate individuals after fire.*

*...*

*Timber harvesting impacts adversely on the Hastings River Mouse by reducing shelter provided by hollow logs and old-growth stems with butt cavities. Harvesting activities also open up the understorey and create roads and tracks potentially leading to increased predation pressure. The Hastings River Mouse has been found in logged areas (Meek et al 2003), however, the largest and most stable populations located to date occur in unlogged old-growth forest (Townley 2000a).*

At Carrai and Werrikimbe, Tasker and Dickman (2004) undertook surveys to assess differences between small mammals at sites that had been grazed and burnt compared to sites with no evident recent burning or grazing, finding 3 Hastings River Mice at 2 grazed sites out of 6,705 trap-nights. This was too small a sample to analyse statistically, though Tasker and Dickman (2004) commented:

*The only two of our grazed/burnt sites at which this species was found had by far the highest number of logs and mid-storey shrubs ("Rolf" site), and the densest cover of ferns ("Fitzroy" site) of any of the grazed/burnt sites.*

*Thus, although the moderately frequent burning associated with many cattle-grazed areas produces an ideal food supply, too-frequent burning or more intense grazing (as in other grazed forests), may remove the essential shelter component for this species. The fire ecology of P. oralis is a topic that warrants further study and manipulative experimentation.*

The Forestry Corporation are strong advocates for the self-justifying (i.e., Pyke and Read 2003) argument that because Hastings River Mouse occurs in localities where logging or burning has occurred that such disturbances are benign or even necessary, as exemplified by Meek's (2003) statement "*where there has been a continuous history of burning, grazing and/or logging, P. oralis survives and breeds successfully*". (i.e. Meek *et. al.* 2003, Meek 2003, Law *et. al.* 2016).

As identified by Pyke and Read (2002) not all fire is equivalent as there are numerous variables associated with fires, they consider:

*The management of fire in and around P. oralis populations is likely to be particularly difficult to resolve because it may be an inappropriate fire regime (i.e., fire frequency, intensity and seasonal timing) rather than the presence or absence of fire that has adverse impacts on the species. As already noted, the presence of fire has been found to be associated with positive, negative or neutral impacts on P. oralis. The challenge will therefore be to determine fire regimes that are beneficial to the species.*

A Law *et. al* (2016) study firstly involved resampling Hastings River Mouse logging exclusions, identifying a decline in the total number trapped since the pre-logging surveys, leading them to conclude the results support their hypothesis that Hastings River Mouse declines *"when disturbance is excluded or too frequent*". Though their results are also open to the interpretation that the exclusion areas are inadequate to mitigate logging impacts, an interpretation is that supported by the apparent increasing numbers with time since logging.

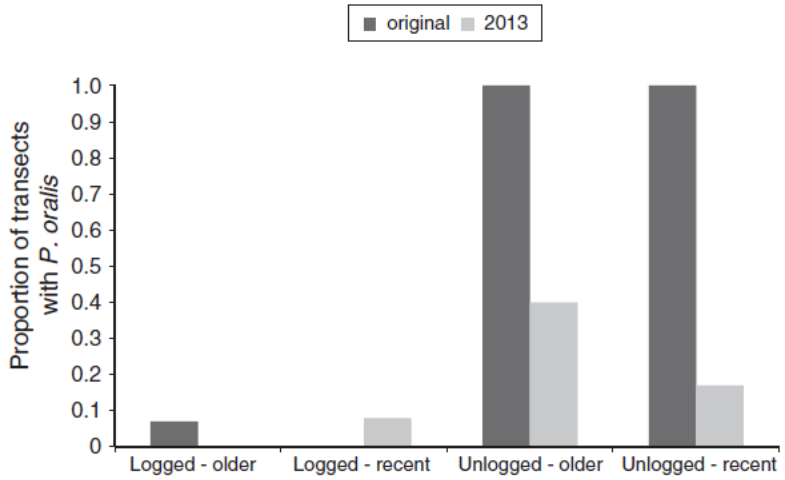



**Fig. 1. from Law et. al (2016). Proportion of transects at which Hastings River mouse, *Pseudomys oralis*, was caught in original pre-harvest and repeat surveys (2013). Older (7–15 years) and recent (2–6 years) refer to the time periods since the original surveys were undertaken. Unlogged refers to areas where the species was recorded originally and logging was excluded. Logged refers to areas where the species was originally absent but was subsequently logged.**

Law *et. al* (2016)'s interpretation is somewhat simplistic as there is apparently no consideration of other factors that could have contributed to the decline, such as logging around the exclusions or subsequent burning events or grazing. While Law *et. al* (2016) do not account for burning or grazing they recognise them as a significant unaccounted issue:

> *One of the key findings from our study was that our repeat survey in 2013 recorded few P. oralis individuals compared with the initial surveys, which were conducted either 2–6 years or 7–15 years previously. Many sites did not appear to offer suitable habitat for P. oralis, either because the original habitat model was not reliable (B. Law, T. Brassil, L. Gonsalves, pers. obs.) or because subsequent management rendered sites unsuitable. For example, extensive grazing and frequent burning have favoured simple and patchy ground cover dominated by blady grass, Imperata cylindrica, at some sites, such as in Chaelundi State Forest. This would partly explain the continuing low occurrence of P. oralis in 2013 at sites where the species was previously absent. Many of these sites were originally marginal for the species and remained so when we surveyed them. There are likely to be many factors at play leading to the lower numbers of P. oralis trapped in 2013, including some sites that were originally suitable subsequently being rendered unsuitable. For example, at one site (Marengo State Forest), seven P. oralis individuals were trapped originally on two transects in November 2010; however, the site was then burnt three times in 2 years by either arson or grazing leasees (J. Willoughby, pers. comm.) and no individuals were trapped in November 2013, when a patchy ground cover had recovered and floristic diversity was slightly above average. At another site, six P. oralis individuals were caught on one transect in 2009, whereas heavy grazing was evident at this site in 2013, resulting in closely cropped grass cover and a lack of P. oralis captures. These observations suggest that frequent disturbance that simplifies ground cover (Catling 1991) is detrimental for P. oralis. Dense ground cover and abundant shelter sites (e.g. logs, rocks) are recognised as key components of the*

*habitat of P. oralis (Townley 2000; Meek 2002; Meek et al. 2006), which is also consistent with the results of our PCA.*

Without accounting for all significant factors any conclusions from such data is spurious.

Law *et. al* (2016) undertook a second set of surveys "*targeting high-quality P. oralis habitat as determined by expert field inspection*" in areas that were no longer classified as high quality habitat under changes to the IFOA made in 2011 and thus "*logging was permitted under the IFOA*". It is perplexing as to why the EPA changed the rules, at Forestry's insistence, in 2011 to exclude such high quality modelled habitat. Though it is not surprising. Sites were stratified by time since logging: immediate (<1 year since logging, *n* = 1), recent (2–6 years since logging, *n* = 4), intermediate (7–15 years since logging, *n* = 3) and exclusion of logging (35–45 years since logging, *n* = 3).

Law et. al (2016) found that Hastings River Mouse is positively "*associated with a greater cover of heath, lomandra and logs and, to a lesser extent, floristic diversity*" and negatively associated with Bush Rats. They do note that "*rat numbers were high on some transects after logging*", though summarily dismiss it as an inconvenient fact.

Most relevantly they found a total of just 27 Hastings River Mice on the sites with "*a four-fold greater number in intermediate-logging sites than in logging-exclusion sites (Dunnett's test, P < 0.05), whereas recently logged sites were in between (Dunnett's test, P > 0.05). In addition, the single site (two transects) surveyed less than a year after logging recorded no P. oralis".* In summary Law *et. al* (2016) state "*We found that recovery after logging was rapid, peaking ~15 years post-logging, but then declining beyond 35–45 years post-logging*".

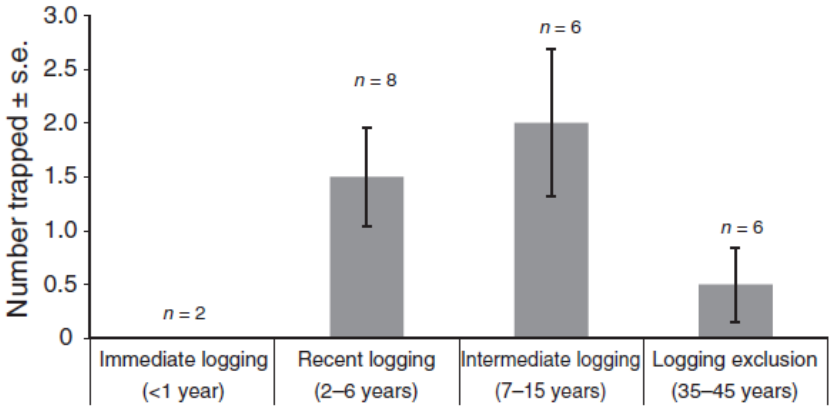



**Fig. 3 from Law *et. al* (2016). Mean number of Hastings River mouse, *Pseudomys oralis*, trapped per transect at different times since logging.**

As there are no baseline pre-logging data, and so many potential variables that could have affected these results it is hard to fathom how Law *et. al* (2016) could conclude that their findings just relate to time since logging. Yet again the influence of fire is recognised, but not accounted for. Law *et. al* (2016) observe "*Three sites had bare ground generated by recent fire and these were characterised by an absence of P. oralis and other small mammals*", and "*Binns (1995) observed in the Dorrigo forests that unlogged areas were, on average, less recently burnt than were logged sites and this could have contributed to the decline of P. oralis we documented in our surveys where logging was excluded*".

Law *et. al* (2016) hypothesise:

> *Initially, P. oralis is likely to be absent or rare in the 1–2-year period of recovery from the mechanical damage to ground cover from logging (and post-logging burn). Thereafter, a dense ground cover flourishes, whereas the canopy remains open. Then, depending on the site and fire frequency, the site remains suitable for P. oralis*

> *or the shrub and eucalypt regrowth layer develops in a more dominant state than it was preharvest and the quality of the ground cover diminishes. If the site progresses along this latter path, then R. fuscipes dominates in shrub, fern, and eucalypt regrowth habitat that has only sparse grassy understorey.*

While Law *et. al* (2016) use their hypothesis to justify frequent logging disturbance (based upon questionable premises), their conclusions can equally be interpreted to argue that the loss of oldgrowth forest, and the ongoing decline in larger trees, with the promotion of dense tree regrowth that shades the understorey, will have significant impacts on the feed species and groundcover attributes required by Hastings River Mouse. It is likely that their habitat is being degraded with each logging event.

Though, aside from conjecture about the long-term impacts of logging and appropriate burning regimes, it is apparent that the short-term impacts of both logging and fire on the habitat and populations of Hastings River Mouse are significant. Therefore the already diminished populations of Hastings River Mouse will have been significantly diminished by the vast majority of their habitat being burnt. To now log their unburnt refuges, or the burnt refuges where mice have survived, is criminal and has to stop.

Now with the fires burning most known localities there can be no excuse for continued complacency. Populations will have been decimated by the fire, and habitat degraded. LLS must take this into account when identifying appropriate logging prescriptions.

The 2005 Recovery Plan includes "*Appendix 2. Interim Hastings River Mouse Trapping and Population Survey Guidelines*" identifying "*The minimum specifications for trapping are as follows*":

> *a) The minimum trap effort at a locality must be 100 size A Elliott traps over four nights (400 trap nights) for areas up to 50 hectares of moderate or high quality habitat or both. An additional 400 trap nights (100 traps for four nights) per 50 hectares above the original 50 hectares.*

It is apparent that extensive surveying is required to identify the presence of Hastings River Mouse. Meek *et. al.* (2003) report the results of pre-logging surveys for Hastings River Mouse at 7 sites where it was recorded (there is no information on how many apparently suitable sites it was not recorded at) identifying "*Trap success for P. oralis at Marengo was 1.7% (excluding recaptures), 0.1% at Chaelundi, 0.3% at Hyland, 0.7% for Styx River, 0.8% for Glen Elgin, 0.4% for Enfield and 0.2% for Gibraltar Range*". At 3 sites only single Hastings River Mouse were recorded, being 1 per 800 trap nights at Chaelundi, 1 per 400 trap nights at Hyland and 1 per 250 trap nights at Enfield (given the minimum effort was meant to be 400 trap nights it is not known why the Enfield trap nights were so low).

The LLS's PNF Code has no requirements for surveys to identify localities of Hastings River Mouse. There is modelled habitat identified that the LLS could require be protected unless adequate surveys show that the Hastings River Mouse is not present. This would be a responsible approach rather than the reckless abandonment of threatened species.

## 3.2. KOALA

**Clear examples of the failure to identify and protect Koalas in PNF operations are provided in the Case Studies 3.1 and 3.2 in NEFA's PNF Review submission. Despite this evidence the LLS recklessly decided to continue to do nothing to require surveys and thus protect Koalas in logging operations. Since then the 2019-20 fires have had a significant impact on remnant Koala populations and still the LLS intend to do nothing.**

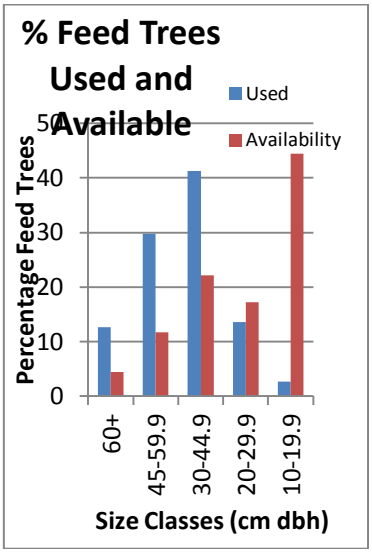
North-east NSW is one of the Koalas remaining strongholds, though the recent fires have taken a heavy toll on many significant populations, killing thousands of Koalas and leaving many more sick, dehydrated and starving. While overall 29.4% of modelled 'likely' Koala habitat burnt in the recent fires, 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.

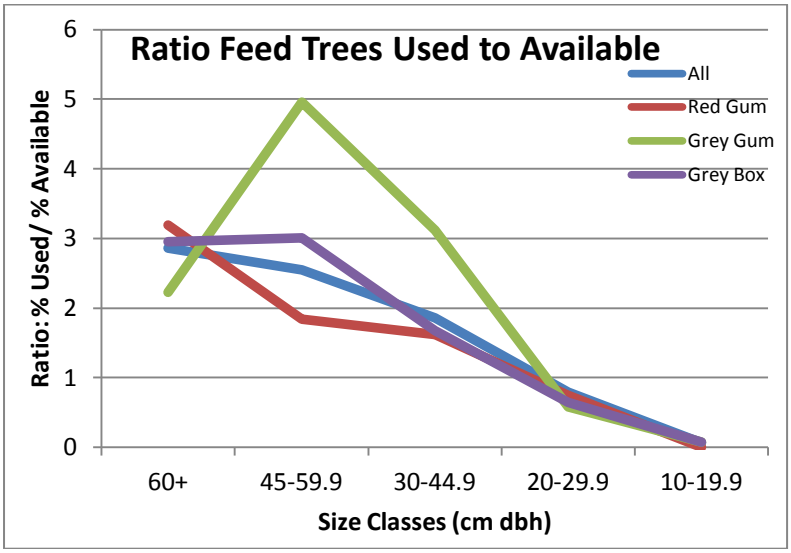
Koalas are particularly vulnerable to wildfires due to their tendency to climb higher into the canopy. As larger trees are targeted for logging, resulting in smaller trees, more contiguous canopies and increased connectivity between ground and canopy fuels, this leaves less refuges for Koala to escape fires. Koalas also clearly prefer larger trees for feeding and roosting, rarely using trees below 20cm diameter, with tree usage increasing in line with tree size. At the same time as their survival is being compromised by land clearing and logging, it is being challenged by increasing wildfires and 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.

NEFA's assessment of the impacts of the 2019 wildfires on Koalas on firegrounds within the Banyabba Koala population (ARKS) found there was little evidence of Koalas surviving in the 59% of forests that were heavily burnt, and the balance of the fireground lost over half its canopy and most Koalas. Because of the ongoing drought, and lack of any concerted Government help, Koalas continued to decline for the next 3 months. It appears that over 90% of the Koala's were lost from the firegrounds. Overall, the Banyabba Koala population was one of the worst affected by the 2019 wildfires, with likely 75% of the population being lost.

**The extent of loss of threatened species, including Koalas, due to the 2019-20 fires needs to be accounted for at the population level, with protection increased for the most severely impacted species and populations.**

Many studies have identified the Koala's 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, Matthews *et. al.* 2007, 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. NEFA's results from the proposed Sandy Creek Koala Park confirm this preference for larger trees.



**Usage of 476 feed trees according to 5 size classes compared to availability of sizes determined from plots. These show a clear preference for larger trees, generally the larger the better.**

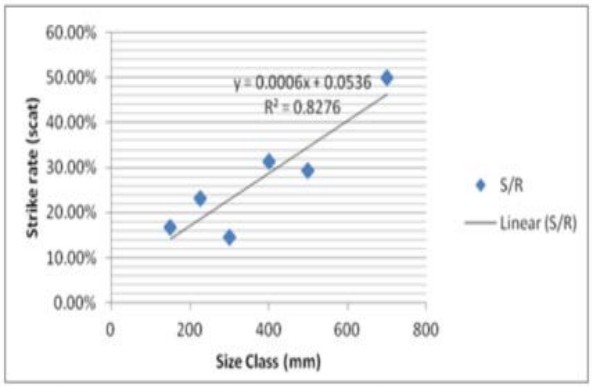



Figure 4: Size class of small-fruited grey gum versus scat strike rate

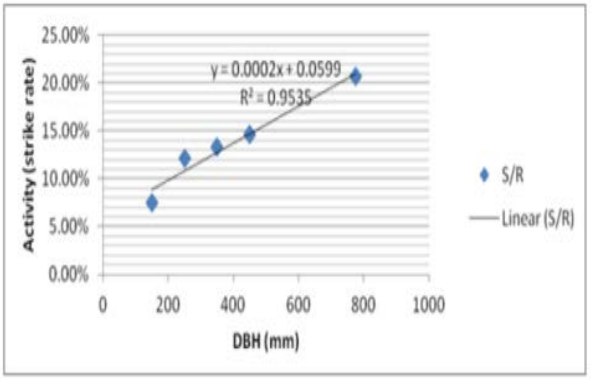
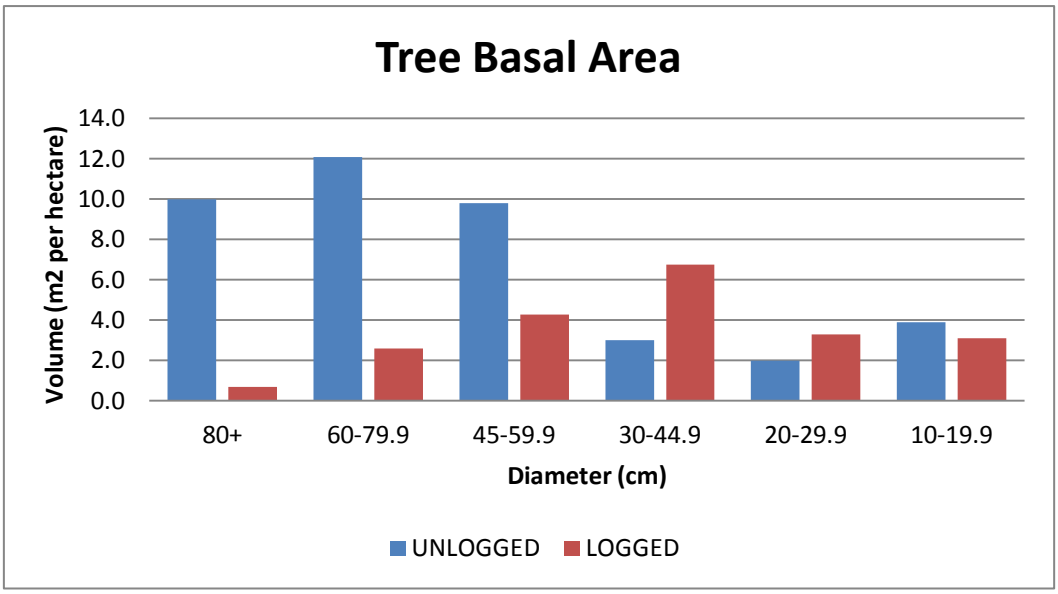



Figure 5: Size class of grey box versus scat strike rate

**EPA (2016) observed data for pooled size classes (diameter at breast height) of Small-fruited Grey Gum (*E. propinqua*) and Grey Box with and without scats for Royal Camp and Carwong State Forests reinforces NEFA's findings that Koalas prefer larger trees.**

NEFA and the EPA's (2016) results for the proposed Sandy Creek Koala Park confirm that Koalas prefer larger trees for feeding and roosting, it is therefore evident that logging of larger trees (large and small sawlogs) will have a detrimental effect on the available feed trees used by Koalas and thus Koala populations. It is essential that logging of the larger trees preferred by Koalas be prohibited in core Koala habitat to stop further population declines.

While there are a variety of factors that will have been affecting Koalas, most notably heatwaves and droughts, it is probable that Koala populations in the proposed Sandy Creek Koala Park have been more than halved because of the logging of food trees in the proceeding decades. Comparison between plots in the proposed Koala Park and floristically similar unlogged plots indicates that browse potentially available for Koalas is likely to have declined by at least half, with the bigger trees and species preferred by Koalas likely declining by over 75%.




**Comparison of the basal area of logged and unlogged forests based on plot data. This illustrates the halving of tree volume due to logging, with the removal of over 75% in the large trees preferred by Koalas.**

**To halt ongoing declines in Koala populations the large trees preferentially used by Koalas must be retained. No Koala feed trees over 30cm diameter should be allowed to be logged in known or potential Koala habitat.**

The DPIE have prepared a Koala Habitat Suitability Model (KHSM) for the north coast that predicts the spatial distribution of potential koala habitat across NSW using a value between 0 and 1 (i.e. a higher value represents a higher probability that a specific location will contain habitat suitable for koalas). The model provides an indication of where koalas have the potential to reside but are not necessarily currently occupied. The Government's recent Koala SEPP incorporates a 'Koala Development Application Map' which identifies this highest classes of the KHSM as '*highly suitable koala habitat ... likely to be occupied by koalas*'. KHSM classes 4 and 5 are used in this assessment to be 'likely' Koala habitat.

The KHSM shows the patchiness of very high quality "likely" Koala habitat within a matrix of variable quality habitat. This illustrates that there are pockets of high quality Koala habitat within a landscape matrix with the potential for a large and viable Koala population. This model does not account for past logging, and the resultant removal of the large feed trees relied upon by Koalas. Koalas are now concentrated in patches where there are enough larger (>30cm diameter) feed trees, with use increasing with the diversity and size of feed trees. Their distribution and abundance is further limited by fragmentation, droughts, fires, road strikes, and dog attacks.

**Rather than doing nothing to mitigate logging impacts on Koalas, the LLS must at least require that thorough searches of 'likely' Koala habitat (KHSM classes 4&5) are undertaken before logging is allowed. This will enable prescriptions to be applied where most required. Given the long term impacts of the fires, and the likelihood that core Koala colonies were eliminated, in burnt forests likely high quality habitat needs to be excluded from logging, irrespective of current occupancy.**

# 4. PROTECTING WATER VALUES

**It is outrageous that unmapped streams are provided with no protection at all, and a mere 5m on mapped streams is outrageous. The current 1:25,000 stream mapping has inaccuracies and excludes around half of headwater streams (ie in catchments <200ha), particularly under forest canopies. To overcome this problem all streams must be protected by description, and ideally most mapped by LIDAR as part of the planning process. All streams require at least 20 m "riparian exclusion zones" from which logging is excluded.**

**The riparian buffer widths required by the current PNF Code are pathetic and do not have a shred of scientific credibility. The riparian buffer widths of 0-5m applied by the PNF Code for unmapped, 1st, 2nd and 3rd order streams are significantly less than the 30-50m identified by Munks (1996) for small streams, tributaries, gully and drainage lines in catchments less than 100 ha, or the 35-40m (up to 200m to improve terrestrial biodiversity) identified by Hansen *et. al.* (2010) for steep catchments and low order streams, or even the 20-30m for erosion control identified by Croke and Hairsine (1995) for temporary and small streams in catchments less than 100ha. Similarly the 20m buffers for wetlands are significantly less than the 10-40m buffers identified for public lands.**

**If there is an intent to implement the basic principle of ESFM to minimise environmental impacts then buffers need to be implemented on unmapped streams, and logging exclusion areas of at least 20m should be implemented on all unmapped, 1st, 2nd and 3rd order streams, with these widths progressively increasing in steeper and more erosion prone country up to at least 40m.**

**The EPA response to repeat breaches has been found to be inadequate and ineffective. There is no disincentive for lawbreakers. It is essential that the protection of riparian buffers is effectively enforced.**

**To reduce erosion and stream pollution all logging operations must be prohibited on slopes over 25°.**

Once again there is no protection provided for unmapped headwater streams (around half headwater streams are unmapped), and logging is only excluded within 5 m "riparian exclusion zones" along all mapped streams. There are variable width "riparian buffer zones" (10-30m) around the exclusion zones though up to 30% of the basal area within these can be logged in any 10 year period and machinery can wander around at whim.

Headwater streams are of overwhelming importance for catchment health as this is where most of the interaction between the terrestrial and aquatic realms occurs. The science is that we should be establishing buffers at least 30m wide around these headwater streams.

The riparian zone is the interface between a stream (and other waterbodies) and land through groundwater, subsurface flows and flooding. The riparian zone can be considered to encompass the entire extent of a stream's floodplain. Riparian vegetation has a direct influence on streams and is influenced by streams.

Hansen *et. al.* (2010) note:

> *The riparian zone (riparia) is the interface between aquatic and terrestrial environments (Naiman and Décamps, 1997) and it mediates the flow of energy, and physical and biotic vectors between the two (Lake, 2005, Naiman et al., 2005). Consequently, riparia are often environments of exceptionally high diversity. The*

*importance of intact riparian zones is universally acknowledged as critical to aquatic-terrestrial ecosystem function and ultimately, to waterway health.*

Riparian vegetation is enhanced by increased soil moisture, increased humidity and nutrients from flood events. They provide resources for a broad range of fauna, especially during droughts. Numerous species are primarily associated with riparian habitats for at least part of their life-cycles, this includes a multitude of plants and invertebrates, most frogs and tortoises, some lizards and birds, and a few mammals (i.e. Platypus, Water Rat and Fishing Bat). Riparian vegetation also regulates the health and functioning of aquatic ecosystems, is the basis of aquatic food chains in upper catchments, and provide the branches and logs that structure many instream habitats for numerous aquatic invertebrates and many fish.

The health of streams is directly related to the health and functioning of riparian vegetation. Riparian buffers serve several functions:

- shading of streams and minimising fluctuations in water temperatures
- reducing the volumes of overland flows entering streams
- trapping sediments and associated pollutants moving from upslope towards streams
- maintenance of stable stream banks and channels;
- providing wood, leaf litter, fruits, flowers, insects and other resource inputs to streams;
- maintenance of habitat requirements for many aquatic and terrestrial species; and,
- provide corridors for the movement of a suite of terrestrial species.

Price and Tubman (2007) identify that riparian vegetation provides many ecosystem services, including:

- ☐*trap sediment, nutrients and other contaminants before they reach the waterway and reduce water quality for downstream users,*
- ☐*lower water tables,*
- ☐*reduce rates of bank erosion and loss of valuable land,*
- ☐*control nuisance aquatic plants through shading,*
- ☐*help ensure healthy stream ecosystems,*
- ☐*provide a source of food and habitat for stream animals,*
- ☐*provide an important location for conservation and movement of wildlife,*
- ☐*help to maintain agricultural productivity and support mixed enterprises,*
- ☐*provide recreation and maintain aesthetically pleasing landscapes, and*
- ☐*provide cultural and spiritual enrichment for people.*

The key threatening process declaration under the *Fisheries Management Act 1994* for 'degradation of native riparian vegetation along New South Wales water courses' states:

*1. Riparian vegetation refers to the vegetation fringing water courses and can be defined as any vegetation on land which adjoins, directly influences, or is influenced by a body of water. Riparian habitats thus include land immediately alongside large and small creeks and rivers, including the river bank itself; gullies and dips that sometimes run with surface water; areas around lakes; wetlands on river floodplains that interact with the river in times of flood.*

...

*4. Degradation of riparian vegetation has a major influence on stream ecosystems by;*

- *Increasing the amount of sediment and nutrients reaching streams as runoff, and increasing light penetration of the water body. These inputs have the combined effect of smothering benthic communities and increasing harmful algal growth.*

- *Reducing the inputs of organic carbon, via leaves, twigs, and branches. Terrestrially derived carbon inputs are the major energy source in most stream ecosystems.*
- *Reducing the amount of large woody debris entering the aquatic ecosystem and thereby negatively impacting on habitat and spawning sites of several vulnerable and endangered species listed under the Fisheries Management Act, 1994.*
- *Destabilising river banks.*
- *Reducing the amount of overhanging riparian vegetation resulting in a loss of shade and shelter for fish.*

Riparian land is „any land which adjoins, directly influences, or is influenced by a body of water", where the body of water could be a stream (permanent or intermittent), river, lake, or wetland.

Price and Tubman (2007) recognise:

> *Riparian land is important because it is often the most fertile and productive part of the landscape, in terms of both agricultural production and natural ecosystems. It often has deeper and better quality soils than the surrounding hill slopes due to past erosion and river deposition and, because of its position lower in the landscape, often retains moisture over a longer period.*

Riparian vegetation only represents a small portion of the landscape, yet is of the utmost importance in maintaining terrestrial and aquatic biodiversity. Many species of plants and animals only occur, or are in far greater abundance, in riparian areas, with their importance increasing during dry periods (Belsky *et. al.* 1999, Burrows 2000, Jansen and Robertson 2001, Allan 2004, Price and Tubman 2007, Martin and McIntyre 2007, Martin 2010). As noted by Burrows (2000):

> *Although they occupy only a relatively small percentage of land area, riparian zones play a disproportionately important role in the overall environment. Per unit area, riparian zones have considerably higher plant and animal biomass and diversity, are more structurally and floristically diverse, provide critical refuge habitats during dry periods and buffer waterways and downstream environments from the effects of surrounding environmental conditions and land uses.*

Price and Tubman (2007) also recognise that:

> *... vegetation on riparian land regulates in-stream primary production through shading (reduced light and water temperature); supplies energy and nutrients (in the form of litter, fruits, terrestrial arthropods and other organic matter) essential to aquatic organisms; and provides essential aquatic habitat by way of large pieces of wood that fall into the stream and through root-protection of undercut banks.*

Kauffman and Krueger (1984) observe:

> *Riparian vegetation produces the bulk of the detritus that provides up to 90% of the organic matter necessary to support headwater stream communities (Cummins and Spengler 1978). In these tributaries of forest ecosystems 99% of the stream energy input may be imported from bordering riparian vegetation (i.e., it is heterotrophic) and only 1% derived from stream photosynthesis by attached algae (periphyten) and mosses (Cummins 1974). Berner (in Kennedy 1977) found that even in large streams such as the Missouri River, 54% of the organic matter ingested by fish is of terrestrial origin.*

Belsky *et. al.* (1999) consider:

> *Rooted streamside plants retard streambank erosion, filter sediments out of the water, build up and stabilize streambanks and streambeds, and provide shade, food,*

*and nutrients for aquatic and riparian species ... Healthy riparian areas also act as giant sponges during flood events, raising water tables and maintaining a source of streamwater during dry seasons. The result is a more stable streamflow throughout the year...*

Burrows (2000) cites a study within the Burdekin catchment that found the riparian zones to contain twice as many bird species than adjacent woodlands, noting:

*Nearly one-third of the bird species were either found in greater abundance in the riparian systems or were only found in riparian systems. Several mammal and reptile species and most amphibian species were also dependent on the riparian zone, not being found in adjacent woodlands.*

As noted by Allan (2004) there have already been profound changes to hydrology of many catchments:

*Geomorphological changes brought about by multiple human activities likely have produced lasting, complex, and often unappreciated changes in physical structure and hydrology of river systems. Landscape changes that occurred within a few decades of European settlement of New South Wales, Australia, including clearance of riparian and floodplain vegetation and draining of swamps, have fundamentally altered river structure throughout virtually the entire Bega catchment (Brierley et al. 1999). Extensive habitat transformation has resulted, including channel widening and infilling of pools in lowland sections and incision of head-water channels owing to more efficient downstream water conveyance and down-stream export of sediments. Overall structural complexity has been reduced and lateral connectivity is largely lost in middle reaches but is now increased in the lowlands.*

Hansen *et. al.* (2010) consider"

*Disturbance and modifications to catchments through clearing vegetation for agriculture and grazing of livestock have resulted in extensive degradation of riparian zones and their adjacent waterbodies. This is predominantly through increased transfer of nutrients, sediment and pollutants into streams, exacerbated bed and bank erosion, and loss of in-stream and terrestrial biodiversity via degradation of riparian and aquatic vegetation and loss of important habitat structure such as large wood.*

From their review of the importance of the riparian zone to freshwater fish, Pusey and Arthington (2003) note:

*Given the number and importance of links between riparian and lotic ecosystems, it is not surprising that spatial and temporal variation in fish assemblage composition and characteristics (i.e. species richness, abundance, biomass) have been linked to variation in riparian cover ... or that fish communities are adversely affected by riparian destruction and recover only when riparian integrity is re-established ...*

Pusey and Arthington (2003) identify a large variety of known and potential impacts on fish as a consequence of changes to riparian vegetation, summarising in part that:

*Impacts associated with changes in light quality range from increased egg and larval mortality due to increased ultraviolet (UV) B irradiation and a decreased ability to discriminate between potential mates to increased conspicuousness to predators. ... The interception of terrestrial sediments and nutrients by the riparian zone has important consequences for stream fish, maintaining habitat structure, water clarity and food-web structure. Coarse organic matter donated to the aquatic environment by the riparian zones has a large range of influences on stream habitat, which, in turn, affect biodiversity and a range of process, such as fish reproduction and predation. Terrestrial matter is also consumed directly by fish and may be a very important source of energy in some Australian systems and under certain circumstances.*

Martin (2010) identifies that:

> *...local riparian habitat characteristics significantly affected the relative abundance of over 80% of bird species' ... local riparian habitat condition as a result of grazing and tree clearing was the primary determinant of bird species composition and abundance. Restoring trees along cleared riparian habitat will result in a dramatic increase in bird species richness, relative abundance and composition*.

Allan (2004) summarises some of the consequences of the degradation and loss of riparian vegetation:

> *Wherever agriculture or other anthropogenic activity extends to the stream margin and natural riparian forest is removed, streams are usually warmer during summer and receive fewer energy inputs as leaf litter, and primary production usually increases (Quinn 2000). Bank stability may decrease, ... and the amount of large wood in the stream declines markedly (Johnson et al. 2003). Stable wood substrate in streams performs multiple functions, influencing channel features and local flow and habitat and providing cover for fish, perching habitat for invertebrates, and a substrate for biofilm and algal colonization (Gregory et al. 2003). Its absence can have a profound influence ...*

## 4.1. WIDTHS OF BUFFERS

Hansen *et. al.* (2010) recognise *"Maximising lateral and longitudinal extent of intact riparian zones, starting in the headwaters, provides the best protection for the waterway".* There is no maximum width for riparian buffers, though there are minimum widths below which the likelihood of significant impacts should be considered unacceptable.

Regrettably, while there have been a variety of studies that help inform the design of riparian buffers, there has been insufficient studies to assess the effectiveness of various buffer widths in protecting various values in Australia. From their review of the scientific literature Hansen *et. al.* (2010) concluded that research *"is inadequate and thus hinders development of meaningful management guidelines for maintaining or restoring aquatic-terrestrial ecosystems"*, lamenting *"the opportunities to gain new information from existing management programs are frequently overlooked"*. Given that NSW Government agencies espouse "adaptive management", the failure to rigorously assess the effectiveness of buffer strips in over 40 years since the Standard Erosion Guidelines were first adopted is reprehensible.

Unfortunately, because logging has been constrained in riparian zones in the past they are now sought after for logging by the timber industry. Management of riparian zones is therefore a political issue. Ecological requirements are usually severely compromised by the quest for resources.

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).

Lowe and Likens (2005) consider:

> *Everywhere on Earth, streams and rivers occur in hierarchical networks resembling the branching pattern of a tree, with smaller branches joining to form larger branches as water travels from uplands to lakes, estuaries, and seas. The finest branches of these networks, beginning where water flowing overland first coalesces to form a discernible channel, are called headwater streams. ... because of their small size, these streams are often missing from maps that guide the management of natural resources.*

> ...
> *There is growing evidence that the water quality, biodiversity, and ecological health of freshwater systems depend on functions provided by headwater streams, which are similar in their importance to the fine branches of the human respiratory system in the lung.*
> ...
> *Headwaters are a source of life. They are critical habitat for rare and endangered freshwater species, and guardians of many downstream resources and ecosystem services on which humans rely ...*

Small headwater streams are where most of the inputs of energy, sediments, nutrients and pollutants from the adjacent terrestrial environment occurs. These streams are often ephemeral or intermittently flow, yet they can harbour endemic invertebrates - many with highly restricted distributions (Barmuta *et. al.* 2009).

Barmuta *et. al.* (2009) consider:

> *For forested headwaters in upland areas, the streams tend to be steep, with a stair-step longitudinal profile, and the catchments are subject to unpredictable land-slips or debris flows. Hydrologically, the permanent streams tend to derive a greater proportion of their modal flows from groundwater than downstream segments, and they tend to be shallow with slow water velocities (Gomi et al. 2002). Because of their small size and large contact with the adjacent terrestrial habitat, flows are responsive to runoff events ...*
> ...
> *In forested areas, the riparian vegetation usually forms a closed canopy, and most of the energy for the in-stream food web is provided by allochthonously-derived inputs of leaf litter (often termed CPOM: coarse particulate organic matter), and leaching of this material yields large quantities of dissolved organic matter (DOM) which can be augmented by direct inputs from interflow, groundwater or overland flow. The DOM pool can be up to 10 times greater than the pool of particulate organic matter and it provides energy and nutrients to in-stream biofilms that form the basal food resource for many invertebrate consumers ...*

Hansen *et. al.* (2010) state:

> *The best opportunity for mitigation of catchment-scale disturbances is by the protection or rehabilitation of headwater systems due to their demonstrated capacity for greatest regulation of water quality and highest contribution to regional biodiversity*".
> ...
> *Erosion in headwater areas makes a disproportionately high contribution to waterway sedimentation and elevated nutrient levels (Lowe and Likens, 2005, Naiman et al., 2005). Ephemeral streams also contribute large amounts sediment and nutrients that are mobilised during storm events (Wenger, 1999, Fisher et al., 2004)*

Davies and Nelson (1993) note that *"the role of first-order streams in sediment transport from hillslopes experiencing accelerated erosion has long been recognised".* concluding that *"enhanced fine sediment movement in streams as a result of logging is most likely to occur owing to disturbance of headwater stream channels*".

Croke and Hairsine (1995) note *"in general it is agreed that buffer strips should extend to the springhead or runoff confluence point of any sub-catchment and should be well upstream of any existing channel or streambed, since flow will occur at a higher point in the catchment once the forest has been cleared."*

Despite the headwaters of catchments warranting the greatest protection, in current practice buffer strips along streams increase in size with stream size. Bren (1999) notes that the

problem with this is that *"compared to more rigorous methods this under-protects the stream head, but overprotects divergent areas downstream. A method based on a constant ratio of upslope contributing area to buffer area gave the widest buffers at the stream head and buffers of diminishing width as one moved downstream."*. Bren notes that having relatively wider buffers for the smaller headwater streams *"makes sense hydrologically but is probably politically unacceptable."*

Munks (1996) reviewed the available literature to recommend buffer widths for various functions.

**Munks (1996) Recommended buffer widths for various functions of riparian vegetation**

| Function of the Riparian Vegetation | Recommended Buffer Width (from edge of bank) |
|---|---|
| Water Quality, Sediment, Pollutants etc. | 20-50m (streams)<br>40-100m (rivers) |
| Bank Stabilisation | 10 m + (rivers and streams) |
| Provision of habitat for terrestrial animals | 50-60 m (rivers) |
| Provision of food, habitat and protection of stream fauna | 30-100 m (streams) |

Based on her review Munks (1996) recommend minimum buffer widths for streams.

**Table 3.5. Munks (1996) recommended <u>minimum</u> buffer widths for streams:**

| Type of River or Stream | Minimum width from stream bank* |
|---|---|
| Main Rivers | 40 m |
| Creeks and streams from the point where their catchment exceeds 100 ha | 30 m |
| Small streams with a catchment of 50 to 100 ha | 30-50 m |
| Small streams, tributaries, gully and drainage lines which only carry surface water during periods of heavy rainfall | 30 m |

* If the slope of adjacent land running down to the stream is greater than 10%, the recommended width is increased to 50m.

Munks (1996) also considers that *"adequate widths of riparian vegetation for fauna protection needs to be species-specific."*

Hansen *et. al.* (2010) undertook a meta-analysis of >200 riparian studies and recommended riparian buffer widths of between 30 and 200 m dependant on land use intensity and the management objective. Hansen *et. al.* (2010) considered forestry operations and grazing at low stocking rates (<5 Dry Sheep Equivalents/ha/annum all stock) as being relatively low impact. Though the impacts of logging operations vary with the logging intensity, slopes and soils.

**Hansen *et. al.* (2010) Minimum width recommendations for Victorian riparian zones based upon available scientific literature and adjusted using expert opinion, where appropriate, to account for known differences between Victorian and international systems. All widths are in metres.**

| Landscape context /Management Objective | Land Use Intensity High | Land Use Intensity Moderate | Land Use Intensity Low | Wetland/lowland floodplain/off-stream water bodies | Steep catchments/cleared hillslopes/low order streams |
|---|---|---|---|---|---|
| **Improve water quality** | 60 | 45 | 30 | 120 | 40 |
| **Moderate** | 95 | 65 | 35 | 40 | 35 |

| | | | | | |
|---|---|---|---|---|---|
| **stream temperatures** | | | | | |
| **Provide food and resources** | 95 | 65 | 35 | 40 | 35 |
| **Improve in-stream biodiversity** | 100 | 70 | 40 | Variable* | 40 |
| **Improve terrestrial biodiversity** | 200 | 150 | 100 | Variable* | 200 |

* Variability in width is related to the lateral extent of hydrological connectivity and thus, any recommendation will be site specific.

In forestry planning stream buffers are usually applied to act as sediment and nutrient filters for subsurface and overland flows (i.e. Barling and Moore 1994). They are more effective for removing sediment than nutrients from the flow and are more effective at removing coarse rather than fine sediments (i.e. Barling and Moore 1994). They are also most effective when the flow is shallow, slow, and enters the strip uniformly along its length (i.e. Barling and Moore 1994). Barling and Moore (1994) note that *"in hilly terrain flow rapidly concentrates, producing higher flow velocities and larger flow depths that can rapidly submerge the vegetation and significantly reduce the effectiveness of the filter strip"*.

Croke and Hairsine (1995) categorised streamside buffers as Streamside Reserves (no logging or machinery disturbance) and Filter Strips (logging, but no machinery disturbance), and made recommendations for their minimum widths along streams and around wetlands based primarily on controlling overland flows of sediments. All their buffers are classed as Streamside Reserves except for those on drainage lines.

**Table 3.6. Croke and Hairsine's (1995) recommended "Minimum Streamside Reserve and Filter Strip Widths according to stream type"**

| Type of River or Stream | Minimum widths |
|---|---|
| Rivers, Lakes and Streams used for water supply | 100 m |
| Creeks and streams from the point where their catchment exceeds 100 ha | 40 m |
| Small streams with a catchment less than 100 ha | 30 m |
| Temporary streams flowing more than 1 in 5 years and carries water for some time (weeks) after rainfall. | 20 m |
| Drainage lines carrying water only during or immediately (hours, days) after rainfall | 10 m |
| Permanent springs, swampy ground, wetlands and bodies of standing water | 30 m |

Croke and Hairsine (1995) note that Streamside Reserves must be:

> *"extended beyond the minimum widths wherever necessary according to a field assessment of the size and flow of the stream or spring, the size and nature of the soak, swampy ground or body of standing water; the nature of the surrounding topography and soil type, the intensity and magnitude of the harvesting operation; the riparian habitat value; and the proximity and physical design of any water supply take-off and distribution system."*

Croke and Hairsine consider that extensions of Streamside Reserve widths must *"be determined according to soil type, hazard class slope, and other climatic and geomorphic variables relevant to the region"*.

Croke and Hairsine (1995) also emphasise that *"It is crucial when defining buffer strips in the field that all sources of runoff generation are included within the buffer strip zone. It is essential to incorporate the 'saturated zone', which is the area along the stream or drainage line that is permanently saturated (e.g. swampy ground) or becomes saturated (e.g, seepage area) with the onset of rain".* They consider that *"this is recognisable through the existence of saturated soil or presence of a vegetation associated with frequently saturated soil".*

The previous PNF Code gives the following buffers:

**Table F: Riparian exclusion and riparian buffer zones**

| Drainage feature | Riparian exclusion zone distance from drainage feature | Riparian buffer zone distance beyond riparian exclusion zone |
|---|---|---|
| Mapped first-order streams | 5 metres | 10 metres |
| Mapped second-order streams | 5 metres | 20 metres |
| Mapped third-order or higher streams | 5 metres | 30 metres |
| Prescribed Streams | 20 metres | 15 metres |

Previous PNF table depicting riparian buffers included the riparian exclusion zone, while riparian exclusion zones have been retained, their removal from the new table will create unnecessary confusion and errors.

PNF logging operations are excluded from riparian exclusion zones, though modified logging is allowed in riparian buffer zones. Machinery exclusion zones must be applied to all unmapped drainage lines, though they can be fully logged. Forest operations must not occur in any wetland or within 20 metres of any wetland.

These requirements are vastly inferior to those applied to public lands in the Environment Protection Licence, which for the past 20 years has required logging to be excluded from filter strips, according to:

**EPL's 1999 minimum filter strip width for mapped and unmapped drainage lines, prescribed streams and watercourses in public native forests (metres - measured along the ground surface).**

| Stream Order | Inherent Hazard Level 1 | Inherent Hazard Level 2 | Inherent Hazard Level 3 |
|---|---|---|---|
| Unmapped | 10 | 10 | 15 |
| 1st order | 10 | 15 | 20 |
| 2nd order | 15 | 20 | 25 |
| 3rd order or greater | 20 | 25 | 30 |

**EPL's 1999 minimum filter strip width for mapped and unmapped wetlands and swamps in native forests (metres - measures along the ground surface).**

| | Total Area of Wetlands or Swamps (ha) | |
|---|---|---|
| | 0.01 - 0.5 ha | Greater than 0.5 ha |
| Wetlands or Swamps | 10 | 40 |

In May 2004 the Forestry Corporation was successful in getting the Environment Protection Licence amended to have the effect of excluding "non-scheduled" forestry operations from requiring licences. Since then the Forestry Corporation have been refusing to obtain licences for over 90% of their logging operations, meaning they are no longer subject to the EPLs. This was done particularly to allow riparian buffers to unmapped streams to be logged in most operations. Though the Forestry Corporations desires were increasingly frustrated by the Fisheries Licence requirement to maintain 10m buffers on unmapped streams within 100km upstream of threatened fish (Class 2 Aquatic Habitat).

For north east NSW the new rules are that most headwater streams in catchments less than 20ha will have buffers reduced from mostly 10m to 5m (except where it is Class 1 Aquatic Habitat ). Class 1 Aquatic habitat will be mapped - it is currently defined as having a threatened fish recorded within 2km upstream or 5km downstream of the site of the proposed works.

While the EPL riparian buffers are theoretically minimums, in practice they usually become maximums. There is never any attempt to expand them in particularly fragile and vulnerable catchments as identified as necessary by numerous authors (i.e. Croke and Hairsine 1995).

The riparian buffer widths of 0-5m applied by the PNF Code for unmapped, 1st, 2nd and 3rd order streams are significantly less than the 10-20m required by the EPL for public lands, the 30-50m identified by Munks (1996) for small streams, tributaries, gully and drainage lines in catchments less than 100 ha, or the 35-40m (up to 200m to improve terrestrial biodiversity) identified by Hansen *et. al.* (2010) for steep catchments and low order streams, or even the 20-30m for erosion control identified by Croke and Hairsine (1995) for temporary and small streams in catchments less than 100ha. Similarly the 20m buffers for wetlands are significantly less than the 10-40m buffers identified for public lands.

Stream mapping from aerial photographs does not identify many smaller streams, and some larger ones, particularly in steeper forested landscapes – these are the unmapped drainage lines referenced by the EPL. These constitute a significant proportion of the headwater streams identified as being particularly important for catchment health. The EPL requires the exclusion of logging from within 10 metres, and the exclusion of machinery from within 5 metres, of unmapped drainage lines. An additional 10 m wide protection zone is applied in which machinery disturbance is meant to be minimised. The Fisheries Licence also protects these in the vicinity of records of threatened fish, when Fisheries bother to report their presence to the Forestry Corporation. The PNF Codes failure to protect them is extremely poor practice.

Not only are the protections for streams and wetlands on private lands pathetic, they are often poorly applied, as identified in PNF Case Studies 3.2 and 3.3. which are annexures to NEFA's January 2019 submission.

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