Submission | Remake of Coastal Integrated Forestry Operations Approvals

Executive Summary

The Nature Conservation Council of NSW (NCC) welcomes the opportunity to comment on the NSW Government discussion paper on the remake of the Coastal Integrated Forestry Operations Approvals.

We represent more than 120 community environmental organisations from across the state. We have a longstanding interest in forest conservation and regulation of forestry activities. Our submission is informed by consultation with our members, including members of the NCC Forest Working Group.

Overall, we are concerned that the proposed changes to the IFOA framework represent a substantial erosion of existing environmental protections, with corresponding risks for environmental values in the public native forest estate. We have set out the basis for our concerns, and our recommended solutions, in detail in the body of this submission.

We note that a number of our member organisations and individual members of the NCC Forest Working Group have made submissions in response to the discussion paper. We note, in particular, the detailed submission prepared by the North East Forest Alliance (NEFA), and offer our support for the analysis, conclusions and recommendations set out in that submission.

Recommendations

Recommendation 1

To end unfair competition, reduce costs to the taxpayer and promote the growth of a competitive plantation sector, the NSW Government should:

- end direct and indirect subsidies for native forestry operations;
- separate plantations from native forests for resource allocation and reporting;
- implement a competitive pricing system to encourage replacement of native forest timber;
- renegotiate timber supply agreements to promote a transition to a plantation-based timber industry;
- ensure long-term management goals, including sustained yields, are set by an independent agency.

Recommendation 2

The NSW Government should undertake a transparent, technically robust assessment of timber supply options for New South Wales, including protection of native forests and a transition to a sustainable plantation-based timber industry.

Recommendation 3

The new draft IFOA should be placed on public exhibition for three months.

Recommendation 4

That existing silvicultural prescriptions be retained and strengthened, to better protect environmental values. The primary aim of silvicultural prescriptions applying to native forests should be to maintain and restore structurally diverse forests, with trees through a natural range of size classes and species, including those trees needed to meet standards set for wildlife habitat, food and recruitment trees.

Recommendation 5

That the proposed forest regeneration framework be informed by the best available science, legally binding and rigorously monitored and enforced.

Recommendation 6

That existing requirements to prepare grazing management plans are honoured, existing requirements for no expansion of grazing on public lands are maintained, and grazing is excluded from riparian areas and wetlands.

Recommendation 7

That the EPA and Forestry Commission to contribute to statewide weed control efforts by enacting binding, comprehensive IFOA conditions in relation to weed management and allocating increased resources to post-harvest weed management and monitoring.

Recommendation 8

That the Minister for Environment provide conservation stakeholders with a written commitment that:

- the review of threatened species prescriptions will be undertaken in a transparent and scientifically rigorous manner, with the data, assumptions and proposed amendments made publicly available;
- the EPA will be required to demonstrate that each proposed amendment to existing threatened species prescriptions will maintain or enhance the level of protection currently afforded to the relevant species or ecological community;
- ecological survey requirements for each species or ecological community will remain in place unless it can be demonstrated that the level of protection afforded to that species or community will be maintained or enhanced by permanently 'switching on' the relevant protective prescription;
- the Office of Environment and Heritage and DPI Fisheries will be provided with the time and resources needed to provide meaningful expert input into the review process.

Recommendation 9

To ensure that historical survey effort is not wasted, and to ensure protection of mapped threatened species, communities and habitat features, IFOA prescriptions triggered by previous ecological surveys must remain in place under the new IFOA.

Recommendation 10

We urge the NSW Government to respond to concerns raised by the Bell Miner Associated Dieback (BMAD) Working Group by:

- identifying and mapping areas that are affected by, or susceptible to, bell miner associated dieback;
- prohibiting logging in affected and susceptible areas until appropriate management responses that restore ecosystem health are developed and implemented;
- undertaking rehabilitation work (including lantana removal) in affected stands;
- strengthening post-harvest weed control and regeneration requirements; and
- monitoring and evaluating treatment methods.

Recommendation 11

Soil and water protection measures in the IFOA should set out outcome-based performance standards, combined with clear, binding prescriptions based on best available science and operational experience. Both the outcome standards and operational prescriptions must be drafted in a manner that promotes compliance and supports effective monitoring and enforcement.

Recommendation 12

That the NSW Government immediately abandon the proposal for a logging trial on steeply sloping land and reaffirm its commitment to the longstanding protection of forests on steeply sloping land.

Recommendation 13

That proposed applications of new technology for mapping and operational planning purposes be tested in low impact field trials, with key stakeholder representatives present.

Recommendation 14

That the Natural Resources Commission be tasked with the development of a strategic environmental monitoring framework for public native forests, with input from key stakeholders, independent experts and the Office of Environment and Heritage.

Recommendation 15

That information in relation to forest management be made freely and publicly available, including: resource assessments; sustained yield estimates; timber supply and pricing arrangements; digital map layers for native forests; digital map layers for plantations; licences, permits and harvest plans; property vegetation plans; and, breach reports and compliance responses.

Recommendation 16

That the NSW Government prepare draft legislative amendments for discussion with key stakeholders, including: making non-licence terms enforceable; ensuring that water pollution conditions apply to all logging operations; requiring accreditation of forest contractors; strengthening penalties and regulatory tools; and, removing the legislative bar to third party enforcement proceedings.

Recommendation 17

That legislative amendments be introduced to separate the commercial and operational role of the Forestry Corporation from the setting of sustainable yields, regulatory policy and ecological surveys.

1. Introduction

The Nature Conservation Council of NSW (NCC) welcomes the opportunity to comment on the NSW Government discussion paper on the remake of the Coastal Integrated Forestry Operations Approvals.

We represent more than 120 community environmental organisations from across the state. We have a longstanding interest in forest conservation and regulation of forestry activities. Our submission is informed by consultation with our members, including members of the NCC Forest Working Group.

Overall, we are concerned that the proposed changes to the IFOA framework represent a substantial erosion of existing environmental protections, with corresponding risks for environmental values in the public native forest estate. We have set out the basis for our concerns, and our recommended solutions, in detail in the body of this submission.

We note that a number of our member organisations and individual members of the NCC Forest Working Group have made submissions in response to the discussion paper. We note, in particular, the detailed submission prepared by the North East Forest Alliance (NEFA), and offer our support for the analysis, conclusions and recommendations set out in that submission.

Previous submissions and timber industry analysis

This submission responds directly to the discussion paper released by the Environment Protection Authority in February 2014. In addition, we have enclosed the following additional resources:

- Independent appraisal of native forest timber resources and alternatives in New South Wales, Commissioned by the Nature Conservation Council of NSW, September (September 2011)
- Submission to the 'Review of NSW Forest Agreements and Integrated Forestry Operations Approvals' (November 2010)
- Submission to the draft report on progress with implementation of the NSW Regional Forest Agreements (September 2009)
- Submission to the Review of the Forestry and National Parks Estate Act (May 2009)
- Submission on the Terms of Reference for the Review of NSW Forest Agreements and Integrated Forestry Operations Approval (December 2008)
- Submission on Improved Regulatory Arrangements for Water Quality and Threatened Species in New South Wales – Five Year Review of the UNE, LNE and Eden IFOAs (2004)

2. Context for the review

Our native forests provide essential habitat for native plants and wildlife, provide clean air and fresh water, protect our soil and store enormous amounts of carbon.

Current logging activities in our native forests are fundamentally unsustainable. Over-allocation of timber resources from our native forests has resulted in timber being harvested faster than it can grow, and has limited opportunities for implementation of ecologically sustainable forest management.

This ongoing degradation of our native forests is primarily driven by the production of large volumes of woodchips and other low value timber products. Our forests are worth more standing, as wildlife habitat, water catchments, carbon stores and natural areas for low impact recreation.

Transition to plantation-based timber industry

Protection of native forests is one of our best opportunities for rapidly reducing Australia's contribution to climate change. Recognising the urgent need for action to reduce carbon emissions, and the cumulative loss of biodiversity as a result of native forest logging, there is an urgent need to implement a transition to a plantation-based timber industry in the shortest possible timeframe.

Since the 1970s, there has been an ongoing decline in the native timber industry in NSW, with a corresponding increase in plantation timber. More than 70% of all timber produced in NSW is currently sourced from plantations. The NSW plantation estate now covers nearly 400,000 hectares, presenting a real opportunity for a transition to a plantation based timber industry.

Independent analysis commissioned by NCC concluded that current levels of native forest logging are unsustainable and that a transition to a plantation-based industry is feasible.[1] Continued unsustainable logging of our native forests is economically and environmentally irresponsible, and should be replaced with a clear, strategic plan for a transition to a sustainable plantation-based industry.

Forest management practices

Forest management practices in New South Wales have historically been oriented primarily towards wood production, resulting in a sustained decline in ecological values. In many areas, destructive logging practices have resulted in biodiversity loss, erosion, reduced water quality and increased vulnerability to weeds and disease.

Forestry operation approvals should be strengthened to improve protection for wildlife, water and other environmental values, reduce logging intensity and improve post-harvest control of weeds and disease.

Market distortions in the forest sector

Independent expert analysis has revealed a number of serious economic failures in public forest management in NSW, including:

- cross-subsidisation of public native forest operations from public plantation profits;
- administered, rather than competitive, pricing mechanisms which lead to lower prices for native forest timber;
- excessively lengthy wood supply contracts which inhibit innovation and investment and create barriers to diversification and competition in the industry; and
- conflation of operational, regulatory and policy responsibilities in a single forestry agency, leading to conflicts between short-term commercial imperatives and long-term management goals.[2]

Combined with substantial direct subsidies over the past two decades, these factors have led to severe market distortions, with cheap timber from public native forests suppressing investment in private hardwood plantations.

---

[1] NCC (2011) Independent appraisal of native forest timber resources and alternatives in New South Wales, September 2011.
[2] URS (2008) *Economic Policy Settings in the Forest and Timber Industry – An inter-jurisdictional comparison*.

Recommendation 1

To end unfair competition, reduce costs to the taxpayer and promote the growth of a competitive plantation sector, the NSW Government should:

- end direct and indirect subsidies for native forestry operations;
- separate plantations from native forests for resource allocation and reporting;
- implement a competitive pricing system to encourage replacement of native forest timber with plantation sourced timber;
- renegotiate timber supply agreements to promote a transition to a plantation-based timber industry;
- ensure long-term management goals, including sustained yields, are set by an independent agency.

3. Objectives of the review

The stated objectives of the IFOA remake are 'to reduce the costs associated with implementation and compliance and improve the clarity and enforceability of the IFOAs'.[3] The NSW Government has stated that it is 'committed to delivering these objectives with no net change to wood supply and no erosion of environmental values'.[4]

In our view, the government's stated commitment to maintaining timber supply from our public native forests at current levels is incompatible with long term protection of environmental values. Current timber supply commitments are known to be unsustainable – failure to address this issue will result in serious impacts on biological diversity and forest health.

Continued unsustainable logging of our native forests is economically and environmentally irresponsible, and should be replaced with a clear strategic plan for a transition to a sustainable plantation-based timber industry for New South Wales.

Recommendation 2

The NSW Government should undertake a transparent, technically robust assessment of timber supply options for New South Wales, including protection of native forests and a transition to a sustainable plantation-based timber industry.

4. Stakeholder engagement

The new draft IFOA should be placed on exhibition for three months, to provide an adequate opportunity for community consultation and stakeholder input, informed by expert analysis and field demonstrations.

This is consistent with the exhibition period for national park plans of management under the *National Parks and Wildlife Act 1974* and marine park zoning plans under the *Marine Parks Act 1997*.

Recommendation 3

The new draft IFOA should be placed on public exhibition for three months.

[3] NSW Government (2014) *Remake of the Coastal Integrated Forestry Operations Approvals: Discussion Paper*, February 2014.
[4] NSW Government (2014) *Remake of the Coastal Integrated Forestry Operations Approvals: Discussion Paper*, February 2014.

5. Legal framework for forestry operations

The timber industry occupies a privileged position in our legal system. Forestry operations covered by an IFOA are exempt from planning and environmental assessment requirements under the *Environmental Planning and Assessment Act 1979*, stop work orders and interim protection orders under the *National Parks and Wildlife Act 1974* and *Threatened Species Conservation Act 1995*, and federal environmental assessment processes under the *Environment Protection and Biodiversity Conservation Act 1999*.

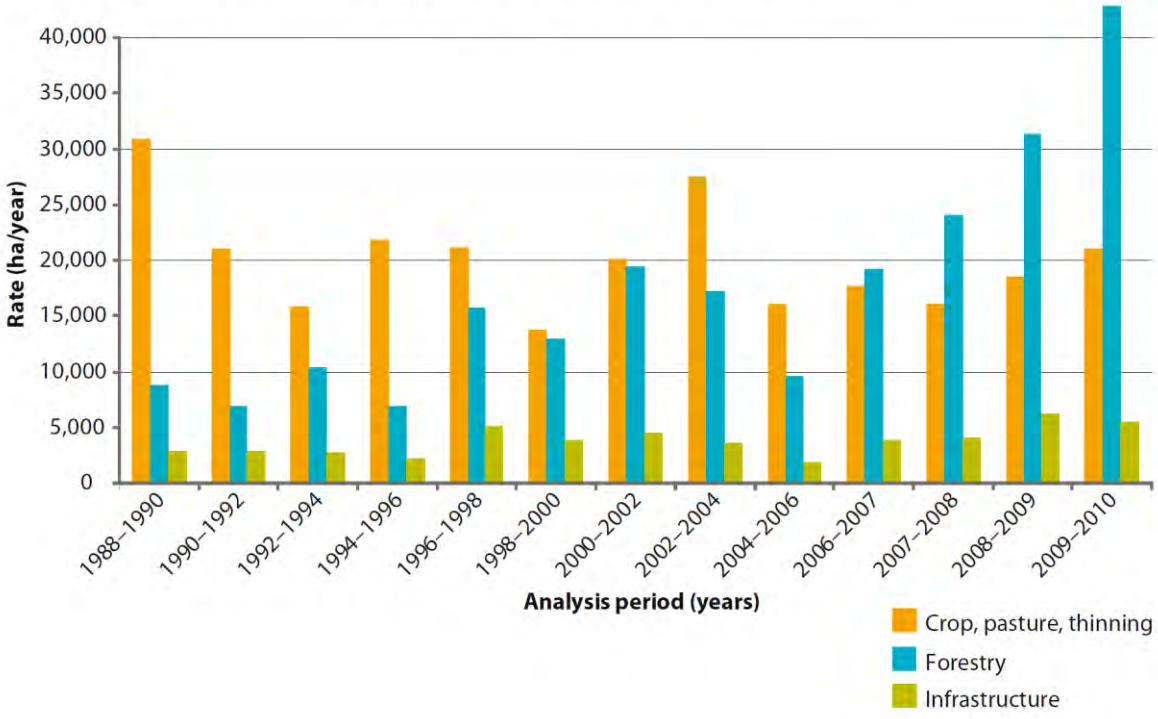
These broad exemptions from environmental laws – which are not available to any other industry – have allowed the forestry industry to have a disproportionate impact on environmental values, relative to the industry's modest contribution to the state economy. The logging industry, which employs a tiny fraction of the state's workforce, has been the largest cause of woody vegetation loss in NSW over the past decade.

Table 5.1 Rate of woody vegetation change annualised by land use category and fire over the period 1988–2010 (ha/year)

	1988–1990	1990–1992	1992–1994	1994–1996	1996–1998	1998–2000	2000–2002	2002–2004	2004–2006	2006–2007	2007–2008	2008–2009	2009–2010
Crop, pasture, thinning	30,900	21,000	15,800	21,800	21,200	13,700	20,100	27,500	16,100	17,700	16,100	18,500	21,200
Forestry	8,800	7,000	10,400	6,900	15,700	13,000	19,400	17,200	9,600	19,200	24,000	31,300	42,700
Infrastructure	2,900	2,900	2,700	2,200	5,100	3,800	4,500	3,500	1,900	3,800	4,000	6,200	5,300
Fire	1,300	6,500	4,900	6,200	7,600	19,700	33,600	102,800	3,700	20,2400	4,200	8,200	48,300

Note: The periods of analysis for the figures in Table 5.1 and Figure 5.2 cover either a 1- or 2-year timeframe. The figures shown are annualised rates to enable relative 'annual' comparisons to be made between all periods. Rates are rounded to the nearest 100 ha.

Figure 5.2 Annual loss of woody vegetation 1988–2010 by land use categories.



6. Range of activities and issues to be covered

Volumes of timber that can be harvested

The volumetric limits contained in existing coastal IFOA's exceed sustainable limits and are inconsistent with ecologically sustainable forest management. Failure to address over-allocation of timber resources will lead to serious impacts on biological diversity and forest health.

Silvicultural practices

We are strongly opposed to the proposal to remove restrictions on silviculture methods. The proposal to remove conditions limiting logging intensity and extent opens the way for intensification of logging and clear felling of native forests.

In response to pressure to meet unsustainable timber supply commitments, the Forestry Corporation has progressively intensified logging operations, compromising ecological values and long-term sustainability for the timber industry.

Existing requirements in relation to silvicultural methods should be reviewed and strengthened to better protect environmental values. Provisions relating to Single Tree Selection and Australian Group Selection should be clarified and strengthened to reduce logging impacts on important environmental values.

The primary aim of silvicultural prescriptions applying to public native forests should be to maintain and restore structurally diverse forests, with trees through a natural range of size classes and species, including those trees needed to meet standards set for wildlife habitat, food and recruitment trees.

Recommendation 4

That existing silvicultural prescriptions be retained and strengthened, to better protect environmental values. The primary aim of silvicultural prescriptions applying to native forests should be to maintain and restore structurally diverse forests, with trees through a natural range of size classes and species, including those trees needed to meet standards set for wildlife habitat, food and recruitment trees.

Regeneration

Effective regeneration is essential for long term forest health. IFOA conditions relating to regeneration must be informed by the best available science, legally binding and rigorously monitored and enforced.

The proposed regeneration framework should be informed by consultation with key stakeholders and experts, including the Australian Association of Bush Regenerators (AABR), Invasive Species Council (ISC) and Bell Miner Associated Dieback (BMAD) Working Group.

Recommendation 5

That the proposed forest regeneration framework be informed by the best available science, legally binding and rigorously monitored and enforced.

Grazing

We do not support the proposal to remove IFOA provisions in relation to grazing activities, including prohibitions on grazing in environmentally sensitive areas (e.g. old growth, rainforest). Grazing is known to have significant effects on forest habitats, through trampling and introduction of weeds.

Instead of removing grazing from the ambit of the IFOA the EPA should ensure that existing requirements to prepare grazing management plans are honoured, ensure that existing requirements for no expansion of grazing on public lands are maintained, and that grazing is excluded from riparian areas and wetlands.

Recommendation 6

That existing requirements to prepare grazing management plans are honoured, existing requirements for no expansion of grazing on public lands are maintained, and grazing is excluded from riparian areas and wetlands.

Weed and pest control

We are deeply concerned about the proposal to remove IFOA provisions relating with weed and pest control. Logging operations result in high impact disturbance of native forest areas, creating ideal conditions for weed invasion. The impacts of poorly managed weed invasion in logged areas can persist for decades, with negative impacts on both environmental values and long term timber production.

The weed control challenges associated with logging operations are distinctive, and warrant a specific regulatory response, rather than simply applying the general duties arising under the *Noxious Weeds Act*.

We welcome the Natural Resource Commission's current review of weed management in New South Wales, and strongly urge the EPA and Forestry Commission to contribute to statewide weed control efforts by enacting binding, comprehensive IFOA conditions in relation to weed management and allocating increased resources to post-harvest weed management and monitoring.

Recommendation 7

That the EPA and Forestry Commission to contribute to statewide weed control efforts by enacting binding, comprehensive IFOA conditions in relation to weed management and allocating increased resources to post-harvest weed management and monitoring.

7. Protection for threatened species and communities

We are strongly opposed to industry proposals to remove pre-logging surveys for threatened species, ecological communities and habitat features.

Given the broad exemptions from environmental assessment laws provided to the logging industry, ecological surveys play a critical role in identifying and mitigating impacts on threatened species and ecological communities.

The ecological impacts of logging operations persist for decades. Logging thousands of hectares of native forest without conducting ecological surveys for threatened species and communities is irresponsible and inconsistent with the principles of ecologically sustainable development.

Removing the requirement to undertake ecological surveys prior to the commencement of logging operations is inconsistent with the principles of ecologically sustainable forest management set out in the Regional Forest Agreements and will place matters of national environmental significance at risk.

In some circumstances, it may be possible to reduce survey effort while maintaining (or enhancing) existing levels of protection by ensuring that relevant species specific prescriptions are permanently switched on (for example, extended exclusion zones for riparian bat and frog species).

To date, based on our knowledge of wood supply demands and the position adopted by the Forestry Corporation in relation to threatened species, we are deeply sceptical about the claim in the discussion paper that 'the overall level of protection provided to threatened species, at all scales, will be enhanced'.

To address the serious concerns raised by our members and expert ecologists, and to fulfil the NSW Government's stated commitment to 'enhancing' protection for threatened species, we seek a written commitment from the Minister for the Environment that:

- the review of threatened species prescriptions will be undertaken in a **transparent and scientifically rigorous manner**, with the data, assumptions and proposed amendments freely available to key stakeholders, scientific experts and the broader public;

- the EPA will be required to demonstrate that each proposed amendment to existing threatened species prescriptions will **maintain or enhance the level of protection** currently afforded to the relevant species or ecological community;

- ecological survey requirements for each species or ecological community will remain in place unless it can be demonstrated that the level of protection afforded to that species or community will be maintained or enhanced by **permanently 'switching on' the protective prescription** that would have been triggered by an ecological survey that revealed the presence of that species or community;

- the Office of Environment and Heritage and DPI Fisheries will be provided with the time and resources needed to provide **meaningful expert input into the review process** and to provide informed advice to the Minister for the Environment and the Minister for Primary Industries on the implications for threatened species and ecological communities.

It is not appropriate for the Forestry Corporation, as a state owned corporation and the regulated entity, to participate in the review of IFOA prescriptions as an equal (or more powerful) negotiator. The EPA is the responsible regulatory authority, and must be permitted to fulfil its responsibilities without undue interference by a commercial entity with a direct conflict of interest.

Under the new IFOA framework, surveys for threatened species and communities, and the identification of required exclusion areas, should be undertaken independently of the Forestry Corporation.

To ensure that historical survey effort is not wasted, and to ensure protection of mapped threatened species, communities and habitat features, IFOA prescriptions triggered by previous ecological surveys must remain in place over time.

Recommendation 8

That the Minister for Environment provide conservation stakeholders with a written commitment that:

- the review of threatened species prescriptions will be undertaken in a transparent and scientifically rigorous manner, with the data, assumptions and proposed amendments made publicly available;

- the EPA will be required to demonstrate that each proposed amendment to existing threatened species prescriptions will maintain or enhance the level of protection currently afforded to the relevant species or ecological community;

- ecological survey requirements for each species or ecological community will remain in place unless it can be demonstrated that the level of protection afforded to that species or community will be maintained or enhanced by permanently 'switching on' the relevant protective prescription;

- the Office of Environment and Heritage and DPI Fisheries will be provided with the time and resources needed to provide meaningful expert input into the review process.

Recommendation 9

To ensure that historical survey effort is not wasted, and to ensure protection of mapped threatened species, communities and habitat features, IFOA prescriptions triggered by previous ecological surveys must remain in place under the new IFOA.

8. Forest health, weeds and bell miner associated dieback

Native forests should be managed in a manner that maintains and restores their ecological values.

In particular, there is an urgent need to more effectively manage weeds, pest animals and diseases and to ensure fire management results in positive ecological outcomes.

Extensive areas of forest are suffering from dieback, a situation that is expected to rapidly worsen due to climate change. Despite this, little effort has been made to rehabilitate affected stands and they continue to be logged. Forests affected by dieback should be excluded from logging and actively rehabilitated.

The discussion paper does not adequately address important factors in maintaining forest health over time, including management of invasive weeds and forest dieback.

Recommendation 10

We urge the NSW Government to respond to concerns raised by the Bell Miner Associated Dieback (BMAD) Working Group by:

- identifying and mapping areas that are affected by, or susceptible to, bell miner associated dieback;
- prohibiting logging in affected and susceptible areas until appropriate management responses that restore ecosystem health are developed and implemented;
- undertaking rehabilitation work (including lantana removal) in affected stands;
- strengthening post-harvest weed control and regeneration requirements; and
- monitoring and evaluating treatment methods.

9. Soil erosion and water pollution

We do not support the proposal to make soil and water protection provisions less prescriptive, by adopting outcome-based standards and non-binding operational protocols. The use of outcome-based standards, unsupported by binding operational requirements, will create significant barriers to effective enforcement, leading to reduced compliance and increased soil erosion and water pollution risks.

In the absence of continuous monitoring, proving that an outcome-based standard has been breached can present substantial evidentiary barriers.

For example, heavy rain combined with defective road construction may result in a temporary, but significant, water pollution incident. Unless enforcement officers attend the scene immediately, direct evidence of the water pollution incident is unlikely to be available, while a breach of road construction requirements will remain evident following the pollution incident.

Recommendation 11

Soil and water protection measures in the IFOA should set out outcome-based performance standards, combined with clear, binding prescriptions based on best available science and operational experience. Both the outcome standards and operational prescriptions must be drafted in a manner that promotes compliance and supports effective monitoring and enforcement.

10. Logging on steep slopes

We are strongly and unequivocally opposed to industry proposals to permit logging on steeply sloping land. The prohibition on logging on steeply sloping land (above 30 degrees) has been in place for many years. Removing this important environmental protection would increase erosion and water pollution risks, promote weed invasion and compromise important wildlife corridors.

Logging on steeply sloping land poses a significant safety risk for forestry workers and regulators.

Steeply sloping land forms the backbone of the Great Eastern Ranges corridor. It is environmentally and economically irresponsible to invest millions of dollars in conserving and restoring the Great Eastern Ranges corridor, while simultaneously removing the longstanding environmental protections that have helped to maintain the integrity of this unique continental wildlife corridor.

Recommendation 12

That the NSW Government immediately abandon the proposal for a logging trial on steeply sloping land and reaffirm its commitment to the longstanding protection of forests on steeply sloping land.

11. Use of new technology

The proposed use of new technologies to identify and map landscape features is a significant operational change. Consistent with the practice adopted for the Environmental Outcomes Assessment Methodology (EOAM) under the *Native Vegetation Act 2003*, this technology should be subject to field trials, with key stakeholder representatives present, to determine its effectiveness and environmental integrity.

Recommendation 13

That proposed applications of new technology for mapping and operational planning purposes be tested in low impact field trials, with key stakeholder representatives present.

12. Monitoring framework

It is deeply disappointing that the ecological data collected under IFOA prescriptions over the years has not been effectively synthesised and analysed to determine trends in forest health and threatened species populations and to assess the effectiveness of existing IFOA prescriptions.

The strategic environmental monitoring framework should be developed in a transparent, rigorous manner, with input from experts and key stakeholders. The framework should be supported by a long-term commitment of funding and in-kind partnerships with universities and community organisations.

Recommendation 14
That the Natural Resources Commission be tasked with the development of a strategic environmental monitoring framework for public native forests, with input from key stakeholders, independent experts and the Office of Environment and Heritage.

13. Community access to information

Lack of transparency in relation to forestry operations and timber supply arrangements creates considerable public mistrust and results in forest management decisions being made without appropriate public scrutiny.

It is in the public interest for information about forest management and timber supply to be made freely available to the public on the internet, including:

- resource assessments;
- sustained yield estimates;
- timber supply and pricing arrangements;
- digital map layers for native forests;
- digital map layers for plantations;
- licences, permits and harvest plans;
- property vegetation plans; and
- breach reports and compliance responses.

Forest management and timber supply decisions should be made in an open and transparent manner, with opportunities for informed public participation. In particular, the results of the recent review of timber supply in North East NSW should be made publicly available, together with the government's proposed response.

Recommendation 15

That information in relation to forest management be made freely and publicly available, including: resource assessments; sustained yield estimates; timber supply and pricing arrangements; digital map layers for native forests; digital map layers for plantations; licences, permits and harvest plans; property vegetation plans; and, breach reports and compliance responses.

14. Proposed legislative amendments

The discussion paper outlines a number of proposed amendments to the *Forestry Act 2012* and the *Protection of the Environment Operations Act 1997*.

Make non-licence terms enforceable

We support the proposal to introduce offence and penalty provisions for 'non-licence terms', together with enhanced powers for regulators to support effective enforcement of these terms.

Consistent application of environmental protection licence

We support the proposal to ensure that the relevant environment protection licence (EPL) applies to all logging operations covered by the IFOA, provided that the EPL sets clear, enforceable water quality outcomes and clear prescriptions for logging, roading and other activities.

Introduce minimum competencies for forest contractors

We support the proposal to introduce an accreditation scheme for forest contractors, noting that accreditation of contractors will not absolve the Forestry Corporation from its responsibility to ensure compliance with relevant regulatory requirements and liability for breaches of those requirements.

Penalties and alternative regulatory tools

Community audits have revealed a pattern of systemic non-compliance with environmental laws in public and private native forests. The extent of non-compliance by the state forest agency was highlighted by the Land and Environment Court in June 2011, when Justice Pepper found that:

> *[T]he number of convictions suggests either a pattern of continuing disobedience in respect of environmental laws generally or, at the very least, a cavalier attitude to compliance with such laws. […]*
>
> *Given the number of offences the Forestry Commission has been convicted of and in light of the additional enforcement notices issued against it, I find that the Forestry Commission's conduct does manifest a reckless attitude towards compliance with its environmental obligations.*

To deter further breaches, the maximum penalties available under relevant legislation should be strengthened, in line with modern environmental legislation. Based on existing legislation, penalties of up to $1.1 million and terms of imprisonment would be appropriate.

To prevent unlawful logging, the following operational measures should be implemented:

- improve training and supervision for logging contractors;
- review harvest operation plans before logging operations commence; and
- increase the use of audits, penalty notices and criminal prosecution.

To improve compliance outcomes, section 69ZA of the *Forestry Act 2012* should be amended to allow third parties to bring proceedings to remedy or restrain breaches of environmental legislation during logging operations.

Notification requirements

We support online publication of information in relation to forestry approvals, but do not believe that publication of information on a website, in isolation, is an adequate public notification method. We recommend that online publication is complemented by: publication of notices in the government gazette, newspaper advertisements, an email subscription service and written notification for key stakeholders.

Recommendation 16

That the NSW Government prepare draft legislative amendments for discussion with key stakeholders, including: making non-licence terms enforceable; ensuring that water pollution conditions apply to all logging operations; requiring accreditation of forest contractors; strengthening penalties and regulatory tools; and, removing the legislative bar to third party enforcement proceedings.

Recommendation 17

That legislative amendments be introduced to separate the commercial and operational role of the Forestry Corporation from the setting of sustainable yields, regulatory policy and ecological surveys.

Attachments:

1. Submission on Improved Regulatory Arrangements for Water Quality and Threatened Species in New South Wales - Five Year Review of the UNE, LNE and Eden IFOAs (2004)

2. Submission on the Terms of Reference for the Review of NSW Forest Agreements and Integrated Forestry Operations Approval (December 2008)

3. Submission to the Review of the Forestry and National Parks Estate Act (May 2009)

4. Submission to the draft report on progress with implementation of the NSW Regional Forest Agreements (September 2009)

5. Submission to the 'Review of NSW Forest Agreements and Integrated Forestry Operations Approvals' (November 2010)

6. Independent appraisal of native forest timber resources and alternatives in New South Wales, Commissioned by the Nature Conservation Council of NSW (September 2011)

NATURE CONSERVATION COUNCIL OF NSW Inc.

Improved Regulatory Arrangements for Water Quality and Threatened Species in NSW State Forests: Five year Review of the Upper and Lower Northeast and Eden Integrated Forestry Operations Approvals

Report prepared by Paul Winn

29 October 2004

Nature Conservation Council of NSW
Level 5, 362 Kent St, NSW SYDNEY 2000
Ph: 02-9279 2466 Fax: 02 9279 2499
Email: ncc@nccnsw.org.au
Website: http://www.nccnsw.org.au

This report is the result of extensive consultation with the NSW forest conservation movement. The recommendations contained within this report were gathered from four workshops held in Lismore, Bega, Newcastle and Sydney during September 2004.
I would like to thank all those who participated in the workshops as well as the DEC staff who kindly agreed to give presentations.
I would like to especially thank Dailan Pugh, Carmel Flint, Barry Griffiths, Susie Russell, Peter Prineas, Mick Harewood, Bob Harris, Chris Allen and Georgina Woods for their assistance with editing, proofing and substantially assisting with the text. Thanks also to Sooty, Tony, Monica, Keith, Pete, Ruth, Bruce, David and Mitra.

Cover photos from top:
Severe dieback in Toonumbar NP formerly Toonumbar SF on the access road to the Murray Scrub Flora Reserve 2004 - Jon Armstrong of Armstrong Photographics.
Forestry roading blocking Tooheys Creek Palmdale, Ourimbah State Forest November 2003 - John Asquith.
Habitat tree retention in Eden Management Area - Nullica State Forest, Compartment 638, June 2004 - Tony Whan.

tober 2004

Executive Summary

The Integrated Forestry Operations Approvals (IFOAs) were introduced by the *Forestry and National Parks Estate Act (1998)* after some of the areas of State Forest and Vacant Crown Land etc identified as requiring reservation in the Comprehensive Regional Assessments (CRA) were protected in the NSW Reserve System. These 20-year Approvals were made for the Upper and Lower Northeast (UNE and LNE), and Eden bioregions in 1999, bringing together licensing for forestry operations under the *Threatened Species Conservation Act (TSC Act)*,[1] the *Protection of the Environment Operations Act (POEO Act)*,[2] and the *Fisheries Management Act (FM Act)*,[3] and incorporating all conditions, prescriptions, and definitions relating to Forestry NSW forestry operations within one document.

The IFOAs are required to be reviewed every five years. The purpose of the review is to assess the implementation of the provisions of the RFAs, and whether IFOAs are effective in achieving their purpose. The stated purpose of an IFOA is to provide a framework for forestry operations on public lands which integrates the regulatory regimes for environmental planning and assessment, for the protection of the environment and for threatened species conservation.[4]

The CRA reserve outcome fell well short of a truly Comprehensive, Adequate and Representative (CAR) forest Reserve System. In all IFOA forests, the reservation of forests was far below that recommended for CAR reserves. This leaves most of the forests in State Forest tenure essential components for the survival of many forest dependant species in NSW. Under the current regime, biodiversity and water quality are being degraded in public forests. The IFOA needs to be amended to address this deficiency.

CRA issues that were to be addressed remain unresolved. For example, Wilderness areas under leasehold have still not been purchased, the CERRA World Heritage areas remain to be renominated to include those areas with World Heritage values, reserved as part of the CRA, and Cultural Heritage sites on State Forest tenure are still being destroyed before they can be protected.

The enabling legislation saw the removal of third party prosecution rights; no member of the public may bring proceedings to enforce a law, agreement, approval, licence or conditions under the IFOAs. It has meant that regulatory agencies such as the Department of Environment and Conservation (DEC) and Fisheries NSW have responsibility for the

[1] S91 *TSC Act*
[2] S55 *POEO Act*
[3] S220ZW *FM Act*
[4] S25 *FNPE Act*

enforcement of compliance of licence clauses and conditions, it appears that DIPNR (formerly DUAP) has responsibility for the overall IFOA and the conditions which do not fall under an actual licence. However DIPNR have done no enforcement or monitoring of these clauses and as far as we know have no dedicated staff to do so.

The expectation that the agencies responsible for the regulation of forestry activities would have been given strict enforcement powers to ensure compliance of clear and unambiguous conditions, developed to adequately mitigate the impacts of logging on biodiversity and water quality, has not been satisfied. This report, therefore, recommends a major overhaul of the IFOAs, to provide adequate protection for many under-reserved forest dependant species and ecological communities, and the mitigation of catchment degradation by current logging practices on public land.

The agencies responsible for ensuring compliance of IFOA conditions are DEC, DIPNR and Fisheries NSW. DEC incorporates the Environmental Protection Agency (EPA) and the National Parks and Wildlife Service (NPWS). As part of the integration of these two agencies the Environmental Protection and Regulatory Division (EPRD) was created, incorporating the Forestry Unit (FU) of the EPA, and the Threatened Species (TSU) Unit of NPWS. This new division is responsible for the compliance of IFOA conditions attached to the Threatened Species Licences (TSL) and Environmental Protection Licences (EPL). Fisheries NSW[5]administers the regulation of the Fisheries Licences, through a separate Threatened Species Unit.

The recommendations contained in this summary and report have been developed in an attempt to warn government and its agencies of growing concern among scientists, the general public and regulatory agencies, for the health of catchments, biodiversity and water quality, as well as the health of IFOA forests themselves. These recommendations seek amendments to the IFOAs that would help mitigate the impacts that have led to such concerns. They are not in order of priority. Some of the recommendations appear to be easily acceptable to the Ministers responsible for the five-year review; others may be more contentious. However, all the recommendations have been developed with the limitations of current Wood Supply Agreements (WSA), agency budgetary constraints, and regulatory simplification and consistency in mind. All have been formulated following wide consultation in the NSW forest conservation movement.

It is recognised that current WSA commitments have placed enormous pressure on FNSW and regulatory agencies. This has led to severe overcutting of forests in an attempt to fulfill these onerous timber commitments, with the result that IFOA catchments and water quality, and forest health and biodiversity have been seriously jeopardised. With this in mind, the following recommendations seek to limit the impact of logging on these values without seriously compromising WSA commitments. The main report should, however, be referred to for a full explanation and justification of all recommendations.

[5] Now integrated into the Department of Primary Industries along with FNSW.

Recommendations 1 to 17 are related to FNSW compliance of IFOA clauses and conditions. Implementation of these recommendations will not affect FNSW timber commitments in any way. It will however, provide for a firm footing on which regulatory agencies can enforce the Approvals and bolster public confidence in those agencies. Without these recommendations being accepted, the general public cannot be assured that the current IFOA clauses and conditions are being adhered to.

The people of NSW cherish our public forests as well as the continuation of a sustainable native forest resource. If accepted, these recommendations will demonstrate that FNSW and timber contractors are truly accountable, and that the NSW government is committed to ensuring the sustainable management of our public forests.

While it is accepted that the cost of regulating FNSW activities may increase with the acceptance of these recommendations, any increased cost to DEC and Fisheries NSW would be more than offset by the full cost recovery of the regulation of FNSW activities inherent in **Recommendation 58**.

Recommendations 18 to 25 are related to current logging practices employed by FNSW in IFOA areas. Few of these recommendations will affect FNSW timber commitments or increase the cost of regulation. **Recommendations 20 and 22,** however, may be of concern to FNSW, in that the Australian Group Selection (AGS) method employed on the north coast and Alternate Coupe Logging in the Eden Management Area are extremely intensive, and therefore provide high short-term timber volumes. It is the short-term nature of these methods that concerns the conservation movement, and should also concern government and the timber industry. Current timber contracts are for more than 20 years, hardly a short-term commitment. The ability of FNSW to fulfill these contracts is, therefore, reliant on healthy forests and the assured recovery and regeneration of the forest resource. These methods severely impact on water quality and biodiversity. As would be expected, forest health is also affected. FNSW must therefore be encouraged to give more focus to the economic sustainability of long-term timber yields of a healthy forest resource by managing forests in an ecologically sustainable manner.

Recommendations 28 to 49 are related to issues that should have been resolved by now. The CRA committed to declaring 90% of all identified Wilderness. However, only about 70% was actually declared and protected as such. Large areas of identified Wilderness remain unprotected on State Forest leasehold land on the north coast and in the EMA. These areas are already protected from logging. However, their purchase and full protection remains incomplete. World Heritage areas were to be protected in the CRA, but the Central Eastern Rainforest Reserves of Australia (CERRA) World Heritage area on the north coast has yet to be declared and vast areas of protected rainforest and oldgrowth eucalypt forest is still being ignored for inclusion. A further 30,000ha of Vacant Crown Land in the UNE and LNE promised under the Forest Agreements awaits transfer to the NSW Reserve System. Priority private land purchases were also required

under the CRAs but are awaiting adequate resources. Cultural Heritage too, was to be resolved by the CRA. FNSW is, however, not managing these values in a culturally appropriate or responsible manner. Additionally, there are iconic forests in the EMA that require reservation and Crown lands of high conservation value that are now earmarked for conversion to freehold under State Government initiatives: While the reserve systems in the LNE and UNE have been updated since the RFA to include iconic high conservation value forests, the EMA reserve estate remains unreviewed. Equally, high conservation value forest on vacant Crown land must be assessed for addition to the reserve estate.

Recommendations 50 to 61, relating to forest and catchment health, represent core requirements for Ecologically Sustainable Forest Management. While FNSW are expected to counter these assertions, the scientific literature overwhelmingly supports them. As discussed above, forest and catchment health is related to both the conservation of environmental values and FNSW's ability to maintain timber commitments. Without healthy forests, IFOA areas will become simplified eucalypt monocultures, largely worthless as habitat for threatened species, and will have dire consequences for down stream water users.

Recommendations 62 to 85 relate to Environmental Protection Licences. These are priority recommendations and cannot be ignored. As none of these recommendations will impact on timber commitments, there is no justification for objection. They are essential for the provision of proper and adequate regulation of FNSW activities and the mitigation of the impacts on water quality. The fact that FNSW is no longer seeking EPLs for non-Scheduled activities is of particular concern. It means that for 98% of IFOA forestry operations, few EPL regulations can be enforced. FNSW has not shown itself to be a responsible self-regulator. The denial of adequate external regulation is therefore unacceptable. By refusing to be regulated by DEC in this regard, FNSW can log the 30% of all drainage features that remain unmapped. Due to these mapping anomalies, FNSW is allowed to undertake these hazardous operations without proper scrutiny, putting at risk the water quality of most NSW coastal communities. This is against the stated purpose of the IFOAs and must not be allowed to continue.

Recommendations 86 to 126 relate to Threatened Species Licences. These too, are priority recommendations. Most would have no impact on timber commitments and would provide for regulatory consistency between IFOA regions. Indeed many would improve cost effectiveness by simplifying the current regulation of FNSW activities while providing for far better ecological outcomes. Some of these recommendations would also benefit FNSW, in that they simplify current assessment and survey procedures. Others, however, may be seen to interfere with FNSW harvesting. **Recommendation 90,** for example, states that if forests in the reserve estate are subject to fire damage and the damaged ecosystems are under-reserved, that ecosystem must be deferred from logging on State Forest tenure until the extant in Reserves can be shown to have recovered from the fire damage. This may impact on timber commitments in the

short term. However, the deferral would only be until the fire damaged forest ecosystem has recovered. As few forest ecosystems reached their target for reservation under the CRA, it falls to the IFOAs to maintain the habitat values of threatened species in these under-represented forests types.

Recommendations 97 to 110 relate to habitat tree retention. These recommendations are essential to mitigate the impact on biodiversity resulting from current logging intensities in IFOA forests. FNSW have been shown to blatantly ignore the needs of threatened species in their care by continuously breaching conditions of the TSLs. They have undertaken flawed assessment and threatened species surveys with untrained personnel, and as a result, few species specific protocols have been triggered. This leaves broad area conditions, such as habitat tree retention, as the only safe and sure way of providing enough habitat for arboreal and hollow-using fauna. These recommendations cannot be ignored. As they will only result in the loss of approximately 2.5% of current standing timber volumes, they are a cost effective way of improving ecological outcomes without significantly effecting access to timber.

Recommendation 111 relates to post-logging burning. It is felt that this recommendation should be easily accepted. This recommendation does not impact in any way on timber availability, and would provide significantly improved water quality and biodiversity outcomes. Indeed, this recommendation would substantially reduce the occurrence of wildfire escape and should improve forest health and the regeneration potential of growing forests. However, it is anticipated that FNSW will object to this recommendation. It has, therefore, been thoroughly researched and fully justified.
Recommendations 113 to 115 relate to grazing in IFOA forests. While FNSW rely on grazing to reduce fuel loads, this has been shown to be a flawed assumption. The ecological impacts of grazing and associated fire have been shown to seriously impact on threatened species and water quality. Indeed, as cattle cannot be successfully excluded from exclusion zones and riparian and streamside buffers, it is essential for IFOA compliance that this recommendation be accepted. Much of the current concern about the degradation of water and habitat quality in logged forest would be allayed if these recommendations (111 and 113-115) were implemented. Given the damage that fire and grazing currently inflict on IFOA forests, it is likely that, without the application of these recommendations, few of the current or recommended measures to protect biodiversity and water quality will have their desired effect.

Recommendations 117 to 126 concern individual forest dependant threatened species. It was not within the scope of this report to fully evaluate all species-specific conditions contained within the TSL conditions. The species for which recommendations have been made are, however, not merely the most easily mitigated for, but are also some of the most at risk of regional and State extinction due to logging and forested land clearing in NSW. While it is hoped that the recommended amendments to the IFOAs clauses and conditions made above can adequately mitigate the impacts of logging on our unique forest wildlife, it must be accepted that to remove significant proportions of so many

species' habitat must eventually lead to such a simplified environment that few forest dependant species can hope to exist outside forest reserves in the long-term. As the forest reserved as a result of the CRAs fell substantially short of meeting the meagre targets of viable populations for these species, the quality of any forest habitat outside of the NSW reserve system is essential to maintain current populations of forest dependant threatened species.

The Spotted-tailed Quoll (**Recommendation 121**) is a Nationally Endangered species. Under the IFOAs, the last large carnivorous marsupial on mainland Australia is being systematically extinguished from NSW State Forests as "collateral" victims of aerial 1080 baiting for foxes and wild dogs. **Recommendation 123** concerns a subspecies of Koala perilously maintaining its hold in our south coast forests. FNSW may say that no species has become extinct due to logging, but many have been pushed to regional extinction due to the combined impacts of landclearing and the simplification of extant forests as a result of intense logging. This intensity is felt the most by the Eden forests. The woodchip giant South East Fibre Exports (formerly Harris Daishoua) is removing Koala habitat faster than it can recover. This is leading to the disappearance of this species from State Forests in the Eden IFOA forests.

RECOMENDATIONS

Recommendation 1.

The relevant Ministers must delegate to the Department of Infrastructure, Planning and Nature Resources powers to enforce IFOA clauses: appropriate penalties must be inserted into the IFOAs for failure to comply with any clause.

Recommendation 2.

Unnecessary discretionary wording must be removed from all IFOA Licence conditions to allow definitive interpretations by the court. Where FNSW discretion is found to be necessary, the circumstances where this discretion is appropriate must be clearly set out in the condition, and FNSW must properly assess the determination of its discretion and report to DEC where it has done so. Pro-formas must be developed for use by FNSW when using its discretion and these must be monitored, assessed and approved by DEC compliance staff prior to the discretion being applied.

Recommendation 3.

DEC must employ at least two dedicated forestry compliance officers within each IFOA region. These officers are to be conversant in both the TSL and EPL conditions.

Recommendation 4.

All compliance-related correspondence between FNSW and regulatory agencies must be publicly available on the appropriate agencies' websites, and DEC warning letters, Penalty Infringement Notices and prosecutions must be made public in local and State-wide media.

Recommendation 5.

The Threatened Species Conservation Regulations must be amended so that compensatory habitat is introduced as a penalty for FNSW breaches of the TSL.

Recommendation 6.

DEC Legal branch must identify whether individual contractors can be held liable for breaches of FNSW markups and directives, and prosecute individuals for such breaches.

Recommendation 8.

FNSW must provide DEC with completed Harvesting Plans and assessments at least three months prior to undertaking operations.

Recommendation 9.

DEC must undertake desk-top pre-logging assessments of all operations undertaken by FNSW, and field audits of at least 10% to determine whether pre-harvest surveys and mark-ups are in accordance with conditions.

Recommendation 10.

The IFOA needs to reflect the importance of timely reporting by all agencies, and penalties must be imposed for tardiness.

Recommendation 11.

Should FNSW remain behind in its reporting responsibilities, independent auditors must be engaged to undertake the role until FNSW can show that its reports will be provided on time. FNSW should bear the costs of such audits.

Recommendation 12.

A clause must be inserted into the IFOAs to ensure that the effectiveness and objectives of all conditions attached to the TSL are audited by DEC/FNSW over the next five years. TSL conditions must be amended to provide DEC with options for implementing more stringent conditions when circumstances demand it or when new information becomes available.

Recommendation 13.

A condition must be inserted into the TSLs that requires FNSW, in consultation with DEC, to undertake scientific trials into the effectiveness of TSL conditions, with appropriate management plans, assessments and periodic reviews to be conducted over the next five years.

Recommendation 14.

Clause 49 of the IFOAs must be redrafted to state that "FNSW must give all and any assistance sought by regulatory agencies in undertaking assessments of the objectives of Licence conditions and compliance." Breaches of such a clause must prescribe penalties for each day the requisite assistance is not provided.

Recommendation 15.

A clause must be inserted into the IFOAs to limit the volumes of all timber products extracted under the IFOA to current levels or less.

Recommendation 16.

The Forestry and National Parks Estate Act should be amended, so that any significant increase in intensity of operations in an IFOA area is subject to Part 5 of the Environmental Planning and Assessment Act 1979.

Recommendation 17.

A clause must be inserted into the IFOA to reflect stated Government policy that there will be no use of native forest timber to produce bio-energy.

Recommendation 18.

A clause must be inserted into the IFOA that encourages FNSW to seek markets for value-added products, and discourage FNSW from seeking markets for low-value products such as woodchip, biomass and charcoal.

Recommendation 19.

FNSW Best Management Practice silviculture guidelines must be developed in consultation with DEC and in accordance with Montreal Protocol ESFM indicators. DEC must analyse FNSW BMP guidelines and additional information must be introduced as it becomes available.

Recommendation 20.

The IFOA must be amended so that no further areas are logged under AGS conditions.

Recommendation 21.

FNSW must identify areas where AGS has been employed and determine the 10% of the Net Harvest Area excluded from logging as per the current IFOA. Should FNSW be found to have logged in the 10% exclusion areas, compensatory habitat must be removed from its Net Harvest Area in other operations of similar forest type, stand condition and stand age.

Recommendation 22.

Alternate coupe logging must cease in the EMA, and single tree selection must be employed in its stead.

Recommendation 23.

A clause be must inserted into the Upper and Lower Northeast IFOAs that sets a limit of 50% of total volume woodchip that can be harvested from any one FNSW operation.

Recommendation 24

The TSLs must be amended so that miscellaneous forestry operations are defined as specified forestry operations.

Recommendation 25

The TSLs must be amended so that thinning is specifically defined as a specified logging activity and regulated as for all logging operations.

Recommendation 26.

All Wilderness capable areas must be excluded from IFOAs.

Recommendation 27.

All areas assessed as being capable of Wilderness Identification must be declared as Wilderness.

Recommendation 28.

The NSW Government should develop a Memorandum of Understanding (MoU) with the Queensland Government to facilitate co-operative management for the four wilderness areas that straddle the NSW-QLD state border – Mt Ballow, Bald Rock, Donnybrook West, Lost World.

Recommendation 29.

The NSW section of Bald Rock should be declared under the Wilderness Act immediately, as the Wilderness is an equivalent size to the declared Lost World wilderness area.

Recommendation 30.

The MoU for the Lost World Wilderness should include management of the 'Border Track' and associated lookouts so as to minimise impacts upon wilderness values, while providing for visitor safety. Regeneration of rainforest along the border would provide the most effective impediment to exotic fauna, including rabbits, and this should replace fences as the primary management tool in the MoU.

Recommendation 31.

Existing IFOA wilderness exclusion areas must remain so excluded from the operation of the IFOA, and therefore from logging, until purchases and declarations are complete.

Recommendation 32.

Existing Identified Wilderness areas that have no impediment to declaration must declared immediately. This includes Chaelundi, Mummel Gulf and Bald Rock.

Recommendation 33.

Additional funds must be provided to promote the voluntary purchase of Identified Wilderness on Crown leasehold over State Forest tenure and other Crown leasehold lands.

Recommendation 34.

All potential Wilderness areas must be placed under an immediate and permanent moratorium from the Crown leasehold conversion process.

Recommendation 35.

Freehold and leasehold Identified Wilderness properties that have been purchased by NPWS, but are subject to mineral objections, should now be gazetted as National Park and declared as Wilderness immediately.

Recommendation 36.

A comprehensive landscape assessment of World Heritage values in north-east NSW must be undertaken to identify all areas qualifying for additions under the rainforest, eucalypt and heritage themes. Based on this assessment, a renomination proposal should be prepared for the whole of CERRA by the end of 2005 and recommended by DEC to the Commonwealth Department of Environment and Heritage (DEH).

Recommendation 37

The remaining 30,000 hectares of vacant Crown land that has been under assessment for reservation in accordance with the UNE and LNE Forest Agreements, must now be transferred to National Parks estate as a matter of urgency.

Recommendation 38.

Government funding must be expressly dedicated to the voluntary purchases of leases over areas identified for reservation as a matter or urgency.

A protocol or Memorandum of Understanding must be developed to ensure FNSW contribute funds to buy leases that are partially identified for future reservation, and partially for future logging.

Recommendation 39.

DEC must be provided with funds to purchase high priority private lands for conservation to match the funds already received by FNSW to purchase private land to log. DEC must be provided with at least $500,000 for on-going monitoring and reviews of conservation data over the next five years of the IFOA.

Recommendation 40.

The following Eden Forestry Compartments should be legislatively transferred to NSW forest Reserve System immediately. Until the fate of these forestry Compartments are

determined they must be removed from all FNSW logging schedules and plans of operation and rezoned as FMZ2..

1. ***Yambulla State Forest - Compartments 550. 556, 557, 573, 574, 577 -588,***
2. ***Yurammie State Forest - 963- 967, 996.***
3. ***Murrah State Forest - 2059 - 2064***
4. ***Mumbulla State Forest - 2161, 2163, 2164, 2167- 2171, 1276 - 2185***

Recommendation 41.

FNSW must immediately upgrade all 'unloggable' FMZ areas. All areas must be included in FMZ1, unless it can be shown that it is not possible or practicable to do so, in which case they should be included in FMZ2, and FMZ3a should only be used as the last option.

Recommendation 42.

FNSW must immediately prepare management plans for all FMZ1 and FMZ2 areas and all large exclusions of high conservation oldgrowth and rainforest, in consultation with DEC.

Recommendation 43.

DEC Cultural Heritage Division must be given the responsibility for all Cultural Heritage protection on State Forests of NSW tenure. DEC must investigate and nominate for protection all Cultural Heritage areas identified during and since the CRA process.

Recommendation 44.

DEC must not issue FNSW retrospective consent to destroy Cultural Heritage.

Recommendation 45.

DEC must develop and fund a consultation process with Indigenous groups and communities to determine the aspiration they have for DEC and the protection of Indigenous Cultural Heritage in IFOA forests.

Recommendation 46.

The maps delineating high conservation oldgrowth and rainforest for protection under the TSL, must be amended to include all oldgrowth forest and rainforest on other Crown Timber Lands such as vacant Crown land and Timber Reserves.

Recommendation 47.

A clause must be inserted in the IFOA preventing FNSW from purchasing timber that was not harvested in accordance with IFOA requirements.

Recommendation 48.

A clause must be inserted into the IFOA that all mapped oldgrowth and rainforest must be protected on any lands purchased by FNSW, and all private lands from which FNSW purchases timber.

Recommendation 49.

A clause must be inserted into the IFOA preventing FNSW from purchasing any areas that contain substantially unmet CAR targets - to be specified by DEC.

Recommendation 50.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials to determine the state of forest health in State Forests and develop management plans and remedial procedures for forests where forest health is found to be in serious decline.

Recommendation 51.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to map areas of degraded forests and identify rehabilitation treatments to restore them to a healthy state as part of all operational planning: these maps and treatments must be incorporated into all FNSW Harvesting Plans.

Recommendation 52.

A clause must be inserted in the IFOAs to restrict access of large machines and trucks, which cause severe soil compaction, to existing roads and log dumps only.

Recommendation 53.

The EPL and TSL must be reviewed in light of the recent change from manual harvesting to mechanical harvesting in NSW, and the dramatic increase in soil and understorey disturbance that this represents. New conditions must be developed to restrict access of this machinery to sensitive areas, and to mitigate impacts on soil, water and threatened species.

Recommendation 54.

A clause must be inserted into the IFOA that requires a review of the operation of the EPL and the TSL whenever DEC is of the opinion that logging practices have changed significantly from practices in use when the original licences were issued.

Recommendation 55.

A clause must be inserted in the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials to determine the effects of intensive logging and post logging burning on mychorrizal fungi, and the consequential impacts this has on the growth of regenerating forest.

Recommendation 56.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials, assessments and management plans to determine the extent of crown decline in IFOA forests and identify what treatment is to be employed in forests affected by dieback and other stress-related crown decline.

Recommendation 57.

Until the underlying cause of dieback is conclusively identified and specific measures developed to effectively manage the problem, areas of forest suffering dieback and those areas vulnerable to dieback be removed from plans of operation and excluded from logging operations.

Recommendation 58.

A clause must be inserted into the IFOAs limiting the logging of any subcatchment to 15% of forest basal area in any one year, with a 15 year subcatchment logging cycle.

Recommendation 59.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to cost the environmental effects of logging, including reduced water yield for down stream water users.

Recommendation 60.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials and assessments, and develop management plans to address the effects of lower water yields after logging on fish, invertebrates, frogs,

aquatic reptiles and water dependant mammals over the next five years. The results of such trials should be used by DEC to develop conditions to mitigate such effects.

Recommendation 61.

A clause must be inserted into both the EPL and the TSL that restricts logging in any compartments that have been recently subject to a moderate to high intensity burn, until a period of at least 5 years has elapsed.

Recommendation 62.

The definition of Scheduled operation contained in the Protection of the Environment Operations Act must be amended to reflect current logging practices, so that it becomes mandatory for all FNSW logging and roading operations to be covered by EPLs.

Recommendation 63.

EPLs and the conditions therein, designed to protect the vegetation alongside unmapped drainage lines (UMDL) must be mandatory for all FNSW operations in IFOA forests

Recommendation 64.

A condition must be inserted into the EPLs that require FNSW to map unmapped drainage lines as they are identified on the ground, and to provide DEC the coordinates and GIS layers of all identified unmapped drainage features including drainage depressions, as they become available.

Recommendation 65.

Original streamside Buffer Zone conditions must be reintroduced in the EPLs.

Recommendation 66.

Buffers and filter strips must be defined as exclusion zones in all IFOAs and appendices, thereby imposing the obligation on FNSW to mark up these important areas prior to logging.

Recommendation 67.

FNSW must provide DEC with independent engineer's certificates for all FNSW roading on slopes above 18 degrees.

Recommendation 68.

A condition must be inserted into the EPLs requiring FNSW to regularly maintain all roads required to be left open in State Forests. This condition must include the maintenance of road surface and drainage structures intended to mitigate sediment runoff.

Recommendation 69.

A condition must be inserted into the EPLs requiring FNSW to close all unused roads, snig tracks and log dumps, and rehabilitate the compaction of roads, snig tracks and log dumps, in excess of requirements for fire control and sustainable recreational pursuits, by deep ripping and seeding with seed gathered adjacent to those roads and snig tracks and log dumps to mitigate the long-term impacts of soil compaction.

Recommendation 70.

A condition must be inserted into the EPLs requiring FNSW to install more effective sediment traps on all road, track, bridge and culvert construction and rehabilitation.

Recommendation 71.

A condition must be inserted into the EPLs that requires FNSW to model point source pollution impact hazards associated with traffic numbers on State Forest roads, based on which DEC can develop conditions to be incorporated into the EPLs, so as to mitigate the impacts.

inserted into the EPLs that requires FNSW to model point source pollution impact hazards associated with traffic numbers on State Forest roads, based on which DEC can develop conditions to be incorporated into the EPLs, so as to mitigate the impacts.

Recommendation 72.

A condition must be inserted into the EPLs that requires FNSW to model the potential pollution impact hazard of sediment plumes and the distances they will travel, based on which DEC can develop conditions intended to mitigate the impact.

Recommendation 73.

A clause must be inserted into the IFOAs requiring FNSW to provide all Harvesting Plans, maps and assessments to Fisheries NSW at least 3 months prior to logging, and incorporate into amended Plans any comments made to mitigate the potential impacts on fish movement.

Recommendation 74.

A condition must be inserted into the EPLs requiring FNSW to provide appropriate independent engineer certification to DEC and Fisheries NSW for the construction of bridges. This must include sediment traps and the minimising of stream bank disturbance.

Recommendation 75.

A condition must be developed by DEC and inserted into the EPLs for the removal of bridges so that erosion and sediment dispersal caused by their removal is minimised. This must include the installation of sediment traps and the rehabilitation of stream banks.

Recommendation 76.

Current EPL conditions for bridges must also be applied to all culverts installed by FNSW.

Recommendation 77.

A condition must be inserted into the EPLs requiring FNSW to identify all snig track crossings on FNSW Harvesting Plan maps and provide DEC with a copy of such maps at least three months prior to logging taking place.

Recommendation 78.

A condition must be inserted into the EPLs requiring FNSW to build temporary culverts for snig track crossing. Their removal must be undertaken so as to minimise sediment dispersal and erosion by implementing similar conditions as for the removal of bridges. Conditions need to explicitly prohibit the use of gully stuffers.

Recommendation 79.

A clause must be inserted into the IFOAs requiring FNSW, in consultation with DEC, to model the potential point source pollution impact hazard associated with drainage structures and distances from the source the sediment will travel, from which DEC can develop conditions intended to mitigate this impact.

Recommendation 80.

A new pre-operational planning pro-forma must be developed by DEC so that adequate monitoring of all FNSW pollution assessments can be undertaken.

Recommendation 81.

DEC must engage the Cooperative Research Centre for Catchment Hydrology to undertake research into the issues of subsurface flows, hydrophobic soils resulting from post logging burns, and stream bank erosion caused by logging operations, and develop conditions appropriate to mitigating these impacts.

Recommendation 82.

A condition must be inserted into the EPLs requiring FNSW, in consultation with DEC, to model the pollution impact hazard of stream bank erosion to enable DEC to develop conditions intended to mitigate this impact.

Recommendation 83.

Independent soil conservation experts must once again be seconded to FNSW to undertake pollution hazard assessments.

Recommendation 84.

FNSW must use updated soil regolith maps as developed by DIPNR.

Recommendation 85.

Standardised dispersible soil testing, and site-specific soil assessment pro-formas must be developed by DEC.

Recommendation 86.

The Threatened Species Conservation Regulations (and the Fisheries Regulation) must be amended to impose a Licence fee on FNSW for TSLs (and FLs). The quantum of the fee must correspond to the fee imposed for the issuing of EPLs.

Recommendation 87.

DEC must randomly monitor the accuracy and veracity of at least 10% of all FNSW assessments.

Recommendation 88.

DEC must undertake a rapid desktop assessment of all potential Endangered Ecological Communities (EEC), Key Threatening Processes (KTP), and Critical Habitat and begin to undertake nominations to the NSW Scientific Committee for their

listing in the Schedules of the TSC Act. Once listed, these must be mapped and incorporated into the TSLs.

Recommendation 89.

DEC and FNSW must adopt the CRA floristic assemblages defined in the CRA GIS layers in all Harvest plan assessments and conditions. Research Note 17 forest typing should only be used for FNSW internal timber assessments.

Recommendation 90.

The following clause must be inserted into the IFOAs: Where a forest ecosystem did not meet its target for reservation in the Comprehensive Regional Assessment, and DEC can show that more than 50% of its reserved extant has been seriously damaged by wildfire, FNSW must reschedule the logging of that forest ecosystem in State Forest tenure until DEC can show that the damaged reserved forest has sufficiently recovered.

Recommendation 91.

DEC must develop an accreditation system for independent field ecologists and compile a list of appropriately trained and experienced field workers who can undertake FNSW pre-harvest surveys. Surveys must be conducted by these accredited, independent contractors instead of FNSW staff. FNSW must provide DEC with information as to the number and location of individual threatened animals and plants and the numbers of threatened species identified by each individual surveyor, to be incorporated into the accreditation database.

Recommendation 92.

Conditions of the TSL must be amended to ensure all suitable hollow-bearing trees are surveyed for bats using the ANABAT method at dusk to identify whether hollows are being used. All bat trees not so surveyed must be retained.

Recommendation 93.

Conditions of the TSL must be amended to ensure surveys are undertaken for riparian frogs at sites at least 800m apart and not in the same gully system.

Recommendation 94.

Conditions of the TSL must be amended to ensure surveys are undertaken for Golden-tipped Bat (Kerivoula papuensis) and Large-footed Bat (Myotis adversus) at sites at least 800m apart.

Recommendation 95.

A condition must be inserted in to the TSLs requiring FNSW to mark up the whole compartment or operation before logging commences.

Recommendation 96.

A condition must be inserted into the TSLs requiring FNSW to employ permanent markings, such as a metal tag at breast height and a small painted blaze at the base of the tree, when marking up all exclusion areas and retained trees. FNSW must enter the GPS coordinates of all tree retention markups and exclusion areas onto GIS layers and provide copies to DEC before logging commences.

Recommendation 97.

Condition 5.6 of the TSLs must be amended to require FNSW to retain "at least twelve habitat trees in every two hectares of the Net Harvest Area, from the largest DBH trees available in every two hectares, determined by 2ha grids mapped across the Net Harvest Area. FNSW must provide DEC with the coordinates of the 2 hectare grids (133.33m x 133.33m) within a 10% margin of error.

DEC should determine whether, in some circumstances, the number of habitat trees might need to be increased. For example, where arboreal or other species' densities are higher than would survive with this number, or where there is a stand of more than 12 large veteran trees (> 80 cm DBH) in a two hectare area of a compartment.

Recommendation 98.

Condition 5.6 of the TSLs must be amended to require FNSW to report to DEC where more than 12 trees of greater that 80cm DBH exist in a two hectare area of Net Harvest Area of an operation, and to require DEC to determine whether the species existing or likely to exist in the area require further habitat trees of this cohort to be retained.

Recommendation 99.

Condition 5.6 of the TSLs must be amended to require FNSW to permanently mark all retained trees with a metal tag nailed at breast height, a small painted blaze at the base of the tree, and reflective paint.

Recommendation 100.

Condition 5.6 of the TSLs must be amended to require FNSW to identify the GPS coordinates of all retained trees and to enter these coordinates onto a GIS layer, to be provided to DEC before logging commences.

Recommendation 101.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have failed to retain the largest trees in every two hectares of the Net Harvest Area, determined by the 2ha grid coordinates, or to have retained less than the requisite number of trees in every such two hectares of the Net Harvest Area, the number of trees in deficit of the above conditions be retained from the largest DBH trees available in subsequent operations (determined by DEC) as compensation for the breach.

Recommendation 102.

The delineation of Regrowth and Non-Regrowth Zones must be removed from all IFOAs.

Recommendation 103.

TSL condition 5.6(e) must be amended to require FNSW to exclude harvesting from the area surrounding dead standing trees, corresponding to the height of the standing dead tree in question.

Recommendation 104.

Condition 5.6 of the TSLs must be amended to require FNSW to retain "at least 24 recruitment trees in every two hectares of Net Harvest Area, from the next largest DBH cohort of those habitat trees retained, and of the same species as those retained habitat trees". DEC should determine whether, in some circumstances, this number needs to be increased, for example where population densities of hollow-dependant species are higher than would survive with this number, and where there are more than 24 large veteran trees > 60cm DBH.

Recommendation 105.

Condition 5.6 of the TSLs must be amended to require FNSW to report to DEC where more than 24 trees of greater that 60cm DBH exist in a two hectare area of Net Harvest Area of any operation, and require DEC to determine whether the fauna species existing or likely to exist in the area, require the retention of additional trees of this cohort.

Recommendation 106.

Condition 5.6 of the TSLs must be amended to require FNSW to permanently mark all retained trees with a small painted blaze at the base of the tree and metal tag nailed at breast height, as well as reflective paint.

Recommendation 107.

Condition 5.6 of the TSLs must be amended to require FNSW to identify the GPS coordinates of all retained trees and enter these coordinates onto a GIS layer, to be provided to DEC before logging commences.

Recommendation 108.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have failed to retain the trees closest in size to those habitat trees retained, in every two hectares of the Net Harvest Area (as determined by the grid coordinates of the compartment) or to have retained less than the requisite number of recruitment trees in every two hectares of the Net Harvest Area, the number of trees in deficit of the above conditions be retained from the largest DBH trees available in subsequent operations (determined by DEC) as well as twice that number of trees from the next largest cohort of trees, as compensation for the breach.

Recommendation 109.

Condition 5.6 of the TSLs must be amended so that the discretionary phrase "to the greatest extent practicable" is removed. FNSW must protect all retained trees from fire by removing all debris or flammable material from their base, and from damage during harvesting operation.

Recommendation 110.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have irreparably damaged retained trees in harvesting or post-logging burning operations, the number of damaged or lost trees are additionally retained from the largest DBH trees available in subsequent operations (determined by DEC) as well as twice that number of trees from the next largest cohort of trees of the same species, in compensation for the breach.

Recommendation 111.

Both the TSLs and EPLs must be amended to prohibit FNSW from undertaking post-logging burns.

Recommendation 112.

A condition must be inserted into the TSLs excluding logging within ten metres either side of all unmapped drainage lines.

Recommendation 113.

A clause must be inserted into the IFOAs prohibiting cattle grazing in IFOA forests.

Recommendation 114.

A clause must be inserted into the IFOAs that requires FNSW to unconditionally acquire all grazing leases on State Forest tenure as they become available for renewal.

Recommendation 115.

DEC must prosecute FNSW and grazing leaseholders for breaches resulting from grazing in exclusion zones and streamside buffers. Once successfully prosecuted, DEC should seek a court injunction prohibiting cattle from entering exclusion zones and streamside buffers. If FNSW and grazing leaseholders cannot show the court that they can exclude cattle effectively, a court order must be sought prohibiting cattle from State Forest tenure, regardless of leases.

Recommendation 116.

A condition must be inserted in to the TSL prohibiting ground scavenging for fallen timber in all IFOA forests.

Recommendation 117.

As part of the IFOA review, DEC must conduct a desktop analysis of all existing harvest plans to review each threatened species prescription and its efficacy in triggering protection measures. This information must then be used to produce improved threatened species prescriptions as an output of the IFOA review.

Recommendation 118.

Prescriptions that are triggered by a record, and only apply in the vicinity of the record, must be improved to apply over a larger area in the vicinity. At the very least, all such prescriptions should be applied within a 1km radius of the record, with larger areas for particular species if determined by DEC.

Recommendation 119.

DEC should immediately design a set of ameliorative measures to be applied within modelled fauna habitat for all threatened fauna species, to complement existing record based measures.

Recommendation 120.

Condition 2.1 (b) of the TSLs allowing FNSW to seek a DEC review of conditions that exclude more than 20% of the Net Harvest Area of a compartment from logging, must be removed.

Recommendation 121.

A condition must be inserted into the TSLs prohibiting aerial and surface 1080 baiting in all IFOA forests and specifying that, within modeled Class One Spotted-tailed Quoll habitat, or known Spotted-tailed Quoll populations, no underground baiting is to be undertaken without assessment of populations of target and susceptible non-target species.

Recommendation 122.

Greater Glider conditions as for UNE and LNE TSLs must be incorporated into the Eden TSL.

Recommendation 123.

Condition 6.11 of the Eden TSL must be amended to require the independent surveyors (recommended in section 7.4 above) to undertake Koala pre-harvest surveys during the Koala breeding season that occurs prior to planned forestry activities to determine whether the areas are being used for breeding association, or has the potential for such use. To determine this, active Koala sites in the EMA must be determined and assessed in the following manner.

Pre-harvest surveys, must include a sweep search of the areas planned for specified forestry activities.

Notification of any evidence of Koala found during this sweep search, including fresh scratches on trees, Koala faecal pellets or bellows, must be given to DEC as soon as Koala evidence is found. An asterisk searches, as well as transects searches for Koalas must then be undertaken to determine whether Koalas are in occupation. Current conditions should then apply.

1. A search of the whole compartment must then be undertaken to identify Koala numbers and a representative sample of faecal pellets collected.

2. All Koala faecal pellets found in pre-harvest surveys must then be sampled to for consistent size differentiation to determine potential breeding males and females.

3. DNA samples of all koala faecal pellets must then be undertaken to determine site fidelity and to determine population numbers of Koalas in occupation.

6. If either of the above assessments result in positive determinations, Koala bellows must be sampled and assessed through unobtrusive visits at night to the identified active Koala sites during the breeding season, or automatically recorded by recording stations triggered by the sound of a bellowing koala. This also needs to be played back at the end of the breeding season to help identify territorial fidelity of males.

If 4, 5 or 6 be assessed as positive the areas must be determined as a Koala breeding association area and all Koala feed trees identified by Phillips (2000) over 30cm DBH as well as any core interaction trees (identified by severe scratches) must be protected from logging.

Recommendation 124.

DEC must develop landscape Koala protocols for the EMA that include the protection from logging of all Koala feed trees identified in Phillips (2000) in known clusters of Koala strongholds in the Bermagui/Murrah areas (including the catchments of the Murrah and Bermagui Rivers and the Cuttagee Creek extending through the Niaira and Dignam's Creek areas) and the Yurammie/Tantawangalo areas. Such identified Koala feed trees must also be protected in corridors on State Forest tenure between these areas to allow for effective genetic interaction. These corridors can be assessed using the methodology set out in Recommendation 119.

Recommendation 125

All known clusters of Koala strongholds and areas identified as Koala breeding associations in the Eden IFOA area must be rezoned as Forest Management Zone 2.

Recommendation 126.

A condition must be inserted into the TSLs requiring FNSW to install a 60ha exclusion zone around all identified Yellow-bellied Glider territories.

Nature Conservation Council of NSW
REPORT
Improved Regulatory Arrangements for Water Quality and Threatened Species in NSW State Forests: Five year Review of the Upper and Lower Northeast and Eden Integrated Forestry Operations Approvals.

Contents

Glossary of acronyms

AGS – Australian Group Selection
ANABAT –
BMP – Best Management Practice
CERRA – Central Eastern Rainforest Reserves (Australia)
CMA – Central Mapping Authority
CRA – Comprehensive Regional Assessment
CWR – Critical weight range
DBH – Diameter at breast height
DBHOB – Diameter at breast height over bark
DEC – Department of Environment and Conservation
DEH – Department of Environment and Heritage (Cth)
DIPNR – Department of Infrastructure Planning and Natural Resources
EEC- Endangered Ecological Community
EPA – Environmental Protection Authority
EPBC Act – Environmental Protection and Biodiversity Conservation Act (Cth)
EPL – Environmental Protection Licence
EMA – Eden Management Area
EPRD – Environmental Protection and Regulation Division (of DEC)
ESFM – Ecologically Sustainable Forest Management
FL- Fisheries Licence
FNSW – Forests New South Wales
FMA- Fisheries Management Act
FNPE Act – Forestry and National Parks Estate Act
FRAMES - Forest Resource Management Evaluation System (FNSW)
FU – Forestry Unit of EPA
GPS – Global positioning system
GIS – geographic information system
IFOA – Integrated Forestry operations Approval
KTP- Key Threatening Process
LNE – Lower Northeast forestry region
NHA - Net Harvest Area
NPWS – National Parks and Wildlife Service
PIN – Penalty Infringement Notice
POEO Act – Protection of the Environment Operations Act
RFA – Regional Forest Agreement
RTA – Roads and Traffic Authority
SFO – Supervising Forestry Officer
TSI – Timber stand improvement
TSL- Threatened Species Licence
TSC Act – Threatened Species Conservation Act
TSU – Threatened Species Unit
UMDL – unmapped drainage lines
UNE – Upper Northeast forestry region
WSA – Wood Supply Agreement

1. Introduction

> Tale of the American Curia [senate] that gave him,
> Warenhauser permission to build the Northwestern railway
> And to take the timber he cut in the process;
> So he cut a road through the forest,
> Two miles wide, an' perfectly legal.
> Who wuz agoin' to stop him!
>
> Ezra Pound, Canto XXII

In 2000, Integrated Forestry Operations Approvals (IFOAs) were made public for the Upper and Lower Northeast (UNE and LNE), and Eden bioregions. These approvals are effective until 31 December 2018. The IFOAs bring together licensing for forestry operations under the *Threatened Species Conservation Act (TSC Act)*,[1] the *Protection of the Environment Operations Act (POEO Act)*,[2] and the *Fisheries Management Act (FM Act)*,[3] and incorporate all conditions, prescriptions, and definitions relating to Forestry NSW forestry operations within one document.

The Ministers who are parties to Regional Forest Agreements (RFA)[4] are required to jointly review the agreements and IFOAs every five years. The purpose of the review is to assess the implementation of the provisions of the RFAs, and whether IFOAs are effective in achieving their purpose.

The stated purpose of an IFOA is to provide a framework for forestry operations on public lands which integrates the regulatory regimes for environmental planning and assessment, for the protection of the environment and for threatened species conservation.[5]

The IFOAs were introduced after some of the areas of State Forest and Vacant Crown Land etc, identified as requiring reservation in the Comprehensive Regional Assessments (CRA), were protected in the NSW Reserve System. Nevertheless, most NSW threatened forest species and ecological communities remain significantly under represented in Reserves. State Forests of NSW, therefore, remain an essential and significant component of available habitat for many of our most threatened forest dependant species.

The Forestry and National Parks Estate Act (*FNPE Act*) enabled the IFOAs and introduced measures intended to facilitate logging in State Forests. These measures include exempting

[1] S91 *TSC Act*
[2] S55 *POEO Act*
[3] S220ZW *FM Act*
[4] The Ministers for Infrastructure, Planning and Natural Resources: Environment and Conservation: and Primary Industries.
[5] S25 *FNPE Act*

forestry activities on public land from the provisions of parts 4 and 5 of the *Environmental Planning and Assessment Act*, with the result that no further environmental impact assessments will be undertaken: Stop work orders under the *Threatened Species Conservation Act* (TSC Act) and interim protection orders under the *National Parks and Wildlife Act* (NPW Act) no longer apply to IFOA forest areas, and the land over which IFOAs operate cannot be identified or declared Wilderness.

The enabling legislation further saw the removal of third party rights, where no member of the public may bring proceedings to enforce a law, agreement, approval, licence or conditions. The open standing provisions under the *Protection of the Environment Operations Act (POEO Act)* and the *Land and Environment Court Act* are important facets of our robust legal system, and should not have been rescinded for forestry operations on public land. It has meant that regulatory agencies such as the Department of Environment and Conservation (DEC) and Fisheries NSW have the sole responsibility for the enforcement of compliance of IFOA clauses and conditions.

Following the introduction of the *FNPE Act*, there was an expectation that these agencies would be proactive in enforcing compliance of IFOA conditions by Forests NSW (FNSW).[6] Sadly, this is the exception, rather than the norm. FNSW are still not managing State Forests in an ecologically sustainable manner. Unless DIPNR, DEC and Fisheries NSW begin to take seriously their role in the regulation of FNSW activities, third party rights should be returned to the general public. FNSW can then be forced to manage State Forests in an ecologically sustainable manner, by individuals and groups who care most for our forests.

The expectation that the agencies responsible for the regulation of forestry activities would have been given strict enforcement powers to ensure compliance of clear and unambiguous conditions, developed to adequately mitigate the impacts of logging on biodiversity and water quality, has not been satisfied. This report, therefore, recommends a major overhaul of conditions attached to forestry licensing and the IFOAs generally, to provide adequate protection for the many under-reserved forest dependant species and communities, and the mitigation of catchment degradation by current logging practices on public land.

2. The regulation of IFOA forestry activities.

Recommendation 1.

The relevant Ministers must delegate to the Department of Infrastructure, Planning and Nature Resources powers to enforce IFOA clauses: appropriate penalties must be inserted into the IFOAs for failure to comply with any clause.

[6] Now part of the Department of Primary Industries.

FNSW undertakes logging in State Forests of NSW under various Licences incorporated in the IFOAs. These Licences include Threatened Species Licences under the s.91 of the *Threatened Species Conservation Act (1995)*, Environmental Protection Licences under the s.42 of the *Protection of the Environment Operations* Act and Fisheries Licences under s.220ZW of the *Fisheries Management Act (1994)*.

The Licences ostensibly protect FNSW from prosecution for offending sections of the relevant Acts. However, the Licences are conditional on FNSW undertaking logging in a way that minimises any harm that would otherwise have constituted an offence under the relevant Acts. The Licences stipulate penalties for breaches of conditions. While these penalties are usually less severe than those for an offence under the Acts, breaches of conditions can carry penalties of many thousands of dollars. The agencies responsible for ensuring compliance with Licence conditions are DEC and Fisheries NSW. DEC incorporates the Environmental Protection Agency (EPA) and the National Parks and Wildlife Service (NPWS). Along with the integration of these two agencies was the formation of the Environmental Protection and Regulation Division (EPRD), which incorporates the Forestry Unit (FU) of the EPA, and the Threatened Species (TSU) Unit of NPWS. This new division is responsible for enforcing compliance with IFOA conditions attached to the Threatened Species Licences (TSL) and Environmental Protection Licences (EPL). Fisheries NSW[7] administer the regulation of the Fisheries Licences, through a separate Threatened Species Unit.

With the introduction of the *Forests and National Parks Estate Act* (1998), all Licensing of FNSW forestry activities and the conditions under which FNSW had to operate in certain regions, were incorporated into one document: the IFOA. IFOAs are valid for the Upper Northeast, Lower Northeast, Eden and Southern Regions.[8] These four forestry regions make up the entire eastern seaboard and include forests as far inland as Tumut and the New England Tablelands. A separate IFOA is issued for each region.

The IFOAs also include clauses, not included in any of the licences, intended to hold FNSW and the relevant regulatory agencies accountable to the Department of Infrastructure Planning and Natural Resources (DIPNR), to Parliament, and ultimately to the NSW public.

However, DIPNR do not have any enforcement powers under the IFOAs. There is no mechanism to effectively enforce IFOA clauses that are not included in the Threatened Species Licence, or the Environment Protection Licence. It also means that there are no penalties or mechanisms to deal with breached of IFOA clauses are. This is particularly disturbing, because it is the clauses of the IFOA, rather than the Licence conditions, that contain some of the most important measures aimed at mitigating the environmental and biological impacts of logging. For example, the constraints on the types of logging that can be conducted (Single Tree Selection, Australian Group Selection and Alternate Coupe

[7] Now integrated into the Department of Primary Industries along with FNSW.
[8] The Southern IFOA Five Year Review is due in 2007.

Logging), are contained only in the IFOA clauses and not appear in any other document. It is unacceptable that these central IFOA clauses remain unenforceable, and contradicts the stated purpose of the IFOAs.

DIPNR must be given full enforcement and compliance powers to ensure compliance with IFOA clauses, and penalties must be included in the IFOA for failure to comply.

Such powers currently lie with the relevant Ministers,[9] who can undertake Civil action against breaches of certain conditions[10] of an IFOA for any remedy or restraint.[11] Subsection. 32 (5) states that:

> Without limiting the powers of the Court under this section, an order under this section may suspend an approval with respect to the forestry operation concerned in the breach.

The Minister for DIPNR can make consent authority orders under Division 2A Part 6 of the *EP&A Act* for unauthorised forestry operations. Such forestry operations would include those undertaken by FNSW that have not or are likely not to comply with IFOA conditions or clauses.[12]

Indeed s.31 of the *FNPE Act* allows the relevant Ministers jointly to revoke, suspend or amendment any clause, condition or operation of an IFOA.

In other words, while the Minister administering DIPNR, DEC and Fisheries have adequate powers to enforce compliance of IFOAs, it remains to be seen if they also have the will to use it. If the Ministers are not prepared to undertake open and transparent regulation of IFOA clauses, these powers must be delegated to the appropriate agency so that proper and adequate compliance of all IFOA clauses and conditions can be undertaken.

2.1. FNSW IFOA compliance

The number of Forests NSW (FNSW) recorded non-compliance incidents in 2002/03 was 1810, 2,242 in 2001/02, and 1,538 in 2000/01. FNSW breaches in 2002/03 consisted of 1304 breaches of the EPL, 372 breaches of the TSL, and 399 safety breaches.[13]Although one fine

[9] "relevant Minister" , in relation to an IFOA means a Minister who is a party to the approval (other than the Minister administering the Forestry Act 1916).
[10] "conditions" means any condition subject to which forestry operation covered by an IFOA may be carried out (other than the terms of a relevant licence set out in the approval).
[11] S.32 *FNPE Act*
[12] S. 36 (3) *FNPE Act* - An order under Division 2A of Part 6 of the EP&A Act does not have effect to the extent that it prevents or interferes with the carrying out of forestry operations authorised by an IFOA
[13] FNSW Social, Economic, and Environmental Report 2002/03, Appendix 12

was issued by the regulatory agencies[14], there were no prosecutions. This low number of fines and prosecutions is a consequence of poor definition of many conditions, inadequate resourcing of regulators, and the difficulties involved in legal standards of proof, among other factors.

However, the reported number of breaches of conditions may well be an understatement. A compliance check sheet is completed by FNSW for every operation. Determining non-compliance should quantify the number of operations where breaches have occurred rather than the number of possible breaches. FNSW reports that it complies with 99% of all issues checked for compliance[15], but it has breached a condition on average in 46% of all operation undertaken; on average 33% of all FNSW operations breached a condition of the EPLs; and on average 10% of all operations breached a condition of the TSLs.[16]

FNSW has a policy of only reporting those breaches that it cannot remedy itself; this means that the real compliance rate is much lower. Most of the breaches listed by FNSW on the Non-Compliance Incident Reports are stated to have "no environmental harm" listed next to them. For example, FNSW reports that:

> Most non-compliance incidents recorded related to soil and water quality issues including accidental tree felling into filter strips and stream exclusion zones, which are considered to have relatively minor environmental impacts or which are rectified before actual damage occurs.[17]

The veracity of this contention is not substantiated, nor are the risks associated with such "accidents" fully evaluated. Therefore, even though FNSW attempt to avoid reporting breaches, where it has no alternative but to report them, it understates their significance.

While the Forestry Unit (FU) of the Environmental Protection Agency (EPA) of DEC has prosecuted FNSW for three breaches, (penalties of between $25, 000 and $40,000 were imposed, plus costs), and have recently prosecuted a fourth, the Threatened Species Unit (TSU) of the National Parks and Wildlife Service (NPWS) has made no prosecutions under the IFOA, notwithstanding their investigations of approximately 60 breach reports. Although fines have been issued, Penalty Infringement Notices (PIN) are not adequate for serious breaches and are an ineffective compliance incentive. PINs do not have the coercive powers for remediation, public notification and continued compliance that a court order carries and should only be used in the event of one-off minor breaches of Licence conditions.

Recommendation 2.

[14] Four fines issues in 2001/02, and 5 in 2000/01
[15] FNSW Social, Economic, and Environmental Report 2002/03, table 12, p40
[16] 3942 compliance sheets completed for 1810 breaches, *ibid.*
[17] *ibid*

Unnecessary discretionary wording must be removed from all IFOA Licence conditions to allow definitive interpretations by the court. Where FNSW discretion is found to be necessary, the circumstances where this discretion is appropriate must be clearly set out in the condition, and FNSW must properly assess the determination of its discretion and report to DEC where it has done so. Pro-formas must be developed for use by FNSW when using its discretion and these must be monitored, assessed and approved by DEC compliance staff prior to the discretion being applied.

The discretionary wording of many conditions further contributes to DEC's limited enforcement powers. Many conditions lack definition or are ambiguous, allowing FNSW to ignore the intention and spirit of conditions. Terms such as "to the greatest extent practicable" do not reflect the importance of the condition, and lead to a reluctance by FNSW to apply conditions strictly. While the EPLs have very few discretionary terms, the TSLs are riddled with them. Where a condition states that FNSW must comply "to the greatest extent practicable" it means that should FNSW breach a condition, its defence is that it was not practicable to comply. A condition with such phrases is meaningless, and ineffective in achieving the objective of the condition. For example TSL condition 1.3(b) sets out that:

> b) SFNSW must, as far as is *reasonably practicable*, mitigate any adverse effect of forestry operations on animals or plants of the species occurring prior to notification by NPWS (my italics).

What does this actually mean? It is questionable whether FNSW knows precisely what they are supposed to do without there being clear guidelines in place.

Condition 3 (a) states that:

> a) SFNSW must prepare planning documentation that demonstrates that operational planning has taken account of the requirements of the conditions of this licence. This must include showing all exclusion zones and buffer zones on the relevant harvesting plan operational map, except where the scale of the
> map does not allow small area features to be adequately represented: in which case the location of the zone should be adequately indicated. The harvesting plan operational map legend must, *to the greatest extent practicable*, indicate to which feature or species the exclusion or buffer zones relates (my italics).

If the scale of the map does not allow small features to be adequately represented, a more appropriately scaled map must be inset, to show the detail of those small features.

Another example is roading and snigging through exclusion zones. For example condition 5.3 (d) (i) allows for roading and snigging through oldgrowth exclusion areas. Rather than clearly stating the factors that may necessitate such roading and snigging, (if, for example,

the alternative would result in greater environmental harm), the condition states that this roading can proceed if:

> i. there is *no practicable alternative* site available for the purposes of the road or snigging:

The condition continues in this vein. FNSW must only ensure that:

> iv. all *practicable* measures are taken to minimise any adverse impacts of the construction or snigging on the environment:

This is lazy regulatory drafting and should not continue to be accepted by regulatory agencies. Where there are circumstances that prevent FNSW from complying, either the operation must cease, or those circumstances that would make it difficult for FNSW to comply while accessing available timber in the Net Harvest Area, must be set out in the Licence. Monitoring procedures must be put in place for reporting such instances, and assessments must be undertaken before the operation can continue.

Although a level of accountable discretion is unavoidable, many examples of the use of such discretionary phrases are simply unnecessary. For example, condition 5.6 (ii) relating to the protection of retained trees states:

> ii. In the course of conducting specified forestry activities, logging debris must not, *to the greatest extent practicable*, be allowed to accumulate within five metres of a retained hollow-bearing tree, recruitment tree, stag, *Allocasuarina* with more than 30 crushed cones beneath, eucalypt feed tree, or Yellow-bellied Glider or Squirrel Glider sap feed tree. Logging debris within a five metre radius of retained trees must be removed or flattened to a height of less than one metre. Disturbance to ground and understorey must be minimised *to the greatest extent practicable* within this five metre radius. Habitat and recruitment trees must not be used as bumper trees during harvesting operations (my italics).

Debris must not be allowed to accumulate within 5 metres of a retained tree. No qualifier is required. To insert a discretionary phrase is unnecessary, since there are no circumstances in which it would not be practical to adhere to this prescription. There is no justification for its insertion, and it must be removed.

These are discrete examples. DEC must look closely at TSL conditions to ensure the removal of unnecessary discretionary wording from all conditions, which inhibits the courts from upholding the intention of the regulation. However, where discretionary language is unavoidable, the circumstances where FNSW can use its discretion must be clearly set out in the condition, and restricted to those stated circumstances.

Recommendation 3.

DEC must employ at least two dedicated forestry compliance officers within each IFOA region. These officers are to be conversant in both the TSL and EPL conditions.

DEC has too few staff dedicated to auditing and compliance: The above Licence amendments would ensure that at least DEC compliance staff have firm legal foundations for prosecution. To undertake the task of auditing FNSW operations adequately, and ensure compliance with Licence conditions, DEC require at least two dedicated forestry compliance officers within each IFOA region. Even this number is insufficient to properly ensure FNSW compliance and monitor assessments. However, given budgetary constraints, we accept that dedicating more than eight officers to IFOA compliance is unlikely.

To maximise the effectiveness of these officers and ensure continuity, they need to be conversant in both the TSL and EPL conditions. Indeed, the TSU has, at the time of writing, lost all TSL compliance staff in the EMA due to natural attrition. This is a circumstance where multi-tasking of compliance officers would have protected against the loss of corporate knowledge within DEC.

Recommendation 4.

All compliance-related correspondence between FNSW and regulatory agencies must be publicly available on the appropriate agencies' websites, and DEC warning letters, Penalty Infringement Notices and prosecutions must be made public in local and State-wide media.

There is a lack of transparency surrounding breach investigations and DEC warning letters to FNSW. FNSW continue to use sophisticated spin-doctoring and glossy colour photography in an attempt to convince the general public of NSW of their environmental record. This is disingenuous to say the least. The Forestry Unit of DEC apparently issues two warnings before issuing a PIN to FNSW. If the breach is severe, they will prosecute without warning. A policy of issuing two PINs, and subsequent prosecution in the courts for similar offences may provide additional deterrence for minor offences.

While DEC audit reports are available through FOI, FNSW self-reported breaches and Clean Up Notices are available on the web, and annual reports regarding compliance are presented to parliament, the level of response to breaches by FNSW and DEC is not adequately transparent. All correspondence between FNSW and regulatory agencies must be publicly available on the appropriate agencies' websites, and warning letters, PINs and prosecutions should be made public in local and Sate-wide media. Publishing such information would provide the public with an adequate level of openness and transparency of the regulatory intentions of DEC, and avoid allegations that government agencies are above scrutiny. This would also allay concerns that regulatory agencies are not undertaking rigorous monitoring and strictly enforcing compliance.

Recommendation 5.

The Threatened Species Conservation Regulations must be amended so that compensatory habitat is introduced as a penalty for FNSW breaches of the TSL

As to the punishment imposed on FNSW for breaches of conditions, it is questionable whether the coercive power of monetary penalties imposed by one government agency on another is effective or appropriate. Obedience to law within an agency depends not so much on the deterrent threat of monetary penalty as on the routine impact of organisational control.[18] The legal remedy of punitive injunctions can be sought through the courts by DEC Legal Branch to oblige FNSW to "hand over" areas of high quality habitat from Net Harvest Area in the form of compensation for breaches. Such penalties have the advantage that FNSW defendants would be required to report in detail to the court the disciplinary action taken in response to being found liable. The dominant impact of punitive injunctions should be interference with managerial power and prestige, rather than the extraction of cash.

Recommendation 6.

DEC Legal branch must identify whether individual contractors can be held liable for breaches of FNSW markups and directives, and prosecute individuals for such breaches.

FNSW must take steps to ensure that its officers and contractors and subcontractors comply with the IFOA.[19] Where agencies are sanctioned for offences, they are supposed to react by using their internal disciplinary systems to impose individual accountability. DEC, however, makes no attempt to ensure FNSW take disciplinary action against errant staff and contractors. While FNSW can take action against contractors by issuing PINs, and striking them off logging the list for a period of time, DEC claims that it cannot hold contractors personally liable due to the principle of vicarious liability. While clause 43 of the IFOA may appear to divest DEC of its responsibilities in this regard, and hold FNSW to be the sole authority ensuring compliance of conditions by its agents, DEC remain the agency ultimately responsible for compliance with licence conditions.

Vicarious liability imposes strict liability on the agency for the mental state or conduct of an agent acting within the scope of his or her employment or authority.[20] However, the extent to which this principle can be applied, should the contractor be operating outside of the scope of the relationship with FNSW, remains untested. For example, should a timber contractor log within clearly marked exclusion zones, is not the contractor liable for breaching the condition, as he or she is working outside the scope of the authority provided them by

[18] see Fisse, 1989. Howard's Criminal Law, pp 598.
[19] Cl 43 (3)
[20] See Fisse, 1989, *Howard's Criminal Law*, pp 604

FNSW? While not wanting to give FNSW a further defence against prosecution for breaches for which it is liable, contractors would become far more judicious in their logging if they had personal liability for clear and unambiguous breaches. Further, reliance on the legal doctrine of vicarious liability may be counterproductive in certain circumstances. FNSW personnel may indeed perceive the prosecution of FNSW to be unjustified, thereby bolstering an organisational culture of resistance to DEC and the judicial process.

2.2. DEC Post-logging audits

Recommendation 7.

DEC must undertake proactive post-logging audits for at least 10% of all FNSW operations.

Last year DEC undertook a mere 30 post-logging audits out of approximately 1000 FNSW harvesting operations. Far fewer audits would have occurred if not for the diligence of local communities in identifying breaches and referring them to DEC or making complaints through the pollution line. However, the continued reliance of regulatory agencies on community vigilance in identifying breaches in the field is impractical. The community will only continue to conduct such audits and lodge complaints if they believe that DEC take their complaints seriously and pursue them. Given the current practice of attending only to the most severe breaches, it is questionable whether DEC will continue to be provided with these complaints.

As FNSW self-assess and implement most aspects of the IFOAs, the number of proactive audits by DEC must increase to adequately monitor FNSW and ensure compliance. To do so would require DEC to undertake post-logging audits of at least 10% of all operations conducted by FNSW. This should be undertaken on a random spot-checking basis.

2.3. DEC Pre-logging audits

Recommendation 8.

FNSW must provide DEC with completed Harvesting Plans and assessments at least three months prior to undertaking operations.

Recommendation 9.

DEC must undertake desk-top pre-logging assessments of all operations undertaken by FNSW, and field audits of at least 10% to determine whether pre-harvest surveys and mark-ups are in accordance with conditions.

DEC undertake water quality monitoring for selected FNSW operations. However, monitoring is required for many more FNSW operations. Traditionally, this type of monitoring takes place at the bottom of catchments. This does not allow for the identification of the source of pollution events and must be undertaken closer to the logging operation so that the source of sediment and nutrient pollution can be identified.

Pre-logging audits must also be undertaken on TSL conditions. Given that FNSW undertake assessments and surveys required by the IFOAs, thorough pre-logging audits should be undertaken on all FNSW Harvesting Plans and assessments carried out by FNSW. Within the three months provided by the above suggested condition, DEC must undertake desk-top audits of all FNSW operations to assess them for compliance and determine whether conditions are adequate for species known to exist or likely to exist in the area (see 7.6).

Further, DEC need to undertake random spot checks on the ground for at least 10% of all FNSW operations. This will allow them to determine whether FNSW's marking-up procedures are adequate for logging contractors to understand and adhere to conditions, and whether conditions are being complied with *before* logging takes place. TSL conditions need to be flexible enough to allow DEC to assess the risk to existing populations of flora and fauna, and impose more stringent conditions when those circumstances arise (see 7.6). To facilitate these measures, FNSW must provide DEC with completed Harvesting Plans and assessments at least three months prior to undertaking operations.

2.4. FNSW annual reporting

Recommendation 10.

The IFOA needs to reflect the importance of timely reporting by all agencies, and penalties must be imposed for tardiness.

Recommendation 11.

Should FNSW remain behind in its reporting responsibilities, independent auditors must be engaged to undertake the role until FNSW can show that its reports will be provided on time. FNSW should bear the costs of such audits.

Although both DEC and FNSW are required to provide performance indicators to DIPNR, and annual reports to Parliament, the most recent report FNSW have provided was for the 1999/2000 year. DEC has provided its reports to 2003.

FNSW's cavalier attitude to reporting must not be allowed to continue. Should FNSW remain behind in its reporting responsibilities, independent auditors should be engaged to undertake the role until FNSW can show its reports can be provided on time. FNSW should bear the costs of such audits.

2.5. Effectiveness of IFOA Licence conditions.

Recommendation 12.

A clause must be inserted into the IFOAs to ensure that the effectiveness and objectives of all conditions attached to the TSL are audited by DEC/FNSW over the next five years. TSL conditions must be amended to provide DEC with options for implementing more stringent conditions when circumstances demand it or when new information becomes available.

Recommendation 13.

A condition must be inserted into the TSLs that requires FNSW, in consultation with DEC, to undertake scientific trials into the effectiveness of TSL conditions, with appropriate management plans, assessments and periodic reviews to be conducted over the next five years.

Part 5 of each IFOA sets out on-going Forest Management Operations. This part stipulates requirements for FNSW to undertake scientific trials concerning thinning,[21]burning,[22] assessment for regeneration,[23] and periodic reviews of grazing, weed management and feral animal control. The IFOAs contain numerous provisions that require FNSW and regulatory agencies to undertake assessments and give them the opportunity, for example, to tender reports on the impact on timber availability of Licence conditions. The EPLs further provide for water quality monitoring reports to be undertaken and tendered by FNSW.[24]

However, nowhere in the IFOAs or appended Licences and conditions is it incumbent on FNSW or regulatory agencies to determine the efficacy of TSL conditions. This anomaly highlights the inconsistency of the IFOAs and puts at risk many forest dependent threatened species and populations. The TSLs must require scientific trials for the effectiveness of threatened species conditions, with appropriate management plans, assessments and periodic reviews to be conducted over the next five years. Given the substantial body of scientific literature on the impacts of logging on threatened species, such trials are imperative. NPWS (now DEC) have been applying logging conditions to minimise impacts on threatened species since the early 1990's, but they have never undertaken assessments to test the efficacy of their conditions. DEC must design trials and develop model management plans, and assessments for periodic reviews. Firm and achievable objectives must be set and rigorous testing of conditions undertaken for all species-specific and tree retention requirements. Detailed empirical data needs to be collected for species most at risk. This

[21] Cl. 29 Eden IFOA
[22] Cl. 31 Eden IFOA
[23] Cl 38 Eden IFOA
[24] Cl 28 Eden EPL

must involve pre-logging assessments of the populations of targeted species over a period of time, strict application of the appropriate prescriptions, and post logging assessments of the targeted species over a period of time, to identify how effective the prescriptions have been in minimising impacts. Obvious species to be targeted initially would be species with relatively small home ranges, such as arboreal marsupials (eg. Squirrel Gliders, Yellow-bellied Gliders, Koalas), rodents (eg. Hastings River Mouse, Broad-toothed Rat), frogs (eg Pouched Frog, *philoria* species, *Mixophes* spp., Giant Burrowing Frog), reptiles, and ground-dwelling birds (eg. Rufous Scrub Bird). More wide ranging species would require catchment-scale assessments.

The IFOA must also allow adaptive management to be applied as new information becomes available in the intervening period. Rigorous pre-logging and post-logging audits would provide an opportunity for the rapid assessment of adaptive management procedures and the auditing of many conditions in achieving their objective. Such adaptive management procedures would use modelled habitat, wildlife atlas records, centres of endemism mapping,[25] and population viability analysis models to develop site-specific habitat requirements for harvesting in areas where at-risk threatened species are known or likely to exist. Where it becomes apparent that a condition is inadequate for minimising impacts on threatened species to acceptable levels, DEC must be able to impose more stringent conditions. The IFOAs must reflect the need for DEC to adapt TSL conditions in areas of high species diversity and where population numbers may be tenuous. For example, tree retention conditions should have a minimum requirement, but should allow DEC to require the retention of additional habitat trees under certain circumstances.

It is expected that once studies have been done into the efficacy of the conditions of the TSL, this information can feed into the next five-year review. However, new scientific understanding should be incorporated into the IFOA conditions as it is released.

Recommendation 14.

Clause 49 of the IFOAs must be redrafted to state that "FNSW must give all and any assistance sought by regulatory agencies in undertaking assessments of the objectives of Licence conditions and compliance." Breaches of such a clause must prescribe penalties for each day the requisite assistance is not provided.

[25] An endemic species was defined in the CRA, as a species for which more than 75% of its range or more than 75% of its total population falls within north-east (UNE and LNE). Centres of Endemism were derived from data analysed by NPWS for the modelled distributions of various assemblages of vascular flora and vertebrate fauna, and from data analysed by the Australian Museum for select genera of invertebrate fauna. This resulted in the identification of 15 Centres of Endemism for assemblages of flora, 6 for assemblages of fauna, and 12 for invertebrates.

Currently, clause 49 of the IFOAs requires FNSW to assist the regulatory agencies in any assessment of the IFOA the regulatory agency decides to carry out.[26]However, there are no provisions for penalties should FNSW decide not to assist. Further, the IFOA does not define what level of assistance is required of them. This clause is, therefore, meaningless and needs to be replaced with a more definitive clause that would prescribe the level of assistance and appropriate penalties for non-compliance.

3. Logging in IFOA forests

Recommendation 15.

A clause must be inserted into the IFOAs to limit the volumes of all timber products extracted under the IFOA to current levels or less.

Recommendation 16.

The Forestry and National Parks Estate Act should be amended, so that any significant increase in intensity of operations in an IFOA area is subject to Part 5 of the Environmental Planning and Assessment Act 1979.

Recommendation 17.

A clause must be inserted into the IFOA to reflect stated Government policy that there will be no use of native forest timber to produce bio-energy.

In an attempt to appease logging companies, long-term timber Wood Supply Agreements (WSA) were signed for periods of up to 20 years for guaranteed timber supplies from IFOA forests. These contracts locked FNSW into providing timber in excess of what is available, and far in excess of ecologically sustainable limits. Following the transfer of the icon areas in the northeast in 2003, Boral – the largest timber merchant on the north coast – negotiated a revised WSA which reduced committed volumes, extended the original term by 5 years, and removed the provision for a review of committed volumes in 2006.[27]FNSW are negotiating similar such agreements with other WSA holders on the north coast.[28]

The Auditor General's report to Parliament in 1999 concluded that:

> Due to the nature of Native Forests there can be no certainty that anticipated yields will be available to meet contracted volumes. However, it would appear that sufficient flexibility has been built into the agreements that enable State Forests to

[26] Cl. 49 IFOA
[27] FNSW Annual Report 2002/2003, p 66.
[28] *ibid*

> substantially meet contract volumes, reducing the likelihood of significant compensation payments.[29]

This flexibility the Auditor General referred to was, however, removed in 2004 when the review clause was not included in the renegotiated WSAs. FNSW is, therefore, left in the invidious position of having to find every scrap of timber available on public lands to satisfy contractual obligations that were the result of its own initial overestimation of the resource. In the event of timber supply being exhausted on public land, FNSW will be increasingly looking for ways around environmentally sustainable forestry management principles and Licence conditions in an attempt to forestall the consequences of overoptimistic assessments. There is, however, worse in store for FNSW.

The future of the global native timber industry is bleak as large plantation timber resources mature. However, Clark (2001) discounts the long and widely held expectation of a global wood shortage generating real inflation-adjusted price increases for wood. She believes there is no evidence for increases in real prices for wood over the long-term. As technology is increasing and resource productivity boosts wood supply, she suggests that real prices for wood are likely to continue to fall. This, she continues:

> …will inevitably discourage commercially-driven investment in plantation establishment on existing agricultural land, and increase industrial pressure for a wood resource that is attractive in cost and quality terms, increasing the risk of biodiversity loss through intensification of native forest management and clearing of native forests for plantations.

Clark (2001) concludes by suggesting:

> As increasing volumes of wood become available from maturing plantations, government policy changes will be required to ensure that levels of logging in native forests actually decline rather than new markets being found for native forest wood.

This analysis has implications for the timber industry in NSW. FNSW have continually re-evaluated the timber resource, leading to the shortening of logging cycles and reducing the defined size of quota sawlogs to meet the WSAs. As rotation periods between cutting cycles diminish, so too does the available size of quota logs. This trend inevitably leads to the growing dominance of low-value products such as woodchips, biomass and charcoal being sourced from State Forests. This is already evident as FNSW seek to supply new markets with these very same products. However, to recover enough timber from such operations to be economically viable, FNSW must employ mechanised clearfelling of large areas of native forest. There is no other option for FNSW to maintain current royalty income than to continue with its myopic silviculture methods. Without government intervention, FNSW will

[29] *ibid*

become even more of an economic basket-case, supplying threatened species habitat to the world for $7 a tonne.

If NSW is to be self-sufficient in timber, it must stop exporting low value products, and secure the long-term supply of high-value products to domestic markets. Until such long-term approaches are taken, FNSW will be forced to cut ever greater quantities of low-value products with increasingly mechanized methods, merely to maintain current income. This would be to the detriment of the timber industry, its workers, the environment and the people of NSW.

While the IFOA limits, to some extent, the volume of high quality sawlogs that can be extracted, it also facilitates logging for other products such as "pulp grade timber" - woodchip, biomass, firewood and sleepers etc. but sets no volume limit on these products.

The intensity of logging operations, and their resultant impact on environmental values, are primarily determined by the volume of timber removed from forests. The impact on threatened species, soil and water of extracting greater proportions of woodchips etc. than sawlogs, is immense. The TSL and EPL must be designed to mitigate for a specified level of timber harvesting. These Licences cannot mitigate an unspecified level of extraction that can increase at any time. A clause must be inserted into the IFOAs to limit the volumes of all timber products extracted at least to current levels.

As the *FNPE Act* enables the IFOAs and the Forest Agreements, any review of these instruments that avoids amendments to that Act must be found wanting. Section 16 of the *FNPE Act* describes the contents of the Forestry Agreements, inter alia, as providing for the promotion of ecologically sustainable forest management (ESFM), as well as providing sustainable timer supplies from forestry operations covered by the Agreements. The Forest Agreements were made with these two competing interests in mind. (ie the promotion of ESFM as well as the sustainable supply of timber).

The Forest Agreements may provide for anything the relevant Ministers consider appropriate, that isn't inconsistent with the *FNPE* or any other Act or law, within their portfolio. As a power to grant an approval must also contain a power to deny or revoke an approval, a relevant Minister may amend an Forest Agreement or IFOA to the extent that it breaches no Act or law, and as long as it is within the influence of their portfolio. Any increase in volumes of any product extracted from any IFOA forest challenges the central legislative intent of the Agreements and IFOAs. If these two competing objectives of the Forest Agreements are not maintained in some semblance of balance by the relevant Ministers, the *FNPE Act* must be amended to allow for the application of Part 5 of the *EP&A Act,* and proper assessment undertaken to quantify and mitigate the likely impact on the environment of such an increase in extraction.

Since 2001, there has been a proposal by the timber industry to extract 500,000 cubic metres of woodchips per year from north-east NSW to burn in power plants for the production of so-called 'green' energy (Clean Green Energy Company, 2001). Fierce opposition from the public and the conservation movement has finally resulted in a change in NSW Government policy that prevents timber from native forests being used for power generation (Unpublished speech by Premier Bob Carr, 29/08/2002), although there is no legislative protection yet in place. This policy should now be implemented into the forest agreements and IFOAs.

Recommendation 18.

A clause must be inserted into the IFOA that encourages FNSW to seek markets for value-added products, and discourage FNSW from seeking markets for low-value products such as woodchip, biomass and charcoal.

That FNSW is looking to supply new markets is curious, considering the difficulty it experiences trying to supply those it is currently obliged. FNSW maintains that it is being pushed to find timber in protection strips and riparian areas and enter negotiations with DEC to access more timber: This challenges the assertion that FSNSW is confident in its estimation of timber reserves. While FNSW estimates of the available native timber in all IFOA regions are questionable, those on the ground - both conservationists and timber contractors - generally accept that term timber contracts cannot be fulfilled. In the Eden region, it is estimated that the mature resource will last perhaps another four years. In the northeast, there may be about ten years supply. Given shortening rotations and the consequent limitations this imposes on the availability of mature quota logs, the fulfilment of the current timber obligations is hardly guaranteed.

New technologies have added to quota sawlog profitability for many mills by reducing the volume of waste. This must be further encouraged. FNSW must begin to look to high-end uses of native forest timber and be discouraged from seeking short-term solutions to low-profitability that reinforce questionable silvicultural objectives. Furniture, laminates, and other processed and specialist timber products that maximise the value from low volume inputs can be cut more sustainably from native forests. This would allow for the application of more stringent constraints on harvesting to minimise environmental risks. However, the industrial style of logging currently undertaken is imprudent and unsophisticated, with little forethought for the next cutting cycle.

3.1 Methods of logging in IFOA forests

Recommendation 19.

FNSW Best Management Practice silviculture guidelines must be developed in consultation with DEC and in accordance with Montreal Protocol ESFM indicators. DEC

must analyse FNSW BMP guidelines and additional information must be introduced as it becomes available.

While FNSW must give effect to the principles of best practice logging methods intended to minimise any adverse impacts on the environment, the notion of "best practice" is amorphous and ambiguous. While best management practice (BMP) continues to be defined by FNSW, it is unlikely that this will change. DEC holds a database on forestry BMP. This must be analysed and additional information must be incorporated into FNSW BMP Guidelines and ongoing development of the Guidelines must occur as new information becomes available. FNSW BMP Guidelines must be developed by DEC in accordance with Montreal Protocol guidelines for ESFM

FNSW should change their focus to managing for multi-aged stands so as to better provide for the range of values of forests. The aim should be to manage a stand of forest to ensure that at least 50% of each age cohort that could naturally be expected to occur is retained or restored throughout the Net Harvest Area. This would have the dual benefit of maintaining or restoring a range of size classes for ecological services while providing a range of size classes of timber, which would encourage value adding. Such a system would ensure that hollow-bearing trees could be maintained in perpetuity (rather than there being gaps in age cohorts resulting in loss of hollow-bearing trees as existing ones die out). Mature trees would be present to provide the necessary nectar, seed and other resources for species, and forests would continue to be able to provide large sawlogs for high value uses. This would enable a genuine ESFM system to be established.

3.1.1. Australian Group Selection (UNE and LNE only)

Recommendation 20.

The IFOA must be amended so that no further areas are logged under AGS conditions.

Recommendation 21.

FNSW must identify areas where AGS has been employed and determine the 10% of the Net Harvest Area excluded from logging as per the current IFOA. Should FNSW be found to have logged in the 10% exclusion areas, compensatory habitat must be removed from its Net Harvest Area in other operations of similar forest type, stand condition and stand age.

Australian Group Selection (AGS) refers to the silvicultural practice where groups of trees are removed, forming gaps of up to 0.25 hectares.[30] It is, in effect, a small clearfell. While the IFOA stipulates that no more than 22.5% of the Net Harvest Area of a compartment can be

[30] Cl. 5(10)(A)(b) LNE IFOA

logged using AGS conditions in each logging event,[31]the return time of only five years between logging cycles[32] is too short to allow stand recovery before the next logging operation begins.[33]In some cases, FNSW have been found utilising single tree selection logging in the areas outside the identified AGS tract. In other words FNSW have been harvesting in the areas supposed to be left for the next cycle in five years.
Additionally, despite numerous requests from conservationists, FNSW have failed to fulfill the requirement that it provide maps of all gaps on its operational plan. FNSW are also required to identify where AGS will be employed[34] and exclude at least 10% of the Net Harvest Area from logging. In most cases FNSW have failed to identify the 10% of the Net Harvest Area that will not be logged. Furthermore, FNSW are supposed to progressively record the total area selected for logging using AGS, and the total area selected for Single Tree Selection.[35] A full four years since the IFOA was introduced, such information remains absent from the FNSW 2002/2003 annual report.

This practice is far too intensive to be sustainable. AGS replaced the discredited "gaps and clusters" technique, but leads to the same negative impacts, particularly in poorly reserved ecosystems and other high conservation value areas. AGS has many serious implications, not only for ESFM, but for growth rates of merchantable timber as well. For example, Wilcynski and Pickett (1993) studied the root biomass in response to canopy gap formation and found that:

> …less fine root biomass was found within canopy gaps than within the intact forest, and this trend may be attributed to root death accompanying the tree(s) that were felled to form the gaps. These results provide strong evidence for the formation of a below-ground gap in association with the creation of a canopy gap.

As much regrowth in NSW is reliant on lignotuber responses, FNSW may be jeopardising its own future resource by undertaking such myopic silviculture. Without lignotuber regeneration, FNSW must rely on seedbanks within the soil. Clearfelling, euphemistically referred to by FNSW as AGS or alternate coupe logging, also seriously reduces the diversity of beneficial root fungi essential for the regeneration of seedlings (see chapter 5.2). Further, intensive cattle grazing in State Forests results in few seedlings actually reaching maturity (see 7.9). Such implications have profound consequences for FNSW's future ability to supply timber to the community.

3.1.2. Alternate Coupe Logging (Eden only)

[31] Cl. 5(10) (A)(c) LNE IFOA
[32] Cl. 5 (10) (C) LNE IFOA
[33] Cl. 5(D) LNE IFOA
[34] CL. 42 (1) (A) LNE IFOA
[35] Cl.. 24(d) LNE IFOA

Recommendation 22.

Alternate coupe logging must cease in the EMA, and single tree selection must be employed in its stead.

The timber industry in the EMA is dominated by the woodchip giant, South East Fibre Exports (formerly Harris Daishowa). This means that forestry activities in the EMA are overwhelmingly for woodchip. The intensive alternate coupe logging method applies to the Eden IFOA area only.[36]Alternate coupe logging entails the division of a compartment into smaller parcels, half of which are logged in one operation. The remaining half is logged after a period of at least five years.[37]The alternate coupe harvesting system in the Eden Management Area (EMA) aims to disperse the environmental impacts of logging across space and time. In reality, the intensity of logging is maximised, as are the impacts on biodiversity and water quality. The five year cutting cycle of alternate coupes, with up to 60% of the Net Harvest Area of the compartment allowed to be logged in any operation,[38]further increases the impacts, as the rotation is too short to allow alternate coupes to recover from logging before the next operation begins. To add insult to injury, the five-year return period and the maximum allowable area clauses do not apply to thinning.

There is an enormous body of scientific literature decrying alternate coupe logging and showing that it has had, and continues to have, severe long-term impacts on biodiversity and water quality in the Eden Management Area (EMA). As far back as 1987, Lunney *et al* (1987) identified that the intensity of logging in the EMA was having a significant impact on the numbers of small mammals and suggested:

> The options for managing this forest for the conservation of small mammals include minimising fire, retaining unlogged forest, extending the time over which alternate coupes are logged and minimising disturbance from heavy machinery.

Kavanagh and Stanton (2003) noted that some hollow-nesting bird species (e.g. treecreepers and cockatoos) had still not fully recovered 22 years after intensive logging in the Eden region. The authors suggested that intensive logging may have had an effect at a local landscape (compartment) level as well as at the level of individual logged coupes. This was indicated by changes to the avifauna of the unlogged coupes over time as the forest regenerated on the adjacent logged coupes.

South East Fibre Exports has indicated that it will no longer be accepting trees of greater diameter at breast height (DBH) than 80 cm. This provides an opportunity to increase habitat

[36] Cl. 5(4)
[37] Cl. 5 (11) (D)
[38] Cl. 5 (11)(B)(b)

tree retention conditions without any loss to the industry that drives logging operations in the region.

As the intensity of logging in the EMA far exceeds that of any other NSW forestry region, the maintenance of any existing forest structure and species populations and diversity is imperative.

3.2. Woodchip operations

Recommendation 23.

A clause be must inserted into the Upper and Lower Northeast IFOAs that sets a limit of 50% of total volume woodchip that can be harvested from any one FNSW operation.

Harvesting operations having the sole purpose of producing pulp (woodchips) may not be carried out in any IFOA area.[39] In the EMA, up to 23,000 cubic metres of quota sawlogs can be harvested, and up to 345,000 tonnes of woodchip per annum.[40]As these figures would suggest, logging operations in Eden are primarily for pulpwood, and as long as there are some sawlogs harvested, operations are deemed to comply. In all the IFOAs, harvesting operations having the sole purpose of producing Pulp Grade Timber are prohibited.[41]However, this condition does not apply to thinning, even where one of the purposes of thinning is the production of timber.[42]

In this regard, the north-coast IFOAs differ substantially from that of the EMA. In the northeast, the principal purpose of harvesting operations must be for sawlogs, veneer logs and poles (high quality timber).[43]In determining the principal purpose of logging, relevant factors including the royalty value to FNSW and the volume must be taken into account.[44]FNSW total royalty income in 2002/2003 was $109 million.[45]FNSW, however, do not provide royalty rates in any of its annual reporting.

Since the introduction of IFOAs, the reported proportion of pulpwood to high quality timber for all FNSW native hardwood operations has been approximately 40%.[46]While it is common for Harvesting Plans on the north coast to estimate the proportions to be greater than 50%, the "principal purpose" condition is defined by FNSW as being the royalty value multiplied by the volume. In other words, although an operation may extract more pulpwood than high

[39] Cl 20 (1)
[40] A cubic meter of sawlog is approximately one tonne
[41] Cl.. 20.
[42] Cl. 20(2)
[43] Cl. 21(1)
[44] Cl. 21(2)
[45] FNSW Annual Report, p 41.
[46] Social, Economic, and Environmental Report 2002/03, Appendix 14

quality timber,[47]as long as the royalty value of the high quality timber harvested is greater than that of the pulpwood, the operation is deemed to comply. Even with this interpretation, FNSW have failed to provide proof that the royalty value of the sawlogs exceeds the value of pulp products in operations where logging is overwhelmingly for pulp.

The intention of the current condition is to maximise value-adding and minimise the impacts of logging in areas where woodchiping is pervasive. While it is accepted that a proportion of all woodchips is actual wastewood from sawlogs etc, a high proportion of the woodchip FNSW currently harvest in the UNE and LNE is from senescent (ie old growth) trees.

FNSW currently focuses on removing senescent trees in an attempt to maximise the area of growing trees. Historically, a defect tree allowance was made to contractors to allow them to undertake ring-barking or felling of these old veteran trees. However, with the advent of the woodchip market, FNSW now remove these trees and receive a royalty for an otherwise low timber value tree. The royalty value of woodchips is about $7 a tonne – one tenth the value of sawlogs. In contrast to their economic value, the value of these trees for biodiversity and forest health is enormous (see 7.6). What is needed is an incentive for FNSW to retain senescent trees, rather than an incentive to remove them. This is particularly important in areas where few large veteran trees exist, such as in coastal forests of the Regrowth Zones (see 7.6.1). As FNSW are under no obligation to supply volumes of woodchip from UNE and LNE IFOA forests, a limit on such volumes would not create unnecessary impacts on the timber industry, but would add enormously to the mitigation of logging impacts on biodiversity.

3.3 Thinning and Miscellaneous Forestry Operations

Recommendation 24

The TSLs must be amended so that miscellaneous forestry operations are defined as specified forestry operations.

Miscellaneous forestry operations[48] allows the removal of up to 80cm trees for various purposes at limited intensities. While these operations are prohibited in exclusion zones, they can be undertaken with impunity everywhere else. Indeed, it is conceivable that retained habitat trees are removed during these operations. This is unacceptable. All harvesting operations must be regulated and all timber extracted from State Forests must accord with IFOA clauses and conditions.

[47] Sawlogs, veneer logs, Poles, Piles, and Girders.
[48] S. 5.2 TSLs Cutting of posts for neighbour boundary fencing and the felling of timber for the construction of causeways and bridges for the purposes of forest management must only involve the felling of up to 50 trees of a maximum 80 centimetres dbhob, at a maximum density of five trees per hectare up to a maximum area of 50 hectares of the compartment.equirements

Recommendation 25

The TSLs must be amended so that thinning is specifically defined as a specified logging activity and regulated as for all logging operations.

Thinning is an ongoing forest management operation. Therefore, FNSW must undertake scientific trial to determine the economic and environmental impacts of thinning.

The IFOAs define "thinning'' as the cutting and removal of trees to increase distance between trees that have the potential to yield high quality timber, for the purpose of promoting their growth by removing poorer quality trees, and if removing poorer quality trees does not result in sufficient distance between trees, removing other trees.

Although the IFOAs currently restrict thinning to stands of regrowth forest and early mature stands of forest and where *most* of the trees in the stand are still growing, and are approximately the same age, up to 75% stand basal areas in the stand can be removed.

While it is accepted that in some areas of State Forest thinning may indeed benefit the forest structure by removing vigorous lignituber regrowth that may be inhibiting canopy and understorey development, thinning is often undertaken to remove large veteran trees (senescent trees, almost always hollow-bearing). Such operations receive scant attention in the IFOAs. Such practices diminish the habitat potential of forests and are largely unaccountable by forestry regulators. Due to the high intensity with which many thinning operations are undertaken they often pose an even greater threat to water quality and threatened species than do some sawlog operations.

The IFOAs do not set out the manner of thinning operations as for harvest operations. Harvest operations in the UNE and LNE must be undertaken under Australian Group Selection or Single Tree Selection methods and in the EMA Alternate Group Selection methods. However, thinning operations, even those where timber products are removed and sold, are not so limited. Indeed FNSW can lawfully virtually clearfell an entire compartment and sell the products harvested so long as the operation is undertaken for the purpose of thinning.

Logging cycles also do not apply to thinning. In other words, thinning operation can be undertaken in the areas left after AGS and Alternate Coupe logging. This means that the areas not logged during these intensive operations, left until the areas logged have recovered, can be intensively thinned before recovery. This leaves vulnerable species at greater risk due than would otherwise be the case.

This anomaly must be removed from all IFOAs and thinning must deemed a specified forestry activity and regulated in the same way as all other logging operations..

4. Unresolved CRA requirements

4.1. Wilderness Assessment and IFOA Wilderness exclusions

Recommendation 26.

All Wilderness capable areas must be excluded from IFOAs.

Recommendation 27.

All areas assessed as being capable of Wilderness Identification must be declared as Wilderness.

At the time of the signing of the IFOAs, there were a number of existing wilderness nominations made under the *Wilderness Act 1987* over State Forest tenure. Many of these have never been assessed in accordance with that Act. The Northern Wilderness Assessment Report 2001 states that 97,178 hectares of Wilderness capable areas was excluded from being declared as a result of the signing of the IFOA.

The following wilderness assessment study areas all contain areas of State Forest tenure that must be excluded from the operation of the IFOA and either immediately declared as Wilderness or subjected to full Wilderness Assessment:

1. Mt Ballow,
2. Cataract,
3. Timbarra,
4. Washpool,
5. Mann River,
6. Bindery Mann West,
7. Chandlers Creek,
8. Guy Fawkes,
9. Styx River,
10. Stockyard Creek,
11. Ingalba,
12. Wilsons River,
13. Doyles River,
14. Tuggolo,
15. Barrington,
16. Giro, and
17. Binghi.

In the Eden region, there remains some 2,100 hectares of Identified Wilderness that is available for logging in the Coolangubra Wilderness area. This includes parts of both Coolangubra and Nalbaugh State Forests.

Recommendation 28.

The NSW Government should develop a Memorandum of Understanding (MoU) with the Queensland Government to facilitate co-operative management for the four wilderness areas that straddle the NSW-QLD state border – Mt Ballow, Bald Rock, Donnybrook West, Lost World.

Recommendation 29.

The NSW section of Bald Rock should be declared under the Wilderness Act immediately, as the Wilderness is an equivalent size to the declared Lost World wilderness area.

Recommendation 30.

The MoU for the Lost World Wilderness should include management of the 'Border Track' and associated lookouts so as to minimise impacts upon wilderness values, while providing for visitor safety. Regeneration of rainforest along the border would provide the most effective impediment to exotic fauna, including rabbits, and this should replace fences as the primary management tool in the MoU.

There were three identified wilderness areas on the NSW-QLD border (Mt Ballow, Donnybrook West and Bald Rock) that could not be declared as Wilderness as they were of insufficient size alone to meet the minimum size of 8,000 hectares. However, large National Parks in Queensland adjoin each of these Identified Wilderness areas. If managed wholistically, these would provide a sufficient core area for recognition as Wilderness. Further, additional wilderness areas on the border adjoining the declared Lost World Wilderness Area exist in Queensland Reserves.

All four of these large, cross-border areas should be managed to protect wilderness values. This could be achieved through a Memorandum of Understanding (MoU) between the NSW and QLD Government to facilitate co-operative management for wilderness areas straddling the state border. The co-operative management of wilderness values has been achieved across the NSW-Victorian border, for example with the Genoa Wilderness, which provides a model for the arrangements proposed above.

Recommendation 31.

Existing IFOA wilderness exclusion areas must remain so excluded from the operation of the IFOA, and therefore from logging, until purchases and declarations are complete.

Recommendation 32.

Existing Identified Wilderness areas that have no impediment to declaration must declared immediately. This includes Chaelundi, Mummel Gulf and Bald Rock.

Recommendation 33.

Additional funds must be provided to promote the voluntary purchase of Identified Wilderness on Crown leasehold over State Forest tenure and other Crown leasehold lands.

Recommendation 34.

All potential Wilderness areas must be placed under an immediate and permanent moratorium from the Crown leasehold conversion process.

Since the Northern Wilderness Assessment report in 2001, there have been a number of identified wilderness areas where leases over State Forest have recently been purchased, enabling Wilderness Declaration to proceed. This is the case with both the Chaelundi and Mummel Gulf wilderness areas. However, despite the purchased lease areas having been gazetted as National Park, they have still not been declared as Wilderness. There should be no delay in these matters. Both wilderness areas should be declared immediately.

There are a large number of Crown leasehold areas, and Crown leasehold over State Forest tenure, that occur within Identified Wilderness. These leases must be voluntarily purchased prior to Wilderness Declaration. Additional funds are required to facilitate and promote the purchase of these leases. All Identified Wilderness leases must be purchased as soon as possible. While this process may take some time to complete, these areas must remain excluded from the operation of the IFOA, and therefore from logging, until their purchase and declaration is complete.

Wilderness Crown leasehold areas that do not occur over State Forest tenure, will now be available for conversion to freehold at far less than market value under the NSW Governments recent sell off of crown leasehold lands. This is likely to result in the destruction of Identified Wilderness areas. All potential wilderness areas must be placed under a moratorium from the Crown leasehold conversion process. Additional funds must be provided as a priority to purchase these lands for protection as NP and declaration as Wilderness.

Recommendation 35.

Freehold and leasehold Identified Wilderness properties that have been purchased by NPWS, but are subject to mineral objections, should now be gazetted as National Park and declared as Wilderness immediately.

There are a number of freehold and leasehold Identified Wilderness properties that have been purchased by the National Parks and Wildlife Service, but that have not been gazetted as National Park or declared as Wilderness due to mineral objections. Mineral objections should not be used to prevent Wilderness declaration. These areas should be declared immediately.

4.2. World Heritage values

Recommendation 36.

A comprehensive landscape assessment of World Heritage values in north-east NSW must be undertaken to identify all areas qualifying for additions under the rainforest, eucalypt and heritage themes. Based on this assessment, a renomination proposal should be prepared for the whole of CERRA by the end of 2005 and recommended by DEC to the Commonwealth Department of Environment and Heritage (DEH).

The rainforests of northeast NSW and southeast Queensland are exceptionally important for their high biodiversity, primitive and relict species, and role in the ongoing evolution of species. The NSW Government World Heritage nominated sites were accepted in 1986 as the Subtropical and Temperate Rainforests of Eastern Australia.

In 1997/98, World Heritage areas were assessed as part of the CRA. The Commonwealth Government prepared a report at the time, which identified the forests of north-east NSW as qualifying for listing on the World Heritage register on the basis of both the rainforest and eucalypt themes and potentially for Aboriginal heritage values.

In 1998, Australia established a 'World Heritage Expert Panel' to identify places of possible outstanding universal values. The panel identified that *Eucalyptus* dominated vegetation in Australia is of World Heritage value as an outstanding example on a continental scale of forest and woodland vegetation dominated by a single genus.

The Panel recommended that the 'Moonee-Bindery' area - a large, nearly continuous area of forest of which the Guy Fawkes Wilderness area is the largest component - be further investigated in relation to the sub-theme. It also noted that, in order to capture the outstanding catena of eucalypt forest diversity in the region, "consideration would have to be given to including other smaller reserves, areas of State Forest, and some private land extending from the Warra State Forest in the west to the coastal Moonee Beach Nature

Reserve in the east". To date, the commitments entered into regarding World Heritage declaration in north-east NSW have not been fulfilled.

North-east NSW now urgently requires a landscape assessment of World Heritage values. It is well recognised across the whole range of World Heritage panels and committees and throughout Government policy as a key geographic area for world heritage values under the rainforest, eucalypt and heritage themes.

It is not possible to assess existing reserves only, because World Heritage is recognised, and must be protected, at the landscape level. Furthermore, in the case of the Moonee-Bindery area, the World Heritage Expert Panel specifically required that freehold land and State Forest areas should be investigated. A comprehensive landscape assessment to identify all areas qualifying for additions under the rainforest, eucalypt and heritage themes should be undertaken immediately and a renomination prepared for the whole of CERRA by the end of 2005.

4.3. Areas for further reservation

Recommendation 37

The remaining 30,000 hectares of vacant Crown land that has been under assessment for reservation in accordance with the UNE and LNE Forest Agreements, must now be transferred to National Parks estate as a matter of urgency.

The Upper North East and Lower North East Forest Agreements required that:

> *NPWS* must assess the forest conservation values of remaining vacant Crown land in consultation with the Department of Land and Water Conservation, the Department of Mineral Resources and other relevant stakeholders by 1 January 2003. Vacant Crown land areas with forest conservation values not adequately represented in the existing reserve system must be designated as *dedicated* or *informal reserves* unless there are significant reasons for exclusion.

A total of 70,000 hectares of vacant Crown land were identified as being available for reservation. To date only 40,000 hectares has been transferred to National Parks estate, and a further 30,000 hectares is in limbo, despite extensive assessments having been conducted of conservation value and availability for transfer. This process is already running almost two years late. Urgent transfer of the remaining 30,000 hectares of vacant Crown land to National Parks estate is now required.

Recommendation 38.

Government funding must be expressly dedicated to the voluntary purchases of leases over areas identified for reservation as a matter or urgency.

A protocol or Memorandum of Understanding must be developed to ensure FNSW contribute funds to buy leases that are partially identified for future reservation, and partially for future logging.

The Upper North East and Lower North East Forest Agreements required that DIPNR, NPWS and FNSW identify certain additional areas of State Forest as 'available for formal reservation'. These areas were to be derived from the 'areas for further consideration' established by the Government's 1998 reserve decision. This process was conducted in concert with the implementation of the Governments 1999 pre-election promise to transfer large areas of 'unloggable' Forest Management Zone areas on State Forest estate that were adjacent to existing National Parks, to the National Parks estate.

These processes were completed in 2002, and all areas that were agreed for transfer to National Parks estate and that were not encumbered by leases, were gazetted on 1 January 2003. However, there remains a total of some 40,000 hectares of leasehold areas on State Forest that have been identified for transfer to National Parks estate but that could not be immediately gazetted. These leases must now be voluntarily acquired by DEC, and transferred to National Parks estate.

However, there have been no Government funds expressly dedicated to the purchase of these leases. Furthermore, leasehold boundaries rarely coincide with the new reserve boundaries, and DEC will frequently be required to purchase leases that cover large areas of loggable State Forest that are not going to be transferred to National Park estate.

Since NPWS would purchase the whole lease, but would be unable to reserve the part of the lease within 'loggable' State forests, funding support for the lease purchase should be provided by FNSW. FNSW gain considerably when DEC purchase leases with loggable areas because they no longer have to pay royalties and are freed from leasehold interests, which are often problematic and expensive. It is inappropriate to spend scarce conservation resources purchasing leases some of which remains available for logging by FNSW.

A protocol or memorandum is required between DEC and FNSW to ensure that unique opportunities to purchase leaseholds identified for reservation are not lost. This would involve FNSW contributing funds to buy leases of interest to DEC if they include a 'loggable' component. The cost of the lease would be divided between DEC and FNSW according to the proportional area of 'unloggable' FMZ to loggable areas. RACD should also be a signatory to the agreement to resolve any disputes that may arise.

Recommendation 39.

DEC must be provided with funds to purchase high priority private lands for conservation to match the funds already received by FNSW to purchase private land to log. DEC must be provided with at least $500,000 for on-going monitoring and reviews of conservation data over the next five years of the IFOA.

The CRA decision included the provision of $18 million for State Forests to purchase private land to log, and a further $5 million as a transport subsidy to the timber industry. It also included $500,000 for on-going monitoring and review of timber supply data. However, there was no money provided to purchase private land for conservation or to upgrade or refine conservation data. This is despite the Government's commitment to both of those aims as part of the NSW Biodiversity Strategy. The reserve system in NSW still falls drastically short of the promised Comprehensive, Adequate and Representative reserve system. Purchase of high priority private lands must now become a key plank to complement and build the existing reserve system through acquisition of poorly reserved vegetation and core fauna habitat.

4.4. Eden Icon Areas

Recommendation 40.

The following Eden Forestry Compartments should be legislatively transferred to the NSW National Park Estate immediately.

1. ***Yambulla State Forest - Compartments 550. 556, 557, 573, 574, 577 -588,***
2. ***Yurammie State Forest - 963- 967, 996.***
3. ***Murrah State Forest - 2059 - 2064***
4. ***Mumbulla State Forest - 2161, 2163, 2164, 2167- 2171, 1276 - 2185.***

Until the fate of these forestry Compartments are determined they must be removed from all FNSW logging schedules and plans of operation and rezoned as FMZ2..

The recent conservation gains on the north coast as a result of the Icon Reservation are laudable. Conservationists have been seeking similar outcomes for Southern and Eden IFOA forests. While not being a party to negotiations for the reservation of iconic forests left out of the Reserve System in these two regions, it is apparent that the list of compartments being sought is both reasonable and easily deliverable within current timber commitments.

As the Eden forests are the most intensively harvested in the State, the reservation of representative habitats and forest ecosystems is the only sure way of adequately mitigating the impacts of logging on the environment and biodiversity.

Export woodchiping was to be phased out of NSW forests by now. However, it appears that this too was merely an election promise that was never to be delivered. If this is the case, the

Eden forests must be given some compensation for continuing to be the sacrifice zone for a large multinational company relied upon by this government to prop-up the employment base of a small rural community through the destruction of these public forests.

4.5. Forest Management Zones and management plans

Recommendation 41.

FNSW must immediately upgrade all 'unloggable' FMZ areas. All areas must be included in FMZ1, unless it can be shown that it is not possible or practicable to do so, in which case they should be included in FMZ2, and FMZ3a should only be used as the last option.

A Forest Management Zoning system has been implemented across the State Forest estate. Forest Management Zones (FMZs) 1, 2 and 3a are not available for logging. However, FMZ2 does allow mining, and FMZ3a allows both mining and grazing.

The Forest Agreement required that areas of clumped oldgrowth and rainforest should all be include in FMZ2, as follows:

> "The *FMZ* 2 areas will comprise:
> (i) The *informal reserves* shown on *Map 2*.
> (ii) Areas of clumped reserves derived from *net harvest area exclusions* including High Conservation Value old growth, *forest agreement* negotiated rainforest etc.
> (iii) Any other areas determined by *SFNSW*."

The JANIS criteria and FNSW's own Forest Management Zoning guidelines require that a zone should only be included in FMZ3a if it "is not possible or practicable" to include it in FMZ2, and it should only be included in FMZ2 if it "is not possible or practicable" to include it in FMZ1. Therefore, unless there is a genuine impediment to prevent it, each area must be accorded the highest possible protected status available in a Forest Management Zone.

These requirements have never been implemented by FNSW. At the commencement of the FMZ process, FNSW simply placed most areas earmarked for protection from logging into FMZ3a, and they have never made any attempt to upgrade them in accordance with the requirements. FNSW are seriously in breach of the JANIS criteria and their own zoning guidelines on this issue. FNSW must now be made to systematically upgrade all 'unloggable' FMZ areas. All areas must be included in FMZ1, unless it can be shown that it is not possible or practicable to do so, in which case they should be included in FMZ2, and FMZ3a should only be used as the last option.

Recommendation 42.

FNSW must immediately prepare management plans for all FMZ1 and FMZ2 areas and all large exclusions of high conservation oldgrowth and rainforest, in consultation with DEC.

The Forest Agreements require that all areas of FMZ1 and FMZ2 be managed for conservation purposes under approved management plans. The Forest Agreements also require that, for all of the larger, more significant exclusions of high conservation value oldgrowth and rainforest

> a management plan must be prepared by *SFNSW* by 1 January 2002, as an attachment to the appropriate Regional *ESFM* Plan and in consultation with *NPWS* ... The management plan must take into account prescribed burning regimes, responses to wildfire, pest plant and animal management, road construction and maintenance and erosion control works.

FNSW have never prepared such plans. They must now be required to do so as a matter of urgency.

4.6. Cultural heritage

Recommendation 43.

DEC Cultural Heritage Division must be given the responsibility for all Cultural Heritage protection on State Forests of NSW tenure. DEC must investigate and nominate for protection all Cultural Heritage areas identified during and since the CRA process.

Recommendation 44.

DEC must not issue FNSW retrospective consent to destroy Cultural Heritage.

Recommendation 45.

DEC must develop and fund a consultation process with Indigenous groups and communities to determine the aspiration they have for DEC and the protection of Indigenous Cultural Heritage in IFOA forests.

FNSW operate under Cultural Heritage Guidelines, developed in consultation with NPWS (now DEC) and the NSW Heritage Office, which draw on the Protective Mechanisms for Cultural Heritage report prepared on behalf of the Cultural Heritage Working Group as part of the CRAs.[49]However, the six-page guideline is no more than a statement of intention to

[49] FNSW Cultural Heritage Guidelines, p 1

consult, assess, monitor and develop protective mechanisms regarding Cultural heritage values within State Forest tenure.

FNSW claim to have protected 95 new aboriginal cultural sites and 554 European cultural sites in 2002/03.[50]Given the vast preponderance of Aboriginal Cultural Heritage in this country, it is curious that European Heritage receives such emphasis by FNSW. This Eurocentric focus stems from the fact that much Aboriginal Heritage is not at first recognisable, unless an awareness and appreciation of local Indigenous Culture is apparent. It is acknowledged that FNSW employ Indigenous Cultural Heritage Officers. However, it is questionable whether such employees of FNSW, isolated by culture and corporate direction, can adequately assess and identify Aboriginal Heritage over such vast tracts of land. Indeed, the protection of such sites is given scant attention in the guidelines, particularly with respect to the threats imposed by grazing and burning. These impacts are very difficult to assess, unlike logging operations, where pre-harvest surveys at least provide an opportunity to identify and protect cultural heritage values before operations commence.

It is apparent that DEC has been issuing FNSW with consent to destroy Cultural Heritage after logging and damage has occurred. This is unacceptable. DEC's consent to destroy must only be issued after consultation has been undertaken with Indigenous groups and communities, well before the destruction has taken place. To issue consent to destroy Cultural Heritage after it has been destroyed is an abuse of process and will lead to further mistrust by Indigenous communities.

Currently, the only involvement by DEC's Cultural Heritage Division into FNSW cultural issues, is issuing FNSW with consent to destroy Indigenous Cultural Heritage. This is contrary to the stated intention of the IFOAs, and has led to an under-representation of protected Indigenous Cultural Heritage. Indigenous communities have historically held deep distrust for NPWS (now DEC). FNSW, on the other hand, has been proactive in developing consultative processes with Local Aboriginal Land Councils. Personal observations have shown these processes to be flawed. FNSW actively seek out individuals who will accept Indigenous Cultural Heritage sites being logged. Such practice is deeply divisive in Aboriginal communities and is unacceptable conduct for a NSW government agency. DEC is, therefore, in a good position to develop better relationships with Indigenous groups and communities by funding consultative processes to identify their aspiration for Indigenous Cultural Heritage in IFOA forests.

While the CRA was required to assess and protect cultural heritage values in public forests, no further systematic assessments of cultural heritage (Indigenous and European) sites have been undertaken and most sites identified by the process have still not been adequately delineated or protected by FNSW or DEC. All identified Cultural Heritage sites identified in the CRA process need be protected and appropriate management plans developed by FNSW.

[50] FNSW Seeing Report 2003/04, p7

4.7. FNSW purchases and other Crown Timber Lands

Recommendation 46.

The maps delineating high conservation oldgrowth and rainforest for protection under the TSL, must be amended to include all oldgrowth forest and rainforest on other Crown Timber Lands such as vacant Crown land and Timber Reserves.

Recommendation 47.

A clause must be inserted in the IFOA preventing FNSW from purchasing timber that was not harvested in accordance with IFOA requirements.

Recommendation 48.

A clause must be inserted into the IFOA that all mapped oldgrowth and rainforest must be protected on any lands purchased by FNSW, and all private lands from which FNSW purchases timber.

Recommendation 49.

A clause must be inserted into the IFOA preventing FNSW from purchasing any areas that contain substantially unmet CAR targets - to be specified by DEC.

The Upper North East and Lower North East Forest Agreements state that:

> Rainforest, high conservation value old growth forest and other areas protected through exclusions of logging, *forest product operations* and other operations as specified in the *Threatened Species Licence* for the *IFOA* are critical to the conservation of protected and threatened species. These and other areas must be protected through prescriptive exclusions consistent with the protection of their conservation values.

However, even though the IFOA applies to all Crown Timber Lands, the map specifying high conservation oldgrowth and other exclusions, was incorrectly confined to State Forest tenures. Therefore, there are no effective protections in place for oldgrowth forests and other high conservation value areas on other Crown Timber lands. There is also no baseline protection for private property blocks purchased by FNSW, and FNSW have used this loophole to log oldgrowth forests in places such as Stroud in the Bulahdelah region. This oversight needs to be addressed immediately.

Both Forest Agreements also required that:

> "The process (prior to any purchases) of selecting land for purchase by *SFNSW** for timber supply must consider key substantially unmet CAR conservation targets. A process for this, and the key targets must be developed by *SFNSW**, including consultation with *NPWS** and DUAP, by 30 June 1999".

No process to consider key substantially unmet CAR conservation targets was ever developed or applied by FNSW prior to the purchase of land for logging. Furthermore, FNSW are believed to have purchased timber off private property that was logged under an exemption to the Native Vegetation Conservation Act 1997. If this is true, it paints the NSW Government in a very poor light, taking advantage of lesser protections on private land to log high conservation value features. This is completely contrary to the intent of the IFOA, and must be immediately rectified. A clause should now be inserted into the IFOA that prevents FNSW purchasing timber from logging with lesser protection mechanisms than the IFOA. An additional clause should be inserted to ensure that all mapped oldgrowth and rainforest must be protected on any lands purchased by FNSW, and all private lands from which FNSW purchases timber.

5. Forest and catchment health

Recommendation 50.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials to determine the state of forest health in State Forests and develop management plans and remedial procedures for forests where forest health is found to be in serious decline.

Recommendation 51.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to map areas of degraded forests and identify rehabilitation treatments to restore them to a healthy state as part of all operational planning: these maps and treatments must be incorporated into all FNSW Harvesting Plans.

Forest health and vitality is one of seven criteria nominated for inclusion in the national Montreal Process forest monitoring program (Commonwealth of Australia, 1997). Damaging forest processes include fire, weeds, vertebrate pests, pathogens, and abiotic factors such as drought, salinisation, soil acidification, air pollution and land clearing (National Forest Inventory 2003). However, few actual assessments have been completed. Stone *et al*. (2004) advocate the need for the development of standardised indicators, such as Crown Damage. These ground-based indices could then be utilised in the (automated) classification of broader-scale geographical and temporal health trends of Australia's eucalypt forests.

Much of the NSW State Forest estate is in poor condition, and this has implications not only for sustained timber resource but also for fauna and flora population viability. That being the case, it is imperative that all key damaging processes are fully assessed and that rehabilitation measures are identified. The ecological implications of the intense harvesting and burning of native forests are poorly understood. The effects of these processes, however, can be seen in many areas where regenerating forest is constrained by vigorous lignotuber regrowth, weeds and native vines allowing little understorey development, with severely altered forest structure, reduced productivity and species composition. Problems such as Bell Miner associated dieback are expanding rapidly and affecting large tracts of forests which is contrary to the very basis of ESFM.

Intense logging of these forests will only compound the problems of poor growth. Forests with poor regeneration or suffering from drought stress, or dieback must be carefully logged, if at all. Studies need to be undertaken by both FNSW and DEC to identify what treatment is to be employed on these forests. However, to log them at the same intensity as a healthy forest is not in the interest of ESFM, forest ecology or silviculture outcomes.

5.1. Soil loss and compaction

Recommendation 52.

A clause must be inserted in the IFOAs to restrict access of large machines and trucks, which cause severe soil compaction, to existing roads and log dumps only.

Undisturbed forest soils have high porosity and low density and are easily compacted by logging machinery (Gent *et al.*, 1983: Gent *et al*., 1984: Froehlich *et al.*, 1985: Aust *et al*., 1993: Aust *et al*., 1995: Rab, 1994: Rab, 1996: Huang *et al.*, 1996 and Lacey and Ryan, 2000). Logging operations have been found to significantly increase soil compaction (Steinbrenner: Greacen: Johnson: Jakobsen: Incerti and Rab *et al*., 1992). Compaction has been shown to have a long-term negative impact on soil properties and tree growth rates particularly on the primary snig tracks, log landings and general logging areas where subsoil has been disturbed (Froehlich, 1979: Wert and Thomas, 1981: Jakobsen, 1983: Froehlich *et al*., 1985: Lockaby and Vidrine, 1984: Rab *et al*., 1992 and Croke *et al*., 2001).

Williams and Nelson (2003) found that soil damage, compaction and displacement during logging affects both the physical and chemical properties of soil and restricts the growth of regenerated trees. These authors found that increasing soil compaction caused a proportional decrease in the growth of seedlings by up to 25%, and that the growth of eucalypt seedlings grown on disturbed soils averaged 30% of that on undisturbed sites.

Rab (2004) showed that soils were very slow to recover from soil compaction and subsoil disturbance. The author found that:

> Ten years after logging, soil bulk density was significantly greater and organic matter content and macroporosity were significantly lower in primary snig tracks and general logging areas where subsoil has been disturbed compared to undisturbed areas…To minimise the long-term impacts of logging on soil physical properties, the areas occupied by subsoil disturbed general harvested areas…, primary snig tracks and log landings…needs to be reduced.

As Lacey (2000) suggests, the use of heavy machinery for forest harvesting results in severe localised ground disturbance and increased potential for erosion and water pollution by eroded sediment.

The increased use of large machinery in forestry operations in NSW is of particular concern. The use of heavy machinery for forest harvesting results in severe localised ground disturbance, compaction and runnoff potential for erosion and water pollution. The increased use of harvesting machinery will increase soil compaction across the Net Harvest Area. Large machines and trucks that impact on soil quality should be restricted to existing roads. While current wood supply commitments may inhibit significant reductions in logged areas, harvesting operations must be conducted to minimise soil loss and soil compaction in native forests. If FNSW maintain current levels of logging intensity, future timber yields and supplies of logs to the timber industry will continually diminish.

Recommendation 53.

The EPL and TSL must be reviewed in light of the recent change from manual harvesting to mechanical harvesting in NSW, and the dramatic increase in soil and understorey disturbance that this represents. New conditions must be developed to restrict access of this machinery to sensitive areas, and to mitigate impacts on soil, water and threatened species.

Recommendation 54.

A clause must be inserted into the IFOA that requires a review of the operation of the EPL and the TSL whenever DEC is of the opinion that logging practices have changed significantly from practices in use when the original licences were issued.

The recent introduction into NSW forests of large Mechanical Harvesters to do the work once conducted by a man with a chainsaw, represents a major increase in soil and understorey disturbance compared to previous practices. The impacts on soil, water and threatened species have not been assessed, and the current regulatory constraints were based on mitigating the impacts of manual harvesting, not mechanical harvesting. The EPL and TSL must now be reviewed in light of the change from manual harvesting to mechanical harvesting.

5.2. Subsoil microorganisms

Recommendation 55.

A clause must be inserted in the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials to determine the effects of intensive logging and post logging burning on mychorrizal fungi, and the consequential impacts this has on the growth of regenerating forest.

Communities of soil organisms are severely altered after logging (Huhta *et al*., 1967: Perry and Rose, 1983: Bird and Chatarpaul, 1986: Forge and Simard, 2000: Battigelli and Berch, 2002). Claridge (2002) notes that:

> The Australian continent is characterised by a harsh climate and highly weathered, nutrient-poor soils. Trees and shrubs in these stressful environmental conditions typically form ectomycorrhizae with a variety of fungi, many of which form hypogeous (underground) fruit-bodies… The precise ecological role of many hypogeous fungi remains to be determined, although most presumably facilitate nutrient and water uptake on behalf of their mycorrhizal partners. Others may also protect their plant host from root pathogens.

Apart from being a necessary food resource for hypogeal fungi obligates, such as potoroos etc, many species of eucalypt form symbiotic relationships with fungi to facilitate nutrient uptake. Given that mycorrhizal fungal diversity significantly enhances plant phosphorus content, they are essential facilitators of growth in regenerating forests that have been logged (Baxter and Dighton 2001).

Jones *et al* (2003) notes that there is compelling evidence that mychoryhizae are damaged or destroyed during logging operations and associated fire. Fire can also cause the liberation of nutrients from ash, burning of soil organic matter, which has implications for mychorrizal diversity (Mikola *et al* 1964: Pietikäinen and Fritze, 1995: Ballard, 2000). Fire also changes nutrient availability and soil microbial communities and increases soil temperature and pH levels (Mikola *et al*., 1964: Pietikäinen and Fritze, 1995: Ballard, 2000). These changes may be just as important as destruction of inoculum in reducing colonization (Perry and Rose, 1983). However, poor colonization rates or changes in the michorrizal fungal community after fire do not appear to be due directly to the presence of ash (Grogan *et al*., 2000: Mahmood *et al*., 2002) or to the loss of topsoil by erosion (Amaranthus and Trappe, 1993).

McMullan-Fisher *et al* (2002) identified the changes in the occurrence of macrofungi with time following forestry activities and fire in Mountain Ash (*Eucalyptus regnans*) dominated forests, and found that there was a distinct change in the macrofungal community over time since disturbance. The authors suggest that:

> The macrofungi evident in the Mountain Ash forest during the first year after fire were the most distinctive. The change in the suite of macrofungi closely reflected the changes in macrofungal substrates in the forests of different ages.

After broadcast burning, soils typically have substantially reduced densities or biomass of residual mycorrhizae compared to unburned areas (Harvey *et al*., 1980: Stendell *et al*., 1999: Visser and Parkinson, 1999). Chen and Cairney (2002), however, found that the total available propogule of michorrhizal fungi were considerably reduced in the top 15cm of soil profiles at two of the three eucalypt forest sites studied following a prescribed burn. Since burning generally eliminates so much mycorrhizal biomass, it is not surprising that the inoculum potential of burned sites is lower than unburned sites (Wright and Tarrant, 1958). Brundrett *et al*. (1996) found a significant reduction in inoculum potential after 4 years of annual burning of unlogged eucalypt forests. A year after a broadcast burn hot enough to eliminate the humus, the percentage of *Pinus sylvestris* (Scots pine) roots colonized was lower than where the fire had not burned the humus (treatment plots not replicated: Mikola *et al*., 1964).

Serious concerns are held for regenerating forest in IFOA areas as a result of reduced mychorizal inoculation of new growth after post-logging burns and clear felling operations such as AGS and Alternate coupe logging, when soil is at its most disturbed. This is just another example of FNSW logging to the detriment of future timber supplies by not incorporating new information into silviculture methods. While long-term timber commitments remain so high, timber extraction will remain at unsustainable levels. So, too, will FNSW continue with its current practice of rapidly removing the largest and most merchantable trees, in preference to long-term forest health.

5.3. Crown dieback

Recommendation 56.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials, assessments and management plans to determine the extent of crown decline in IFOA forests and identify what treatment is to be employed in forests affected by dieback and other stress-related crown decline.

Recommendation 57.

Until the underlying cause of dieback is conclusively identified and specific measures developed to effectively manage the problem, areas of forest suffering dieback and those areas vulnerable to dieback be removed from plans of operation and excluded from logging operations.

Over 2.5 million ha of the State Forest of NSW estate is potentially vulnerable to dieback, and tens of thousands of hectares are currently affected. While "dieback" is used to describe the consequences of many causes of reduced canopy cover – like fungal and soil pathogen infection, drought stress, insect herbivory, nutrient alteration etc – the majority of crown decline in native regrowth forests in southeastern Australia is associated with colonisation by Bell Miners (*Manorina melanophrys*) (Stone, 1999).

Kavanagh and Stanton (2003) suggest that Bell Miners are associated with disturbed forests and are implicated in eucalypt canopy dieback. These authors found that Bell Miners established colonies in regenerating forest that was logged 22 years prior to their study.

Bell Miners are cooperatively breeding honeyeaters (family Meliphagidae), endemic to southeastern Australia (Clarke and Schedvin, 1999), and are extremely efficient at excluding other species of birds from their communally defended territory (Loyn *et al*., 1983: Clarke, 1984a and Poiani *et al.*, 1990). They live in complex social units (colonies) comprising numerous breeding pairs occupying abutting home ranges, which they share with non-breeding helpers. All birds in a colony, which can number over 200 individuals in an area of several hectares, share in the task of defending the colony's territory from intrusion by other species of birds (Clarke, 1984b and Clarke and Fitz-Gerald, 1994).

While Bell Miners commonly occur at sites where eucalypt trees are suffering from severe infestations of phytophagous insects, especially psyllids (Chandler, 1922: *Loyn et al*., 1983: Clarke and Fitz-Gerald, 1994 and Stone, 1996), Clarke and Schedvin (1999) found little evidence to support the assumption that Bell Miners enhance the probability of an infestation occurring. This was despite extensive work and debate about the relationship between Bell Miners and psyllids (Loyn *et al*., 1983: Loyn, 1985: Loyn, 1987: Loyn, 1995: Poiani, 1993a: Poiani, 1995 and Stone, 1996). It is suggested by some land managers and authors that Bell Miners are the primary cause of eucalypt ill-health (e.g. Heatwole and Lowman, 1986 and Low, 1994.) Contrary to this belief, however, Clarke and Schedvin (1999) suggest that Bell Miners may simply be exploiting pre-existing psyllid infestations, which themselves may be occurring because the trees are stressed by other factors, e.g. water-logging or drought, elevated nutrient levels or soil pathogens (White, 1969 and Landsberg and Wylie, 1983).

Clarke and Schedvin (1999) removed Bell Miners from a site in southeast Victoria in an attempt to determine whether forest health would improve. Unlike the study by Loyn *et al.* (1983), however, the cleared site was re-invaded by Bell Miners, and no long-term improvement in the health of trees was observed following the original removal of the birds. While these authors found an increased production of epicormic growth following removal of Bell Miners, they suggest that the production of epicormic growth can be evidence of stress in many eucalypts and often precedes a rapid decline in health (e.g. Landsberg and Wylie, 1983). Clarke and Schedvin (1999) found no sign of recovery during long-term monitoring after Bell Miners were removed.

While these authors did not specifically address possible fire related causes of the stress, the site where they conducted the study was last subjected to serious fire in 1962, after which the Bell Miners had been in continuous occupation.

While Bell Miner invasion may be a *symptom* of stress, insect predation appears to be a major contributing factor in crown dieback. Lowman and Heathwole (1992) noted that insect defoliation was commonly associated with and assumed to be a cause of mortality in Australian eucalypts where trees suffer from the eucalypt dieback syndrome. They found that some eucalypt species suffered greater defoliation than others, which was related to their observed susceptibility to dieback. For example, the authors found that *Eucalyptus nova-anglica* (peppermint) and *E. stellulata* suffered severe dieback, while *E. caliginosa and E. dalrympleana* showed little evidence of the syndrome.

However, insect attack itself may be merely a result of another more complex indicator of forest ill health. Radho-Toly *et al* (2001) found that the levels of insect herbivores on trees could be influenced by the nutritional quality of foliage, as nutrient rich new leaves are favoured by herbivorous species. The level of nutrients, particularly nitrogen, within leaves is an important limiting agent for the growth and development of phytophagous arthropods (Southwood 1972). In a series of papers concerning arboreal arthropods on native eucalypts within eastern and Western Australian forests, Majer *et al*. (1992) and Recher *et al*. (1996) observed that trends in the abundance and diversity of arthropods on the different tree species were consistent with variations in nutrient levels within leaves. Within each of the two forests they studied, tree species with highest foliar nutrient levels supported the greatest abundance and diversity of arthropods. This trend is consistent with the idea that insects respond to higher nutrient levels in foliage (Landsberg 1990: Landsberg *et al*. 1990).

Eucalypt forests and woodlands experience an increase in the availability of soil nutrients following fire (Humphries and Lambert 1965: Tomkins *et al*. 1991: Bauhaus *et al*. 1993: Chambers and Attiwill 1994). Radho-Toly *et al* (2001) suggests that the increased nutrient uptake by saplings may result in more nutrient-rich foliage and that this could flow on to arthropod herbivores, with implications for the vigour of the post-fire regrowth. These authors found that:

> … leaves in the post-fire environment contain more nutrients, and there are greater numbers of arthropods and increased rates of herbivory. This may result in reduced shoot growth in saplings that grew up following the fire.

If this relationship is causal, there may be a trade-off for the plant, which in the nutrient rich post-fire environment can produce nutrient-rich, photosynthetically superior leaves that achieve higher growth rates but are poorly defended against herbivores (Westoby 1998). However, Radho-Toly *et al* (2001) suggest an alternative explanation, that;

> …if reduced shoot extension in the post- fire environment is caused by increased abundance in herbivores, it may be an example of a negative feedback mechanism that reduces the vigour of plant growth following fire: increased leaf nutrients result in increased arthropod levels, which in turn lead to increased herbivory.

FNSW's stated position on Bell Miner associated dieback is typically unsophisticated and lacking any scientific credibility. They baldly state that Bell Miner associated dieback results from the colonization of mesic understorey due to a *lack* of fire. This is in direct contradiction to the studies quoted above. Indeed, it would appear from the above discussion that FNSW's own strategy of using fire to increase growth in regenerating forests and maintain green pick for graziers, is contributing to dieback in our forests.

No matter what the cause, FNSW need to address the dieback of forests in their care. Currently, a Committee has been constituted to look into what can be done. FNSW, however, continue to deny the causal link between dieback and their management practices, including intensive harvesting and fire.

Until the underlying cause of dieback is conclusively identified and urgent action taken to prevent it, areas of forest suffering dieback must be removed from plans of operation and excluded from intensive logging operations and fire.

5.4. The effects of logging on water yield

Recommendation 58.

A clause must be inserted into the IFOAs limiting the logging of any subcatchment to 15% of forest basal area in any one year, with a 15 year subcatchment logging cycle.

Recommendation 59.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to cost the environmental effects of logging, including reduced water yield for down stream water users.

Recommendation 60.

A clause must be inserted into the IFOAs that requires FNSW, in consultation with DEC, to undertake scientific trials and assessments, and develop management plans to address the effects of lower water yields after logging on fish, invertebrates, frogs, aquatic reptiles and water dependant mammals over the next five years. The results of such trials should be used by DEC to develop conditions to mitigate such effects.

A significant body of empirical evidence shows that water yield from catchments is related to forest stand age (Langford, 1976: MacKay and Cornish, 1982: Kuczera, 1985: 1987: Jayasuria *et al*, 1993: Cornish, 1993: Wronski, 1993: Vertessey, 1996: Watson *et al*., 1999: Roberts *et al.* 2000: Lane and Mackay 2001).

This evidence shows that the initial response to logging in catchments is a significant increase in flows followed by a sustained decrease. MacKay and Cornish (1982) quantified the effects of integrated logging for woodchips and sawlogs, compounded by the effects of wildfire, in the Yambulla State Forest, southeast of Eden. While a burnt catchment had completely recovered its pre-wildfire stormflow response in 28 months, two logged catchments (one logged over 42% of its area before the fire, the other salvage-logged over 80% of its area after the fire) still showed a 3 to 4 fold increase in stormflow volume. The authors attributed the increase in stormflow to the persisting effects of logging on the catchment surface and/or persisting effects of vegetation removal.

However, studies into the sustained reduction in stream flows after logging has focused on Mountain Ash forest in Victoria. For example, intense wildfires in 1939 killed large areas of oldgrowth Mountain Ash forests in the Melbourne water supply catchments, and very dense, even-aged stands developed in its place. Within about 5 years, water yields had declined to a significant degree. The decline was shown to be related to the proportion of the catchment occupied by regenerating mountain ash (Kuczera, 1985). Vertessy *et al.* (2001) confirmed that:

> There is a well-documented empirical relationship between stand age and water yield for mountain ash (*Eucalyptus regnans*) forested catchments in the Central Highlands of Victoria, Australia. Catchments covered with oldgrowth stands of mountain ash yield almost twice the amount of water annually as those covered with re-growth stands aged 25 years.

These cool moist forests differ markedly in the leaf litter and overstorey dominance from many forests in NSW. However, there is now clear evidence that this phenomenon is not confined to the Ash type forests of Victoria. Cornish (1993) examined the effects of 3 treatments (clearfelling of oldgrowth followed by eucalypt plantation establishment or natural regeneration, with and without fire) in Karuah State Forest in the LNE IFOA area. There was an initial increase in water yield after logging which generally declined after 2 to 3 years. Subsequent water yield reductions in catchments with the highest stocking rates reached statistical significance in years 5 and 6 after logging (Cornish, 1993).

An unpublished report on the Tantawangalo Research Catchments, west of Bega, showed that base flow had declined to below the pre-logging level only 18 months after logging for sawlogs and woodchips over 32 % of one catchment. (Wronski, 1993). This reduction in base flow appeared to be accelerating by year 3 post logging

Roberts *et al.* (2000) compared transpiration rates of *Eucalyptus sieberi* stands of various ages in the Yambulla catchments in southern New South Wales to show that transpiration per unit leaf area in 14-year old stands was almost three times greater than in a 160-year old stand of the same species. Vertessy *et al.* (2001) notes that such differences in leaf area efficiency suggest that these forests would also exhibit a stand age/water yield relationship, with oldgrowth stands yielding more runoff.

Lane and Mackay (2001) report that 8-year-old mixed-species eucalypt forests in the Tantawangolo catchments of southern New South Wales yielded up to 190 mm per year less runoff than the oldgrowth stands they replaced. These authors undertook an 11-year paired-catchment study to assess the effect of different logging practices on stream flow in mixed-species eucalypt forest at Tantawangalo Creek, in the EMA. The two catchments were treated to 22% and 12% removal of basal area respectively. The treatments resulted in an initial increase in monthly total stream flow and base flow at both treated catchments. In annual terms, total streamflow increased by 10% in the first 3 years after 22% removal of basal area, and by 31% for the first 4 years after 12% basal area removal.

The authors found that:

> Streamflow then returned to pre-treatment levels for 1 year and subsequently declined by 20% below pre-treatment levels over the next 4 years at Wicksend [22% removal]. Willbob [12% removal], displayed a return to, but not below, pre-treatment levels over the same period. Although there were some large post-treatment stormflows, changes in baseflows were largely responsible for the streamflow increases, and at Wicksend explained the streamflow decreases in the latter observation period. Differences in regeneration densities between the treated catchments indicate the greater magnitude and persistence of flow increases at Willbob were due to poor regeneration following the thinning treatment, while dense and vigorous under - and overstorey regeneration dampened initial flow increases and facilitated significant decreases at Wicksend (Lane and Mackay, 2001).

However, it is not only logging in mature/senescent forest that changes catchment hydrology. Thinning in regrowth forests has been shown to increase water yield in the short-term, with strip thinning causing a greater increase than selection thinning. Nevertheless, the typical response of understorey and adjacent vegetation to thinning makes any increase in water yield very short-lived relative to the likely frequency of thinning operations (Jayasuria *et al*, 1993, Ruprecht and Stoneman, 1993).

The reduction in evapo-transpiration as forests thin-out naturally with age is largely explained by the reduction in cross-sectional area of sapwood in trees which constitute the upper canopy. Oldgrowth forests may have stocking rates as low as 20 or 30 dominant trees per hectare compared to tens of thousands of seedlings in young regenerating stands.

The impact of logging on water yields is most pronounced during low flows at times of drought and low rainfall. These periods are when the available water yields from forested watersheds are in greatest demand. Any reduction during these periods will have severe implications for coastal communities and instream ecology.

These findings have two significant implications for FNSW. Firstly, where large areas of forest are logged or thinned intensively (ie. >15% of basal area), more sophisticated drainage structures must be employed to mitigate the increased runoff and stream bank erosion potential. Secondly, given the dire water crisis manifesting in many overpopulated NSW coastal communities, it may well be unviable to continue logging in water catchments, where significant human populations downstream exist.

The hydrological effects of logging appear to be most pronounced when >~15% basal area is logged. It would, therefore, be prudent to limit the logging of any one subcatchment to below 15% of Net Harvest basal area. This would give six logging cycles before the entire Net Harvest Area of a subcatchment was logged. On highly productive sites, this would provide enough time for a mature merchantable sawlog to grow, and would reduce the effects of logging on water yield. While even this level of logging may still have significant effects over the medium to long-term, the effects are more likely be shorter-lived. It would also help reduce cumulative erosion and stream degradation problems. As opposed to the current intensive logging regime in IFOA forests, subcatchment logging cycle of 15 years would allow for the effects to be spread spatially and temporally. However, as the hydrological affects of logging manifest over centuries, even this small restriction would not be totally effective in mitigating the lost water resulting from the increased evopo-transpiration of regenerating forests.

In order to contextualise the loss of water caused by logging activities, DEC need to include reduced water yield for down stream water users in a thorough costing of the environmental effects of logging operations and balance this cost with the stated economic benefits of timber extraction. Once determined, the cost of any reduction in water yields should then be borne by FNSW, which would flow through to increased logging royalties passed on to timber merchants, thereby incorporating the true cost of the harvesting of native forests into the cost of timber. To achieve this costing, gauging stations must be installed downstream of all logged forests to monitor altered hydrology. The results of these gauges must include flow duration in dry periods, not just annual water yields.

Further, IFOA conditions must address the lower water yields that are a consequence of logging. While reduced water yields have serious implications for down-stream water users, the ecological implications would include significant effects on in-stream ecosystems. Fisheries Licences should reflect concern for lower flows caused by logging and its effects on fish and invertebrate species, and DEC need to develop conditions for frogs, aquatic

reptiles and water dependant mammals to mitigate the effects of reduced stream flows after logging.

The above discussion also has serious ramifications for plantation establishment in upper catchments. For a proponent to undertake plantation establishment, the inevitable cost of the loss to stream flows must form part of the assessment of the proposal by regulatory agencies and land managers.

5.5.The combined effects of logging and fire

Recommendation 61.

A clause must be inserted into both the EPL and the TSL that restricts logging in any compartments that have been recently subject to a moderate to high intensity burn, until a period of at least 5 years has elapsed.

The EPL and TSL are have been designed to mitigate the impacts of logging, not the impacts of logging following moderate or higher intensity fire. There is evidence to suggest that buffers that have been burnt are not effective in mitigating erosion impacts and will fail to reduce overland flow or sediment yields. The EPL will therefore be ineffective in mitigating the impacts of logging on water after such a fire event.

Furthermore, unburnt areas represent vital refuges for fauna and flora to enable local populations to survive. Logging in these areas soon after fire may be expected to lead to local extinctions. Again, the provisions of the TSL as currently drafted do not address this cumulative impact of logging and fire.

6. Environment Protection Licences

Recommendation 62.

The definition of Scheduled operation contained in the Protection of the Environment Operations Act must be amended to reflect current logging practices, so that it becomes mandatory for all FNSW logging and roading operations to be covered by EPLs.

Studies have shown that timber harvesting and associated forest-management practices can have significant effects on stream water temperature, sediment loads, turbidity, nutrient levels and flow regimes (Boughton, 1970: Graynoth, 1979: Langford and O'Shaughnessy, 1980: Flinn *et al.*, 1983: Clinnick, 1985: Cornish and Binns, 1987).
It is well accepted that logging is associated with changes to the infiltration capacity and runoff characteristics of areas disturbed during harvesting and road construction (Ziemer 1981: Riley 1984: Bren 1985: Huang *et al* 1996: Croke *et al* 1999a and Croke *et al* 1999b). Severely disturbed surfaces such as forest roads and logging tracks have been found to

enhance erosion potential (Reid and Dunne 1984: Grayson *et al* 1993: Reid, 1993 and Croke *et al* 1999b). The effects of logging on water quality due to sediment runoff is pervasive, as the effects of surface soil compaction has been reported to persist for between 30 and 40 years after logging has ceased (Froehlich, 1979: Jakobsen 1983: and Rab *et al*., 1992).

Due to the serious risks to water quality associated with logging operations the *Protection of the Environment Operations Act* (*POEO Act*)[51]requires that a proponent of an activity listed in Schedule 1[52]*must* seek an Environmental Protection Licence (EPL). However, for non-scheduled forestry activities FNSW *may* notify the EPA that it proposes to commence forestry activities, after which it must operate in accordance with conditions of the EPL.[53]Consequently, FNSW have chosen *not* to seek EPLs for non-scheduled operations in the UNE and LNE.[54]As conditions attached to the TSL and EPL stream protection zones overlap only for mapped drainage features, FNSW has found a loophole which enables them to log alongside Unmapped Drainage Lines (UMDL).

The voluntary nature of EPLs is of great concern. After third party rights were removed under the *FNPE Act,* State government agencies undertook to perform strict and comprehensive regulation of logging operations. In the absence of third party rights, the general public must be assured that FNSW are being consistently regulated by government agencies. For FNSW to be allowed to voluntarily seek licensing for its operations denies such full and proper regulation. The IFOA was developed to provide a framework for forestry operations which integrates the regulatory regimes for environmental planning and assessment, for the protection of the environment and for threatened species conservation,[55] and to ensure vigilant regulation of forestry activities would be undertaken. How can DEC impose a regulatory regime for the protection of the environment without the regulatory instrument being applied?

Further, it is not in keeping with open and transparent regulation to allow FNSW to undertake logging activities on public land without adequate monitoring, assessment and compliance enforcement by regulatory conditions. Without EPL application, FNSW are not

[51] S.48 *POEO Act* Premises-based

[52] Schedule 1 Part 1 of the *POEO Act* includes logging operations carried out on State forests or Crown timber lands. This defines scheduled logging as:

(1) the cutting and removal of timber (being sawlogs or pulplogs) from a compartment, where:

(a) at least 20% of the compartment has a slope greater than 18 degrees, and

(b) at least 30 timber stems (at least 40 cm in diameter at breast height) are to be cut and removed from each hectare of the compartment when averaged over the Net Harvest Area of the compartment, or

(2) the construction of new access roads within a compartment for cutting and removal of timber as referred to in paragraph (1), or

(3) the construction of new access roads for hauling timber from more than one compartment.

[53] Con. 7.3 EPL

[54] It is understood they will shortly not be seeking the EPL for Southern Region.

[55] S.25 *FNPE Act*

required to list breaches on a Non-Compliance Incident Report, nor are they subject to Penalty Infringement Notices (PIN), for breaching Licence conditions.

Furthermore, as water quality breaches under the *POEO Act* are notoriously difficult to prosecute, FNSW has successfully sidestepped the statutory obligations that would otherwise impinge upon its ability to extract higher volumes of timber to the detriment of the environment, thus posing significant risks to water quality along the eastern seaboard of NSW.

The importance of EPLs cannot be overstated. It is obvious that DEC need to educate FNSW in the importance of the EPL in addressing long-term catchment degradation. Without mandatory EPLs, the ability of DEC to engage FNSW in water quality issues is greatly diminished. It is, therefore, imperative that EPLs become a mandatory requirement of all FNSW operations in IFOA forests.

Under the current regime, FNSW are not required to obtain EPLs for almost 98% of IFOA operations: They are operating outside of regulatory frameworks that were set up to ensure that monitoring and regulation would always occur and to compensate the community for the loss of third party rights. This situation is neither open, transparent nor accountable, and is contrary to the stated purpose of the IFOA as set out in the *FNPE Act*.

Scheduled logging operations are defined in the *POEO Act* as quota sawlogs operations (ie. not thinning operations). Currently, for FNSW, quota sawlogs can be as small as 25cm diameter. Contrary to current practice, the definition of Scheduled logging operations in the *POEO Act* applies only to the removal of 30 x 40cm logs – reflecting the change in FNSW practice since the time the IFOA was written. The outdated definition in the *POEO Act* has allowed FNSW to conduct quota operations without seeking an EPL, despite quota logging operations being listed in the Schedule. Clearly, the definition requires amending to bring it in line with current standards of a quota sawlog operation.

The *POEO Act* Schedules must be amended to incorporate *all* logging activities into the IFOA, to ensure mandatory EPL for *all* FNSW operations. It should be expanded to include thinning operations, which, like quota operations, have significant environmental effects.

There is no justification for FNSW to remain exempt from being required to seek an EPL to undertake logging. The significant environmental impacts on water quality directly related to logging operations on the east coast of NSW makes the volunteer nature of EPLs for FNSW operations unacceptable.

6.1. Unmapped drainage lines

Recommendation 63.

EPLs and the conditions therein, designed to protect the vegetation alongside unmapped drainage lines (UMDL) must be mandatory for all FNSW operations in IFOA forests

Recommendation 64.

A condition must be inserted into the EPLs that require FNSW to map unmapped drainage lines as they are identified on the ground, and to provide DEC the coordinates and GIS layers of all identified unmapped drainage features including drainage depressions, as they become available.

As FNSW currently has the option of not invoking the EPL conditions for non-scheduled operations, and the TSL does not protect Unmapped Drainage Lines (UMDL), FNSW are exploiting a loophole in the IFOAs, allowing them to log these sensitive features of the forested environment, with no accountability procedures.

While the Fisheries Licence (FL) prohibits the logging of UMDLs within 100km upstream of a record of a Threatened Species that is listed in the Schedules of the *Fisheries Management Act*, the two Licences are intended to mitigate separate issues. Nevertheless, as the recent recovery plans being developed for the Oxleyan Perch and Adams Emerald Dragonfly may soon provide for the protection of UMDLs in parts of the LNE and Southern IFOA regions, FNSW will have few arguments against not seeking EPLs for all IFOA regions.

Although UMDLs are logged under FNSW "Best Management Practices For Unmapped Drainage Lines" conditions 1-3, the guidelines still allow for trees to be felled up to the incision of UMDLs. Machinery is excluded within 5m of an UMDL, except in the construction and use of crossings. However, within 10m of an UMDL, mechanical harvesting and shovel extraction is permitted, and log extraction with grapple skidder or dozer is permitted where the machine does not have the capacity for chain or rope snigging. It must be remembered, however, that these are operational guidelines developed by FNSW; they are not binding or enforceable by regulatory agencies, and do not form part of the IFOA. There is no obligation for FNSW to rehabilitate the soil disturbance created by undertaking such activities so close to drainage features. Because of this, the risk of a major pollution event occurring is too great to allow FNSW to continue to log these important protective features. Even if no single event occurs there will be the cumulative effects of bank erosion.

The conditions attached to the EPLs prescribe actions to mitigate fine scale mapping anomalies such as the absence of drainage lines and depressions on Central Mapping Authority (CMA) maps. These features are not trivial – they can be quite large water courses – and their omission from maps are often merely the consequence of mistakes. For example, I have personally observed an UMDL in compartment 9 of Chichester State Forest which was a permanent water course.

Wallbring and Croke (2002) caution the reliance on streamside buffers alone to retain fine sediment, and suggest that any improvement in the sediment trapping ability of the general harvest area,

> … would give considerable benefits. For example, by reducing the reliance on stream-side vegetation as filters, decreasing the potential for adverse impacts on downstream water quality and giving improved tree productivity in future rotations by enhanced retention of fines and nutrients.

UMDLs account for almost 30% of all drainage features in north-east IFOA forests (SFNSW, 2000),[56]the logging of UMDLs corresponds to a 30% reduction in the sediment trapping ability of undisturbed watercourses. Logging UMDLs also increases the risk of erosion of watercourses and associated pollution hazards. Furthermore, logged watercourses reduce the leaf litter and riparian vegetation cover and have increased susceptibility to fire, which further increases pollution hazards. A significant amount of nutrients and fine sediment particles lost on compacted snig tracks and disturbed general harvest areas is therefore currently allowed into waterways in our upper catchments due to the logging of UMDLs.

6.2. Buffers Zones

Recommendation 65.

Original streamside Buffer Zone conditions must be reintroduced in the EPLs.

Recommendation 66.

Buffers and filter strips must be defined as exclusion zones in all IFOAs and appendices, thereby imposing the obligation on FNSW to mark up these important areas prior to logging.

Within riparian zones, EPL, TSL, and Fisheries Licence (FL) conditions apply. Condition 22 of the EPLs allows FNSW to conduct research into alternative filter strip protection methods and develop a research program to assess the impacts of altered management practices within and adjacent to filter strips.

FNSW identified a "buffer on buffer" effect which excluded access to timber which was technically available but for the condition that trees were not allowed to be felled into filter strip buffers. This prohibition resulted in an unofficial buffer being left around prescribed filter strip exclusion zones (the "buffer on buffer" effect). Although DEC questioned the figures, FNSW (2000) claimed that an average of 25% of a compartment is excluded from

[56] SFNSW, Net Harvest Area Statement for the Upper North East. Final State Position pp 32 - 33 - table 5a-b:

logging, of which 13% was attributable to the "buffer on buffer" effect. In 2003, after the transfer of icon areas on the north coast into the reserve estate, the UNE and LNE IFOAs were amended. These amendments changed EPL exclusions protecting streams and watercourses into "Soft" and "Hard" Protection Zones.

The hazard level of the compartment and the order of the watercourse determines the width of filter strips (Hard Protection Zone) into which logs cannot be deliberately felled, and harvest machinery must not enter (except for approved road construction). Within Soft Protection Zones,[57] trees must not be felled (except for approved road and snig track construction). However, trees may be felled *into* them, and harvest machinery may operate in the outer 5m (with qualifications, eg not when the soil is saturated, etc.) if it is the only practical method of felling trees within the Net Harvest Area.

While DEC demand that FNSW rehabilitate 70% of the area disturbed by logging within the soft buffer, the risks associated with such logging are high. This is firstly due to the increased risk of the filter strip failing during high rainfall events. As filter strips protect water courses from sediment disturbed during logging, a reduction in its undisturbed width diminishes its capacity to trap fine sediment. In addition, the soil disturbed in the soft buffer itself, resulting from the removal of trees, is at risk of entering water courses.

Lacey (2000) found that a ten metre undisturbed stream buffer removed 80-90% of runoff and over 95% of sediment produced by logging snig tracks on 21 degree slopes in a native forest in eastern New South Wales**.** The author found that undisturbed buffers greatly reduced overland flow and decreased sediment yields by about 95%.

However, Lacey (2000) identified that disturbed buffers can yield as much or more runoff and sediment than the snig tracks, suggesting that disturbance increased the risk of buffer failure.

This author suggested that while narrow buffers trap almost all sediment entering from snig track source areas under most flow conditions, buffer effectiveness declines when runnoff input was concentrated, for example during high rainfall events. However, these authors suggest that disturbed buffers displayed "breakthrough" behaviour, as they were either almost fully effective or completely ineffective.

While Wallbrink and Croke (2002) confirmed the importance of snig track cross banks, which divert about 60% of the coarser sediment runoff, finer sediment (90% < 63 um silt and clay material) escapes. They found that cross banks trapped only about 18% of all sediment, and that a further 28% of all sediment – including very fine sediment – lost from cross banks was trapped by filter strips. These authors found that on an area-weighted basis, the filter

[57] EPL Schedule 4 conditions 20A-20J, and TSL con. 5.7b, and j-q apply.

strips retained ~8 times more sediment, and over 90% more of the fine-grained sediment, than the general harvesting area (Wallbrink and Croke, 2002).

While FNSW initially identified significant timber resources within the soft buffer, more recent analysis suggests that this is not the case. Indeed, Soft and Hard buffers only apply where TSL habitat corridors, riparian vegetation exclusions and rainforest exclusions do not apply, so the ability of FNSW to access the limited timber available in the buffer on buffers is minimal. The risks associated with maintaining the Soft and Hard buffers can not, therefore, be justified and conditions should revert to the original.

6.3. Roads and snig tracks

Recommendation 67.

FNSW must provide DEC with independent engineer's certificates for all FNSW roading on slopes above 18 degrees.

While clauses and conditions within the IFOAs restrict *where* FNSW can build roads and snig tracks, FNSW is under no obligation to build roads and snig tracks in a way that minimises their long-term pollution hazard. This is contrary to consistent regulatory control. As long as FNSW do not breach water quality conditions, they can build badly designed roads and tracks with little regard to long term environmental impacts.

FNSW has been subject to penalties, prosecutions and community litigation over water pollution resulting from badly designed roads on steep slopes falling into watercourses. Independent engineers need to be engaged by FNSW to design roads on steep slopes and provide certification of the road's ability to withstand heavy vehicle traffic and high rainfall events, without allowing pollution to enter watercourses.

Recommendation 68.

A condition must be inserted into the EPLs requiring FNSW to regularly maintain all roads required to be left open in State Forests. This condition must include the maintenance of road surface and drainage structures intended to mitigate sediment runoff.

Recommendation 69.

A condition must be inserted into the EPLs requiring FNSW to close all unused roads, snig tracks and log dumps, and rehabilitate the compaction of roads, snig tracks and log dumps, in excess of requirements for fire control and sustainable recreational pursuits, by deep ripping and seeding with seed gathered adjacent to those roads and snig tracks and log dumps to mitigate the long-term impacts of soil compaction.

FNSW are currently under no obligation to maintain existing roads to minimise sediment runoff, or to rehabilitate unused roads and snig tracks, other than installing cross-banks. However, the persistent sediment loads of runoff from unused roads and snig tracks continues for many decades after logging operations are completed.

Wallbring and Croke (2002) found the greatest single loss of material after logging occurred from the snig tracks (7-15%). These authors concluded that highly disturbed and compacted surfaces such as snig tracks, are the major sources of sediment in forested areas. They found that:

> …experiments confirmed the disturbed and compacted areas, such as skid tracks, as significant sources of overland flow and sediment. Infiltration on the track surfaces are as low as 10 mm h^{-1} compared to values of 140 mm h^{-1} on the general harvest area.

Forestry roading and snigging have been found to continue to severely impact on water quality many years after operations have been completed. Megahan (1974) suggests that erosion rates on forest roads remain one order of magnitude higher than on undisturbed lands almost 40 years after the period of initial disturbance. Reid (1993) showed that road erosion rates remained five times the background rate five years after logging. Wallbrink and Croke (2002) found that, five years after logging, sediment deposition rates remain at ~ 50% of that produced directly after logging during medium and high rainfall events. Indeed, five years after logging on light granite regolith sites high volumes of sediment are still produced during all rainfall events (Wallbrink and Croke 2002). Croke, *et al*. (1999) found that soil compaction:

> …shows no significant recovery over the 5-year time period [studied], highlighting the more persistent nature of machinery compaction on the surface soil structure of disturbed forest snig tracks.

It is accepted that some roads are required to be open for recreational visitors and fire suppression purposes. The level of State Forest roading is, however, far beyond this legitimate need. Roads and tracks are implicated in weed infestation and the introduction of feral pests into forests. Unused roads must be rehabilitated by FNSW after logging operations have been completed.

Recommendation 70.

A condition must be inserted into the EPLs requiring FNSW to install more effective sediment traps on all road, track, bridge and culvert construction and rehabilitation.

Recommendation 71.

A condition must be inserted into the EPLs that requires FNSW to model point source pollution impact hazards associated with traffic numbers on State Forest roads, based on which DEC can develop conditions to be incorporated into the EPLs, so as to mitigate the impacts.

inserted into the EPLs that requires FNSW to model point source pollution impact hazards associated with traffic numbers on State Forest roads, based on which DEC can develop conditions to be incorporated into the EPLs, so as to mitigate the impacts.

Recommendation 72.

A condition must be inserted into the EPLs that requires FNSW to model the potential pollution impact hazard of sediment plumes and the distances they will travel, based on which DEC can develop conditions intended to mitigate the impact.

DEC must develop strict conditions to mitigate sediment pollution from entering watercourses as a result of FNSW construction works. There is no justification for allowing FNSW to undertake unregulated construction and rehabilitation. DEC need to develop conditions to mitigate the point source pollution of all FNSW construction and rehabilitation operations. The Roads and Traffic Authority has a Code of Practice for water management while developing and managing roads (RTA, 1999) that could be used to develop such conditions. The RTA Code of Practice seeks to minimise their impacts on existing natural overland flows, groundwater regimes and aquatic and riparian environments in and around road corridors by incorporating appropriate actions to contain and treat road run-off. The RTA design road projects to utilise source control techniques, and where this is not possible, use non-point source or dispersal techniques such as table drains, grass buffer strips, grass swales, edge drains, and grassed median strips. While any seed used in native forest rehabilitation must be native seed sourced from nearby to the rehabilitation, the RTA incorporates the use of vegetative methods in preference to engineering structures for protecting eroding streambanks wherever practicable, but install energy dissipaters, or other scour prevention measures, downstream of culverts or other structures to minimise erosion, and rehabilitate areas effected utilising local plant seeds.[58]

6.4. Water course crossings

Recommendation 73.

A clause must be inserted into the IFOAs requiring FNSW to provide all Harvesting Plans, maps and assessments to Fisheries NSW at least 3 months prior to logging, and incorporate into amended Plans any comments made to mitigate the potential impacts on fish movement.

[58] RTA Code of Practice for Water Management – Road Development and Management, p 11

Recommendation 74.

A condition must be inserted into the EPLs requiring FNSW to provide appropriate independent engineer certification to DEC and Fisheries NSW for the construction of bridges. This must include sediment traps and the minimising of stream bank disturbance.

Recommendation 75.

A condition must be developed by DEC and inserted into the EPLs for the removal of bridges so that erosion and sediment dispersal caused by their removal is minimised. This must include the installation of sediment traps and the rehabilitation of stream banks.

Recommendation 76.

Current EPL conditions for bridges must also be applied to all culverts installed by FNSW.

Recommendation 77.

A condition must be inserted into the EPLs requiring FNSW to identify all snig track crossings on FNSW Harvesting Plan maps and provide DEC with a copy of such maps at least three months prior to logging taking place.

Recommendation 78.

A condition must be inserted into the EPLs requiring FNSW to build temporary culverts for snig track crossing. Their removal must be undertaken so as to minimise sediment dispersal and erosion by implementing similar conditions as for the removal of bridges. Conditions need to explicitly prohibit the use of gully stuffers.

Recommendation 79.

A clause must be inserted into the IFOAs requiring FNSW, in consultation with DEC, to model the potential point source pollution impact hazard associated with drainage structures and distances from the source the sediment will travel, from which DEC can develop conditions intended to mitigate this impact.

Recommendation 80.

A new pre-operational planning pro-forma must be developed by DEC so that adequate monitoring of all FNSW pollution assessments can be undertaken.

FNSW must be forced to give notification to Fisheries NSW for all its operations and incorporate any comments made by Fisheries NSW to mitigate the impacts of crossings

Poor engineering standards employed by FNSW in constructing watercourse crossings has led to concern for water quality amongst regulatory agencies and conservationists.[59]

While all crossings are to be authorized by a Harvesting Forester, or the Regional Manager for Riparian Habitat Protected crossings, FNSW are not obliged to provide engineering certificates or, indeed, to conform to any assessments or guidelines for such crossings.

Where implemented, the EPLs and FLs operate to mitigate some effects of poorly designed creek crossings. The blocking of fish passage is a Key Threatening Process listed in the Schedules of the *FMA.*. Section 219 of the *Fisheries Management Act*, for example, prohibits the blocking of fish passage for private individuals. However, for government agencies, the proponent must only notify Fisheries NSW,[60] and take into account any ameliorative comments suggested. Although FLs are prescriptive, in many instances compartments are not subject to FLs. In this event, s. 219 of the *FM Act* must apply, and the proper notification to Fisheries NSW be given. In spite of this, the agency has never received such notification from FNSW. FNSW must be forced to give notification to Fisheries NSW for all its operations and incorporate any comments made by Fisheries NSW to mitigate the impacts of crossings

6.5. Stream bank erosion

Recommendation 81.

DEC must engage the Cooperative Research Centre for Catchment Hydrology to undertake research into the issues of subsurface flows, hydrophobic soils resulting from post logging burns, and stream bank erosion caused by logging operations, and develop conditions appropriate to mitigating these impacts.

Recommendation 82.

A condition must be inserted into the EPLs requiring FNSW, in consultation with DEC, to model the pollution impact hazard of stream bank erosion to enable DEC to develop conditions intended to mitigate this impact.

While it is accepted that the intermittent nature of many stream flows makes it difficult to develop conditions to mitigate stream bank erosion, current conditions only exclude logging during certain months when rainfall is predicted to be highest. As such, there is a significant

[59] . EPL schedule 4 conditions 42 to 57 apply to snig track crossings.
[60] Now Department of Primary Industries.

risk of stream bank erosion occurring during high rainfall events outside these excluded months.

It is understood that DEC engages the Cooperative Research Centre for Catchment Hydrology to undertake research on its behalf. This relationship should be expanded to include issues such as subsurface flows, hydrophobic soils resulting from post logging burns and stream bank erosion caused by logging operations and develop conditions appropriate to mitigating these impacts.

6.6. FNSW EPL assessments

6.6.1. FNSW pollution hazard assessments

Recommendation 83.

Independent soil conservation experts must once again be seconded to FNSW to undertake pollution hazard assessments.

Movement and dispersal of soil caused by forestry operations can have a major impact on water quality and site productivity. Therefore, in planning scheduled and non-scheduled forestry activities, FNSW must apply the soil erosion and hazard assessment model,[61] and identify the hazard levels of the compartment and roading area, including mass movement and dispersible soil.

The conditions of the EPLs for IFOA regions states that FNSW must ensure that only appropriately trained and competent people undertake the requirements of schedules 2, 3, 4 and 5 of the licence.[62] This involves assessing the pollution hazard using a number of criteria leading to indices between one and four, which dictate the conditions to apply to the operation.[63] These assessments have led to the identification of 3,532 Low Hazard operations, 405 High Hazard, 4 Very High, and 1 Extreme Pollution Hazard sites in 2002/03.[64]

To date, Department of Infrastructure, Planning and Natural Resources (DIPNR)[65] soil conservation experts have undertaken these assessments. However, these staff are now being transferred back to DIPNR, and FNSW are seeking to accredit its officers to undertake soil assessments in their stead.

[61] EPL Schedule 3
[62] Con. 45 EPL
[63] Con. 11 EPL
[64] FNSW Social, Economic, and Environmental Report 2002/03, Appendix 12
[65] Formerly Department of Urban Affairs and Planning: and Department of Land and Water Conservation.

Although DEC use indicative maps to monitor FNSW pollution assessments, it must be questioned whether FNSW are suitably qualified, and whether they will be (or have ever been) capable of undertaking the assessments objectively.

The four DIPNR soil conservation experts seconded to FNSW collectively cost FNSW ~$320,000 per annum. The continuation of this cost is fully justifiable, on the basis that a significant cost still applies to the increased workload of Supervising Forestry Officers (SFO) if they undertook the duties formerly ascribed to these staff. Indeed, SFOs currently have enormous responsibility for planning, marking, assessing and overseeing logging operations. It is, therefore, questionable whether they have the requisite knowledge and expertise to undertake the complex soil and landscape assessments, as well as competently undertake their current onerous responsibilities.

6.6.2. FNSW soil assessments.

Recommendation 84.

FNSW must use updated soil regolith maps as developed by DIPNR.

Recommendation 85.

Standardised dispersible soil testing, and site-specific soil assessment pro-formas must be developed by DEC.

FNSW currently assess pollution hazards based on outdated soil regolith mapping. Updated mapping developed by DIPNR needs to be incorporated into EPL assessment conditions. Further, dispersible soil testing undertaken by FNSW needs to be standardised so that DEC can monitor assessments through a standardised and repeatable method. Site specific soil conditions and assessments must also be standardised and repeatable.

7.Threatened Species Licences

Recommendation 86.

The Threatened Species Conservation Regulations (and the Fisheries Regulation) must be amended to impose a Licence fee on FNSW for TSLs (and FLs). The quantum of the fee must correspond to the fee imposed for the issuing of EPLs.

Recommendation 87.

DEC must randomly monitor the accuracy and veracity of at least 10% of all FNSW assessments.

The TSLs issued to FNSW by DEC authorise anyone to undertaking forestry operations identified in the IFOAs, that are likely to result in the harming or picking of threatened fauna and flora – listed in the *Threatened Species Conservation Act* – and the damage to their habitat.[66]The objectives of the TSLs are to set out the minimum measures to protect threatened species and their habitat from activities associated with logging.[67]The Licence sets out habitat protection measures that are to apply to FNSW estate where IFOAs apply, in the form of general conditions, and protection of features such as rainforest, high conservation value old growth forest, habitat trees and riparian habitats.

FNSW must ensure that the scale and intensity at which it carries out, or authorises the carrying out of, forest operations in any IFOA area, does not hinder the sustained ecological viability of the relevant species of tree, shrub or other vegetation within the IFOA area. In regard to threatened fauna species, however, the TSL conditions are the only mechanism in force that can prevent FNSW from driving a fauna species to extinction. It is well accepted among ecologists that FNSW logging, roading, burning, and grazing cause severe impacts on forest dependant flora and fauna species. It is also well accepted that forestry activities threaten, the viability of local populations of forest dependant species, and may well lead to the extinction of certain species, particularly those most susceptible to logging, such as arboreal species.

Therefore, conditions contained within TSLs need to be adequate and strictly enforced. Significant costs are associated with the monitoring of FNSW assessments and operations for compliance with Licence conditions. However, although FNSW must pay DEC for its EPLs, there are no provisions in the *TSC Act* for TSLs to carry a fee. The ability of the current TSU to carry out routine assessments, monitoring and compliance audits is hampered by underfunding. There is no just reason why FNSW should be exempt from meeting the costs associated with the regulation of its activities. In the interest of consistency, TSLs and FLs need to carry a Licence fee of similar quantum as that of EPLs.

7.1 Endangered Ecological Communities etc.

Recommendation 88.

DEC must undertake a rapid desktop assessment of all potential Endangered Ecological Communities (EEC), Key Threatening Processes (KTP), and Critical Habitat and begin to undertake nominations to the NSW Scientific Committee for their listing in the Schedules of the TSC Act. Once listed, these must be mapped and incorporated into the TSLs.

The TSL states that it does *not* authorise the carrying out of an activity that is likely to:

[66] Part 4 of the *Forestry and National Parks Estate Act*
[67] TSL, p 5

1. Harm an endangered population or an endangered ecological community,

2. Result in the picking of a plant that is part of an endangered population or endangered community:

3. Damage critical habitat: or

4. Damage the habitat of an endangered population or endangered community,

This means that the harming or picking of an endangered ecological community *cannot* be licensed under the TSL. No listed threatened populations or ecological communities have been identified in IFOA forests, and no critical habitat identified for threatened species. There is an obvious need to address Key Threatening Processes (KTP)[68], Endangered Ecological Communities (EEC), and Critical Habitat in IFOA forests.

The failure to identify KTP, EEC, and Critical Habitat within the State Forest estate is a significant deficiency that must be remedied.

7.2. Forest type and floristic assemblage mapping.

Recommendation 89.

DEC and FNSW must adopt the CRA floristic assemblages defined in the CRA GIS layers in all Harvest plan assessments and conditions. Research Note 17 forest typing should only be used for FNSW internal timber assessments.

Forest types play a critical role in environmental impact assessment in New South Wales, because the impacts of logging on species richness and composition are assessed within and between forest types.

[68] Those applying to forestry operations would include,

- *Competition from feral honey bees, Apis mellifera L.*
- *High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*
- *Removal of dead wood and dead trees*
- *Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)*
- *Predation by the Feral Cat Felis catus (Linnaeus, 1758)*
- *Infection of native plants by Phytophthora cinnamomi*
- *Introduction of the Large Earth Bumblebee Bombus terrestris (L.)*
- *Invasion of native plant communities by Chrysanthemoides monilifera*
- *Invasion of native plant communities by exotic perennial grasses*
- *Loss or degradation (or both) of sites used for hill-topping by butterflies*
- *Anthropogenic climate change*

The CRA process, at significant expense, developed fine-scale forest ecosystem GIS layers to identify and discriminate the diversity of forest ecosystems across all land tenures. While these data layers are not an end point and further developments have occurred and are required, they do provide the best guidelines for habitat assessment and floristic composition. FNSW, however, rely on a forest classification system developed by Baur (1968) incorporated in the *Research Note 17 Forest Types in NSW* (RN 17).

FNSW's reliance on the outdated RN 17 has implications for the conservation of ecological values. For example, all current habitat modelling is based on the floristic assemblages developed in the CRA, and Endangered Ecological Community listings within FNSW estate cannot occur for the coarse overstorey groupings RN 17 provides (see 7.1).

7.3. Under-reserved forest ecosystems and wildfire.

Recommendation 90.

The following clause must be inserted into the IFOAs: Where a forest ecosystem did not meet its target for reservation in the Comprehensive Regional Assessment, and DEC can show that more than 50% of its reserved extant has been seriously damaged by wildfire, FNSW must reschedule the logging of that forest ecosystem in State Forest tenure until DEC can show that the damaged reserved forest has sufficiently recovered.

Forest ecosystems were focused upon in the CRA as a surrogate for biodiversity, as some species only exist within certain forest ecosystems. While the CRA process identified targets for all forest ecosystems, many were not met. This left a significant proportion of the targeted reserve of forest ecosystems available for logging within State Forest tenure. For example Pugh (1998) found that in the north-east IFOA forests, the CRA achieved only 61% of targets for forest ecosystems. This author further found that;

> In the UNE 43% of forest ecosystems are under 50% of their CRA targets, and 15% under 10% of their targets. Of the 103 most vulnerable (V1and2) forest ecosystems only 27% achieve targets, while 53% are under 50% of their targets, and 19% are under 10% of their targets. An additional area of 351,400 ha was needed to be reserved to achieve CRA targets for forest ecosystems in the UNE. A total of 159,300 ha (45%) of this required area occurs on available public lands excluded from CRA process.

Wildfire commonly occurs in National Parks and Reserves. These fires can severely alter forest ecosystems and communities in the short to medium term. Should wildfire therefore destroy significant proportions of these under-reserved forest ecosystems within the Reserve System, many species and communities will be placed under additional threat.

For example, the January 2003 bushfires resulted in the massive destruction of oldgrowth Alpine ash - Mountain gum forests within Kosciuszko National Park. This devastation included vast areas of Forest Ecosystem type 87.[69] Alpine ash is extremely fire sensitive and will not regenerate through epicormic growth after extreme fire exposure. While it does normally regenerate from seed, this process is slow and does not replace destroyed oldgrowth ash stands for many hundreds of years. It has been estimated by some that the destruction may have resulted in as much as 60% of Forest Ecosystem type 87 being lost to the January 2003 bushfires. The recent logging of oldgrowth Alpine ash and Mountain gum stands in the Bago and Maragle State Forest (2003-2004), exacerbated the recent fire impacts on the extant of this forest ecosystem.

It must be remembered that remnant forest in NSW is isolated by cleared land. While some of these patches are very large, they remain isolated, leaving forest dependant species trapped and at far greater risk from wildfire. To achieve effective forest conservation, TSL conditions need to be able to adapt to damaging processes such as wildfire.

7.4. FNSW Pre-harvest Surveys

Recommendation 91.

DEC must develop an accreditation system for independent field ecologists and compile a list of appropriately trained and experienced field workers who can undertake FNSW pre-harvest surveys. Surveys must be conducted by these accredited, independent contractors instead of FNSW staff. FNSW must provide DEC with information as to the number and location of individual threatened animals and plants and the numbers of threatened species identified by each individual surveyor, to be incorporated into the accreditation database.

Recommendation 92.

Conditions of the TSL must be amended to ensure all suitable hollow-bearing trees are surveyed for bats using the ANABAT method at dusk to identify whether hollows are being used. All bat trees not so surveyed must be retained.

Recommendation 93.

Conditions of the TSL must be amended to ensure surveys are undertaken for riparian frogs at sites at least 800m apart and not in the same gully system.

Recommendation 94.

[69] Subalpine Escarpment Moist Shrub / Herb Grass Forests

Conditions of the TSL must be amended to ensure surveys are undertaken for Golden-tipped Bat (Kerivoula papuensis) and Large-footed Bat (Myotis adversus) at sites at least 800m apart.

Schedule 12 of the TSLs sets out the requirement and design of pre-harvest surveys. Condition 8.3 of the TSLs sets out the experience required of FNSW surveyors. They must have extensive field experience in the identification of flora and fauna, be familiar with herbariums or museum specimens of threatened species, or have relevant tertiary qualifications. However, it is incumbent on FNSW to undertake the survey in a manner that will deliver results. TSL conditions are not triggered where willful blindness fails to record or identify a threatened species. Due to the low number of threatened species identified in FNSW pre-harvest surveys, it is questionable whether FNSW survey staff have the requisite experience and objectivity to undertake pre-harvest surveys with any accuracy or precision. It is likely that a significant number of populations of threatened and at-risk species are not being recorded. Even when they are recorded, the relevant condition is only triggered for the immediate vicinity of the record. Given that the species has been recorded, and is therefore highly likely to be present in other areas in the compartment and adjacent compartments, the condition should apply over a much wider area.

One test for whether pre-harvest surveys are effective is whether they are identifying new species, and if that number is increasing. While the following figures are for the entire FNSW estate, the figures are indicative for IFOA forests.

In 2002/03, although the number of completed compliance check sheets and expenditure on harvest planning rose,[70]("reflecting the increase in the total area planned for harvest,"[71]) the number of pre-harvest fauna surveys decreased to 1,616 from 2,277 in 2001/02.[72]Nevertheless, the number of species protocols invoked rose significantly, from 475 in 2001/02, to 635 in 2002/03.[73]

The history of FNSW's pre-harvest surveys since the IFOAs were introduced, demonstrates the coarseness of the current methodology.

For example, in that time, FNSW have only found four scheduled arboreal species, and the number of found individuals of these species decreased from 2001/02 to 2002/03, as did the number of ground mammals, the number of frogs, the number of bats and the number of non-raptor birds.

Their history of finding threatened reptiles is even more poor. Only four scheduled reptiles species have been recorded in pre-harvest surveys and a total of eight individuals were

[70] FNSW Social, Environmental and Economic Report 2002/03, table 12, p40
[71] *op cit*, p41
[72] FNSW Social, Environmental and Economic Report 2002/03, table 13, p 41
[73] *ibid*

recorded during pre-harvest surveys in 2000/01, two in 2001/02, and three in 2002/02. No broad-headed and no pale-headed snakes have been found during IFOA surveys.

Given the abysmal history above, it is clear that, without adequate broad area conditions being invoked by habitat modelling, few species-specific prescriptions would have been triggered by pre-harvest survey recordings. For the most part, and although some new fauna species are being recorded, the numbers of individual threatened species being identified during pre-harvest surveys is declining. For example in 2000/01, the total number was 2769: Following an increase to 3499 in 2001/02, it fell again in 2002/03 to only 2307. This is despite the stated increase in area planned for harvesting, the stated area of native forest harvested remaining constant at about 50,000ha,[74]and the volumes of native hardwood products extracted increasing from 1,283,000m3 in 2000/01, to 1,330,000m3 in 2002/03.[75]

A telling example of FNSW's reluctance to find threatened species that might limit its access to timber, is the appallingly low number of threatened flora identified. FNSW have found only *one individual* threatened plant[76]within the entire NSW State Forest estate since the IFOAs were introduced, and this was only in the last financial year.[77]While it is understandable that FNSW survey staff may find it difficult to identify small cryptic fauna, there is no excuse for not identifying threatened flora. Some threatened flora are quite large trees and shrubs; for FNSW to find only one individual in five years over millions of hectares of forest, is totally unacceptable.

It is questionable whether FNSW personnel are adequately trained in fauna and flora identification to undertake even the most rudimentary fauna and flora assessment. As FNSW survey teams do not have any demonstrated familiarity with the threatened fauna species they are attempting to survey, and have no skills in the identification of threatened plant species, it is understandable that few threatened species are found. It is understood that most FNSW fauna and flora surveyors have no tertiary training in ecology or fauna and flora identification and limited experience in survey techniques and species identification. FNSW survey teams are provided with two-day training workshops before undertaking fauna and flora surveys. This is totally inadequate. Indeed, it is in breach of already existing TSL conditions. It is further questionable whether FNSW survey officers actually *want* to find any threatened species in a compartment where FNSW are also trying to find as much timber as it can extract to satisfy timber commitments. Therefore, it is proposed that fauna and flora assessments are conducted by independent contract surveyors paid by FNSW and selected and accredited by DEC, rather than by FNSW staff. This seems to be the only way to ensure that surveys are conducted in an unbiased and expert manner.

[74] FNSW Social, Environmental and Economic Report 2002/03, table 16, p50
[75] *op cit,* Appendix 14 - This excludes firewood, sleepers, and fencing, and treated hardwood products etc.
[76] The CRA only achieved 18% of the 339 or threatened flora targets in the north-east.
[77] *Melalueca groveana*

In the course of preparing this document, one anecdote was recounted of a FNSW surveyor whose employment was terminated because he was giving surveys too much effort. This is unacceptable. Individuals such as these must be supported in their diligence, certainly not disciplined or fired because they do a good job in the identification of threatened species.

7.5. FNSW pre-harvest mark-ups

Recommendation 95.

A condition must be inserted in to the TSLs requiring FNSW to mark up the whole compartment or operation before logging commences.

Recommendation 96.

A condition must be inserted into the TSLs requiring FNSW to employ permanent markings, such as a metal tag at breast height and a small painted blaze at the base of the tree, when marking up all exclusion areas and retained trees. FNSW must enter the GPS coordinates of all tree retention markups and exclusion areas onto GIS layers and provide copies to DEC before logging commences.

Currently, FNSW are required to mark-up at least 100 metres in advance of harvesting operations, road construction and road re-opening operations, so relevant exclusion and buffer zones can be implemented prior to harvesting, road construction and road re-opening occurring.[78]

This condition is continually flouted by FNSW. Adherence to this condition allows contractors to clearly identify exclusion zones and tree retention requirements. It is also allows regulatory agencies to identify whether the conditions are being upheld, should they wish to conduct pre-logging audits.

Permanent marking of all exclusion areas and retained trees would provide DEC with definitive markings to monitor compliance with and relieve FNSW from having to continually mark-up compartments in successive logging operations.

7.6. Habitat tree retention

Recommendation 97.

Condition 5.6 of the TSLs must be amended to require FNSW to retain "at least twelve habitat trees in every two hectares of the Net Harvest Area, from the largest DBH trees available in every two hectares, determined by 2ha grids mapped across the Net Harvest

[78] Con. 5.1 (h) TSL

Area. FNSW must provide DEC with the coordinates of the 2 hectare grids (133.33m x 133.33m) within a 10% margin of error.

DEC should determine whether, in some circumstances, the number of habitat trees might need to be increased. For example, where arboreal or other species' densities are higher than would survive with this number, or where there is a stand of more than 12 large veteran trees (> 80 cm DBH) in a two hectare area of a compartment.

Recommendation 98.

Condition 5.6 of the TSLs must be amended to require FNSW to report to DEC where more than 12 trees of greater that 80cm DBH exist in a two hectare area of Net Harvest Area of an operation, and to require DEC to determine whether the species existing or likely to exist in the area require further habitat trees of this cohort to be retained.

Recommendation 99.

Condition 5.6 of the TSLs must be amended to require FNSW to permanently mark all retained trees with a metal tag nailed at breast height, a small painted blaze at the base of the tree, and reflective paint.

Recommendation 100.

Condition 5.6 of the TSLs must be amended to require FNSW to identify the GPS coordinates of all retained trees and to enter these coordinates onto a GIS layer, to be provided to DEC before logging commences.

Recommendation 101.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have failed to retain the largest trees in every two hectares of the Net Harvest Area, determined by the 2ha grid coordinates, or to have retained less than the requisite number of trees in every such two hectares of the Net Harvest Area, the number of trees in deficit of the above conditions be retained from the largest DBH trees available in subsequent operations (determined by DEC) as compensation for the breach.

Inspection of the *Threatened Species Conservation Licence Compliance Register* reveals that a significant number of breaches by FNSW relate to habitat and recruitment tree retention prescriptions. Consequently, fewer hollow-bearing and recruitment trees are retained in many harvesting operations than the inadequate number required by the Licence prescriptions.

In the UNE and LNE, TSL conditions require the retention of 10 hollow-bearing trees per two hectares, to be scattered throughout the Net Harvest Area. However, the prevailing

interpretation of this condition is such that the requisite number of retained hollow bearing trees applies to the entire Net Harvest Area, not to each discrete two hectares of Net Harvest Area.[79]For example, a compartment with a Net Harvest Area of 100 ha requires 500 habitat trees to be retained. However, as long as these 500 are retained somewhere within the 100ha, FNSW claim to be complying. This means that habitat trees are often retained in portions of the Net Harvest Area not capable of providing sawlogs, or not logged for other reasons. It also often means that heavily logged areas are largely devoid of habitat trees, and habitat trees are clumped in areas of lower logging intensity, such as areas of low site quality or steep slopes. However, while some arboreal marsupials appear to favour clumps of hollow-bearing trees, others require these trees to be spread throughout the forest. When the condition is interpreted in this manner, a breach can only be proved if there is a survey of the entire harvest area. Given that FNSW, more often than not, do not mark-up habitat trees ahead of the operation, DEC is in no position to enforce conditions for habitat trees before operations commence.

It has become apparent that FNSW does not take tree retention conditions seriously. FNSW have attempted to avoid retaining the requisite number of trees spread across the Net Harvest Area by retaining small patches of 10 retained trees and asserting that such small patches can comply, as a circle drawn around the small patch will coincide with many arbitrary 2 ha areas. Within this interpretation and without clear definition of the 2 ha areas, DEC are unable to determine compliance. For this reason, all compartments should have simple 2 ha grids applied to them and the coordinates of these grids should be provided to DEC so it can definitively determine compliance of this condition.

In Eden, mapped High, Moderate, and Low Quality Habitat distinctions determine the number of trees retained. In High Quality Habitat, 12 habitat trees must be retained, in Moderate 8, and in Low Quality Habitat 4. The hollow-bearing trees must be scattered across each two hectares of the Net Harvest Area, if and where they exist, otherwise, non-hollow-bearing trees are retained to make up the number required. The same number of recruitment trees must be retained as habitat trees. [80]

Habitat tree retention rates proposed in the 1994 Eden EIS were one, three or five individuals in low, medium and high "habitat quality" forest respectively. In 1995, the Department of Planning required this to be increased to two, four and six (DOP 1995). The intensity of harvesting operations, with massive removal of pulp-logs over several decades, has taken much of the high quality habitat, and a significant proportion of available hollows throughout these forests. This kind of harvesting features short rotations, very high percent canopy removal, increasingly large coupes, very short time intervals for logging adjacent coupes (NPWS submission to DOP 1995) in the "alternative coupe" system, and very low habitat tree retention.

[79] Con. 5.6 LNE TSL
[80]Eden TSL p17

Clearly, the tree retention experiment in the EMA has not worked, and the ecological impacts of failed tree retention conditions are evident. Tree retention conditions should, therefore, be constant across all IFOA areas.

Over 303 Australian vertebrate species use hollows for either permanent or temporary refuge and breeding sites. Approximately 100 of these are considered rare or threatened (Gibbons and Lindenmayer, 2002). However, tree retention conditions, which have relatively minor effects on timber production, are often successfully sidestepped by FNSW. Current tree retention conditions are inadequate to mitigate logging impacts on arboreal and hollow-using fauna. This inadequacy is compounded by the different recruitment conditions for the regrowth and non-regrowth zones, and for the northeast and the EMA IFOA areas (see 7.6.1.)

The type and species of tree likely to develop hollows suitable for fauna is also important, and varies in different areas and forest types. One study found that all trees from a range of stringybark species contained hollows above a certain diameter, whereas the proportion of Silvertop Ash that contained hollows never exceeded 60% (Gibbons 1994). FNSW practice has been to preferentially retain unmerchantable tree species, such as Silvertop Ash in the EMA, arguing that "unmerchantable trees include those which are healthy but have crooked or twisted stems" (DOP 1993b). Clearly, selection of recruits should be guided by the tree species that are known to develop hollows suitable for fauna in a given area (Gibbons and Lindenmayer 2002). Braithwaite (1988) also identified Silvertop Ash forest types as being of lesser habitat quality than other more commercial species. As FNSW preferentially retain Silvertop Ash in the EMA because of its low commercial value, the retention of representative tree species must be strictly enforced in the EMA.

It has been estimated that relatively undisturbed temperate forests support about 13-27 hollow-bearing trees per hectare (Gibbons and Lindenmayer 2002). While TSL conditions demand the retention of various numbers of hollow-bearing/habitat trees per two hectares, nowhere does this mirror natural occurrences. It is therefore, questionable whether these conditions can adequately mitigate the impacts of logging on arboreal and other hollow dependant species.

Harper *et al* (2004) suggest that managing the abundance of tree hollows in forest areas is critical to the persistence of hollow dependent fauna. Indeed, the long-term survival of hollow dependent fauna in timber production forests in Australia is threatened by the loss of hollow-bearing trees during timber harvesting (Loyn, 1985). This is especially true for arboreal marsupials (Tyndale-Biscoe and Calaby, 1975: McIlroy, 1978: Smith and Lindenmayer, 1988: Lindenmayer *et al*., 1990). However, Gibbons and Lindenmayer (2002) state that the number of hollows is declining and becoming scarce in some Australian forests and woodlands. This has lead some authors to recommend that artificial nest boxes be employed as ways of assisting population recovery for species threatened by the dearth of natural cavities (eg Newton 1994: Spring *et al* 2001).

The methods FNSW employ to determine whether a tree has hollows is by scanning for them from the ground. The accuracy of these ground-based surveys of tree hollows has been analysed through comparison of initial ground surveys of standing trees with surveys after the trees have been felled (e.g. Mackowski, 1984: Gibbons, 1999: Whitford, 2001: Whitford and Williams, 2002). Although, these analyses have been critisised (see Harper *et al*, 2004), they indicate that counting hollows from the ground is inaccurate. Studies by Harper *et al* (2004) estimate that ground-based surveyors identified at most 44% of the total hollows found by climbing the trees in situ. Gibbons *et al.*, (2002) found that only 43% of hollows identified in their study showed signs of prior occupancy. This counters the assumption that arboreal species requirements are catered for merely by retaining a certain number of hollow-bearing trees per hectare, assessed from the ground.

FNSW are required to retain only those hollow-bearing trees that can be identified from the ground, and retain non-hollow bearing trees, that may have the potential to develop hollows to make up the numbers to comply with tree retention conditions. Furthermore, in coastal areas in the UNE and LNE regions, if there are no trees present with visible hollows, there is no requirement to retain any recruitment trees. This results in a significant shortfall in the number of hollows required to maintain populations of existing hollow-dependant species.

This shortfall is compounded by the current lack of permanent marking of habitat and recruitment trees. As the marking medium on retained non-hollow-bearing trees only remains for a short time, retained trees that are intended to become habitat trees are available to be felled in the next logging cycle. The notion of their "recruitment" as habitat is, therefore, misleading. Introducing metal tags, reflective paint and blazes on retained trees and entering the GPS coordinates of those trees into a database to be held by DEC will avoid this problem and ensure the perpetuity of trees designated as habitat.

Results of studies into the accuracy of ground based hollow assessments reveals that the level of experience of the ground surveyors is positively related to their ability to find hollows. Regardless of experience, ground surveyors who take more time with their survey find a greater proportion of hollows (Harper *et al*, 2004). Given the time and budgetary constraints on FNSW pre-harvest surveys, and the limited experience FNSW survey staff possess, it may be more prudent to retain the trees with the largest DBH available. This practice is supported by Harper *at al* (2004) who suggests that:

> The increased time taken to find additional hollows decreased the efficiency of the surveys to the point where the ratio of time taken for surveys approached the critical ratio.

Although hollow-formation is related to a number of factors, including tree diameter, tree form (senescence), tree species, the presence of fire scarring, and tree age (Gibbons and Lindenmayer 2002), the positive relationship between the diameter at breast height (DBH)

and the presence of hollows in eucalypts and the number of hollows these hollow-bearing trees contain is well documented (Mackowski, 1984: Lindenmayer *et al*., 1993, 2000: Taylor and Haseler, 1993: Bennett et al., 1994: Gibbons, 1999: Ross, 1999: Wormington and Lamb, 1999: Gibbons *et al*., 2001: Whitford, 2002: Fan *et al*., 2002: Wormingtion *et al*, 2003: Harper *et al*, 2004). For example, Mackowski (1987) states that, in Blackbutt forest:

> Only trees > 100 cm dbhob were utilised by wildlife... Larger trees (> 140 cm dbhob) were utilised by more wildlife than were trees 100 -140 cm dbhob. Larger hollow-utilising birds such as ducks, cockatoos and owls... are probably restricted to nesting in blackbutt >140 cm dbhob as larger hollows mainly occurred in these trees.

While trees may commence to form hollows at a young age, hollows suitable for use by vertebrate fauna generally do not occur in eucalypts less than 120 - 180 years old, depending on the species and the site, with large hollows remaining rare in eucalypts less than 220 years old (Gibbons and Lindenmayer, 2002). A study in Southeast Queensland found that large hollows formed in Tallowwood after about 250 years and in Scribbly Gum in about 300 years (Wormington, 1996).

Gibbons *et al* (2001) found that:

> Trees of all sizes and ages contained hollows, although larger and older trees had a higher probability of doing so. For two tree species (Brown Barrel or Cuttail *Eucalyptus fastigata* and Messmate *E. obliqua*), the probability of live trees containing hollows remained below 0.5 for stems less than 180 years of age.

Although the study was limited to a single forest type dominated by yellow gum (*Eucalyptus leucoxylon*), Harper *et al* (2004) suggests a positive relationship between number of hollows and the DBH of the tree. The authors found that 18 out of 20 trees >50 cm DBH contained at least one hollow.

Wormington *et al* (2003) suggest that:

> The DBH where there was >50% of trees with hollows should therefore be used to estimate the average age of trees forming hollows.

Lindenmayer *et al* (2000) identified a simple, general rule that highlights the relationships between cavities and readily measured tree attributes. The authors of this study found that:

> … in general, both the number of cavities and cavity size were directly proportional to tree diameter, but inversely proportional to the square root of tree height.

While tree age and DBH are related to site conditions, and species etc, it is suggested that preferentially retaining trees with the maximum DBH available would provide a greater

number of hollows retained than is presently the case with ground based assessments of actual hollows. Indeed large diameter trees are characterised by more branch-end hollows – found to be occupied more often - whereas main trunk cavities were typically the most prevalent cavity type in smaller diameter stems (Lindenmayer *et al* 2000).

The large veteran trees which are characteristically hollow-bearing are also important because they provide nesting sites for species which are not hollow-using, and other species that use hollows, but are not obligate hole-nesters. Some species place their nests only or primarily on dead branches. Recher (1991) cites Sittellas as obligate dead wood nesters, and mentions flycatchers and cuckoo shrikes as nesting most often on horizontal dead branches. Some species such as Grey Shrike Thrush and Scarlet Robin place their nests in open cavities. Such sites are primarily associated with large old trees (Recher 1991). Indeed, large forest owls are known to spend their days roosting inside large hollows of old eucalypts (Kavanagh and Murray 1996).

Fauna occupancy is also increased as tree diameter increases, especially in live trees (Gibbons and Lindenmayer, 2002). For example, van der Ree *et al* (2001) found that all phascogale individuals in one study used multiple nest trees, with nests generally located in trees >80 cm diameter at breast height.

Current TSL conditions aim to retain a quota of hollow-bearing trees per unit area. However, this simplistic method merely attempts to retain a quota of identified trees with at least one hollow. The benefit of this regime to hollow-dependant species is limited by the fact that trees with multiple hollows are more likely to contain some suitable hollows (Gibbons *et al*., 2002).

The economic cost of providing artificial hollows, such as nest boxes, can also be weighed against the cost of identifying and retaining existing hollows, and the habitat quality of artificial hollows compared to natural hollows. Indeed, the arboreal vertebrate occupancy of nest-boxes has been found to be limited. Lindenmayer *et al* (2003) found that:

> Relatively limited use of nest-boxes [by arboreal vertebrates] supports concerns about the use of nest-boxes over large scales and long timeframes as an effective recovery tool for species threatened by the loss and subsequent shortage in the number of naturally occurring hollows.

Studies further suggest that within wood production areas, modified timber-harvesting practices that ensure more trees survive to an age where they can begin to develop natural cavities is the best economic and ecological option for a wide range of hollow-dependant species (see for example McKenny and Lindenmayer, 1994: Lindenmayer *et al*, 2003).

Indeed, the retention of larger, and, therefore, older trees within the general logging area has positive benefits to non-hollow-dependant species. Pausus *et al* (1995) found that the main

factor predicting the occurrence of arboreal marsupials was the availability of food (e.g. quantity of leaves). However, when food was not a limiting factor, forest structure (e.g. number of large trees) determined habitat quality. As Smith (1985) found in his study into bird populations in regenerating forests near Bega in the EMA:

> If no trees had been left, there would have been far fewer birds in the regenerating forest. The retention of such trees is an effective procedure for reducing the adverse effects of logging on birds.

Based on data from a range of eucalypt forests and woodlands, Gibbons and Lindenmayer (2002), estimate that hollow-bearing trees in forests are likely to be occupied at a rate of around 6-15 per hectare, indicating that demand exceeds supply in most production forests in NSW. Smith (1993) estimated that fauna could use 6-13 hollow-bearing trees per hectare in some forests, and yet only 4-6 existed in the logged forest studied (Gibbons and Lindenmayer 1997b). As ground-based hollow identification has been shown to identify only 50% of actual hollow-bearing trees, in the forest these authors studied only 2-3 would have been retained. In these forests current tree retention conditions would be a mere 25-30% of what is required to maintain healthy arboreal populations.

This leads to the conclusion that the maintenance of healthy populations of hollow-using and hollow-dependant vertebrate species in production forests would require the retention of far more hollow-bearing trees, or recruits, than are currently being kept.

DEC should use this information to determine the necessary tree retention condition for the specific forest type before logging commences. The tree retention condition should reflect the species requirements of the harvestable area and formulate the number of hollow bearing trees to be retained. However, the number of retained trees should be at least 6 habitat trees every two hectare across the Net Harvest Area.

The reduction in assessment cost to FNSW should be of interest. As has already been discussed, due to the time taken to scan every tree capable of containing hollows or capable of developing hollows, the current FNSW assessment is costly and unaccountable. The suggested conditions would not require significant survey time to identify the largest size and the requisite number. To retain 12 trees of the greatest DBH available in every two hectares across the Net Harvest Area is far more economically and ecologically effective. Further, the cost of ensuring compliance would also be minimised as a simple measurement of cut stumps would reveal whether the “size condition” had been adhered to, and random sampling of two hectare area sites across the compartment using the grid coordinates would reveal compliance with the “number condition”. Ambiguity would be removed, and standardisation of tree retention conditions across IFOA areas would simplify the conditions and lead to greater compliance and more secure ecological outcomes.

Smyth *et al* (2002) cite the Queensland Department of Natural Resources (1998) who developed the prescriptions for the Maryborough forestry district in Queensland to:

> require six habitat trees ha-1 to be retained with a further two trees ha-1 recruited as potential habitat trees. When there are more potential habitat trees than required, the relative importance of other tree characteristics (size, spacing of neighbouring trees, species, and features important for wildlife) are used to select the required number.

This is a far more ecologically-based tree retention condition than those currently applied in NSW, as it allows for more recruitment or potential hollow-bearing trees to be retained in areas where the forest structure indicates that potentially, population numbers are high. Large populations of arboreal and other hollow-dependant species' still existing, are more likely to be maintained with such a flexible approach to tree retention.

The cost of the above tree retention condition is germane to the likelihood of it being acceptable to the Ministers responsible for forestry regulation. It is submitted that the cost to timber production in retaining six senescent trees per hectare is minimal.

While FNSW state that current tree retention conditions cost less than 1% of timber production and current hollow tree retention conditions are already factored into the FNSW Forest Resource Management Evaluation System (FRAMES), Wormington *et al* (2003) cite two studies that found that the retention of trees in Western Australia was found to decrease total wood production by double the proportion of the total area occupied by the crown of the veteran tree (see Incoll, 1979: Rotherham, 1981). Applying this model, Wormington *et al* (2003) found that this would result in the loss of 14% in timber production if six living hollow-bearing trees per hectare were retained in the dry sclerophyll forests of southeast Queensland. However, these authors assert that the Western Australian studies overestimated the loss and cite a Victorian study which found that the retention of senescent *Eucalyptus fastigata* (Brown Barrel) resulted in a far smaller loss in timber volumes than the study of undermature retained trees in Western Australia (Florence, 1996).

Worthington *et al* (2003) estimate that for retention of 4 habitat trees per hectare, the loss of productivity would be between 5 and 10%.[81]To extrapolate this to five trees per hectare, as is current for northeast IFOA forests, the loss is between about 6 to 12.5%; and an additional 2.5% loss for each tree retained per hectare.

The suggested new condition would retain the largest and therefore oldest trees. These trees are generally senescing and of little timber value. Indeed, Worthington *et al* (2003) cite a Queensland report which suggests that:

[81] For the retention of four hollow-bearing trees/ha

> …the retention of 4–6 live hollow-bearing trees may not affect the capacity for timber production at present as there are up to 5 trees/ha considered not useful for timber production that could be retained (The Habitat Tree Technical Advisory Group, 1998).

Therefore, in general, and in forests where significant forest structure still remains, the cost to production of retaining additional hollow-bearing trees is minimal or, indeed, non-existent.

7.6.1. Regrowth Zones

Recommendation 102.

The delineation of Regrowth and Non-Regrowth Zones must be removed from all IFOAs.

Non-Regrowth and Regrowth Zones apply in all IFOAs under review. These areas are delineated by the escarpment and differentiated into areas where old growth is prevalent, and where old growth is almost non-existent. TSL conditions for the two Zones are, for the most part, identical, but for one important difference: within the regrowth zone in the the UNE and LNE, hollow-bearing trees, and supplementary recruitment trees, are only required to be retained "where present."[82]In the Eden Regrowth Zone hollow-bearing and recruitment trees are to be retained at variable rates depending on habitat quality and number of hollow-bearing trees present.[83]

This has instituted a ratchet effect that will eventually negate any tree retention conditions, once all the hollow-bearing trees are gone. The issue of recruitment trees, therefore, becomes essential to restoring healthy ecosystems, particularly in coastal areas where few hollow-bearing trees remain, and arboreal and other hollow-bearing tree dependant species are barely hanging on.

In many coastal forests where Timber Stand Improvement (TSI)[84] has been employed in the past or that have been heavily logged, there are no hollow-bearing trees left. Thus, there is no requirement under the IFOA to retain any large trees. There are now numerous examples of coastal forests where no trees over 25 cm DBH are left standing after logging.

This is having a severe impact on forest dependant species that inhabit coastal forests. The Barking and Masked Owls, for example, inhabit the open forests that have been subject to extensive clearing in the coastal lowlands and on the tablelands. These coastal forests were the furthest from achieving reservation targets under the CRA, due to their perceived commercial importance. Pugh (1998) found that the CRA reserve system protected less than

[82] Con. 5.6 (c) and (d) UNE and LNE TSLs
[83] Con. 5.6 (h) Eden TSL
[84] Ring-barking and poisoning of old senescent trees

half the identified habitat on public lands for reservation for both these owl species, and their populations achieve 21% of targets at best, thereby jeopardising their long-term survival.

Pugh (1998) further suggests that in developing the targets for another coastal forest species, the Squirrel Glider, the expert panel identified 8 populations of 2,530 breeding family groups. This author found that:

> Three populations remain at fewer than 10% of their CRA targets and at best, 32% of the required number of breeding females was achieved. Only 35% of the Squirrel Glider habitat available for reservation on public lands was protected under the CRA.

There is no justification for the Regrowth Zones to remain. Ecologically, these coastal forests contain some of the least represented forest ecosystems in Reserves, and contain species that largely exist only in Regrowth Zones. Populations of these species are tenuous, since many of the coastal forests on private land are some of the most disturbed in Australia, having been cleared for agriculture and urban development. Despite their rarity, these important coastal forests remnants of the Regrowth Zone have some of the longest harvest histories in Australia. It is, therefore, essential that any remaining forest structure, in the form of large veteran trees, be retained in these areas. Questionable silviculture objectives aside, as large veteran trees have little or no economic value, there is no excuse for their removal.

7.6.2. Standing dead trees

Recommendation 103.

TSL condition 5.6(e) must be amended to require FNSW to exclude harvesting from the area surrounding dead standing trees, corresponding to the height of the standing dead tree in question.

Many hollow-using fauna use dead trees as nest sites. Indeed, in many landscapes, dead trees represent a significant proportion of all hollow-bearing trees. Retention of stags (dead veterans) is mandatory under TSL conditions.[85]However, this applies only to a maximum level of 10 per two hectares, and only where it is safe to do so. It is, therefore, very easy for FNSW personnel, or, in most cases, logging contractors, to identify safety issues which demand the removal of stags. This is just one example of safety issues under Occupational Health and Safety Regulations interacting with TSL or EPL conditions and successfully overriding conditions which would otherwise apply.

In forests subjected to Timber Stand Improvement (TSI), where trees useless to timber production have been killed by ringbarking or poisoning, densities of live hollow-bearing trees are low. Within these areas, dead stags act as the major hollow-bearing component of

[85] Cond. 5.6 (i) Eden TSL: Cond. 5.6 (e) UNE and LNE TSL

the forest. The standing life of dead hollow-bearing trees is estimated to be between 50 and 100 years (Borsboom, 1991: Lindenmayer *et al.*, 1997: Ross, 1998), considerably less than the time expected for living trees to reach maturity and form hollows (Mackowski, 1984: Mawson and Long, 1994: Ross, 1998: Gibbons, 1999: Wormington and Lamb, 1999: Whitford, 2002).

Wormington *et al* (2003) suggest that:

> This time difference between the standing life of hollow-bearing stags and the time for existing living trees to form hollows could mean that, for a period of time, there may be a shortage of hollow-bearing trees to maintain the species richness and abundance of arboreal marsupials…

Many hollow-using fauna use dead trees as nest sites (Gibbons and Lindenmayer 1997a). Eyre and Smith (1997) found the occurrence of the Yellow-bellied Glider in forests in southeastern Queensland was significantly related to the abundance of dead hollow-bearing trees, and speculated that this was due to the paucity of living hollow-bearing trees. Generally, Yellow-bellied Gliders are found to prefer live trees (Recher, 1980; Rohan-Jones and Smith, 1980), and it would appear that whilst this preference holds for many species, others, probably including bat species, prefer hollows in dead trees.

Large proportions of dead trees contain hollows. Surveys cited by Gibbons and Lindenmayer (2002) found that dead trees represented 18-19% of all hollow-bearing trees in forests in East Gippsland, southeastern NSW and northern Victoria, and 44% in forests in southeast Queensland. These trees may, however, be short-lived, and their hollows merely a temporary resource. Dead hollow-bearing trees are especially susceptible to loss from fire. On one site in Alpine Ash forest, approximately 25% of ring-barked trees had fallen after 14 years, with most having fallen after 40 years (Shepherd 1957, cited in Gibbons and Lindenmayer 2002). The vulnerability of these trees to loss from fire, windthrow or firewood collection, heightens the urgency of greater protection being afforded live hollow-bearing trees, and strengthening the requirement to retain dead trees.

Large dead trees have been seen on log trucks heading out of Chichester State Forest (pers. com. John Lloyd - Newcastle workshop). If these trees have been deliberately felled for timber or firewood it is an abuse of the TSL conditions, and is itself a hazardous operation that should not be undertaken under the pretence of Occupational Health and Safety guidelines.

While FNSW can fell standing dead trees for safety reasons, the decision is ultimately left to the contractors. In these circumstances, if a stag is in the way, or can provide firewood for the family, it is likely to be removed. The TSL condition does nothing to protect dead standing trees, and must be amended to prohibit harvesting in the area surrounding dead standing

trees, corresponding to the height of the tree. This is particularly important in areas, such as the current Regrowth Zone, where few - if any -live hollow bearing trees remain.

While there may be concern that this could make the DEC liable for any breach of the exclusion area that results in injury, it should be noted that this condition is imposed for the protection of the stags and the threatened species that depend on them.

Occupational Health and Safety Regulations would be expected to prohibit such dangerous activities as felling brittle dead trees that often snap off while being felled. The agency responsible for prohibiting such activities would therefore be liable for any injury sustained as a result of harvesting within the stag exclusion zone. That agency would be FNSW.

The importance of the protection of standing dead trees can not be overstated. However, should the above condition be found to hold DEC liable for injuries, DEC Legal Branch should develop an alternative condition to protect stags or provide deterrence for the removal of them.

7.6.3. Recruitment trees

Recommendation 104.

Condition 5.6 of the TSLs must be amended to require FNSW to retain "at least 24 recruitment trees in every two hectares of Net Harvest Area, from the next largest DBH cohort of those habitat trees retained, and of the same species as those retained habitat trees". DEC should determine whether, in some circumstances, this number needs to be increased, for example where population densities of hollow-dependant species are higher than would survive with this number, and where there are more than 24 large veteran trees > 60cm DBH.

Recommendation 105.

Condition 5.6 of the TSLs must be amended to require FNSW to report to DEC where more than 24 trees of greater that 60cm DBH exist in a two hectare area of Net Harvest Area of any operation, and require DEC to determine whether the fauna species existing or likely to exist in the area, require the retention of additional trees of this cohort.

Recommendation 106.

Condition 5.6 of the TSLs must be amended to require FNSW to permanently mark all retained trees with a small painted blaze at the base of the tree and metal tag nailed at breast height, as well as reflective paint.

Recommendation 107.

Condition 5.6 of the TSLs must be amended to require FNSW to identify the GPS coordinates of all retained trees and enter these coordinates onto a GIS layer, to be provided to DEC before logging commences.

Recommendation 108.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have failed to retain the trees closest in size to those habitat trees retained, in every two hectares of the Net Harvest Area (as determined by the grid coordinates of the compartment) or to have retained less than the requisite number of recruitment trees in every two hectares of the Net Harvest Area, the number of trees in deficit of the above conditions be retained from the largest DBH trees available in subsequent operations (determined by DEC) as well as twice that number of trees from the next largest cohort of trees, as compensation for the breach.

Mortality rates for live hollow-bearing trees are high. Mackowski (1987) notes that, in Blackbutt forest:

> …there is a mortality of about 1 tree per hectare every 8 years during the 80 years the cohort takes to grow from 100 to 140 cm average dbhob, and about 1 tree per hectare every 18 years during the 80 years the cohort grows from 140 - 180 cm average dbhob.

This means that for every veteran still standing in the forest, over 14 trees have been lost due to natural mortality

> Mackowski (1987) notes that the frequent occurrence of fire in 40 m site height Blackbutt forest precludes a 100% chance of survival for habitat trees, as a proportion will be damaged, or weakened, or burnt down by each fire.

Lindenmayer *et al* (1990a) found that in Mountain Ash and Alpine Ash forest 18% of the total population of hollow-bearing trees collapsed over a five-year period.

Tree hollows, particularly those in branches, are often ephemeral because branches are regularly shed by eucalypts (Jacobs 1979). Saunders (1979) recorded a loss of hollows suitable for cockatoos at the rate of 2.2 - 4.8% per year over a five-year period. (cited in Gibbons and Lindenmayer 2002).

Milledge *et al* (1991) state that:

> …there are practical difficulties in maintaining the prescribed densities of hollow bearing trees and stags on logged coupes when these are often incinerated during post-harvesting

burning or collapse when exposed to wind.

On the basis of a mean annual rate of collapse of hollow-bearing trees of 4.1% (Lindenmayer *et al* 1997), van der Ree and Loyn (2002) conservatively estimated that at a site studied in the central highlands of Victoria, a reduction in hollow-bearing trees would occur from 7.6 standing trees per three hectares to two standing trees per three hectare within a period of 30 years.

van der Rees and Loyn (2002) concluded that there is:

> … an important need to spread the risk spatially by maintaining populations of all species by using a mixture of management strategies (Loyn 1985: Gibbons and Lindenmayer 1996, 1997: Lindenmayer *et al* 1997) that maintains a perpetual supply of old trees and other habitat requirements across the entire forest landscape

However, since trees retained as recruitment trees to replace and perpetuate hollow-bearing trees may not form hollows for up to 200 years, the selection of suitable recruitment trees is vital. The health of retained trees is important for determining the number of hollows persisting after logging. Gibbons (1999) found that suppressed stems have only a small likelihood of developing into trees with hollows suitable for fauna: FNSW practice has been to preferentially retain unhealthy or suppressed trees as habitat trees. In 1993 State Forests of NSW (now FNSW) objected to the Department of Planning (now DIPNR) proposal that retained trees should be healthy trees of good form, on the grounds that "release of trees from competition after logging would be expected to improve the health of those retained" (DOP 1993b, Appendix A). However, most species are unable to recover once their growth has been curtailed beyond a certain stage - although this is less pronounced in species that are relatively tolerant of competition, such as woodland trees (Gibbons and Lindenmayer 2002, Florence, 1996).

At best, TSL conditions require one recruitment tree to be retained for each retained habitat tree. It is self-evident that this is inadequate to sustain the habitat tree resource, given that mortality of hollow-bearing trees is high. This is particularly the case in areas of high logging intensity where protection from wind is reduced, the risk of infection by pathogens increased and post logging burns end in many hollow-bearing trees being lost due to neglect, or the build-up of debris around them after logging (see 7.6.4).

The TSL states that recruitment trees must show potential for the development of hollows and be selected from trees in mature to late-mature growth stage. However, marked recruitment trees are often felled in subsequent operations due to the short-term nature of the marking medium, and short logging cycles.

In the long-term, the retention of hollow-bearing trees will be irrelevant if sufficient recruits of the required size classes are not retained to replace the existing hollow-bearing trees as

they die out. In order to maintain hollow-bearing trees through time, it is essential that sufficient recruits from all size classes be retained. A study should be undertaken to quantify the numbers of recruitment trees in each size class required to maintain the prescribed number of hollow-bearing trees. However, to retain 50% of the natural number of trees in each size class is considered to be the most effective means to achieve this.

It needs to be recognised that as well as retaining recruitment trees in the next cohort likely to develop into hollow bearing trees, there is a need to retain trees in the next cohort likely to develop into recruitment trees. In other words, if the government is serious about retaining hollow-bearing trees in perpetuity, it is necessary to retain trees in every age class to provide for a continuous supply of hollow-bearing trees into the future.

7.6.4. Protection of retained trees

Recommendation 109.

Condition 5.6 of the TSLs must be amended so that the discretionary phrase "to the greatest extent practicable" is removed. FNSW must protect all retained trees from fire by removing all debris or flammable material from their base, and from damage during harvesting operation.

Recommendation 110.

Condition 5.6 of the TSLs must be amended so that, should FNSW be found to have irreparably damaged retained trees in harvesting or post-logging burning operations, the number of damaged or lost trees are additionally retained from the largest DBH trees available in subsequent operations (determined by DEC) as well as twice that number of trees from the next largest cohort of trees of the same species, in compensation for the breach.

TSL conditions 5.6 states that damage to retained trees, and logging debris accumulation around them, must only be "minimised to the greatest extent practicable." The discretionary nature of this and other conditions allows FNSW to evade their obligations under the TSLs. In almost every post-operation audit conducted by the conservation movement in IFOA forests, damage to retained trees or debris piled around them has been evident.

It is clear that FNSW do not take the protection of retained trees seriously. Smith (1991) records that during field inspections "I was advised that it was generally not practical to retain any living habitat trees because they are all killed during post-logging regeneration burns".

As retained trees are often the only habitat potential in the Net Harvest Areas of IFOA forests, their protection is vital. Therefore, as an incentive for FNSW to protect retained trees,

compensatory trees needs to be additionally retained from subsequent operations when retained trees are damaged or lost. The operations where these additional trees are to be retained should be determined by DEC.

7.7. Post logging burning

Recommendation 111.

Both the TSLs and EPLs must be amended to prohibit FNSW from undertaking post-logging burns.

As has already been discussed, post-logging burns have severe ecological consequences. Smith, (1998) suggests that:

> The adverse impacts of fire on biodiversity are overwhelmingly the result of frequent fire - especially regular low intensity burning combined with grazing - not infrequent wildfire. High Frequency Fire has been listed as a Key Threatening Process by the NSW Scientific Committee, which has stated that "inappropriate fire regimes largely equates to too high a fire frequency....Statistics also show that property loss from wildfire has predominantly resulted from escaped deliberately-lit burns. Many forest and woodland areas thus have a history of high frequency of both wildfire and low intensity burning.

Fire can cause the liberation of nutrients from ash, burning of soil organic matter and increases in soil pH (Mikola *et al* 1964: Pietikäinen and Fritze, 1995: Ballard, 2000). Fire has significant effects on important soil fungi essential for nutrient uptake in regenerating forests (see 5.2). Further, fire increases nitrogen levels, which is responsible for greater insect herbivory and may result in crown dieback (see 5.3).

As Watson and Wardell (2004) found in a Queensland forest, time-since-fire or fire frequency affected community composition. These authors further found that moisture availability due to fire also influenced floristics and ground dwelling vertebrates. Watson and Wardell (2004) conclude that variable fire regimes, which include inter-fire intervals of at least 15 years, could be necessary for the continuity of all species in the community studied.

Woinarski *et al*. (2004) found in a Northern Territory forest:

> Total fuel loads did not differ significantly between the unburnt and annually burnt sites, but their composition was markedly different, with far less grassy fuel, but far more litter fuel, in the unburnt block. There were major differences between treatments in the composition of trees and shrubs, manifest particularly in the number of stems. There was no overall difference in plant species richness between the two

> treatments, but richness of woody species was far higher in the unburnt treatment, and of annual and perennial grasses, and perennial herbs in the annually burnt treatment.

These authors also found that there was a far higher representation of rainforest-associated species in the unburnt block. They state that:

> …such species need to be better accommodated by fire management through strategic reductions in the frequency of burning.

To undertake burning operations - including hazard reduction and post-logging - FNSW must prepare annual plans including the location, timing (including season and frequency), and undertake comparative assessment of potential impacts on the environment of proceeding and not proceeding with the burn. FNSW must also prepare a site-specific plan of burning operations, setting out the measures taken to minimise impacts and risks of wildfire. Scientific trials must also be undertaken to assess the environmental impacts, and take into account any comments made by regulatory agencies.

TSL conditions apply to prescribed burning regimes, ensuring that they are varied seasonally and take account of wildfire history and the ecological requirements of threatened species in the area. Burning is also to be conducted in a manner that promotes and maintains an understorey. In areas where intervals between fires are less than five years, prescribed burning is to be conducted in a manner that minimises the impact on understorey vegetation and large fallen logs (> 40 cm dbh and five metres in length).

However, for post-logging burns, very little regulation is apparent. Anecdotal observations suggest it is common for post-logging burns to infiltrate streamside buffers, UMDLs and rainforest exclusion zones. The impacts on moist, habitat dependant species of these breaches are severe. Moreover, the frequency and intensity with which many FNSW burns are undertaken is having a significant detrimental effect on species composition, changing from rainforest types to drier forest types.

As logging cycle periods continue to be contracted, post-logging burning will become more frequent. The silvicultural value of such intense burning regimes is questionable, but FNSW persist with post-logging burning without any credible scientific evidence that it actually improves regeneration.

Further concerns are held over FNSW undertaking post-logging burns under the guise of hazard reduction burning. While we are cognizant of the ramifications of extreme fire seasons placing pressure on land managers to undertake hazard reduction burns during the cooler months, post-logging burns are not conducted for this reason. Rather, FNSW burn after logging with the simplistic assumption that new eucalypt regeneration will be assisted with the reduction of ground cover which provides a competitive advantage to timber

productive species, and nutrients contained in the logging debris and understorey will become available to regrowth more quickly.

The ecological damage from post-logging fires intensifies the impacts of the loss of resources and habitat by logging. The practice has the potential to reduce the filtration capacity of the general harvest area, and has associated risks which often results in filter strips and exclusion zones being burnt. Indeed, many forest wildfires have resulted from unattended FNSW burns, affecting water quality and destroying threatened species habitat. This cannot be tolerated. There is no justification for the continuation of post-logging burns

7.8. Gullies, streamside buffers and unmapped drainage lines.

Recommendation 112.

A condition must be inserted into the TSLs excluding logging within ten metres either side of all unmapped drainage lines.

Many studies have shown that timber harvesting and associated forest-management practices can have significant effects on stream water temperature, sediment loads, turbidity, nutrient levels and flow regimes (Boughton, 1970: Graynoth, 1979: Langford and O'Shaughnessy, 1980: Flinn *et al.,* 1983: Clinnick, 1985:Cornish and Binns, 1987).

These effects have, in turn, been shown to result in significant changes to stream macroinvertebrate community structure (e.g. Robinson, 1977: Newbold *et al.,* 1980: Gurtz and Wallace, 1984: Richardson, 1985: Noel *et al.,* 1986: Campbell and Doeg, 1989: Stone and Wallace, 1998) and fish populations (e.g. Morgan and Graynoth, 1978: Bisson and Sedell, 1984: Davies and Nelson, 1994: Wellman *et al.,* 2000).

Streams and associated riparian environments also provide important habitats for many amphibian species. Many species breed exclusively in streams and play important functional roles in the dynamics of stream ecosystems (Flecker *et al.,* 1999).

One of the major impacts on streams from timber harvesting and associated forest-management activities is increased sediment loads (Graynoth, 1979: MMBW, 1980: Reid and Dunne, 1984: Campbell and Doeg, 1989). The negative impacts of increased sediments on stream-dwelling organisms, including fishes, macroinvertebrates and periphyton, and amphibians are well documented (Corn and Bury, 1989: Power, 1990: Newcombe and MacDonald, 1991: Waters, 1995: Welsh *et al.*, 1998: Gilespie, 2002).

Significant concern has been expressed over the declines in amphibian populations throughout the world (Blaustein and Wake, 1990: Tyler, 1991: Bee-bee, 1992). While the cause of most declines is uncertain, and in many cases a range of factors may have been involved (Pechmann and Wilbur, 1994); at least some declines have been attributed directly

to logging (Means *et al*., 1996: Pearman, 1997). Studies have indicated that long term reductions in amphibian diversity and abundance correlate with logging activity. Changes to features of the environment such as hardwood shrub abundance (Corn and Bury, 1991: Welsh and Lind, 1995), leaf litter depth (Heatwole, 1962: Pough *et al.,* 1987) or the type and the amount of coarse woody debris (Welsh and Lind, 1991: Petranka *et al.,* 1993) can have an impact on amphibian densities and species richness.

However, Corn and Bury (1989) found that:

> Increased fine sediment load was the most important difference for amphibian species density between streams in logged and un-logged catchments. Amphibian density was most reduced in stream sections with the highest sediment loads. The effect was most severe in stream sections with low gradients, where lower water velocities result in higher sediment-deposition rates.

Increases in deposited sediment loads in streams reduced the availability or quality of egg-laying sites or tadpole shelter sites for amphibians due to the filling of interstitial spaces in the stream bed and blanketing substrata (Welsh *et al.,* 1998). Increased sediment input smothers and reduces availability of important food resources such as algae (Power, 1990), thus impeding growth and development of frog larvae (Gillespie, 2002).

Gillespie (2002) found that:

> …activities that increase sediment deposition in streams may have significant adverse impacts upon the fitness of tadpoles of lotic anuran [water dwelling fogs] species by retarding growth and development, which may result in reduced population recruitment.

Such activities include the logging of drainage lines that have the potential to release significant sediment loads, which are then deposited into lower gradients and low water velocities down-stream.

Mesic vegetation in the lower stratum of the forest is associated with a moist microclimate and is also important for ground dwelling amphibians (Barker *et al,* 1995: Lemckert, 1999). Parris (2002) notes that the composition of riparian habitat has been identified as an important correlate of habitat suitable for a range of forest-dwelling amphibians. Lemckert and Bassil (2000) observed the Giant Barred Frog (*Mixophys iteratus*) sheltering under leaf litter or amongst low vegetation in riparian areas. Other species for which riparian habitats are important are the cascade treefrog and the spotted treefrog (*Litoria spenceri)* from eastern Australia. Indeed, the Stuttering Frog (*Mixophys balbus)* and Fleay's Frog (*Mixophys Fleayi*) which are reliant on moist microclimates such as drainage lines have suffered serious population declines and contractions of their range in the last 20 years (Hines *et al,* 1999). Due to the logging intensity currently practiced in IFOA forests, the last remaining intact

mesic understorey often only exists in drainage lines, 30% of which remain unmapped, and therefore logged.

Lemckert (1999) found that:

> …negative effects of logging were also recorded for three species. The great barred frog *Mixophyes fasciolatus* decreased in numbers in more recently logged areas, the giant barred frog *Mixophyes iteratus* decreased in abundance in recently-logged areas and at sites where little undisturbed forest was available and the tusked frog *Adelotus brevis* appeared to be dependant on patches of undisturbed forest.

Lemckert (1999) further found that:

> Both the hip-pocket frog *Assa darlingtoni* and sphagnum frog *Philoria sphagnicolus* require a moist substrate on which to lay their eggs. If such sites are not identifiable as a ``soak" then they are protected only if they are known to have one of these species present (SFNSW/NPWS, 1995). Therefore, such habitats can be directly disturbed by machinery and post-logging fire. The hip-pocket frog was found only in unlogged forest, suggesting that they are indeed affected by disturbance of the forest… The drying of the forest floor due to the loss of canopy cover and leaf litter may be tolerable in areas of higher and more consistent rainfall, but intolerable in areas where moisture levels are marginal and so lead to a decline and loss of the species.

Streamside habitats are also important mammalian refuge. As Claridge *et al* (1991) found:

> … most captures of long-nosed bandicoots were in gullies and areas with open ground… Similarly, spotted-tailed quolls are found mostly along densely vegetated drainage lines in southeastern New South Wales (Belcher, personal communication).

Kavanagh *et al* (1995) suggested that the establishment of a network of retained undisturbed vegetation along most gullies would be a prudent course of action to maintain biological diversity. Results from this study support that action for ground-dwelling mammals also.

In south-eastern New South Wales, common wombats, red-necked wallabies and swamp wallabies were more abundant in gullies (Lunney and O'Çonnel 1988: Catling and Burt 1995b) and the highest abundance of most small mammals was near creeks (Catling and Burt 1995b). Additionally, Lunney (1987) found that deep unlogged gullies were important habitat for possums and gliders. Indeed Kavanagh and Webb (19998) found that:

> The persistence of these gliders was attributed to the retention of unlogged forest within and adjacent to logged areas. This highlights the role of riparian reserves ("wildlife corridors") and filter strips in retaining residual populations of the Greater

> Glider and the Yellow-bellied Glider until the logged areas are suitable for recolonization, and the importance of determining the effective size for these unlogged reserves.

Riparian sites are also important for the protection of moist flora species. As Pharo and Baettie (2001) state:

> The riparian forest clearly has high regional conservation value. Riparian sites have remained unburned for longer than the other forest types and have significantly higher bryophyte species diversity than two of the dry forest types. Riparian sites also have significantly different lichen species compositions from the three driest forest types. Protecting an adequate percentage of the riparian zone appears imperative.

Light environment maintenance is also considered a particularly important function of buffers aimed at protecting riparian habitat value (Barton *et al* 1985). Plants adapted to low light environments often sustain damage to their photosynthetic ability when light increases (Watling *et al* 1997). While some plants adapted to low light gain their competitive advantage through their use of spectrally altered light which makes up a significant portion of energy available where direct light penetration is low (Lee 1987).

Dignan and Bren (2003) suggest that:

> …light is one of the main factors influencing the establishment and development of many forest species and plays a major role in the ecology of the intrinsically species rich riparian forest. Light penetration gradients across the transition from riparian forest to open forest can be steep, particularly close to the forest floor where species diversity is greatest, and light penetration is highly correlated with microclimate variables such as temperature and relative humidity.

These authors found there was:

> … a distinct riparian light environment that can be radically altered by edge creation. In the area studied, buffers of 70-100m should provide maintenance of the light environment in the riparian zone. However, the degree of protection afforded a given width of buffer varies with height above ground and with site characteristics…

Gullies and water courses, even those of ephemeral flow, have significant habitat value as they are often the areas where a deep leaf litter and moisture layer inhibits burning, allowing refuge for ground dwelling vertebrates and other organisms affected by logging in the general harvest areas. Perhaps these areas are even refuges for symbiotic fungi essential for recruitment and growth of regenerating forest (see 5.2).

Trade-offs were made between timber supply and the adequate protection of these essential habitats. Streamside buffers are, therefore, not adequate to provide an acceptable mitigation of logging impacts. No protective measures have been developed to exclude grazing and fire damage in riparian zones, and streamside buffers (see 7.7 and 7.9). Therefore, any attempt to reduce current streamside buffer conditions will receive strenuous objections and sustained protest.

While streamside riparian zones are protected from logging in the form of streamside buffers and habitat corridors, almost 30% of all drainage features in State Forest of NSW remain unprotected from logging. This is due to the TSL not containing a condition excluding logging from unmapped drainage lines (UMDL). By allowing this anomaly to continue, many mammals, amphibians, reptiles, fish and moisture dependant flora such as bryophytes, ferns, fungi and lichen, dependant on moist microclimates, thick leaf litter, and clean streams, remain unprotected from intense logging activities. Stream dwelling fishes, amphibians and macroinvertebrates also are at risk from increased fine sediment loads dispersed by logging to the edge of UMDL.

7.9. Grazing in IFOA forests

Recommendation 113.

A clause must be inserted into the IFOAs prohibiting cattle grazing in IFOA forests.

Recommendation 114.

A clause must be inserted into the IFOAs that requires FNSW to unconditionally acquire all grazing leases on State Forest tenure as they become available for renewal.

Recommendation 115.

DEC must prosecute FNSW and grazing leaseholders for breaches resulting from grazing in exclusion zones and streamside buffers. Once successfully prosecuted, DEC should seek a court injunction prohibiting cattle from entering exclusion zones and streamside buffers. If FNSW and grazing leaseholders cannot show the court that they can exclude cattle effectively, a court order must be sought prohibiting cattle from State Forest tenure, regardless of leases.

Grazing is defined in the TSL as a "specified forestry activity" and FNSW must have Grazing Management Plans prepared by the first five yearly review.[86]These Plans must consider the habitat requirements of threatened species and include management actions to

[86] Con. 5.15 LNE TSL

protect threatened species and their habitats. FNSW are required to consult with DEC during the preparation of these Plans.

The TSL further states that FNSW must, *to the greatest extent practicable*, (see 2.1) protect ground habitat from specified forestry activities,[87]and grazing regimes *should* aim to minimise adverse impacts on Critical Weight Range (CWR) species.[88]The TSL also states that grazing and associated burning should be excluded from swamps and ephemeral wetlands to protect frogs,[89]and that grazing is prohibited from exclusion areas including high conservation old growth, rainforest, rare non-commercial forest types, stream exclusion zones, ridge and headwater habitat, wetlands, heath and scrub, rocky outcrops and cliffs, and species specific exclusion zones. It is questionable that FNSW can exclude cattle from these areas unless it erects fences. As the fencing of exclusion zones is unrealistic in State Forest, cattle grazing is having, and will continue to have, a significant affect on areas supposedly protected from specified forestry activities. Grazing and the consequential increased burning regime, has been shown to severely impact on forest dependant species, forest health and stream banks, to cause erosion, reduce water quality, and lead to soil compaction and reduced overstorey recruitment.

Henderson and Keith (2002) found seasonal grazing by cattle and the consequential burning to promote green pick for stock feed in the forests of northeast NSW, has led to a simplification of the forest understorey. In particular, they noted depletion in the density and species richness of shrubs and concluded that historical grazing and burning has had a substantial impact on the woody understoreys.

These authors suggest that adversely affected species spanned a range of life-history functional types: species richness and population densities of woody species were lower where grazing and burning disturbance was more intensive.

Grazing can effectively remove some plants species from grazed areas. Clarke and Knox (2002) conducted research into post-fire response and recruitment patterns of shrub taxa recorded from research burns and wildfires on the New England Tablelands over 4 years. These authors studied the response to fire in grassy woodlands, open forests, shrubby open forests, wet heaths and rocky outcrops to determine the ratio of obligate seeder -plants that reproduce only by seeding - to resprouter species. They found the highest ratio occurred on rocky outcrops (90:10) and the lowest in grassy forests (19:81). They suggest that:

> Rather than fire, perhaps grazing frequency may have removed obligate seeders from the grassy woodlands where both native and introduced herbivores occur in higher densities than in the shrub-dominated communities...

[87] Con.5.17 TSL
[88] Pr.17 (f) *T*SL
[89] Pr. 18 (b) TSL

Pettit *et al* (1998) found that species richness and diversity were reduced in heavily grazed sites studied, and the differences in the flora between grazed and ungrazed sites, was high. These authors also found, in the heavily-grazed sites, that weeds made up almost half of the flora species recorded and that the frequency and cover of native perennial species was significantly reduced in *all* the grazed sites.

Pettit *et al* (1998) state that:

> Grazing also resulted in a significant increase in surface soil compaction and water repellency as well as concentration of soil N [nitrogen] and P [potasium]. Size-class distribution of the overstorey indicated that no recruitment had taken place for many years and, although germination of overstorey species occurred each year, no seedlings survived at the heavily grazed sites. In these sclerophyll woodlands, grazing has altered plant community structure, from an understorey dominated by perennial shrubs to one dominated by exotic annual grasses and forbs. Resilience of native perennial species is dependent on reproductive strategy, life form and morphology, life history and palatability. Annual exotic species are favoured by increases in soil nutrients and disturbance, reduction in competition and an ability to withstand a high level of disturbance

Grazing and related fire management is an important factor in the colonisation of weeds in forests. Duggin and Gentle (1998) studied the effects of disturbance of dry rainforest and open forest in northeast NSW and the increased invasion of Lantana and found that, to minimise weed invasion in forest…

> …high intensity disturbance, such as wildfire in association with intensive grazing, must be avoided. Low intensity fires can also pose a significant, albeit lower, invasion hazard. Ideally, fire should be completely removed from ecotones...

Such management strategies will encourage rainforest expansion (Bennett, 1989) and avoid the establishment and expansion of Lantana populations in the long term by maintaining barriers to invasion (Radosevich and Holt, 1984: Reader and Bricker, 1994).

Grazing also significantly affects fauna, particularly herpetofauna, ground dwelling species and birds. For example, Calver and Dell (1998) found that grazing had a negative impact on 22% of the forest bird species recognised, and changed fire regimes negatively impacted on 45% of forest bird species identified.

Catling and Burt (1995) suggest that:

> The composition of the ground-dwelling mammal fauna in southeastern forests is determined by the complexity of the understorey. A significant reduction in

> understorey shrubs would result in a decrease in the abundance and number of species of small and medium-sized mammals and an increase in large grazing mammals.

Damage to streams and riparian areas by cattle grazing in forests has been identified as a possible threatening process for frogs. (Parris and Norton, 1997; Berger *et al*, 1998: Hines *et al*., 1999 Parris, 2001). Parris (2001) suggests that the observed relationship between the presence *of Litoria pearsoniana* and mesic midstorey vegetation in the riparian zone supports the exclusion of cattle grazing, and the associated tree clearing and frequent burning from public forests. These practices, she suggests, alter the light and moisture regimes in the lower strata of the forest, and dramatically change the structure and composition of the understorey and midstory vegetation (Anonymous, 1998). This results in a more open forest with a simple, xenic understorey and midstorey dominated by grass and weeds (Leigh and Holgate, 1979; Pettit *et al*, 1995), which on the basis of the study by Parris (2001), is less suitable for some frog species. Leckert (1998) a FNSW ecologist goes so far as recommending that

> …grazing should be phased out of some state forest areas and burning regimes modified to provide a diversity of habitats.

Cattle tend to congregate around streams, using them as watering points or shelter in the riparian forest. Trampling of riparian areas by cattle leads to deterioration of water quality, erosion of stream banks and channels, and changes in stream morphology (Armour *et al*., 1991: Trimble and Mendel, 1995: Borsboom, 1996).

It is environmentally unacceptable to allow grazing in State Forests. In addition to direct impacts, the harm caused by the associated higher fire frequency and incidence of wildfire escapes greatly exacerbates the alleged benefit of reduced fuel loads. It is also of limited grazing value, given the poor quality of grass available in forest environments. There is no rational justification for maintaining State Forests as cow paddocks.

In order to comply with conditions attached to the TSLs prohibiting cattle from exclusion areas, FNSW have no practical alternative to prohibiting grazing from all State Forests. While it is acknowledged that current grazing leases remain in operation and perpetual leases are in existence, TSL conditions must be rigidly enforced, and FNSW and leaseholders prosecuted for breaches when cattle are found in exclusion zones and riparian buffers.

7.10. Firewood collection in IFOA forests.

Recommendation 116.

A condition must be inserted in to the TSL prohibiting ground scavenging for fallen timber in all IFOA forests.

Commercial firewood collection is a specified forestry activity for the purposes of the IFOAs. FNSW must *to the greatest extent practicable* (see chapter 2.1), protect ground habitat from specified forestry activities,[90]and commercial firewood collection must not be permitted in compartments where ground dwelling threatened species exist that may be affected.[91]However, for domestic firewood collection, although there are conditions, it is questionable, given the low level of supervision, that these can be, or have ever been enforced.

FNSW report that the volumes of firewood extracted from the entire State Forest estate has fallen from 76,000 tonnes in 1997/98 to just 19,000 tonnes in 2002/02.[92]And while it states that firewood collection is managed sustainably by requiring commercial operators to have harvest plans, and issuing permits for personal use,[93]the fact remains that harvesting fallen timber cannot be sustainable unless strict conditions are imposed and enforced on the volumes and methods used to collect firewood. MacNally *et al* (2002) identified that fallen timber has been systematically, and in many places completely stripped from forest floors leaving many forests bereft of an important structural element. The authors note the many correlative studies linking woody debris to species richness and the occurrence of certain taxa.

Lindenmayer *et al* (2002b) note the role of fallen logs as a key component of stand structural complexity and nutrient cycling often ignored in forestry operations. The authors suggest that the removal of logs, which alters forest ecosystem function and negatively impacts upon log-dependent species, needs to be urgently addressed. These authors cite the critical functional roles of fallen logs for forest biodiversity to include:

- providing nesting and sheltering sites for biota,
- providing foraging substrates for predators like snakes and predatory invertebrates such as velvet worms,
- providing basking and hibernation sites for reptiles,
- facilitating animal movement,
- providing places for key social behaviours,
- acting as plant germination sites,
- providing substrates to promote the growth of fungi,
- providing mesic refugia for organisms during drought and/or fire, and
- contributing to heterogeneity in the litter layer and patterns of ground cover.

They suggest that prescriptions for the retention and future recruitment of logs must be developed to avert possible losses in biodiversity. The persistence of fallen logs in

[90] Con. 5.17(a)
[91] Con. 5.17(b)
[92] FNSW Seeing Report 2002/03, p 64
[93] *op cit*, p 20

undisturbed forest varies among tree species. Mackensen *et al* (2003) suggest lifetime decay rates, without termite influence, for native Australian species, ranged from 7 years in *Eucalyptus regnans* to 375 years *in E. camaldulensis*. Maintaining these essential habitats in State Forests is difficult enough, given the intensity of logging and fire. To allow ground scavenging for the little fallen timber that is available ground habitat is unacceptable.

FNSW are under no obligation to supply firewood to the timber industry. The ample waste timber available after a harvesting operation that is presently burnt, could more than satisfy commercial and domestic demand for firewood. Similarly, non-commercial eucalypt plantation thinnings could satisfy domestic firewood demand. Given that unregulated scavenging for personal use cannot be effectively managed, to ensure IFOA compliance, the removal of fallen timber must be prohibited in IFOA forests.

7.11. Species specific conditions

7.11.1. Demonstrably inadequate prescriptions

Recommendation 117.

As part of the IFOA review, DEC must conduct a desktop analysis of all existing harvest plans to review each threatened species prescription and its efficacy in triggering protection measures. This information must then be used to produce improved threatened species prescriptions as an output of the IFOA review.

A brief desktop review of a random selection of harvest plans by conservationists in north-east NSW has revealed that there are number of species specific prescriptions that are rarely, if ever triggered. This is due either to the too high thresholds set for the prescription, or to the use of discretion in placement to implement excluded areas in non-commercial forests only. They are demonstrably inadequate to achieve the stated aim of ameliorating impacts because they are rarely, if ever, implemented.

It is not necessary to wait another 5 years for a scientific review of the efficacy of the prescriptions to identify that a number of them are simply not being triggered often enough to provide of protection for threatened species. In particular, the conservationist's review revealed that Koala High Use and Intermediate Use areas, Large Forest Owl landscape exclusions, and maternal den and permanent den sites and latrine sites for Spotted-tailed Quolls, have resulted in almost *no* additional protection of commercial forests throughout north-east NSW.

As part of the IFOA review, DEC must conduct a desktop analysis of all existing harvest plans to review each threatened species prescription and the area of commercial forest protected under each prescription. This is a straight-forward auditing task. This information must then be used to produce improved threatened species prescriptions as an output of the

IFOA review. In particular, each of the prescriptions described above needs to be amended with more appropriate thresholds and requirements to ensure that in the future they will have some discernible affect in ameliorating impacts on the species for which they are designed.

7.11.2. Record based prescriptions

Recommendation 118.

Prescriptions that are triggered by a record, and only apply in the vicinity of the record, must be improved to apply over a larger area in the vicinity. At the very least, all such prescriptions should be applied within a 1km radius of the record, with larger areas for particular species if determined by DEC.

There are a number of prescriptions for threatened frogs, bats and some bird species, for which prescriptions apply only within 100m-300m of the record. This includes prescriptions for the Golden-tipped Bat, Large-footed Myotis, Rufous Scrub-bird, Alberts Lyrebird, Giant Barred Frog, Fleay's Frog, and Stuttering Frog.

Given the limited nature of surveys, it is likely that significant numbers of populations are not being recorded, yet when they are recorded at one site, they only trigger the prescription within a very limited area in the vicinity. Given that the species have been recorded, and are therefore highly likely to be present in unsurveyed areas in the compartment and adjacent compartments, the prescription should apply over a much wider area. At the very least the prescription should be applied over a 1km radius as a minimum for all species, with larger areas for those species which DEC considers warrant a larger area.

7.11.3. Model based prescriptions

Recommendation 119.

DEC should immediately design a set of ameliorative measures to be applied within modelled fauna habitat for all threatened fauna species, to complement existing record based measures.

There is a body of scientific evidence identifying major problems with record based measures to protect threatened species. Many threatened species are cryptic and difficult to record in surveys, and survey intensity will always be grossly inadequate to identify even a proportion of threatened species populations. Instead, there is strong evidence to show that habitat protection should represent a significant component of measures to ameliorate impacts on threatened species.

Coastal NSW is unique in having one of the best systematic biological databases in Australia. This database includes a set of spatial fauna models depicting fauna habitat for a large

number of threatened fauna species. The models have been developed using best practice analytical techniques and rigorous expert review. They effectively provide fauna habitat maps for many forest dependent fauna.

There should be an increased emphasis on designing ameliorative measures around modelled fauna habitat. This should provide a landscape component to complement the existing record-based prescription measures. DEC should immediately design a set of ameliorative measures to be applied within modelled fauna habitat for threatened fauna species, to complement the record-based prescriptions.

7.11.4. Maximum 20% exclusion of Net Harvest Area.

Recommendation 120.

Condition 2.1 (b) of the TSLs allowing FNSW to seek a DEC review of conditions that exclude more than 20% of the Net Harvest Area of a compartment from logging, must be removed.

Where twenty percent or more of the Net Harvest Area of a compartment is made unavailable because of exclusion zones (including oldgrowth exclusions and 3% of Owl Landscape exclusions), FNSW may request that DEC review the conditions applying to that compartment or operation.[94] This clause has only been triggered once, when the TSL condition to mitigate the impacts of logging on Brush-tailed Phascogales excluded more than 20% of the Net Harvest Area of a compartment. Van der Ree *et al* (2001) had identified the size of Phacogale home range as being on average about 5.0 ha; one-eighth the mean home-range size previously recorded for the species reflected in the TSL at the time. FNSW sought a review and NPWS (now DEC) reduced the exclusion area for this species based on this new information. It is inconsistent for reductions in exclusion areas occur when new information becomes available, but not increases in exclusion areas when new information supports it. This one-sided adaptive management can no longer be accepted.

Nevertheless, where more than 20% of the NHA is excluded from logging due to a species-specific condition, it means that the species or the cumulative exclusion for species is due to a large and obvious population or healthy ecological community existing in the area. To allow a reduction in the required logging exclusion threatens such healthy populations and ecological communities. These levels of exclusion are not common and should not be reduced to allow for increased logging intensity in areas where such healthy populations and communities exist.

7.11.5. Quolls and 1080 baiting

[94] Cond. 2.1(b) TSL

Recommendation 121.

A condition must be inserted into the TSLs prohibiting aerial and surface 1080 baiting in all IFOA forests and specifying that, within modeled Class One Spotted-tailed Quoll habitat, or known Spotted-tailed Quoll populations, no underground baiting is to be undertaken without assessment of populations of target and susceptible non-target species.

Dasyurus maculatus maculatus (Spotted-tailed Quoll, Tiger Quoll), is listed as vulnerable in NSW, and has recently been declared nationally Endangered under the *Environmental Protection and Biodiversity Conservation Act* (Cth) (*EPBC Act*). Mansegh (1983) suggested that the factors involved in its decline include habitat destruction and the widespread use of trapping and poisoning.

The CRA outcomes for the Spotted-tailed Quoll were poor. For example, in the UNE and LNE, the expert panel identified the need to reserve *all* high quality habitat for four populations amounting to 354 to 1500 breeding females (Pugh, 1998). The CRA reserve system encompasses half the modelled habitat available for reservation on public lands and achieves only 10% of targets for two of the four populations: "There can be no doubt that this species will continue to decline towards extinction on the mainland" (Pugh,1998).

The Listing Advice (Determination) for the *EPBC* listing states that:

> Habitat loss and degradation, competition with introduced predators and inappropriate 1080 poison baiting programs may all play a significant role in localised population declines to the extent that local populations may decline rapidly to extinction. This is particularly the case where populations are fragmented and numbers already low. The magnitude of the declines has resulted in population numbers that are low throughout all areas of the current range with the exception of northern NSW and there are no indications of the observed declines being slowed or reversed.

The Advisory Guidelines state that:

> Similarly, ground baiting programs where the baits are buried at a depth greater than 10cm are unlikely to pose a significant threat to the Spotted-tailed Quoll as this species is known to display very little interest in baits which are buried at a depth greater than 10cm. Baiting programs proposed in known or potential Spotted-tailed Quoll habitat should be examined closely to determine if they are necessary and if so, to what degree they can be designed to lower the risk of poisoning Spotted-tailed Quolls.

Belcher (2003) found that:

> Males are more likely to encounter baits, due to their significantly larger home range and movements during breeding season. Following baiting, no adult males were recorded, despite the presence of adult females…The capture of a male [Spotted-tailed Quoll] displaying symptoms of 1080 poisoning in 1998 at White Ash Road, while clearly showing that full-grown male [Spotted-tailed Quolls] may find, eat and be killed by aerial deployed 1080 baits, was an unusual event. Monitoring populations before and after baiting, however, showed that most Spotted-tailed Quolls were likely to disappear after baiting, assumed dead. The densities of [Spotted-tailed Quolls] at the southern end of Badja Sate Forest in 2001–02 was similar to the densities recorded at Suggan Buggan in 1994, around Pikes Saddle in 1996-97 and White Ash Road in 1997-99 prior to baiting (J. Nelson, personal communication), suggests that the population declines recorded after baiting were not due to a natural population cycle.

And that:

> On the basis of their mean weight, most [Spotted-tailed Quolls] would be likely to receive a lethal dose from consuming one 1080 poison bait, and at temperatures below 13 degrees, an even higher proportion would be likely to receive a lethal dose from one bait…An aerial baiting trial in 1999 found that at least 67% of the [Spotted-tailed Quoll] population and 86% of adult males and breeding females had consumed one or more baits (Belcher 2000). Results of trapping one month after 1080 poison aerial baiting in 2000 indicated a 70% reduction in population.

The author concludes:

> The strong correlation between 1080 baiting and population crashes would suggest that the current 1080 poison baiting method poses an unacceptable risk to a species listed as "Vulnerable" nationally and in New South Wales…

The recent reintroduction of aerial baiting in National Parks means that even reserved habitat is no longer safe for Quolls. While aerial 1080 baiting may be cheap, it is pushing the last large carnivorous marsupial found on the Australian mainland to extinction. Other more sensitive approaches must be found to eradicate wild dogs and foxes in public forests.

7.11.6. Greater Gliders (Eden only)

Recommendation 122.

Greater Glider conditions as for UNE and LNE TSLs must be incorporated into the Eden TSL.

Kavanagh and Webb (1998) found that:

> The arboreal marsupials, in particular the Greater Glider *Petauroides volans*, were among the species more sensitive to logging disturbance. …The species requiring management consideration include those that declined as a result of logging, but which had not recovered within eight years (the Greater Glider, the Yellow-bellied Glider *Petaurus australis*, the Sugar Glider *P. breviceps*, and the *skink Niveoscincus coventryi*)… It is unclear when the species most disadvantaged by integrated logging, that is, the large gliding possums, will recolonize the logged areas.

There are no Greater Gliders conditions in the EMA. Although they are an important resource for all the large forest owls listed in the Schedules of the *TSC Act*, they are among the most sensitive to logging disturbance. Studies have yet to determine when, if ever, these large gliding possums will recolonise logged areas.

In keeping with the need to make Licence conditions consistent across IFOA areas, Greater Glider conditions for the UNE and LNE TSLs must be incorporated into the Eden TSL.

7.11.7. Koalas (Eden only)

Recommendation 123.

Condition 6.11 of the Eden TSL must be amended to require the independent surveyors (recommended in section 7.4 above) to undertake Koala pre-harvest surveys during the Koala breeding season that occurs prior to planned forestry activities to determine whether the areas are being used for breeding association, or has the potential for such use. To determine this, active Koala sites in the EMA must be determined and assessed in the following manner.

1. Pre-harvest surveys, must include a sweep search of the areas planned for specified forestry activities.

2. Notification of any evidence of Koala found during this sweep search, including fresh scratches on trees, Koala faecal pellets or bellows, must be given to DEC as soon as Koala evidence is found. An asterisk searches, as well as transects searches for Koalas must then be undertaken to determine whether Koalas are in occupation. Current conditions should then apply.

3. A search of the whole compartment must then be undertaken to identify Koala numbers and a representative sample of faecal pellets collected.

4.All Koala faecal pellets found in pre-harvest surveys must then be sampled to for consistent size differentiation to determine potential breeding males and females.

5. DNA samples of all koala faecal pellets must then be undertaken to determine site fidelity and to determine population numbers of Koalas in occupation.

6. If either of the above assessments result in positive determinations, Koala bellows must be sampled and assessed through unobtrusive visits at night to the identified active Koala sites during the breeding season, or automatically recorded by recording stations triggered by the sound of a bellowing koala. This also needs to be played back at the end of the breeding season to help identify territorial fidelity of males.

If 4, 5 or 6 be assessed as positive the areas must be determined as a Koala breeding association area and all Koala feed trees identified by Phillips (2000) over 30cm DBH as well as any core interaction trees (identified by severe scratches) must be protected from logging.

Recommendation 124.

DEC must develop landscape Koala protocols for the EMA that include the protection from logging of all Koala feed trees identified in Phillips (2000) in known clusters of Koala strongholds in the Bermagui/Murrah areas (including the catchments of the Murrah and Bermagui Rivers and the Cuttagee Creek extending through the Niaira and Dignam's Creek areas) and the Yurammie/Tantawangalo areas. Such identified Koala feed trees must also be protected in corridors on State Forest tenure between these areas to allow for effective genetic interaction. These corridors can be assessed using the methodology set out in Recommendation 119.

Recommendation 125

All known clusters of Koala strongholds and areas identified as Koala breeding associations in the Eden IFOA area must be rezoned as Forest Management Zone 2.

While FNSW must ensure that its operations do not hinder the sustained ecological viability of flora in the EMA,[95] the same is not so for fauna. In the EMA, the Koala is at serious risk of regional extinction and action must be urgently taken to reverse this trend. After undertaking community surveys Lunney *et al* (1997) found that:

> ...koalas are rare in the Eden region, and that the number of koalas has been constantly low for the last four decades... The once abundant and widespread local koala population of late last century has been reduced by habitat loss and fragmentation to a few small, isolated populations.

[95] Cl. 26

Even though important Koala habitat was reserve as part of the CRA, there is still insufficient high quality Koala habitat protected in reserve to adequately ensure the survival of this species in the region. Indeed, the EMA CRA outcome for Koalas was poor. While only about 50% of habitat thought necessary to sustain the species in the long term is protected in reserves, the intensity of logging as a result of Alternate Coupe logging and the introduction of intensive woodchip extraction was not taken into account when determining habitat requirement for viable Koala populations. Most forest in the EMA is young regrowth and of poor Koala habitat potential; due to the level of habitat fragmentation and the poor condition of much of the forest regrowth, Koalas in the EMA require much larger areas to survive than the 50ha suggested by the expert panel who developed the CRA Koala data and models.

Koalas are extremely rare in the EMA. Allen (1999) states that it has been over ten years since FNSW's pre-logging surveys encountered Koala evidence (Murrah forest in 1994). It is, therefore, patently obvious that to expect FNSW to actually find Koala evidence is both unproductive and ineffective. Indeed, no matter the technique or the will used by the Koala surveyor, to rely on species specific conditions to be triggered by Koala evidence in the EMA is ineffective in mitigating the impacts of logging on this species and will do nothing to secure its future in the Region. As current Koala conditions are unreliable to safely integrate Koala conservation with current logging intensity in the EMA, all Koala habitat sustaining breeding associations must be protected in Forestry Management Zones (FMZ) 2.

Landscape protocols also need to be developed along the same lines as Large Owl landscape protocols. However, it is apparent that current Koala habitat modelling in the EMA is not useful in developing such protocols. Allen (1999) suggests that;

> Despite some inaccuracies, NPWS Wildlife Atlas records provide a useful guide as to where there are concentrations of Koala records. These occur in clusters in the Bermagui/Murrah and Yurammie/Tantawangalo areas. Based on this evidence Cork (1995) concluded that these areas contain the most significant populations of Koalas known in the southeast. There has been no evidence since the assessment by Cork (1995) that indicates that any other comparable population in the region exists.
>
> Of the two areas, the Bermagui/Murrah appears to sustain a higher number of koalas ranging over a larger area (South East Forests Conservation Council 1998). This includes the catchments of the Murrah and Bermagui Rivers and the Cuttagee Creek. More recent surveys suggest that this population extends through the Niaira and Dignam's Creek areas (SFNSW unpublished data).

Allen (1999) further suggests that:

> Koala numbers in the Tantawangalo and Yurammie forests appear to have declined in recent years and there is very real concern that the population in the former area is

now extinct. Nevertheless, a precautionary approach to these areas is warranted until clearer evidence emerges as to their conservation status. The conservation of koala habitat is more critical in and around these core areas. This is because Koalas are more likely to use these areas as they extend out from their maternal home ranges into adjoining suitable habitat, or return to join a breeding association after dispersal.

In these areas retention of *all* species identified in Phillips (2000) as Koala browse species that are over 30cm DBH is the only way to ensure that the Koalas' food supply is not reduced. Other species may well be important for the health of the ecosystem. For example, *E. tricarpa* is one of the few winter-flowing eucalypts and as such may provide habitat and food for a range of species that are essential for the health of the ecosystem. Although a moratorium on logging in these core Koala areas appears to be the *only* appropriate method of adequately mitigating the effects of such intensive logging in the EMA, it is possible that some flexibility to a blanket moratorium could be considered. For example, some of the pure strands of *E.maculata* in the Bermagui area could not be considered to be important for Koalas.

Between these two core areas is contiguous forest that is largely in the reserve system, although some forests continue to be managed by FNSW (eg Mumbulla and Tanja State Forests). One of the strategies of the recovery program must be to encourage the exchange of Koalas between the core areas described above to maximize genetic interchange of the populations. Therefore, Koala habitat that occurs in this corridor should also be considered as an important resource for Koalas.

While the above strategy will inevitably mean a reduction in woodchip and sawlog volumes being extracted, the acceptance of such is essential for the Regional survival of this iconic species. Any reductions in access to timber will, however, be relatively small in terms of the overall timber volumes available from across the region. This is because all core Koala areas have been intensively logged in the first of the alternate coupes. Many areas have had the second of the alternate coupes also logged (eg much of southern Murrah and Bermagui forests).

7.11.8. Yellow-bellied Gliders

Recommendation 126.

A condition must be inserted into the TSLs requiring FNSW to install a 60ha exclusion zone around all identified Yellow-bellied Glider territories.

The Yellow-bellied Glider *Petaurus australis* is an arboreal marsupial that has an extensive but patchy distribution in native eucalypt forests along the east coast of Australia (Godingray and Possingaham, 1995). It is considered a vulnerable species due to widespread habitat loss and low population densities resulting from social groups using exclusive homeranges of 25-

85 ha (Godingray and Possingaham, 1995). Within a stand containing a range of stem sizes, Kavanagh (1987) found that yellow-bellied gliders foraged preferentially in the largest trees in a study area. This evidence implies that foraging requirements contribute to the finding that Yellow-bellied Gliders are most likely to occur in large areas of oldgrowth.

The CRA outcomes for Yellow-belied Gliders were poor. In north-east IFOA forests, for example, the Expert Panel identified the viable population of 3,460 breeding pairs of Yellow-bellied Gliders in three discrete populations was required to be protected, yet the CRA only protected sufficient habitat for a mere 20% of these (Pugh, 1998).

TSL condition 6.17 requires the retention of 15 feed trees within 100 metres of a sap feed tree, observation or den site record, and within 200 m of a call-detection site record, and a 50m exclusion around den sites. These trees are for food, however, and not necessarily roost or nest trees, which are supposed to be provided under the broad area hollow-bearing tree retention condition 5.6.

Incol *et al* (2001) suggest that the persistence of a yellow-bellied glider family maintaining a home range of about 50 ha, is limited by food, whereas occurrence of greater gliders may be limited by hollows. These authors found yellow-bellied gliders in small areas of oldgrowth forest (6, 18, and 35 ha). A population viability analysis (PVA) has suggested that 150 glider groups would be necessary to maintain a viable population requiring a fully occupied forest area of 9750 ha (Goldingay and Possingham, 1995). This suggests that yellow-bellied gliders may be susceptible to local extinction in small fragmented oldgrowth patches. Results from Possingham *et al* (1994) and other studies support the view by Lindenmayer and Lacy, (1995a,b,c) that selected areas of regrowth forest should be excluded from current rotations of 80-120 years to ensure the continuing recruitment of oldgrowth forests (Loyn, 1985; Macfarlane and Seebeck, 1991; Lindenmayer and Possingham, 1995; Possingham *et al*., 1994; Goldingay and Possingham, 1995).

Incol *et al* (2001) showed that large patches are preferable to multiple small patches of oldgrowth forest for Yellow-Bellies and Greater Gliders. Similarly, Milledge *et al*. (1991) found that sooty owls and yellow-bellied gliders were associated with large patches of oldgrowth forest.

As Yellow-bellies are reliant on oldgrowth patches to survive, have a family home range of 25-85 ha of oldgrowth which can not be provided by those feed trees and hollow-bearing trees presently retained, small 60ha areas retained around identified Yellow-bellied Glider sites would best provide the requisite feed trees and hollow-bearing trees for a Yellow-bellied Glider family within logged forests.

References

Allen, C., 1999**.** Submission on IFOA survey and logging Protocols for koalas in the Eden region. Prepared for the National Parks Association Far South Coast Branch

Anonymous 1998. Forest Grazing. Queensland CRA/RFA Steering Committee, Queensland and Commonwealth Government Brisbanne.

Amaranthus MP, Trappe. JM. 1993. Effects of erosion on ecto- and VA-mycorrhizal inoculum potential of soil following forest fire in southwest Oregon. *Plant and Soil* **150**: 41–19.

Armour, C. L., Duff, D. A., Ellmore, W. 1991. The effects of livestock grazing on riparian and stream ecosystems. *Fisheries* **16,** 7-11.

Aust, W.M., Reisinger, T.W., Burger, J.A. and Stokes, B.J., 1993. Soil physical and hydrological changes associated with logging a wet pine flat with wide-tired skidders. *SJAF* **17**, 22–25

Aust, W.M., Tippett, M.D., Burger, J.A. and McKee Jr., W.H., 1995. Compaction and rutting during harvesting affect better drained soils more than poorly drained soils on wet pine flats. *SJAF* **19**, 72–77.

Bauhaus J., Khana P. K. and Raison R. J. 1993. The effect of fire on carbon and nitrogen mineralisation and nitrification in an Australian forest soil. *Aust. J. Soil Res.* **31,** 621–39.

Ballard TM. 2000. Impacts of forest management on northern forest soils. *Forest Ecology and Management* **133**: 37–42.

Barker, J., Grigg, G. C., and Tyler, M. J. 1995. A field guide to Australian frogs, 2nd ed., Surry Beaty: Sydney.

Barton, P., Erhart, D. W., Biette, R. M. 1985. Dimensions of riparian buffer strips required to maintain trout habitat in Southern Ontario streams. *North American Journal of Fish Management*. **5**, 364-378.

Battigelli J, Berch S. 2002. Soil fauna in the Sub-Boreal Spruce (SBS) installations of the Long-Term Soil Productivity (LTSP) study of central British Columbia: One-year results for soil mesofauna and macrofauna. *British Columbia Ministry of Forests Note* #LTSPS-05. **131**: 461–469.

Baxter JW, Dighton J. 2001. Ectomycorrhizal diversity alters growth and nutrient acquisition of grey birch (*Betula populifolia*) seedlings in host-symbiont culture conditions. *New Phytologist* **152**: 139–149.

Baur, G. N. (1968) Developing a clasification system of forests in NSW. Paper to 9th Comm. For Conf

Baumgartl, T., Rostek, J. and Horn, R., 2000. Internal and external stresses affecting the water retention curve. In: Horn, R., van den Akker, J. and Arvidsson, J., Editors, 2000. *Soil Compaction: Distribution, Processes and Consequences Advances in GeoEcology* vol. 32, Catena-Verlag, Reiskirchen, **13**–21 462

Beebee, T.J., 1992. Amphibian decline? *Nature* (London) 355, 120.

Belcher, C. A. 2003. Demographics of Spotted-tailed Quoll *(Dasyurus maculatus maculatus*) populations in southeastern Australia. Australian Journal of Zoology, **51**, 611-626

Bennett, R.J., 1989. Dry rainforest-fire interactions in the Apsley-Macleay gorges: Implications for management, M. Nat. Res. thesis, University of New England, Armidale.

Bennett, A.F., Lumsden, L.F., Nicholls, A.O., 1994. Tree hollows as a resource for wildlife in remnant woodlands: spatial and temporal patterns across the northern plains of Victoria, *Australia. Pac. Conserv. Biol*. **1**, 222–235.

Berger, L., Spear, R., Daszac, P., Green, D. E., Cunningham, A. A., Goggin, C. L., Slocombe, R., Ragan, M. A., Hyatt, A. D., McDonald, K. R., Hines, H. B., Lips, K. L., Marantelli, G., Parks, H., 1998. Chrydomycosis causes amphibian mortality associated with population declines in rain forests of Australia and Central America. *Proceedings of the National Academy of Science* **95,** 9031-9036.

Bird BA, Chatarpaul L. 1986. Effects of whole-tree and conventional forest harvest on soil microarthropods. *Canadian Journal of Zoology* **64**: 1986–1993.

Bisson, P.A., Sedell, J.R., 1984. Salmonid populations in streams in clearcut vs. oldgrowth forests of western Washington. In: Meehan, W.R., Merrell Jr., T.R., Hanley, T.A. (Eds*.), Fish and Wildlife Relationships in Oldgrowth Forests.* American Institute of Fisheries Research and Biology, Juneau, Alaska, pp. 121–129.

Bren, L.J. and Leitch, C.J., 1985. Hydrologic effects of a stretch of forest road. *Aust. For. Res.* **15**, 183–194.

Blaustein, A.R., Wake, D.B., 1990. Declining amphibian populations: a global phenomenon*? Trends in Ecology and Evolution.* **5,** 203-204.

Borsboom, A., 1991. Senescent Tree Study Report. Queensland Department of Primary Industries, Brisbane, Australia.

Borsboom, A. 1996. A forest for frogs. *Wildlife Australia*, Spring, 26-29.

Braithwaite, L. W., Binns, D. L., and Nowlan, R. D. 1988. The distribution of arboreal marsupials in relation to eucalypt forest types in the Eden New South Wales Australia wood chip concession area *Australian Wildlife Research.* **15**(4). 363-374.

Boughton, W.C., 1970. E.ects of Land Management on Quantity and Quality of Available Water. A Review (Water Resources Lab. Report No. 120). University of NSW, Sydney.

Brundrett MC, Ashwath N, Jasper DA. 1996. Mycorrhizas in the Kakadun region of tropical Australia. I. Propagules of mycorrhizal fungi and soil properties in natural habitats. *Plant and Soil* **184**: 159–171.

Calver, M. C., and Dell, J. 1998. Is there evidence of direct links between forestry practices and species decline and extinction? Pacific *Conservation Biology*. **4**(4). 296-314.

Campbell, I.C., Doeg, I.J., 1989. The impact of timber production and harvesting on streams: a review. *Australian Journal of Marine and Freshwater Research* **40**, 519–539.

Catling, P. C., and Burt, R. J.,.1995. Studies of the ground-dwelling mammals of eucalypt forests in Southeastern New South Wales: The effect of habitat variables on distribution and abundance. *Wildlife Research.* **22**(3).271-288.

Catling, P.C., Burt, R.J. and Forrester, R.I., 2002. Models of the distribution and abundance of ground-dwelling mammals in the eucalypt forests of northeast New South Wales in relation to environmental variables. *Wildlife Research,* **29**, 313-322.

Chambers D. P. and Attiwill P. M. 1994. The ashbed effect in *Eucalyptus regnans* forest: Chemical, physical and species tended to be rich in nutrients when compared microbiological changes in soil after heating or partial sterilisation. *Aust. J. Bot.* **42,** 739–49.

Chandler, L.G., 1922. Bush Charms. Whitcombe and Tombs, Melbourne.

Chen DM, Cairney JWG. 2002. Investigation of the influence of prescribed burning on ITS profiles of ectomycorrhizal and other soil fungi at three Australian sclerophyll forest sites. *Mycological Research* **106:** 532–540.

Claridge, A. W. 2002. Ecological role of hypogeous ectomycorrhizal fungi in Australian forests and woodlands. *Plant and Soil*. **244**(1-2). 291-305.

Clarke, M.F., 1984. Interspecific aggression within the genus *Manorina*. *Emu* **84**, 113–115

Clarke, M.F., 1984. Co-operative breeding by the Australian Bell Miner, *Manorina melanophrys* Latham: a test of kin selection theory. *Behav. Ecol. Sociobiol.* **14**, 137–146

Clarke, M.F. and Fitz-Gerald, G.F., 1994. The spatial organization of the cooperatively breeding Bell Miner, *Manorina melanophrys*. *Emu* **94**, 96–105

Clark, J. 2001. The global wood market, prices and plantation investment: An examination drawing on the Australian experience. *Environmental Conservation.* **28**(1). 53-64.

Clarke, M. F., and Schedvin, N. 1999. Removal of bell miners *Manorina melanophrys* from *Eucalyptus radiata* forest and its effect on avian diversity, psyllids and tree health. *Biological Conservation* . **88** (1) 111-120

Clarke, P. J., and Knox, K J.,. 2002. Post-fire response of shrubs in the tablelands of eastern Australia: do existing models explain habitat differences? *Aust. J. Bot.*, **50,** 53–62

Clinnick, P.F., 1985. Buffer strip management in forested areas: a review. *Australian Forestry* **48**, 34–45.

Corn, P.S., Bury, R.B., 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. *Forest Ecology and Management* **29**, 39–57.

Commonwealth of Australia. 1997. *Australia's First Approximation Report for the Montreal Process.* Montreal Process Implementation Group for Australia, Canberra, Australia.

Commonwealth of Australia. 2004. *Sustainable Forest Management – Criteria and Indicators for Sustainable Management of Australia's Forests.* Montreal Process Implementation Group for Australia, Canberra, Australia.

Croke, J., Hairsine, P. and Fogarty, P., 1999a. Runoff generation and redistribution in logged eucalyptus forests, southeastern Australia. *J. Hydrol.* **216**, 55–77.

Croke, J., Hairsine, P. and Fogarty, P., 1999b. Sediment production, storage and redistribution on logged hillslopes. *Hydrol. Process.* **13**, 2705–2720

Cork, S. J., 1995. *Koala Conservation in the South East Forests*. NPWS, PO Box 1967, Hurstville, NSW, 2220.

Corn, P.S., Bury, R.B., 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. *Forest Ecology and Management* **29**, 39–57.

Corn, P.S., Bury, R.B., 1991. Terrestrial amphibian communities in the Oregon Coast Range. In: Ruggerio, Douglas-fir forests, USDA Forest Service General Technical

Cornish, P.M., Binns, D., 1987. Streamwater quality following logging and wild.re in a dry sclerophyll forest in southeastern Australia. .*Forest Ecology and Management* **22** 1-28.

Cornish, P M. 1993. The effects of logging and forest regeneration on water yields in a moist eucalypt forest in NSW, Australia. Journal of Hydrology, **150**, 301-322.

Davies, P.E., Nelson, M., 1994. Relationships between riparian buffer widths and the effects of logging on stream habitat, invertebrate community composition and fish abundance. *Australian Journal of Marine and Freshwater Research* **45**, 1289–1305.

Dexter, A.R., 2004. Soil physical quality Part I. Theory, effects of soil texture, density, and organic matter, and effects on root growth. Geoderma, **120.** 201-214

Dignan, P., and Bren, L. 2003. A study of the effects of logging on the understorey light environment in riparian buffer strips in a southeast Australian forest. Forest Ecology and Management **172**, 161-172

DOP, 1993b. Wingham Management Area Determination, Department of Planning. Supplementary Director's Report, Kibble 16.3.93.

DOP, 1995. Environmental Impact Assessment Report for Eden Management Area 1994 EIS. Department of Planning, Kibble, 18.9.95.

Duggin, J. A., and Gentle, C. B. 1998. Experimental evidence on the importance of disturbance intensity for invasion of *Lantana camara* L. in dry rainforest-open forest ecotones in northeastern NSW, Australia. Forest Ecology and Management **109**, 279-292

Fan, Z., Shifley, S., Spetich, M., Thompson, F., Larsen, D., 2002. Distribution of cavity trees in midwestern oldgrowth and second-growth forests. Can. J. For. Res. **33**, 1481–1494.

Flecker, A.S., Feifarek, B.P., Taylor, B.W., 1999. Ecosystem engineering by a tropical tadpole: density-dependent efects on habitat structure and larval growth rates. *Copeia*, 495–500.

Fetcher, N., Strain, B.R., Oberbauer, S.F., 1983. Effects of light regime on the growth, leaf morphology, and water relations of seedlings of two species of tropical trees. *Oecologia* **58,** 314-319.

Florence, R.G., 1996. Ecology and Silviculture of Eucalypt Forests. CSIRO Publishing, Collingwood, Vic. Forest Resources and Management Evaluation Systems

Forcella, F., Harvey, S.J., 1983. Eurasian weed infestation in western Montana in relation to vegetation and disturbance. *Madrono* **30**, 102-109.

Froehlich, H.A., 1979. Soil compaction from logging equipment: effects on growth of young ponderosa pine. *J. Soil Water Conserv*. **34**, 276–278

Froehlich, H.A., Miles, D.W.R. and Robbins, R.W., 1985. Soil bulk density recovery on compacted skid trails in Central Idaho. *Soil Sci. Soc. Am. J.* **49**, 1015–1017.

Forge TA, Simard SW. 2000. Trophic structure of nemotode communities, microbial biomass, and nitrogen mineralization in soils of forests and clearcuts in the southern interior of British Columbia. *Canadian Journal of Soil Science* **80**: 401–410.

Gent, J.A., Ballard Jr., R. and Hassan, A.E., 1983. Impact of harvesting and site preparation on physical properties of Lower Coastal Plain forest soils. *Soil Sci. Soc. Am. J.* **47**, 595–598

Gent, J.A., Ballard Jr., R., Hassan, A.E. and Cassel, D.K., 1984. Impact of harvesting and site preparation on physical properties of Piedmont forest soils. *Soil Sci. Soc. Am. J.* **48**, 173–177.

Gibbons, 1994. Sustaining key old growth characteristics in native forests used for wood production: retention of trees with hollows. in *Ecology and Sustainability of Southern Temperate Ecosystems.* P.W Norton and S.R. Dovers (Eds.) CSIRO Collingwood. pp 59-84

Gibbons, P., 1999. Habitat tree retention in wood production forests. Ph.D. Thesis. The Australian National University, Canberra.

Gibbons, P., and Lindenmayer, D. B. 1996. Issues associated with the retention of hollow-bearing trees within eucalypt forests managed for wood production. *Forest Ecology and Management* **83**, 245-279.

Gibbons, P., and Lindenmayer, D. B. 1997. Developing tree retention stratergies for hollow-dependant arboreal marsupials in the wood production eucalypt forests of eastern Australia. *Australian Forestry* **60**, 29-45.

Gibbons, P. and Lindenmayer, D.B., 1997b. A review of prescriptions employed for the conservation of hollow-dependent fauna in wood production forests of south-eastern Australia. In: P. Hale and D. Lamb (Eds) *Conservation Outside Nature Reserves*, Centre for Conservation Biology, University of Queensland, pp. 497-505.

Gibbons, P. and Boak, M. 2000. The importance of paddock trees for regional conservation in agricultural landscapes. NPWS, Discussion Paper for Riverina Highlands Regional Vegetation Committee.

Gibbons, P., Lindenmayer, D.B., Barry, C., Tanton, M.T., 2001. Hollow formation in eucalypts from temperate forests in southeastern Australia. *Pacific Conserv. Biol.* **6,** 218–228.

Gibbons, P., Lindenmayer, D.B., 2002. Tree Hollows and Wildlife Conservation in Australia. CSIRO Publishing, Sydney, 211 pp.

Gibbons, P., Lindenmayer, D.B., Barry, C., Tanton, M.T., 2002. Hollow selection by vertebrate fauna in forests of southeastern Australia and implications for forest management *Biol.Conserv.* **103**, 1–12.

Gillespie, G. R. 2002. Impacts of sediment loads, tadpole density, and food type on the growth and development of tadpoles of the spotted tree frog *Litoria spenceri:* an in-stream experiment. *Biological Conservation* **106**, 141–150

Goldingay, R., and Kavanagh, R. 1993. Home-range estimates and habitat of the yellow-bellied glider (Petaurus australis) at Waratah Creek, New South Wales. *Wildlife Research.* **20**(3). 387-404.

Goldingay, R., and Possingham, H. 1995. Area requirements for viable populations of the Australian gliding marsupial Petaurus australis. *Biological Conservation*. **73**(2), 161-167.

Grayson, R.B., Haydon, S.R., Jayasuriya, M.D.A. and Finlayson, B.L., 1993. Water quality in mountain ash forests- separating the impacts of roads from those of the logging operation. *J. Hydrol.* **150**, 459–480

Greacen, E.L. and Sands, R., 1980. A review of compaction of forest soils. *Aust. J. Soil Res.* **18**, 163–189.

Graynoth, E., 1979. E.ects of logging on stream environments and faunas in Nelson. *New Zealand Journal of Marine and Freshwater Research* **13**, 79–109.

Grogan P, Baar J, Bruns TD. 2000. Below-ground ectomycorrhizal community structure in a recently burned bishop pine forest. *Journal of Ecology* **88:** 1051–1062.

Guinto, D. F., Xu, Z. H., House, A. P., and Saffigna. 2001. Soil chemical properties and forest floor nutrients under repeated prescribed-burning in eucalypt forests of southeast Queensland, Australia *New Zealand Journal of Forestry Science*. **31**(2)170-187.

Gurtz, M.E., Wallace, J.B., 1984. Substrate-mediated response of stream invertebrates to disturbance. *Ecology* **65**, 1556–1569.

Harper, M. J., McCarthy, M. A., van der Reeb, R., and Fox, J. C., 2004. Overcoming bias in ground-based surveys of hollow-bearing trees using double-sampling. Forest Ecology and Management **190**, 291–300.

Harvey AE, Larsen MJ, Jurgensen MF. 1980b. Partial cut harvesting and ectomycorrhizae: early effects in Douglas-fir-larch forests of western Montana. *Canadian Journal of Forest Research* **10**: 436–440.

Heatwole, H., 1962. Environmental factors influencing local distribution and activity of the salamander Plethodon cinereus. *Ecology*. **43**, 460-472.

Henderson, M. K., and Keith, D. A. 2002. Correlation of burning and grazing indicators with composition of woody understorey flora of dells in a temperate eucalypt forest. *Austral Ecology*. **27**(2). 121-131.

Hines, H. B., Mahony, M. J., McDonald, K. R. 1999. An assessment of frog decline in wet subtropical Australian frogs. (Ed. A. Campbell), Environment Australia: Canberra, pp 44-63

Huang, J., Lacey, S.T. and Ryan, P.J., 1996. Impact of forest harvesting on the hydraulic properties of surface soil. *Soil Sci*. **161**, 79–86.

Huenneke, L.F., Hamburg, S.P., Koide, R., Mooney, H.A., Vitousek, P.M., 1990. Effects of soil resources on plant invasion and community structure in Californian serpentine grassland. *Ecology* **71**, 478-491.

Hughes, L. 2003. Climate change and Australia: Trends, projections and impacts. *Austral Ecology*. **28**(4). 423-443.

Humphries F. R. and Lambert M. J. (1965) An examination of a forest site which has exhibited the ashbed effect. *Aust. J. Soil Res.* **3,** 81–94.

Huhta V, Karppinen E, Nurinem M, Valpas A. 1967. Effect of silvicultural practices upon arthropod, annelid, and nematode populations in coniferous forest soil. *Annales Zoologici Fennici* **4:** 87–113.

Incerti, M., Clinnick, P.F. and Willatt, S.T., 1987. Changes in the physical properties of a forest soil following logging. *Aust. For.* **17**, 91–108.

Incoll, W.D., 1979. Effect of overwood trees on growth of young stands of Eucalyptus sieberi. Aust. For. **42**, 110–116.

Incoll. R. D.,, Loyn. R. H. , Ward. S. J., Cunningham. R. B., Donnelly. C. F. 2001.The occurrence of gliding possums in oldgrowth forest patches of mountain ash (*Eucalyptus regnans*) in the Central Highlands of Victoria. *Biological Conservation* **98**, 77-88

Ismail, B.S., Rosmini, B.I., Samiah, K., 1996. Factors affecting germination of Siam weed (Chromolaena odorata (L.) King and Robinson) seeds. *Plant Protection Quarterly* **11,** 2-5.

Jacobs, M.R., 1955. Growth Habits of the Eucalypts. Commonwealth of Australia Government Printer. Canberra, Australia.

Jakobsen, B.F., 1983. Persistence of compaction effects in a forest Kraznozem. *Aust. For. Res.* **13**, 305–308.

Jakobsen, B.F. and Greacen, E.L., 1985. Compaction of sandy forest soils by forwarder operations. *Soil Till. Res.* **5**, 55–70.

Jayasuria M D A, Dunn G, Benyon R and O'Shaughnessey P J. (1993) Some factors affecting water yield from mountain ash (*Eucalyptus regnans)* dominated forests in southeast Australia. *Journal of Hydrology*, **150**, 345-367

Johnson, M.G. and Beschta, R.L., 1980. Logging, infiltration capacity, and surface erodibility in western Oregon. *J. For.* **78**, 334–337.

Jones, M. D., Durall, D. M., and Cairney, J. W. G. 2003 Ectomycorrhizal fungal communities in young forest stands regenerating after clearcut logging *New Phytologist,* **157,** 399–422

Katou, H., Miyaji, K. and Kubota, T., 1987. Susceptibility of undisturbed soils to compression as evaluated from the changes in the soil water characteristic curves. *Soil Sci. Plant Nutr.* **33** 4, 539–554

Kavanagh, R.P., 1987. Forest phenology and its effect on foraging behaviour and selection of its habitat by the yellow-bellied glider conservation (Petaurus australis: Shaw). *Australian Wildlife Research*. **14**, 371-384.

Kavanagh, R. P., and Murray, M. 1996. Home range, habitat and behaviour of the Masked Owls Tyto novaehollandiae near Newcastle, New South Wales. *Emu.* **96**(4), 250-257.

Kavanagh, R., and Webb, G A.1998. Effects of variable-intensity logging on mammals, reptiles and amphibians at Waratah Creek, southeastern New South Wales. Pacific Conservation Biology. **4**(4). 326-347.

Kavanagh, R. P., and Stanton, M. A. 2003. Bird population recovery 22 years after intensive logging near Eden, New South Wales. *Emu*. **103**(3). 221-231.

Kuczera, G. 1985. Prediction of water yield reductions following a bushfire in ash-mixed species eucalypt forest. Melbourne and Metropolitan Board of Works. Report No. MMBW-W-0014.

Kuczera, G.A., 1987. Prediction of water yield reductions following a bushfire in ash-mixed species eucalypt forest. *J. Hydrol*. **94,** 215-236.

Lacey, S.T. and Ryan, P.J., 2000. Cumulative management impacts on soil properties on soil physical properties and early growth of *Pinus radiata*. *For. Ecol. Manage.* **138**, 321–333

Lacey, S. T. 2000. Runoff and sediment attenuation by undisturbed and lightly disturbed forest buffers. *Water, Air, and Soil Pollution.* **122**(1-2). 121-138.

Landsburg, J., and Wylie, F. R. 1983. Water stress leaf nutrients and defoliation a model of dieback of rural eucalypts. Journal of Ecology. **8**(1).. 27-42.

Landsberg J. 1990. Dieback of rural eucalypts: Does herbivory relate to dietary quality of tree foliage? *Aust. J. Ecol.* **15,** 72–87.

Lane, P.N.J., Mackay, S.M., 2001. Streamflow response of eucalypt forests to patch cutting and thinning treatments. *For. Ecol. Mgmt.* **150,**

Langford, K.J., 1976. Change in yield of water following a bushfire in a forest of Eucalyptus regnans. *J. Hydrol*. **29**, 87 - 114.

Langford, K.J., O'Shaughnessy, P.J. (Eds.), 1980. Water Supply Catchment Research (Second Progress Report, Coranderrk.MMBW Report W0010). Melbourne and Metropolitan Board of Works.

Lee, D. W. 1987. The spectral distribution of radiation in two neotropic rainforests. *Biotropica.* **19** (2), 22-30

Leigh, J. H., and Holgate, M. D,. 1979. The response of the understorey of forests and woodlands of the Southern Tablelands to grazing and burning. *Australian Journal of Ecology*, **4,** 25-45.

Lemckert, D. W. 1999. Impacts of selective logging on frogs in a forest area of Northern New South Wales. *Biological Conservation*. **89**, 321-328.

Lemckert, F,.1998. A survey for threatened herpetofauna of the south-west slopes of New South Wales. *Zoologist***. 30** (4). 492-500.

Lockaby, B.G. and Vidrine, C.G., 1984. Effect of logging equipment traffic on soil density and growth and survival of young loblolly pine. *South. J. Appl. For.* **8**, 109–112.

Lindenmayer, D.B., Cunningham, R.B., Donnelly, C.F., Tanton, M.T., Nix, H.A., 1993. The abundance and development of cavities in Eucalyptus trees: a case study in the montane forests of Victoria, southeastern Australia. *Forest Ecology and Management.* **60**, 77–104.

Lindenmayer, D.B., Cunningham, R.B., Donnelly, C.F., 1997. Decay and collapse of trees with hollows in eastern Australian forests: impacts on arboreal marsupials. *Ecol. Applicat.* **7**, 625–641.

Lindenmayer, D.B., Cunningham, R.B., Tanton, M.T., Smith, A.P., Nix, H.A., 1990. Habitat requirements of the mountain brushtail possum and the greater glider in the montane ashtype eucalypt forests of the central highlands of Victoria, Australia. Aust. *Wildl. Res*. **17**, 467–478.

Lindenmayer, D.B., Cunningham, R.B., Pope, M., Donnelly, C.F., Gibbons, P., 2000. Cavity sizes and types in Australian eucalypts from wet and dry forest types—a simple rule of thumb for estimating size and number of cavities. *For. Ecol. Manage.* **137**, 139–150.

Lindenmayer, D. B., Claridge, A. W., Gilmore, A. M., Michael, D., and Lindenmayer, B. D. 2002 b. The ecological roles of logs in Australian forests and the potential impacts of harvesting intensification on log-using biota. .*Pacific Conservation Biology***. 8**(2). 121-140.

Lindenmayer, D.B., Lacy, R.C., 1995a. Metapopulation viability analysis of arboreal marsupials in fragmented oldgrowth forests:comparison among species. *Ecological Applications* **5**, 183-199.

Lindenmayer, D.B., Lacy, R.C., 1995b. Metapopulation viability analysis of Leadbeater's possum, *Gymnobelideus leadbeateri*, in fragmented oldgrowth forests. *Ecological Applications* **5**, 164-182.

Lindenmayer, D.B., Lacy, R.C., 1995c. A simulation study on the impacts of population subdivision on the mountain brushtail possum, Trichosurus caninus Ogilby (*Phalangeridae: marsupialia*) in south-eastern Australia I. Demographic stability and population persistence. *Biological Conservation* **73**, 119-129.

Lindenmayer, D. B., MacGregor, R. B., Cunningham, R. B., Incoll, R. D., Crane, M., Rawlings, D., and Michael, D.R., 2003. The use of nest boxes by arboreal marsupials in the forests of the Central Highlands of Victoria. *Wildlife Research*, **30**, 259-264.

Lindenmayer, D. B., Cunningham, R. B., MacGregor, C., Incoll1, R. D., Michael, D. A survey design for monitoring the abundance of arboreal marsupials in the Central Highlands of Victoria . 2003. .*Biological Conservation* **110** , 161–167

Lowman, M. D., and Heathwhole, H. 1992.. Spatial and temporal variability in defoliation of Australian Eucalypts. *Ecology.* **73**(1) 129-142.

Loyn, R.H., 1985. Strategies for conserving wildlife in commercially productive eucalypt forest. *Aust. For*. **48**, 95–101.

Lunney, D., Cullis, B., and Eby, P. 1987. Effects of logging and fire on small mammals in Mumbulla State Forest near Bega New South Wales Australia. *Australian Wildlife Research*. **14**(2). 163-182.

Lunney, D., Esson, C., Moon, C., Ellis, M., and Alison, M. 1997. A community-based survey of the koala, Phascolarctos cinereus, in the Eden region of Southeastern New South Wales. *Wildlife Research.* **24**(1). 111-128.

Loyn, R.H., Runnalls, R.G., Forward, G.W. and Tyers, J., 1983. Territorial Bell Miners and other birds affecting populations of insect prey. *Science* **221**, pp. 1411–1412

Loyn, R.H., 1985. Birds in fragmented forests in Gippsland, Victoria. In: Keast, A., Recher, H., Ford, H.F., Saunders, D. (Eds.), Birds in Eucalypt Forests and Woodlands: Ecology, Conservation and Management, Surrey Beatty, Sydney. pp. 323-331.

Loyn, R.H., 1987. The bird that farms the dell. *Nat. Hist.* **96**, pp. 54–60

Loyn, R.H., 1995. Bell Miners and the farming hypothesis—a comment. *Emu* **95**, pp. 145–146

Macfarlane, M.A., and Seebeck, J.H., 1991. *Draft management strategies for the Conservation of Leadbeater's Possum Gymnobelideus leadbeateri in Victoria*. Arthur Rylah Institute Technical Report Series No. 111, Department of Conservation and Environment, Melbourne.

MacKay S M and Cornish P M. 1982. Effects of wildfire and logging on the hydrology of small catchments near Eden, NSW. *Proceedings of the First National Symposium on Forest Hydrology.* National Conference Publication No. 82/6. Institution of Engineers of Australia . 111-117

Mackensen, J., Bauhus, L., and Webber, E. 2003. Decomposition rates of coarse woody debris: A review with particular emphasis on Australian tree species. .Jo*urnal of Botany*. **51**(1). 27-37.

McMullan-Fisher, Saphire, J. M., May, T. W., and Keane, P. J. 2002. The macrofungal community and fire in a Mountain Ash forest in southern Australia.. *Fungal Diversity*. **10**, 57-76.

MacNally, R., Horrocks, G., and Pettifer, L. 2002. Experimental evidence for potential beneficial effects of fallen timber in forests. .*Ecological Applications***. 12**(6). 1588-1594.

Mackowski, C.M., 1984. The ontogeny of hollows in Blackbutt (Eucalyptus pilularis) and its relevance to the management of forests for possums, gliders and timber. In: Smith, A., Hume, I. (Eds.), Possums and Gliders. Australian Mammal Society, Sydney, pp. 553–567.

Mackowski, C.M., 1987. Wildlife hollows and timber management, thesis for Master of Nat. Res., University of New England, Armidale, N.S.W.

Mahmood S, Finlay RD, Wallander H, Erland S., 2002. Ectomycorrhizal colonization of roots and ash granules in a spruce forest treated with granulated wood ash. *Forest Ecology and Management* **160**: 65–74.

Majer J. D., Recher H. F. and Ganeshanandam S. 1992. Variation in foliar nutrients in *Eucalyptus* trees in eastern and Western Australia. *Aust. J. Ecol.* **17,** 383–93.

Mansegh, I. 1983. The status distribution and abundance of Dasyurus-Maculatus Spotted-tailed Quoll in Australia with particular reference to Victoria *Australian Zoologist*. **21**(2). 109-122.

McIlroy, J.C., 1978. The effects of forestry practices on wildlife in Australia: a review. *Aust. For.* 41, 78–94.

McKenny, D. W., and Lindenmayer, D. R., 1994. An economic assessment of a nest box staratergy for the conservation of an endangered species. *Canadian Journal of Forest Research* **24**. 2012-2019.

May BM and Carlyle JC. 2003. Effect of defoliation associated with *Essigella alifornica* on growth of mid-rotation *Pinus radiata*. *Forest Ecology and Management* **183**, 297–312.

Means, D.B., Palis, J.G., Bagget, M., 1996. E.ects of slash pine silviculture on a Florida population of flatwoods salamander. *Conservation Biology* **10**, 426-437.

Megahan, W.F., 1974. Erosion over time on severely disturbed granitic soils: a Model Research Paper INT-156, USDA, Forest Ser., Intermountain Forest and Range Experiment Station, 14 pp

Mikola P, Laiho O, Erikainen J, Kuvaja K. 1964. The effect of slash burning on the commencement of mycorrhizal association. *Acta Forestalia Fennica* **77**: 1–11.

Milledge, D.R., Palmer, C.L., Nelson, J.L., 1991. Barometers of change: the distribution of large owls and gliders in mountain ash forests of the Victorian Central Highlands and their potential as management indicators. In: Lunney, D. (Ed*.), Conservation of Australia's Forest Fauna*. Royal Zoological Society of New South Wales, Mosman, pp. 53-65.

MMBW, 1980. MMBW Catchment Hydrology Research: Summary of Technical Conclusions to 1979 (MMBW-W-0012).MelbourneWater.

Morgan, S.R., Graynoth, E., 1978. The influence of forestry practices on the ecology of freshwater fish in New Zealand—an introduction to the literature. *Fisheries Research Division Occasional Paper No. 14.*

Morley,. S., Grant, C., Hobbs, R., and Cramer. 2004. Long-term impact of prescribed burning on the nutrient status and fuel loads of rehabilitated bauxite mines in Western Australia. *Forest Ecology and Management***. 190**(2-3). 227-239.

National Forest Inventory. 2003. *Australia's State of the Forests Report 2003.* Bureau of Rural Sciences, Canberra, Australia.

Newbold, J.D., Erman, D.C., Roby, K.B., 1980. Effects of logging on macroinvertebrates in streams with and without buffer strips. *Canadian Journal of Fisheries and Aquatic Science* **27**, 1076–1085.

Newcombe, C.P., MacDonald, D.D., 1991. E.ects of suspended sediments on aquatic ecosystems. *North American Journal of Fisheries Management* **11**, 72–82.

Newton, I., 1994. The role of nest sites in limiting the number of hole-nesting birds- a review. Biological Conservation **70**, 265-276.

Noel, D.S., Martin, C.W., Federer, C.A., 1986. Effects of forest clearcutting in New England on stream macroinvertebrates and periphyton. *Environmental Management* **10**, 661–670.

NPWS, 1999. Conservation Protocols as part of a Regional Forest Agreement for Upper North East and Lower North East. Revised Protective Measures.

Pechmann, H.K., Wilbur, H.M., 1994. Putting declining amphibian populations in perspective: natural fluctuations and human impacts. *Herpetologica* **50**, 65-84.

Parris, K. M., and Norton, T. W. 1997. The significance of State Forests for the conservation of Litoria Pearsoniana (Copeland) and associated amphibians. In Hale, P., and Lanb, D (Eds.*) Conservation Outside Nature Reserves. Centre for Conservation Biology*, University of Queensland, pp 521-526

Parris, K. 2001. Distribution, habitat requirements and conservation of he cascade treefrog (*Litoria pearsoniana, Anura*: Hylidae). *Biological Conservation* **99**, 285-292.

Pearman, P.B., 1997. Correlates of amphibian diversity in an altered landscape of Amazonian Ecuador. *Conservation Biology* **11**, 1211-1225.

Perry DA, Rose SL. 1983. Soil biology and forest productivity: opportunities and constraints. In: Ballard R, Gessel SP, eds. *IUFRO Symposium on Forest Site and Continuous Productivity, Corvallis, USA.* United States Department of Agriculture, Forest Service General Technical Report PNW-**163**, 229–238.

Pettit, N. E., Froend, R. H., Ladd, P. G. 1995. Grazing in remnant woodland vegistation, changes in species composition and life form groups. *Journal of vegetation Science*, **6,** 121-130.

Pettit, N. E., Ladd, P. G., and Froend, R. H. 1998. Passive clearing of native vegetation: Livestock damage to remnant jarrah (Eucalyptus marginata) woodlands in western Australia. *Journal of the Royal Society of Western Australia.* **81**(2). 95-106.

Pietikäinen J, Fritze H. 1995. Clearcutting and prescribed burning in coniferous forest: comparison of effects on soil fungal and total microbial biomass, respiration activity and nitrification. *Soil Biology and Biochemistry* **27**: 101–109.

Pharo, E. J. and Baettie, A. J. 2001.Management forest types as a surrogate for vascular plant, bryophyte and lichen diversity. A*ust. J. Bot*, **49**, 23–30

Parris, K. 2002. The distribution and habitat requiremnts of the great barred frog (Mixophyes fasciolatus) Wildlife Research 29, 469-474.

Pechmann, H.K., Wilbur, H.M., 1994. Putting declining amphibian populations in perspective: natural fluctuations and human impacts. *Herpetologica* **50**, 65-84.

Pennington, P.I., Laffan, M., Lewis, R., Churchill, K., in press. Impact of major snig tracks on the productivity of wet Eucalyptus obliqua forest in Tasmania measured 17–23 years after harvesting. *Aust. For. J*.

Perry DA, Rose SL. 1983. Soil biology and forest productivity: opportunities and constraints. In: Ballard R, Gessel SP, eds. *IUFRO Symposium on Forest Site and Continuous Productivity, Corvallis, USA.* United States Department of Agriculture, Forest Service General Technical Report PNW-**163**, 229–238.

Petranka, J.W., Eldridge, M.E., Haley, K.E., 1993. Effects of timber harvesting on southern Appalachian salamanders. Conservation. *Biology* **7**, 363-370.

Phillips, S., 2000. Tree species preferences of the Koala *Phascolarctos cinereus* as a basis for the delineation of management areas for recovery planning in NSW. Report to NPWS.

Poiani, A., 1993. Bell miners: what kind of farmers are they?. *Emu* **93**, pp. 188–194

Poiani, A., 1993. Reproductive biology of the Bell Miner (*Manorina melanophrys*, Meliphagidae) at Healesville, southeastern Victoria. *Wildl. Res.* **20**, pp. 579–598

Poiani, A., Rogers, A. and Rogers, D., 1990. Asymmetrical competition between the bell miner (*Manorina melanophrys*, Meliphagidae) and other honeyeaters: evidence from Southeastern Victoria, Australia. *Oecologia* **85**, pp. 250–256

Possingham, H.P., Lindenmayer, D.B., Norton, T.W., Davies, I., 1994. Metapopulation viability analysis of the greater glider *Petauroides volans* in a wood production area. *Biological Conservation* **70**, 227-236.

Pough, H.F., Smith, E.M., Rhodes, D.H., Collazo, A., 1987. The abundance of salamanders in forest stands with different histories of disturbance. *Forest Ecology and Management* 20, 1-9.

Power, M.E., 1990. The importance of sediment in the grazing ecology and size class interactions of an armored cat.sh, Ancistrus spinosus. *Environtal Biology of Fish* **10**, 173–181.

Power, M.E., 1990. The importance of sediment in the grazing ecology and size class interactions of an armored cat.sh, Ancistrus spinosus. *Environtal Biology of Fish* **10**, 173–181.

Pugh, D. 1998.Establishing a CARR Reserve System in North East New South Wales. Unpublished report to the NSW Government.

Queensland Department of Natural Resources. 1998. Code of practice for native forest timber production. Queensland Department of Natural Resources (Forest Allocation Unit), Brisbane.

Recher, H.F. 1991, The conservation and management of eucalypt forest birds: resource requirements for nesting and foraging. In Conservation of Australia's Forest Fauna. D. Lunney (Ed). Royal Zool. Soc. NSW: Mosman. Pp. 24-34.

Recher H. F., Majer J. D. and Ganesh S. 1996. Eucalypts, insects and birds: On the relationship between foliar nutrients and species richness. *For. Ecol. Manag.* **85,** 177–95.

Rab, M.A., Anderson, H., Boddington, D., Van Rees, H., 1992. Soil disturbance and compaction. In: Squire, R.O. (Ed.), First Interim Report for the Value Adding Utilisation System Trial, Department of Conservation and Environment, Vic.

Rab, M.A., 1994. Changes in physical properties of a soil associated with logging of *Eucalyptus regnans* forest in southeastern Australia. *For. Ecol. Manage.* **70**, pp. 215–229.

Rab, M.A., 1996. Soil physical and hydrological properties following logging and slash burning in the *Eucalyptus regnans* forest of southeastern Australia. *For. Ecol. Manage.* **84**, pp. 159–176.

Rab, M.A., 2004. Recovery of soil physical properties from compaction and soil profile disturbance caused by logging of native forest in Victorian Central Highlands, Australia Forest Ecology and Management **191**, 1-3. pp 329-340

Radho-Toly, S, Majer, J. D.., and Yates, C. 2001. Impact of fire on leaf nutrients, arthropod fauna and herbivory of native and exotic eucalypts in Kings Park, Perth, Western Australia *Ecology.* **26**, 500–506

Reid, L.M. and Dunne, T., 1984. Sediment production from forest road surfaces. *Water Resources Res.* **20**, 1753–1761.

Reader, R.J., Bricker, B.D., 1994. Barriers to the establishment of invading non-forest plants in deciduous forest nature reserves. *Environmental Conservation* **21**, 62-66.

Reid, L.M., 1993. Research and cumulative watershed effects. USDA For.Ser., GT Report, PSW-GTR-141, Pacific Southwest Research Station, 118 pp

Richard, G., Cousin, I., Sillon, J.F., Bruand, A. and Guérif, J., 2001. Effect of compaction on the porosity of a silty soil: influence on unsaturated hydraulic properties. *Eur. J. Soil Sci.* **52**, 49–58.

Richardson, B.A., 1985. The impact of forest road construction on the benthic invertebrate fauna of a coastal stream in southern New South Wales. *Bulletin/Australian Society for Limnology* **10**, 65–88.

Riley, S.J., 1984. Effect of clearing and roading operations on the permeability of forest soils, Karuah catchment, NSW, Australia. *For. Ecol. Manage.* **9**, 283–293

Robinson, D.P., 1977. The Study of Invertebrate Fauna of Three Mountain Streams in Relation to the Type of Land Use in Each of the Three Stream Catchments. BSc Honours thesis, Monash University, Melbourne, Australia (unpublished).

Roberts, S., Vertessy, R.A., Grayson, R.G., 2001. Transpiration from *Eucalyptus sieberi* (L. Johnson) forests of different age. *For. Ecol. Mgmt.* **150**

Radosevich, S.R., Holt, J.S., 1984. Weed Ecology: Implications for Vegetation Management, Wiley, New York.

Roads and Traffic Authority of NSW, 1999. Code of Practice for Water Management - Road Development and Management. http://www.rta.nsw.gov.au/environment/downloads/wcop1.pdf

Ross, Y., 1998. Hollow-Bearing Trees in Permanent Plots in SouthEast Queensland. Queensland Department of Natural Resources, Brisbane, Australia. *Aust. For*. **45**, 42–50.

Ross, Y., 1999. Hollow-Bearing Trees in Native Forest Permanent Inventory Plots in Southeast Queensland. Queensland Department of Natural Resources, Brisbane, Australia. Thesis. The University of Queensland, Brisbane, Australia.

Rotherham, I., 1981. Suppression of growth of surrounding regeneration by veteran trees of karri (Eucalyptus diversicolor). *Aust. For.* **46**, 8–13.

Ruprecht J K and Stoneman G L. 1993. Water yield issues in the jarrah forest of south-western Australia. *Journal of Hydrology* **150**, 369-391

South East Forests Conservation Council, 1998. *Modelling Koala Habitat and Use in Murrah and Bermagui Forests.* An unpublished report commissioned by RACAC for the Comprehensive Regional Assessment in the Eden Region. Prepared by the South East Forests Koala Research Project. SEFCC, PO Box 797, Bega, 2550.

Steinbrenner, E.C. and Gessel, S.P., 1955. The effect of tractor logging on physical properties of some forest soils in Southwestern Washington. *Soil Sci. Soc. Am. Proc.* **19**, 72–376

Smith, P. 1985. Effects of intensive logging on birds in eucalypt forest near Bega New-South-Wales australia. *Emu.* **85**(1), 5-21.

Smith, A.P. 1993. *Habitat tree retention in the Wingham Management Area*. Report to the Department of Planning.

Smith, A. P. 1998. Ecological Assessment of Fire in Forests. In *Protecting the Environment and Land, Life and Property*. Conference Proceedings. Bush Fire Management Committee Conference, Nature Conservation Council of NSW. Sydney.

Smith, A. P., 2000. *Guidelines for Sustainable Forestry on Private Lands in NSW.* Draft report prepared for DLWC.

Smith, A.P., Lindenmayer, D., 1988. Tree hollow requirements of Leadbeater's possum and other possums and gliders in timber production ash forests of the Victorian central highlands, Australia. *Aust. Wildl. Res.* **15**, 347–362.

Smyth, A., Mac Nally, R., and Lamb, D. 2002. Comparative influence of forest management and habitat structural factors on the abundances of hollow-nesting bird species in subtropical Australian eucalypt forest. *Environmental Management* **30,** 547–559.

Southwood T. R. E. 1972. The insect–plant relationship: an evolutionary perspective. In: *Insect–Plant Relationships* (ed. H. F. Van Emden) pp. 3–30. Wiley, New York.

Spring, D. A., Bevers, M., Kenedy., , J. O. S., and Harley., D., 2001. Economics of a nest-box program for the conservation of an endangered species: a reappraisal. *Canadian Journal of Forest Research* **31**, 1992-2003.

State Forest of NSW. 2000. Upper Northeast and Lower Northeast CRA Regions Net Harvest Area Modifier. *Project Report Draft Final Report.* Pennant Hills, Sydney.

State Forests of NSW, 2000b. Application of the protective measures and forest practices into a quantitative database Upper North East and Lower North East Regions. A project undertaken for the Joint Commonwealth NSW Regional Forest Agreement Steering Committee as part of the NSW Comprehensive Regional Assessments. Project Number NA57/ESFM

Stendell ER, Horton TR, Bruns TD. 1999. Early effects of prescribed fire on the structure of the ectomycorrhizal fungus community in a Sierra Nevada ponderosa pine forest. *Mycological Research* **103**: 1353–1359.

Stone, C. 1996. The role of psyllids (Hemiptera: Psyllidae) and bell miners (Manorina melanophrys) in canopy dieback of Sydney blue gum (*Eucalyptus saligna Sm.*) *Australian Journal of Ecology*. **21**(4), 450-458.

Stone, M.K., Wallace, J.B., 1998. Long-term recovery of a mountain stream from clear-cut logging: the effects of forest succession on benthic invertebrate community structure. *Freshwater Biology* **39**, 151–169.

Stone, C., Chisholm, L., and Coops, N., 2001. Spectral reflectance characteristics of eucalypt foliage damaged by insects *Aust. J. Bot.***, 49**, 687–698

Stone C, Wardlaw T, Floyd R, Carnegie A, Wylie R and de Little D. 2003. Harmonisation of methods for the assessment and reporting of forest health in Australia – a starting point. *Australian Forestry* **66**, 233– 245.

Stone, C. and Coops, N. C. 2004. Assessment and monitoring of damage from insects in Australian eucalypt forests and commercial plantations *Australian Journal of Entomology* **43,** 283–292

Stoneman, G.L., Rayner, M.E., Bradshaw, F.J., 1997. Size and age parameters of nest trees used by four species of parrot and one species of cockatoo in southwest Australia: critique. *Emu* **97**, 94–96.

Taylor, R.J., Haseler, M., 1993. Occurrence of potential nest trees and their use by birds in sclerophyll forest in northeast Tasmania. *Aust. For.* **56**, 165–171.

The Habitat Tree Technical Advisory Group, 1998. Managing Habitat Trees in Queensland Forests. Queensland Department of Natural Resources, Brisbane, Australia.

Tomkins I. B., Kellas J. D., Tolhurst K. G. and Oswin D. A. 1991. Effects of fire intensity on soil chemistry in a eucalypt forest. *Aust. J. Soil Res.* **29,** 25–47.

Turton, S.M., Duff, G.A., 1992. Light environments and floristic composition across an open forest-rainforest boundary in northeastern Queensland. *Australian Journal of Ecology* **17**, 415-423.

Trimble, S. W., and Mendel, A. C. 1995. The cow as a geomorphic agent – a critical review. *Geomorphology*, **13**, 233-253.

Tyler, M.J., 1991. Declining amphibian populations - A global phenomenon? An Australian perspective. *Alytes* **9,** 43-50.

Tyndale-Biscoe, C.H., Calaby, J.H., 1975. Eucalypt forests as refuge for wildlife. *Aust. For*. **38,** 117–133.

van der Ree, R., Soderquist, T. R., and Bennett, A. F. 2001.Home-range use by the brush-tailed phascogale (Phascogale tapoatafa) (Marsupialia) in high-quality, spatially limited habitat. *Wildlife Research.* **28**(5). 517-525.

van der Ree, R., and Loyn, R. H. 2002. The influence of time since fire and disturbance from fire boundary on the distribution and abundance of arboreal marsupials in *Eucalypt regnans*- dominated forest in the Central Highlands of Victoria. Wildlife Research. **29**, 151-158

Vertessey, R.. 1996. Letter to John Franklin, Principal Hydrologist at Gutteridge, Haskin and Davey concerning advice on the Bemboka Catchment Study, dated 24/7/96.

Vertessy, R., Watson, F., O'Sullivan, S., Davis, S., Campbell, R., Benyon, R., Haydon, S., 1998. Predicting water yield from mountain ash forest catchments. Industry Report No. 98/4. Cooperative Research Centre for Catchment Hydrology, Monash University, Victoria, Australia, p. 38.

Vertessy, R. A., Watson, F. G., O'Sullivan, S. L. 2001. Factors determining relations between stand age and catchment water balance in mountain ash forests. *Forest Ecology and Management* **143**,13-26

Visser S, Parkinson D. 1999. Wildfire vs. clearcutting: impacts on ectomycorrhizal and decomposer fungi. In: Meurisse RT, Ypsilantis WG, Seybold C, eds. *Proceedings: Pacific Northwest Forest and Rangeland Soil*

Wallbrink, P. J.,and Croke, J., 2002**.** A combined rainfall simulator and tracer approach to assess the role of Best Management Practices in minimising sediment redistribution and loss in forests after harvesting. *Forest Ecology and Management* **170, 1-3**, 217-232

Watling, J. R., Robinson, S.A., Woodrow, L.. E., and Osborne, C.B. 1997. Response of rainforest understorey plants to excess light during sunflecks. *Australian Journal of Plants Physiology*. **24** (1) 17-25.

Watson, F.G.R., Vertessy, R.A., McMahon, T.A., Rhodes, B., Watson, I., 1999. The hydrologic impacts of forestry on the Maroondah catchments. Report No. 99/1. Cooperative Research Centre for Catchment Hydrology. Monash University, Victoria, Australia, p. 80.

Waters, T.F., 1995. Sediment in Streams: Sources, Biological Effects and Control. American Fisheries Society Monograph 7, Bethesda, MD, USA.

Watson, P., and Wardell- Johnson, J. 2004. Fire frequency and time-since-fire effects on the open-forest and woodland flora of Girraween National Park, southeast Queensland, Austral Ecology. **29**(2). 225-236.

Whitford, K.R., 2001. Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees. *Forest Ecology and Management.* **160**, 201–214.

Whitford, K. R., Williams, M. R., 2002. Hollows in jarrah (Eucalyptus marginata) and marri (Corymbia calophylla) trees. II. Selecting trees to retain for hollowdependent fauna. *For.Ecol.Manage***. 160**, 215–232.

Wilczynski, C., and Pickett, S. T. A. 1993. Fine root biomass within experimental canopy gaps: Evidence for a below-ground gap. *Journal of Vegetation Science***. 4(**4). 571-574.

Williams, J. R., and Nelson, W. A. 2003. The effect of soil compaction, profile disturbance and fertilizer application on the growth of eucalypt seedlings in two glasshouse studies. *Soil and Tillage Research.* **71**(2).. 95-107.

Woodgate, P.W., Peel, B.D., Coram, J.E., Farrell, S.J., Ritman, K.T., Lewis, A., 1996. Oldgrowth forest studies in Victoria, Australia concepts and principles. *For. Ecol. Manage***. 85**, 79–94.

Wormington, K.R., 1996. Tree hollow-formation and forestry management. B. App. Sc. Honors thesis, University of Queensland, Brisbane. Cited in Gibbons and Lindenmayer (2002).

Wormington, K.R., Lamb, D., 1999. Tree hollow development in wet and dry sclerophyll eucalypt forest in southeast Queensland, Australia. *Aust. For***. 62**, 336–345.

Wormington, K. R., Lamb, D., McCallumb, H.,I., and Moloney, D. J. 2003. The characteristics of six species of living hollow-bearing trees and their importance for arboreal marsupials in the dry sclerophyll forests of southeast Queensland, Australia. *Forest Ecology and Management* **182**. 75–92

Woinarski, J. C. Z., Risler, J., and Kean, L. 2004. Response of vegetation and vertebrate fauna to 23 years of fire exclusion in a tropical Eucalyptus open forest, Northern Territory, Australia. *Austral Ecology*. **29**(2).156-176.

Wronski E and Associates. 1993. Tantawangalo Research Catchments. Changes in water yield after logging. Forestry Commission of NSW 1st July 1993.

Wellman, J.C., Combs, D.L., Cook, S.B., 2000. Long-term impacts of bridge and culvert construction or replacement on fish communities and sediment characteristics of streams. *Journal of Freshwater Ecology* **15**, 317–328.

Welsh Jr, H.H., Lind, A.J., 1995. Habitat correlates of the Del Norte Salamander, *Plethodon elongatus*, in northwestern California. .*Journal of Herpetology* **29**, 198-210.

Welsh Jr., H.H., and Ollivier, L.M., 1998. Stream amphibians as indicators of ecosystem stress: a case study from California's redwoods. *Ecological Applications* **8,** 1118–1132.

Westoby M. 1998. A leaf–height–seed (LHS) plant ecology strategy scheme. *Plant Soil* **199,** 213–27.

Wert, S. and Thomas, B.R., 1981. Effects of skid roads on diameter, height, and volume growth in Douglas-fir. *Soil Sci. Soc. Am. J.* **45**, 629–632.

White, T.C.R., 1969. An index to measure weather-induced stress of trees associated with outbreaks of psyllids in Australia. *Ecology* **50**, 905–909

Wright E, Tarrant RF. 1958. Occurrence of mycorrhizae after logging and slash burning in the Douglas-fir forest type. United States Department of Agriculture Forest Service, Pacific Northwest Forest and Range Experiment Station Research Note 160. Portland, USA: United States Department of Agriculture Forest Service.

Ziegler, A.D. and Giambelluca, T.W., 1997. Importance of rural roads as source areas for runoff in mountainous areas of northern Thailand. *J. Hydrol.* **196**, 204–229.

Ziemer, R.R., 1981. Storm flow response to road building and partial cutting in small streams of northern California. *Water Resources Res.* **17**, 907–917.

Nature Conservation Council of NSW
The voice for the environment since 1955

North Coast Environment Council Inc.

North East Forest Alliance

NATIONAL PARKS ASSOCIATION OF NSW

Submission to the 'Review of NSW Forest Agreements and Integrated Forestry Operations Approvals'

23rd November 2010

Please accept this submission to the document titled 'Review of NSW Forest Agreements and Integrated Forestry Operations Approvals' (hereafter called 'the Review) on behalf of the Nature Conservation Council of NSW, the National Parks Association of NSW, the North Coast Environment Council and the North East Forest Alliance.

NSW environment groups have made extensive submissions to the various State and Federal processes for review of public forest related agreements, statutes and legal instruments over the last six years.

In particular, we would draw attention to the following:

1. Nature Conservation Council of NSW Submission on Improved Regulatory Arrangements for Water Quality and Threatened Species in NSW – Five Year Review of the UNE, LNE and Eden IFOAs, 2004.

2. Joint groups submission on the Terms of Reference for the Review of NSW Forest Agreements and Integrated Forestry Operations Approval, December 2008.

3. Joint groups submission to the Review of the Forestry and National Parks Estate Act, May 2009

4. Joints groups submission to the draft report on progress with implementation of the NSW Regional Forest Agreements, September 2009.

We have provided each of these documents again as attachments to this submission. We are incredibly disappointed that the detailed input and scientific advice that we have provided in those submissions has been ignored by the Review. Rather than improving the obvious and by now well-documented environmental deficiencies of the FAs and IFOAs, the Review instead proposes to weaken their environmental provisions even further.

The review of the IFOAs and FAs purports to have considered the previous submissions by the Nature Conservation Council of NSW and other groups, but it has done little or nothing to address the points raised in those submissions.

Instead of providing a rigorous, scientific evaluation of the environmental impacts of the FAs and IFOAs and their provisions, the Review appears to be based entirely on hearsay and is largely framed to accede to Forest NSW wishes to gain access to more timber rather then to address environmental issues. Empirical data is completely absent, and information on the basis for the changes that are proposed is glaringly inadequate.

At the very highest level, the complete failure to address climate change and its impacts is appalling. Climate change was not considered when the FAs and IFOAs were signed. Therefore, the single most important task of the Review, in our opinion, was to fully address the likely impacts of climate change and identify increased protection measures to assist in climate change adaptation and mitigation.

In reality, however, the Review completely ignores this critical issue. This is extraordinary given that the NSW Government has declared climate change adaptation to be one of its major policy initiatives.

Below we provide some detailed comments on the elements of the Review, which can be summarised as follows:

1. We do not agree with the way that the milestones have been addressed and we propose a set of changes that represent a far better reflection of their status, and which aim to set clear timelines for delivery on milestones that have simply not been conducted.

2. The proposed changes to the conditions made in the Review are, collectively, a major backward step in environmental protection. We are opposed to 24 of the changes which aim to reduce protection of our most threatened species and to reduce reporting requirements.

3. There are numerous major changes required to improve the licence and non-licence conditions of the IFOAs that are not contained in the Review. We refer you to our extensive and exhaustive previous submissions on this topic, and instead of going over those detailed points again, in this submission we merely highlight nine major changes that are needed as the highest priority to improve the current unsatisfactory situation.

REVIEW OF MILESTONES

The Review of milestones is very poor. It contains only three categories – complete, on-going and not applicable. This framework is clearly designed to obscure the many failures with implementation of milestones that have occurred over the last decade and that continue to occur. The Review should have contained categories for 'incomplete' or 'not undertaken'.

We note that as part of our submission on the draft report on progress of the NSW Regional Forest Agreements in May 2009, we conducted a detailed review of the progress on milestones and compared it with the NSW Government reports on progress. Our assessment found that 31 milestones had not been completed, and 13 had been completed late. The NSW Government, on the other hand, both then and now, concluded that most milestones had been completed or that they were now re-classified as simply 'not applicable'.

The Review attempts to use the category 'not applicable' to completely absolve the NSW Government from many commitments that were made in the FAs and that are still outstanding. This means that many important tasks, which should in most cases have occurred years ago, will now never be undertaken. The Review also uses the category 'complete' to end reporting on numerous other milestones that are actually on-going, and that require continued oversight as part of future review processes.

<u>Recommendations</u>

Milestones categorised as 'complete' should not be dropped from future reporting requirements, as many of these require on-going oversight to ensure that they continue to be implemented and applied correctly and in accordance with the FA.

The category of 'not applicable' should be removed from the Review. Instead of absolving NSW agencies from implementing these important milestones, the Review should enforce them and set a date by which they must now be completed. In particular, we want to see the following milestones (which are erroneously described as 'complete' or 'not applicable') enforced with a date set for delivery:

- Milestone 2.11 – There are still important areas in both Southern NSW and Northern NSW that should be gazetted as Special Management Zones. This should be an on-going process to ensure all FMZ 1, 2 & 3a areas are gazetted. It is not complete.

- Milestone 2.5 - The Working Group should be formed as required. The measures undertaken unilaterally by FNSW clearly do not meet the intent of the commitment.

- Milestone 5.1 - This point refers mostly to allowing Forests NSW to weaken protections when more than 20% of a compartment is effected, and there is no process to improve protections when new science becomes available. There should be an on-going process to strengthen protection measures identified.

- Milestone 5.5 – The Hastings River Mouse Model should be refined as promised.

- Milestone 5.6 – The Pine Creek Koala Management Plan should not be arbitrarily discontinued, as important areas of key koala habitat are still available for logging in Pine Creek State Forest.

- Milestone 6.5 - Although there has been a Working Group formed to work on BMAD, there are no resources allocated to it and it has done nothing to change logging practices towards BMAD. This should be an on-going priority.

- Milestone 8.7 - The requirement for a timber inventory of the freehold land timber resource should be undertaken and a time set on completion. It should not be classified as 'not applicable' and dropped.

- Milestone 10.4 – The NP&W Act 1974 is not sufficient to protect wild rivers, and this important component of the FAs should not be dropped, but implemented as promised.

- Milestone 12.1 – We are very concerned that the Review proposes to drop the requirement for assessing parks applicable for addition to Schedule 14 of the National Parks and Wildlife Act 1974. It should be retained and a timeframe set on delivery.

- Milestone 12.6 – This milestone does not seem to be complete at all, and clearly there does need to be a formal joint strategy developed so that all traditional owners have well-articulated rights.

- Milestone 14.4 – There has been no review of legislation and policies relevant to the allocation and pricing of hardwood logs. In fact, in 2009 the NSW Auditor General again required that FNSW simplify and improve timber pricing by introducing a new pricing system that 'ensures log production costs are recovered' and 'is transparent. This milestone is not complete, it is still applicable, and it should be required with a timeframe set.

- Milestone 16.3 – There has never been a genuine independent review conducted of the entire FRAMES system by an expert who has access to the entire system. This milestone is not complete, and a strict timeline and clear process should be set to ensure that it is delivered.

- Milestone 16.7 – This milestone is not 'complete'. The wood reviews that were required have never been undertaken. The Review should require that they are conducted immediately and set down requirements for how that must be achieved.

There are also a number of milestones that are described as 'on-going', but which have actually never been done properly and for which this Review has failed to clearly set a timeline to deliver. In particular, we want to see clear enforcement and timelines for delivery on the following milestones:

- Milestone 3.3 – The Review suggests that substantial areas of the FURCONS (Areas for Further Consideration) will remain as State Forests, and that other areas that have been agreed for transfer to DECCW will apparently remain available for logging in the interim. The Review should recommit to the full protection of the FURCONS, and ensure they are fully zoned as FMZ2 or 3a until such time as they are transferred to DECCW. It should put a timeline on such transfers.

- Milestone 4.2 – The Review notes that there are still 21,000 hectares of high conservation value Crown Lands required for transfer to National Park in accordance with the FAs in north-eastern NSW. However, it does nothing to move that forward, simply noting they are 'on-going'. A strict timeline should be set on delivery of these outcomes.

- Milestone 7.4 – It is extraordinary that 10 years after the forest decision, discussions are still 'continuing' between agencies as to how to phase out occupational permits from FMZ 1 and 2 areas. A strict deadline should be set on delivery, rather then leaving this as 'on-going'.

- Milestone 10.2 – The north-east Forest Agreements committed the Ministers to the Forest Agreements to further studies to investigate and document potential World Heritage values of the reserve system by April 2002. This has not been done and the Review makes no commitment to address it. A clear timeframe and re-commitment is needed, especially since the World Heritage Expert panel has already identified these areas as likely to meet its requirements for eucalypt diversity.

- Milestone 16.4 – This milestone is described as 'on-going' but the actual wording contained within it basically means that there is no requirement for FNSW to ever do it. This is extraordinary, given that the Audit Office recently confirmed how important it was for FNSW to undertake such reconciliations of actual vs predicted yields. It is simply not true that FNSW can not do this because FRAMES doesn't operate at a 'sub-regional level'. FNSW log at a sub-regional level, and they need to have informed estimates of timber volume at that level. They must be required to conduct this work immediately – it is long overdue.

- Milestone 16.5 & 16.6 – None of these timber volume related milestones have ever been conducted properly in accordance with the Forest Agreements. The Review should set down the details of how the should be conducted, and set strict timelines on their delivery.

PROPOSED CHANGES TO CONDITIONS IN THE REVIEW

The changes to the licences and conditions that are proposed in the Review are largely a one-way street of yet more reductions in survey and protection requirements for threatened species and environmental attributes. It would seem that these changes are largely based on nothing more than demands by Forests NSW – there has been no attempt whatsoever to conduct either a desktop or field based review of the efficacy of the conditions on protecting species and habitats. It is a science-free zone.

Under these circumstances, and given the complete lack of balance in the proposed changes, we are opposed to the following changes to licence and non-licence conditions:

- EPL 3 – weakening the oversight on changes to summary of operations etc
- EPL 13 – reduced reporting requirements
- TSL 4 – decrease in survey and protection for Hastings River Mouse
- TSL 5 & 6 – increasing access to protected zones for roading
- TSL 8 & 30 – authorisation of logging in habitat of Broad-toothed Rat Endangered Population
- TSL 10 – reduction in survey and protection of Broad-toothed Rat elsewhere
- TSL 11 – dropping Pine Creek Koala Plan of Management (says only 200ha, check)
- TSL 12 – decrease in survey and protection for Giant Burrowing Frog
- TSL 13 – reduced survey requirements utilising scat, track and hairtube methods.
- TSL 16 – reduced protection for Brush-tailed Phascogale
- TSL 17 – reduced survey for Sooty Owl and White-footed Dunnart in South Coast.
- TSL 19 – remove survey and protection for Large-footed Myotis.
- TSL 20 – reduced protection measures for Northern Corroboree Frog.
- TSL 36 – remove survey and protection for the White-crowned Snake, Pale-headed Snake and Broad-headed Snake.
- TSL 37 – remove survey and protection for Black-breasted Button-quail.
- FL4 – remove requirement for marking of riparian protection boundaries.
- NL 1 – shorten return times for AGS logging in Tumut.
- NL 2 (Pt 2) – removing the exemption for wilderness identification and declaration on specified timber lands
- NL 3 – substantial weakening of FNSW reporting requirements.
- NL 4 – weakening of reporting requirements for other forest products
- NL 5 – weakening of reporting requirements on volumes logged and areas effected by each silvicultural type.
- NL 7 – apparent weakening of reporting requirements

With regard to TSL 9, we note this task is long overdue, and although there is an urgent need to identify oldgrowth forest on other Crown timber land, we do not agree that there should be ‘a process’ because we know full well from long experience that it will simply lead to FNSW declaring the areas are not oldgrowth and logging them. Detailed maps of oldgrowth are available from the CRAFTI layer throughout NSW, and all oldgrowth mapped on other Crown timber lands should simply be protected through inclusion of the map in the IFOA. There is no need for a ‘process’. With regard to private property purchases, there has already been a lengthy negotiation process between DECCW and FNSW to arrive at agreed maps, and these should be included in the IFOA.

RECOMMENDED CHANGES FROM ENVIRONMENT GROUPS

Previous submissions by environment groups on these matters have made detailed recommendations supported by scientific references for substantial improvements to the FAs and IFOAs. Those have been ignored by the NSW Government in this review. Therefore, we do not attempt to repeat them again here, but rather refer the NSW Government back to those documents, and instead just reiterate nine major areas where substantial changes are urgently required to the FAs and IFOAs that have been ignored in the Review.

We would like to see the following changes as the highest priority:

1. New measures should be put in place to both improve the climate change adaptation capabilities of forests and contribute to mitigation, as follows:

    - Protect all older forests that act as carbon reservoirs, particularly in temperate forests.

    - Implement improved constraints on logging to better protect species that are likely to be negatively affected by climate change.

    - Identify and protect refugia and corridors to enable species to adapt to climate change.

    - Increase reservation of wetland and floodplain areas, which are particularly threatened by climate change and whose reservation will contribute significantly to mitigation

    - Prohibit logging on steep slopes and improve soil erosion mitigation requirements to address likely increases in rainfall intensity and erosion potential.

    - Protect rainforest areas from logging and fire by dramatically improving the rainforest protocol and applying substantial buffer zones on all rainforest.

2. The loophole that allows Forests NSW to log unmapped drainage lines, causing major damage to biodiversity and waterways, needs to be closed. The loophole gives FNSW the choice as to whether they 'switch on' the Environment Protection Licence for most logging operations. They are choosing not to switch it on and then logging unmapped drainage lines, leading to major pollution events and habitat damage. Either the EPL should be made mandatory for all logging operations, or a provision protecting unmapped drainage lines should be included in the Threatened Species Licence. Either way, changes need to be enacted urgently to prevent any further logging of unmapped drainage lines.

3. Major improvements need to be made to habitat and recruitment tree retention, with current rules both inadequate and unenforceable. The following changes should be made, particularly in light of the fact that since the FAs and IFOAs were signed, loss of hollow-bearing trees has been listed as a Key Threatening Process in NSW:

    - Permanent 'marking' of H&R trees and feed trees by recording them with a GPS during mark-up or with permanent marking in the field. This will ensure they are retained permanently and increase enforceability of licence conditions.

- Insert provisions into the licence that specify how H&R recruitment will be enforced, with reference to a grid-based on-ground approach and a process of pre- and post mark-up and audit. This will ensure that the provisions are enforceable in a court of law.

- Setting a strict upper size limit on trees that can be removed, to prevent systematic rorting of habitat tree retention as is occurring at present, with large hollow-bearing trees systematically removed and smaller trees retained.

- Immediately removing the weaker provisions on habitat tree retention in the regrowth zone and instead applying the general provisions with improvements.

- DECCW to conduct detailed research on the mortality rates of retained trees and the efficacy of the retention rates for biodiversity persistence in logged forests.

4. Major improvements are need to compliance and enforcement of the FAs and IFOAs, including the following:

    - A major increase in resources is required for compliance and enforcement work within DECCW, including the allocation of at least 5 new full time positions to the audit team.

    - Making logging contractors at least partially liable for any breaches of the licence for which they are responsible, and also introduce a system of demerits and disqualifications for logging contractors who breach the licence.

    - Dramatic increases in possible penalties for non-compliance are required with regard to breaches of the licence, as well as making compensatory habitat protection a potential compliance measure available to DECCW.

    - Non-licence conditions of the IFOA and FA are not currently enforceable by DECCW according to advice they have previously provided, and changes need to be made to ensure that they can be enforced in the future.

5. Wilderness protection is inadequate as proposed by the Review. Whilst we agree with the proposed NL 2 (Pt 1), we believe that it should go much further, and ensure that all other Crown-timber lands (as defined in the Forestry Act 1916) are available for wilderness identification and declaration. In particular, we note the importance of large areas of Crown leasehold in the Deua wilderness area which should be included in NL 2 (Pt 1) and excluded from the operation of the IFOA.

6. We are shocked that the Review has done absolutely nothing to address Key Threatening Processes under the Threatened Species Conservation Act 1995 that have been listed since the FAs and IFOAs were introduced. New clauses should be inserted requiring that any news listings of KTPs must trigger a mandatory review and amendment of relevant licences, and the Review should address all those that have been listed in the last decade and make changes to the licences immediately to ameliorate the impact and prevent the spread of those threats. Specifically, we provide the following recommendations for changes relating to Bell Miner Associated Dieback:

    - Indications of the presence of Bell Miners as well as signs of canopy decline as a result of BMAD must be identified during the harvest planning process and clearly indicated in harvest plans.

- Site specific plans of management to prevent and control the development and spread of BMAD in at risk forest types must be included in harvest plans.

- Appropriate post-logging rehabilitation and on-going weed control must be required, and included in harvest plans, to prevent the spread of Bell Miner Associated Disturbance in at risk forest types.

7. The Review has not addressed the issue of burning native forests for biomass energy, as currently proposed by the Eden Chipmill. Specific provisions should be included in the IFOA prohibiting the use of any material from IFOA logging operations being burnt for power under any circumstances.

8. Stricter rules should be set on logging practices such as Australian Group Selection and Single Tree Selection, including setting strict basal area and canopy retention requirements, to dramatically reduce the intensity of logging and to enable compliance and enforcement, and clearfelling as practiced in Southern NSW should be strictly prohibited.

9. Urgent regulatory improvements should be made to the control of Forests NSW management of the forest resource, in light of the 2009 report by the Auditor General and the failure of FNSW to meet the requirements of the FA in relation to sustained yield estimation and reviews. These should include new provisions included in the IFOA as follows:

- A legal requirement for regular, independent sustained yield reviews with stiff penalties imposed for failure to undertake them.

- A legal requirement that yields are immediately reduced to sustainable levels subsequent to such reviews.

- Mandating a timber pricing system that fully covers the cost of production

- Mandating a program of systematic reconciliation of actual versus predicted yields

- Prohibiting wood supply agreements that incur a compensation risk to the taxpayer

Independent appraisal of native forest timber resources and alternatives in New South Wales

Commissioned by the Nature Conservation Council of NSW

September 2011

Table of Contents

Table of Figures

Table of Tables

EXECUTIVE SUMMARY

NSW supplies 21% of the total Australian log supply, amounting to 5.4M cubic metres. It is the third largest producer of native eucalypt logs, behind Tasmania and Victoria and almost equal with Victoria as the largest producer of plantation softwood pine. Some 72% of all timber in NSW is currently sourced from plantations, mostly softwood plantations, and the remainder from native forests. According to available data, there is a strong reliance on public lands with 83% of all timber in NSW sourced from State Forests.

Since the 1970s, there has been an ongoing decline in the native hardwood timber industry in NSW as it is replaced by plantation softwood. This substitution process is still occurring. Since 2002/03 there has been a decline of 463,000m^3 in native forest sawlogs produced in NSW and a commensurate increase of 401,000m^3 in sawlog production from softwood plantations. Softwood pulp is a rapidly growing resource that increased by 588,000 tonnes per annum over the ten year period to 2010. That increase alone represents an amount that is sufficient to entirely replace hardwood pulp volumes in NSW.

High quality large logs account for only 25% of all native timber from State Forests whilst pulp logs account for 44%. High quality logs are sourced predominantly from the north-east regions whilst the majority of pulpwood is sourced from south-east regions. In the context of all hardwood and softwood timber produced in NSW, high quality large sawlogs from State Forests represent just 6% of total volume. The shift from native forest to hardwood plantations is already well underway in the north of the state, with 29% of State Forest hardwoods currently derived from plantations, including 47% of pulpwood, 21% of small high quality sawlogs and 6% of large high quality sawlogs.

There is a total plantation area of 383,182 hectares in NSW across all tenures, comprised of 75% softwood plantations and 25% hardwood plantations. Of this, 247,015, or 64%, is in public ownership, with 206,085 of softwood plantations on State Forests and 49,690 of hardwood. Almost all hardwood plantations are located in the north-east of NSW, and the majority of softwood plantations are located in the south-east. When plantation areas in adjoining states are taken into account, the total area of plantations within a fair transport distance to NSW mills is 770,315 hectares.

From December 2001 to June 2010 a total of 132,199 hectares of plantations were authorised in NSW, with hardwoods slightly exceeding softwoods. The rapid rate of plantation establishment over that period has since declined along with the collapse of several companies who invested heavily in plantations in NSW as part of Managed Investment Schemes. The future of many of these plantations are now in question. In 2001, a detailed study of plantation capability and suitability in NSW concluded that there were 425,000 hectares of previously cleared land in NSW where prospective plantation returns compared favourably with estimated farm business profits and hence were likely to provide a strong economic incentive for plantation establishment.

The trend in the sawmilling industry across Australia in the decade from 1996/97 to 2006/07 has been one of a rapid decline in the number of mills driven largely by mechanisation and efficiencies of scale in processing. The total number of broadleaved sawmills is estimated to have fallen by 43% across Australia over the last ten years, with small mills being the most heavily affected.

There are 184 broad-leaved sawmills and 26 coniferous sawmills in NSW, which means that the state has the largest number of broadleaved mills in Australia and the second largest number of coniferous mills in Australia. In NSW, State Forests supply all coniferous mills and approximately 30% of broad-leaved mills in NSW, equating to an estimated 53 broad-leaved mills and 26 coniferous mills. The private native forest resource is predominantly sourced by small mills.

Softwood processing in NSW is focused on three major centres: Oberon/Bathurst, Tumut and Albury, although there are scattered operations across both northern and southern NSW. As far as hardwood processing is concerned, there are effectively five major centres in northern NSW around Lismore/Casino, Grafton, Coffs Harbour, Port Macquarie and Bulahdelah/Newcastle. Southern NSW has

the only hardwood woodchip mill in NSW at Eden, and a relatively small number of scattered mills which are mostly along the coast north to Nowra. In Western NSW, mills are now largely restricted to five towns – Gunnedah, Baradine, Condobolin, Narrandera and Barham.

Estimates of total direct and indirect employment in the wood and wood products sector in NSW range from 8,635 to 12,744. Forests NSW estimates that 6,344 of these jobs are dependent on timber from State forests. It is apparent that most of the jobs are based on plantation resources, although accurate estimates are not available. Notably, data that is available shows that forestry employment is not highly sensitive to major reductions in hardwood quota sawlog supply. For example, from 1997-2009 there was a 55% reduction in hardwood quota sawlog allocations from State Forests in NSW and yet the reduction in forestry employment over that same period amounted to only 5% of the NSW forestry sector, equivalent to just 682 jobs.

Most employment declines in the timber industry continue to be the result of increased mechanisation and corporate rationalisation. For example, since the Forest Agreements were signed in 1999 Boral have closed six hardwood sawmills in NSW with estimated resultant job losses of up to 200 employees, despite obtaining 20 year wood supply contracts and $22 million in industry development assistance from the NSW Government.

Total sawn wood production in NSW equates to 1.7million m^3 of which 75% is softwood and 25% hardwood. The major softwood sawn product by volume in NSW is house framing, whilst the major hardwood sawn product is floorboards. NSW runs only a minor trade deficit in primary wood product ($16M) in value terms but in volume terms it runs a major surplus of primary wood products exporting almost four times as much as it imports. NSW imports mostly value-added products and exports very little value-added product. Coniferous logs are the predominant primary product exported into and out of NSW, with most primary wood products sourced from New Zealand and only a relatively minor volume from tropical countries. NSW has a major trade deficit in all wood products due largely to furniture imports from China.

The value of all log production (softwood and hardwood) across tenures in NSW in 2007/08 was $379 million which equates to approximately 0.09% of gross state product. Forests NSW currently operate at a loss, and in 2008/09 they lost $8.1 million from native forest operations. Some of the major economic failings of public forest management in NSW have included:

1. The use of administered, rather than competitive, pricing mechanisms which lead to lower prices for timber and can result in allocation of timber to lower value uses.
2. Excessively lengthy wood supply contracts which inhibit innovation and investment and create barriers to diversification and competition in the industry.
3. Cross-subsidisation of public native forest operations from public plantation profits, exacerbated by failure to report financial results for the two sectors separately.
4. Conflation of operational responsibilities with regulatory and policy responsibilities in a single forestry agency which can lead to conflicts between short-term commercial imperatives and long-term management goals.

The end result of these factors, when combined with the impacts of very substantial direct subsidies over the last two decades is that cheap, subsidised public timber continues to out-compete private plantation timber. This has stifled the development of a sawlog-driven hardwood plantation sector on freehold land - hindering the long-term future of the timber industry whilst in the short-term allowing it to degrade our valuable natural assets.

Native forest logging in NSW is not sustainable and many of the forests are being demonstrably over-cut, particularly the north-east forests where the NSW Auditor-General has found that Forests NSW are cutting trees faster than they can grow back. Native forest timber resources are over-committed, with wood supply agreements in place for Forests NSW to supply 942,216m^3 of sawlog and 521,450m^3 pulp. However, these supply agreements are not being met due to declining volumes, and this incurs a compensation risk to the taxpayer. Boral Timber have recently commenced legal action against Forests NSW for failure to supply timber committed in a wood supply contract.

Alternatives that should be considered to timber sourced from native forests in NSW include plantations, locally-grown bamboo and recycled plastic. Bamboo can provide a direct replacement for native hardwood flooring. It is a fast-growing resource that can be harvested 4-7 years after planting, and which coppices after logging thus allowing selective harvesting on an annual basis. A feasibility study is required into the potential to develop a locally-grown bamboo resource to provide bamboo flooring in NSW.

There are a variety of recycled plastic products now available on the Australian building market that can be used as an alternative to hardwood timber in a range of outdoor building applications. The range of plastic lumber products on offer include decking, bearers, joists, posts, and rails, for use in areas such as patio decks and verandas, pool decks, boat docks, bridges, viewing platforms and walkways. The volume of plastic going to landfill represents an opportunity to replace timber from native forests.

In north-eastern NSW, timber commitments from public native forests are inflated and the contracted volumes of timber required cannot be supplied. The forests are being over-cut, yield estimates are unreliable and the region is increasingly facing a wood supply crisis. The future of the timber industry can best be characterised as a combination of a rapidly declining high quality log resource from native forests, with a virtually irreversible collapse expected by 2019, and a substantial and still maturing high quality hardwood plantation resource, supplemented by a modest, mature softwood resource.

The likely timber supply situation in north-east NSW in early 2019 (as the current Forest Agreements end) will, on the basis of the analysis provided in this report and assuming that the current plans for the region continue to be implemented, look something like this:

- Public native forests capable of supplying 40,161m^3 of HQL sawlogs, and up to 50,000m^3 HQS sawlogs, 180,000m^3 of low quality logs and 90,000m^3 of pulp.
- Private native forests capable of supplying 144,146m^3 HQL, 360,363-586,000m^3 total sawlogs and 465,534m^3 pulp
- Hardwood plantations capable of supplying 60,000m^3 of high quality sawlogs (large and small), 144,000-288,800m^3 total sawlogs and 198,000m^3 pulp
- Softwood plantations capable of supplying 300,000-355,000m^3 sawlog and 75,000-104,000t pulp

Forests NSW are already planning a substantial transition from native forests to plantation hardwoods in the medium term due to rapidly declining supplies from native forests and increasing costs of accessing them. The analysis presented in this report indicates that the planned transition is undoubtedly going to occur far more rapidly than predicted by Forests NSW, due to the rapidly declining nature of the resource, particularly the high quality large sawlog resource.

This inevitable transition should not be left unmanaged because if so it will undoubtedly have major negative impacts on both the environment and the communities of north-eastern NSW. A dramatic adjustment shock can be expected in 2019 if NSW and Federal Governments do not take action now and prepare for the transition in a staged manner. In this context, the transition that has been forced onto the industry through unsustainable logging can now be seen to also provide an opportunity to protect public native forests, rather than waiting until the native forests are entirely logged out and degraded.

In south-eastern NSW, native forest timber is logged at unsustainable and declining levels to supply a pulpwood dominated industry, with the primary customer being the Eden export woodchip mill. In

contrast, in southern NSW and adjacent areas in Victoria there are major increases predicted in softwood timber supply from 2010-2020 with a total estimated yield prediction of 5.5million m^3. Softwood pulp availability is predicted to rise from 1.2million m^3 currently to 2.3million m^3 of which 1.7million m^3 will be located in southern NSW. Softwood sawlogs are predicted to increase from 2.1million m^3 to 3.2 million m^3.

It is possible to immediately discontinue supply of native timber from NSW public forests to the Eden woodchip mill and to fully replace it with an equivalent volume of softwood pulplogs. The mill already operates a softwood supply line and is in a position to immediately substitute the volume. Replacing the hardwood volume with softwood is likely to be possible through a re-negotiation of the wood supply contract, and may thus avoid incurring any compensation costs.

As far as hardwood sawlogs are concerned, there are no options available for direct replacement of hardwood timber to hardwood sawmills in south eastern NSW in the short or medium term. However, there are sufficient increases in softwood sawlogs predicted in the region to completely offset the volumes lost if hardwood supplies are discontinued, although these will be supplied to softwood mills and will not represent a direct supply substitution.

Most importantly, the evidence suggests that it is possible to conduct a transition without causing a net loss in economic value or employment in the region. The opportunities to expand the softwood timber industry with increasing sawlog and pulp supplies means that there are new economic options available to offset any impacts from ending native forest supplies.

In particular, late in 2010 the New South Wales Government gave the go-ahead for a $65 million upgrade to a softwood mill at Bombala in that state's far south-east and an increase in log supplies from 106,000m^3 to 400,000m^3 per annum of Radiata Pine. That volume equates to almost 3 times the volume of sawlogs that would be forfeited if public native forest logging is ended. However, one of the companies involved with the mill, Willmott Forests, has since gone into receivership and the future of the expansion at this stage seems uncertain. Governments should do their utmost to support new softwood processing developments of this nature in the south-east region.

INTRODUCTION

Forested Area

The National State of the Forests report (SoFR) gives the total area of native forests in NSW at 26.208M hectares[1]. Of this, 19.6% is contained in nature conservation reserves and 7.6% in State Forests, with the remainder on private land or other crown tenures (predominantly leasehold). The distribution of forests within NSW according to this study is depicted in Map 1 and quantified in **Error! Reference source not found.**.

Table 1. Forests by land tenure in NSW[2]

Tenure	Area ('000 ha)	Proportion of Total (%)
Private land	8,076	30.8%
Nature conservation reserves	5,148	19.6%
State Forests	1,980	7.6%
Other Crown Reserves and Leasehold	10,834	41.3%
Unresolved Tenure	170	0.7%
Total	**26210**	**100.00%**

These figures are, however, based on a very broad definition of forest where overstorey crown cover is greater than 20% and tree height is greater then 2m, and which therefore includes extensive areas of woodland and even some mallee. Therefore, only a small subset of the area reported in the SoFR will encompass tall forests with potential for production forestry[3].

This study has derived a more accurate estimate by using the best available map data and reviewing the most recent assessments of forest extent in NSW separately for coastal forests, river red gum and cypress forests. The results are set out in **Error! Reference source not found.**.

Table 2 Estimates of commercial forest extent in NSW by tenure[4]

Region/Type	State Forest Area (M ha)	National Park Area (M ha)	Other Tenures* (M ha)	Total (M ha)
Coast and Tablelands	1.381	3.188	5.627	10.196
River Red Gum	0.030	0.125	0.255	0.410
White Cypress	0.359	0.513	1.079	1.951
Total	**1.769**	**3.827**	**6.961**	**12.558**

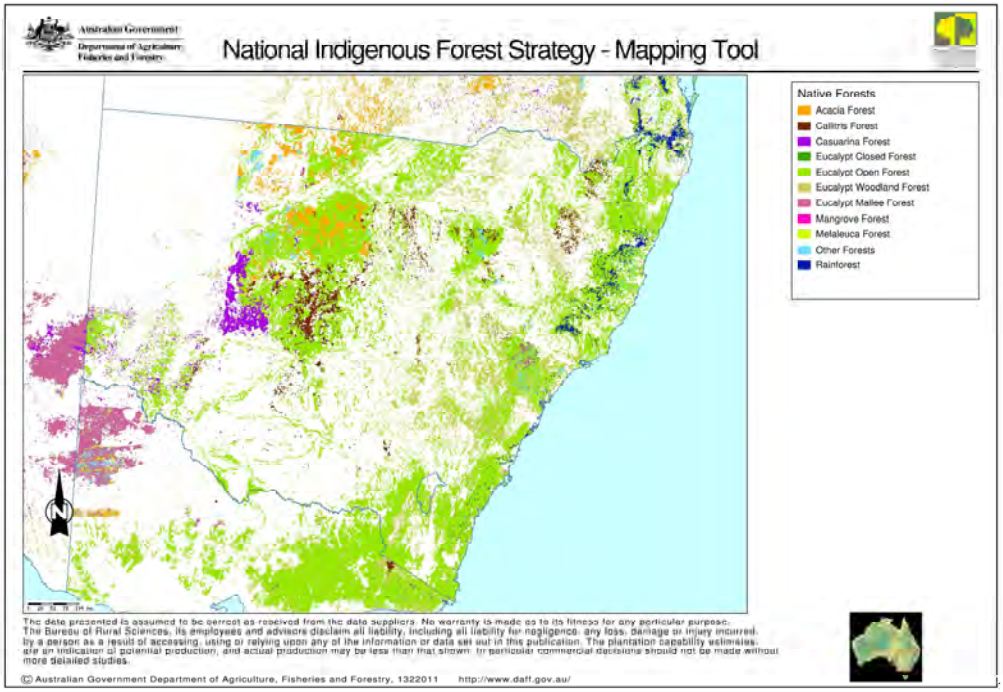
*Includes freehold land plus other crown tenures and leasehold.

Therefore, the area of forests is estimated to be approximately 12.5M hectares, of which 3.8M hectares is already protected in the National Parks estate and 1.7M hectares is located on State Forests with a further 6.9M hectares on other tenures. It is notable that some other sources estimate the area of

1 MIG 2008
2 Adapted from ABARE 2010b
3 MIG 2008
4 For Red Gum, the analysis used NRC 2009 figures, updated for the July 2010 National Park gazettals. For Cypress, the analysis used NRC 2010 figures for the central division only (because commercial forestry opportunities are very limited in the western division), updated for the January 2011 National Park gazettals and addition of BBS area figures. For coastal forests, the analysis utilised the Eastern Bushlands Database forest categories, using data held under licence from DECCW.

forests on private land in NSW somewhat higher, at 8.523M hectares[5].

Figure 1. Distribution of Forests in NSW according to the National State of the Forests Report



Current Logging

Current harvesting plans for native forests located in State Forests within NSW are set down in Forest Agreements and differ in their end date from December 2018 for the north-east regions to January 2031 for the Riverina. Hardwood plantations are included within the plans for volumes to be harvested, even though they are managed differently from native forests.

Table 3. Current plans for harvesting in State Forest native forests and hardwood plantations

Forest Agreement Region	**Quota Volume**	**Pulpwood/Firewood**
Upper North East[6]	109000m^3 until 31st December 2018	Unspecified
Lower North East[7]	160000m^3 until 31st December 2018	Unspecified
Eden[8]	23000m^3 until 31st December 2018	345000 tonnes per annum until 31st December 2018
Southern[9]	48500 from the South Coast Subregion until 31st December 2020 48000 from the Tumut Subregion until 31st December	Unspecified

5 URS Forestry 2008
6 Integrated Forestry Operations Approval and Forest Agreement for the Upper North East Region
7 Integrated Forestry Operations Approval and Forest Agreement for the Lower North East Region
8 Integrated Forestry Operations Approval and Forest Agreement for the Eden Region
9 Integrated Forestry Operations Approval and Forest Agreement for the Southern Region

	2020	
Riverina[10]	4315m^3 until 1st January 2031	17533 pa until 1st January 2031, and 43000 pa until December 2013 then subject to review
Western Region[11]	46050m^3 in Brigalow/Nandewar until 1st January 2026 22815m^3 committed in wood supply agreements in South-west Cypress Region to 2026, with an IFOA pending	9800m^3 of ironbark firewood in Brigalow/Nandewar until end 2013, then 6,500 m^3 until 1st January 2026.

Planted softwood State Forests in NSW are managed in accordance with yields estimated in estate models developed by Forests NSW. The current plans for harvesting in those forests is set out in Table 4.

Table 4. Current plans for harvesting in State Forest softwood plantations

Planted Forest Region	**Net Area (ha)**	**Veneer & Sawlogs**	**Pulpwood**	**Total Timber**
Hume[12]	87435	950000m^3	600000m^3	1550000 m^3
Macquarie[13]	73719	632500t	517500t	1150000 t
Monaro[14]	35900	na	na	600000 m^3
Northern[15]	42024	300000m^3	75000 m^3	375000 m^3

10 Integrated Forestry Operations Approval for the Riverina Red Gum
11 Integrated Forestry Operations Approval for the Brigalow/Nandewar and NRC 2010
12 FNSW 2008a
13 FNSW 2008b
14 FNSW 2008c
15 FNSW 2008d

TIMBER RESOURCES

Harvested Volumes

The total volume of timber production in NSW and Australia in 2008/09 is provided in Table 5. In 2008/09 the total volume of timber production in NSW was 5.374 million cubic metres and in Australia was 25.197 million cubic metres[16]. Therefore, only a modest amount (21%) of the total Australian log supply is sourced from NSW, considering its size and relatively large forested area. NSW supplies 28.6% of all coniferous timber produced in Australia - which is predominantly softwood plantation but does include some native cypress. As far as broad-leaved timber is concerned NSW produces only 18.6% of all native broad-leaved timber and 5% of broad-leaved plantation timber in Australia.

Table 5. Timber production in NSW and Australia in 2008/09[17]

Source	NSW ('000m^3)	Australia ('000m^3)	NSW Proportion
Broad-leaved native	1441	7749	18.6%
Broad-leaved plantation	228	4506	5.1%
Coniferous	3705	12941	28.6%
Total	**5374**	**25197**	**21.3**

NSW is the third largest producer of broad-leaved native logs in the country, behind Tasmania and Victoria[18]. It is almost equal with Victoria as the largest producer of pine, and falls well behind most other states in broad-leaved plantation volumes where Western Australia and Tasmania substantially outstrip all others[19].

Table 6 provides information on the production of timber across tenures and sources in NSW. It indicates that some 72% of all timber is currently sourced from plantations in NSW whilst only 28% is sourced from native forests. The plantation resource in NSW is currently dominated by pine plantations, with only 4% of total log production sourced from broad-leaved plantations in 2008/09[20].

Table 6 Total timber production by source and tenure in NSW in 2008/09[21]

Source	Total NSW ('000m^3)	% of Total	State Forests ('000m^3)	State forests as % of total	Other tenures* ('000m^3)	Other tenures as % of total
Broad-leaved native	1,441	27%	1,082	75%	359	25%
Broad-leaved plantation	228	4%	217	95%	11	5%
Cypress	62	1%	56	91%	6	9%
Plantation softwood	3,643	68%	3,099	85%	544	15%
Total	**5,374**	**100%**	**4,455**	**83%**	**919**	**17%**

*Derived by deducting column 2 from column 1

Table 6 indicates that the vast majority of timber in NSW is produced from State Forests and that only

16 ABARE 2010a. This report utilised here instead of ABARE 2010b because of errors in the 2009/10 log production figures for NSW in ABARE 2010b.
17 Ibid
18 Ibid
19 Ibid
20 Ibid
21 FNSW 2010a

17% of all timber, amounting to a total volume of 919,000 cubic metres, is sourced from non-State Forest tenures in NSW each year. It is estimated that 25% of all broad-leaved native timber is derived from non-State Forest tenures. The accuracy of these figures is difficult to gauge as it is derived to some extent by private millers self-reporting and hence could possibly be a considerable underestimate. There is little alternative data available to inform this figure.

A comparison of timber harvesting by Forests NSW between 1999/2000 and 2009/10 reveals that there has been a substantial drop in the volume of sawlogs harvested from native forests over that time period, but that the volume of softwood logs has increased by a commensurate amount such that overall there has actually been a slight increase in total sawlog production. Table 7 shows that there has been a decline of 276,000 cubic metres per annum of sawlogs produced from public native forests over the ten year period from 1999/00 to 2009/10. Over the same period there has been an increase of 381,000 cubic metres in softwood sawlog production. In 2009/10, native forest hardwood sawlogs accounted for only 22% of all sawlogs produced from State Forests. This data therefore illustrates the on-going decline of the native hardwood industry and its replacement by softwood.

The same trend is apparent across all tenures. In 2002/03, 1.904M cubic metres of native forest hardwood timber was produced in NSW along with 3.304M cubic metres of plantation softwood. In 2008/09, native forest hardwood had reduced to 1.441M cubic metres but plantation softwood had increased to 3.705M cubic metres[22]. Therefore, overall there was an approximate 500,000m^3 shift from native forest hardwood to softwood production.

Error! Reference source not found. also indicates that softwood pulp is a rapidly growing resource and that the increase in softwood pulp over the ten year period of 588,000 tonnes is sufficient to replace the entire hardwood pulp production from State Forests. It confirms that native forest pulpwood harvesting is completely decoupled from sawlog production, and that major decreases in sawlog production have not resulted in any substantial reduction in pulpwood harvesting, revealing a trend towards a pulplog dominated native forest hardwood timber industry in NSW.

Table 7. Volume of timber harvested from State Forests, by source, from 1999 to 2010[23]

Product	**1999/00**	**2009/10**	**Change**
	('000m^3)	('000m^3)	
Native forest sawlogs	899	623	69%
Hardwood plantation sawlogs	58	122	210%
Softwood plantation sawlogs	1720	2101	122%
Total sawlogs	**2677**	**2846**	**106%**
	('000t)	('000t)	
Native forest pulp	504	488	97%
Hardwood pulp	83	84	101%
Softwood pulp	636	1224	192%
Total pulp	**1223**	**1796**	**147%**

The total area of native forest harvested on State Forests in 2009/10 was 38,784 hectares and the total area of plantation harvested was 13,491 hectares[24]. Therefore, in order to produce one third of the volume of sawlogs, three times the area of native forests was harvested compared to plantations on State Forests.

22 Montoya 2010
23 Data for 1999/00 from FNSW 2009b
24 FNSW 2010a

Data is provided in Table 8 below on the types of native timber products harvested by Forests NSW by region (based on 2007/08 data because it is the last year for which such information was reported). The data includes hardwood and plantation native log volumes. This data indicates that the majority of quota sawlogs in NSW are sourced from the north-eastern regions, and that the vast majority of pulp is sourced from the Eden and Southern regions. It is also evident that in 2007/08, quota sawlogs accounted for only 25% of all eucalypt timber logged on State Forests in NSW whilst pulp grade logs comprised 44% of all eucalypt logged. To put that in the context of the total timber harvested from both native forests and plantations in 2007/08 (6.005M m^3 according to ABARE[25]) indicates that high quality large sawlogs from State Forests currently represent just 6% of all timber harvested in NSW.

Table 8. Volume of native timber products harvested in State Forests in 2007/08[26]

Region	High Quality Large Sawlogs (m^3)	High Quality Small Sawlogs (m^3)	Poles, Piles, Girders (m^3)	Low Quality Sawlogs (m^3)	Pulpwood (m^3)	Total
Upper North East	59,502	23,922	7,359	77,622	29,786	198191
Lower North East	126,858	41,091	29,122	187,561	129,940	514572
Eden	22,677	684	0	7,726	285,306	316393
Southern (incl Tumut)	71,107	7,472	819	51,077	124,055	254530
Riverina Red Gum	32,091	NA	NA	29,725	79,339#	141,155
Cypress	50,581	NA	NA	NA	NA	50,851
Total	**362,816**	**73,169**	**37,300**	**353,711**	**648,426**	**1,475,692**

#Firewood

NB. The volume figures provided in Auditor General (2009) as supplied by Forests NSW for 2007/08 differ (sometimes significantly) from the figures provided for 2007/08 in MCCE 2010a. The table above uses data provided in MCCE 2010a because it is a formal reporting process and it is more recent.

Table 9 provides a detailed breakdown of hardwood and plantation timber sourced from State Forests by product for north-eastern NSW (which includes the Upper North East and Lower North East regions). This indicates that the shift to plantation hardwoods is already well underway in north-east NSW with 29% of all hardwood timber currently derived from plantations, including 47% of pulpwood. Whilst plantations currently only supply 6% of large high quality logs, they are already supplying 21% of small high quality logs.

Table 9 Volume of State Forest hardwood logs by source and type in north-eastern NSW in 2007/08[27]

Product	Native Forest (m^3)	Plantation (m^3)	Total (m^3)	Plantation as % of Total
High Quality Large Sawlogs	175,179	11,181	186,360	6%
High Quality Small Sawlogs	51,074	13,939	65,013	21%
Poles, Piles & Girders	22,195	14,286	36,481	39%
Low Quality Sawlogs	174,764	91,419	266,183	34%
Pulpwood	84,958	74,726	159,726	47%
Total	**508,170**	**205,551**	**713,763**	**29%**

Table 10 provides data on the volume of softwood timber by product derived from State Forests for each

25 ABARE 2010a

26 For coastal regions uses data from Minister for Climate Change and the Environment 2010a, and for Riverina uses volume data from FNSW 2009 (annual allocation figures for 2008/09 used because 2007/08 data was for an 18 month period) and net harvest area figures from FNSW 2008e. For Cypress, uses data from Auditor General 2009.

27 All data derived from Minister for Climate Change and Environment 2010a, except for the high quality large volume figure that did not provide the split between sources. The high quality large split was derived by applying the figure provided in Auditor General 2009 of 6% of high quality large sawlogs sourced from plantations in 2007/08 to the overall HQ sawlog volume.

of the four Regional Forest Agreement regions. The totals do not represent the full volume of softwood timber produced from State Forests, because the RFA regions did not include the Macquarie planted forest regions. However, this limited data is the only information available on the breakdown of softwood timber by log type. The data indicates that across the four RFA regions alone, softwood plantations already supply almost double the volume of high quality sawlogs and an equivalent volume of pulp to native forest areas.

Table 10 Volume of Softwood Logs Harvested by State Forest Region in 2007/08

Region	Veneer (m^3)	High Quality Sawlogs (m^3)	Low Quality Sawlogs (m^3)	Preservation Timber (m^3)	Pulp grade (t)	Total
UNE	25,801	80,383	30,137	0	4,089	140,410
LNE	570	0	14,439	0	3,166	18,175
Eden	0	154,213	39,866	21,172	290,963	506,214
Sthn	3,818	481,557	0	4,826	183,755	673,956
Total	**30,189**	**716,153**	**84,442**	**25,998**	**481,973**	**1,338,755**

Harvestable Area

Native Forests

The total area of State Forests in NSW is 2.4M hectares[28]. Of this, native forests that are available for logging cover approximately 1.28M hectares[29]. There are additional areas of other Crown-timber lands that are also available for logging, but these are not included in any reporting provided by FNSW. Net harvest area by region is provided in Table 11. This indicates that the Western Region has the largest area available for logging, followed closely by the Lower North East Region. The Riverina has by far the smallest area available for logging, and Eden has the smallest area available of the coastal regions.

Table 11. Net harvest area of State Forests by region

Region	Net Harvest Area (ha)
Upper North East*	158,096
Lower North East*	288,640
Eden*	120,700
Southern*	173,440
Western[30]	329,730
Riverina[31]	27,779#
Total	**1,098,385**

*Based on most recent IFOA/FA Implementation Report[32]

#Forests NSW frequently quote a figure of 311,600ha for Riverina, but this includes Western Land Leases most of which are not Red Gum and are not harvestable, and also includes State Forests that have since been transferred to National Parks. This figure represents the best estimate of NHA on State Forests post-reserves.

It is notable that there are wide discrepancies in different estimates of net harvest area by Forests NSW in various different documents. Estimates in Annual Reports differ from estimates in IFOA/FA implementation reports, which differ from the estimates provided to the Auditor General (2009). In fact, net harvest areas differ quite significantly for the same region in successive years in IFOA/FA implementation reports. The same is the case with reporting of actual harvest volumes. This points to

28 FNSW 2010b

29 From FNSW 2010a, summing FMZ categories 3b, 4 and 8, and subtracting 100,000ha as an approximate NHA extent for the River Red Gum and Cypress reserves gazetted in the second half of 2010.

30 FNSW 2008f

31 NHA given for Koondrook-Perricoota/Campbells Island in NRC 2010b

32 Minister for Climate Change and Environment 2010b

substantial problems with Forests NSW basic data management. In this document, the author has tried to use the figures that appear to be most accurate and most recent.

Private land

The total area of private native forests that have been approved for logging in NSW is 338,073 hectares over the three and a half year period in which the Private Native Forestry (PNF) Code of Practice has been in operation[33]. This amounts to an average rate of approval per annum of approximately 100,000 hectares, and has involved the granting of 1,534 approvals in total. Although DECCW argued in the early stages that the dramatic rate of initial approvals would gradually ease, that has not occurred. The approvals are provided in the form of Private Native Forestry Property Vegetation Plans, which in most cases are granted for a 15 year time period.

The vast majority of the approvals by number and area have been issued for northern NSW, followed by the River Red Gum. Only relatively minimal areas have been approved by comparison in Southern NSW and the Cypress and Western Hardwood Forests.

Table 12. Area of Private Native Forests approved for logging to date in NSW

Region	**PNF PVP Area (hectares)**	**Number of Approved PNF PVPs**
Northern NSW	240,724	1,318
Southern NSW	17,296	73
Cypress and Western Hardwood Forests	15,761	38
River Red Gum	64,292	105
Total	**338,073**	**1,534**

The area approved in Northern NSW in just three years is more than 50% of the total area of forest available for logging on State Forests in northern NSW. The area approved for logging in River Red Gum is equivalent to almost 30% of all River Red Gum forests known to occur on private land in the Riverina region[34].

Plantations

Estimates of plantation area in NSW vary, sometimes substantially, between different sources. Table 13 below provides a breakdown of plantation area for NSW and adjoining states from the National Plantation Inventory, which is considered a reliable and up-to-date source. This data indicates a total plantation area of 383,182 hectares in NSW across all tenures, comprised of 75% softwood plantations and 25% hardwood plantations. NSW has a larger total plantation resource then Queensland but somewhat less then Victoria, but a larger softwood resource then either state.

The notable thing about the plantation resource in NSW compared to Victoria is the extent of public ownership – the vast majority of plantations in Victoria are in private hands (97%) while in NSW a substantial majority (64%) are in public hands. Public ownership provides an important opportunity for plantation resources to be re-directed as necessary to implement changes in forest policy.

Table 13. Plantation area by type and ownership[35]

33 Private Native Forestry Public Register accessed on 22nd February 2010 from http://www.environment.nsw.gov.au/pnf/approvedpnfpvps.htm

34 Estimated at 201,000ha by the NRC 2009

35 Ibid

	NSW (ha)	Queensland (ha)	Victoria (ha)
Hardwood	92,541	63,618	202,703
Softwood	287,820	190,663	220,009
Other	2,821	2,108	1,438
Total	**383,182**	**256,389**	**424,150**
Public	247,015	198,941	4,352
Private	131,362	54,677	412,757
Joint	4,805	2,771	7,040
Total	**383,182**	**109,952**	**424,150**

The distribution of plantations (public and private) by the regions used for the National Plantation Inventory is depicted in Figure 2 and provided in

Table 14. This includes all regions that occur in NSW and in adjacent parts of Victoria and Queensland. The results indicate that there is a total plantation resource of 770,315 hectares in, and closely adjoining, NSW across all tenures.

Figure 2. Distribution of plantations in south-eastern Australia

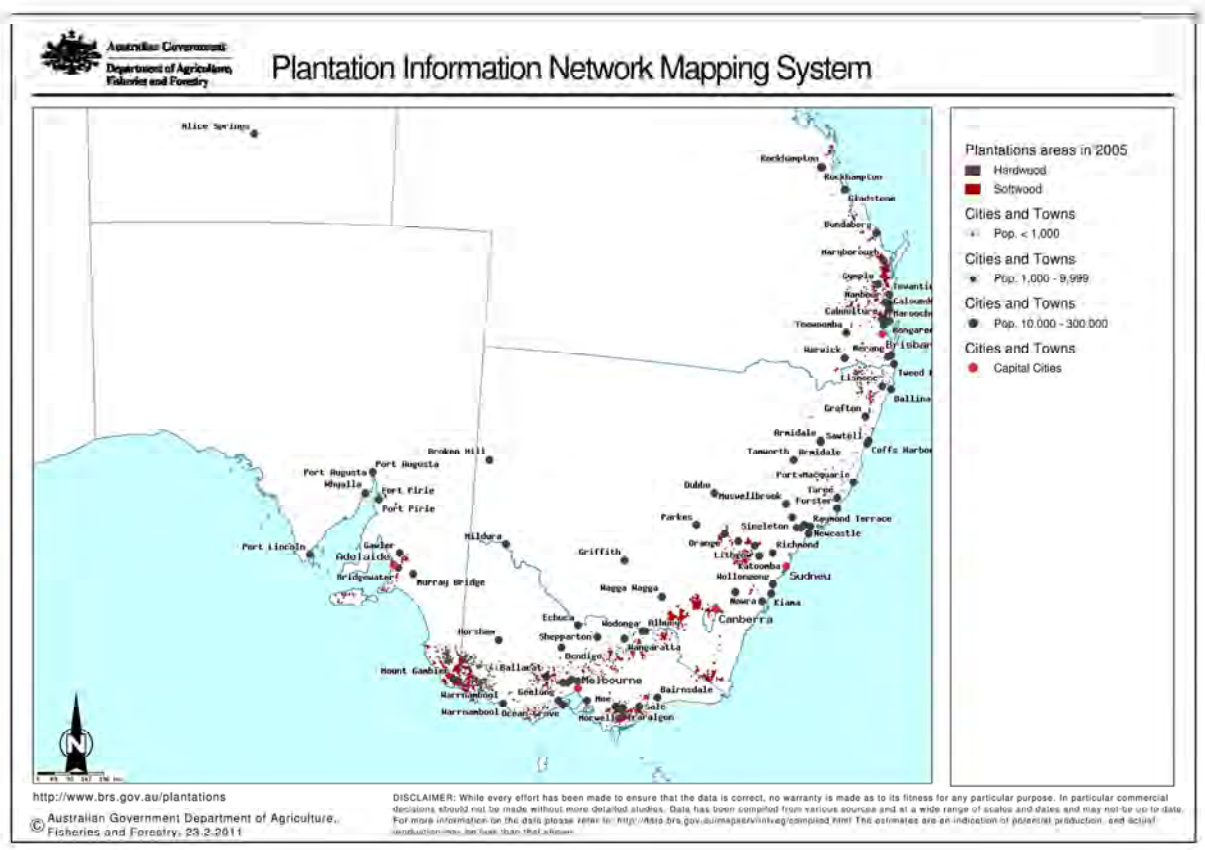


Table 14. Plantation area by National Plantation Inventory Region[36]

Region	Hardwoods (hectares)	Softwoods (hectares)	Other categories (ha)	Total (hectares)
South-east Queensland	41,668	161,849	1108	204625
Northern Tablelands	1,933	14,871	314	17118
North Coast	86,296	16,069	984	103349
Central Tablelands	984	80474	0	81458
Southern Tablelands	416	21602	1	22019
Murray Valley	6,761	188705	106	195572
East Gippsland-Bombala	4,633	42823	266	47721
Central Gippsland	38,828	58803	821	98452
Total	**181519**	**585196**	**3600**	**770315**

Forests NSW indicate that the State Forest estate plantation in 2009/10 is comprised of 206,085 ha of softwood plantation and 49,690 hectares of hardwood plantations[37]. This provides an overall figure of State Forest plantations of 255,755 hectares, which is similar to that reported in the NPI[38].

Hardwood plantations on State Forests are restricted almost entirely to the Upper North East and Lower North East CRA Regions, with only 40ha being located in the Southern Region. The hardwood plantation timber resource in the north coast region is basically split into two groups – pre-1994 and post-1994 plantations. The pre-1994 hardwood plantations were mostly established in the 1960s and 1970s, and include some areas that were first established as early as 1939[39]. The total area of pre-1994 plantations is given as 20,700ha[40], of which approx 14,000ha (located around Coffs Harbour) was purchased by Forests NSW from the Australian Paper Manufacturers in 1994[41]. These latter plantations were originally established to provide pulpwood. Flooded Gum and Blackbutt are the major species planted in the pre-1994 plantations, with some Silvertop Stringybark, Blue-leaved Stringybark and Sydney Blue Gum[42].

The post-1994 plantations comprise the remainder of the hardwood plantation estate, covering some 27,400 hectares[43]. They are all less then 16 years old, with the predominant species planted being Flooded Gum, Blackbutt and Spotted Gum[44]. It seems that approximately half of the post-1994 plantations are in the 1-10 year age class and the other half are in the 11-20 year age class[45]. In 2009/10, Forests NSW purchased some 7,000 hectares of newly established plantations (aged 1-10 years old) from TEPCO[46]. This included an unspecified area of hardwood plantations on the north coast of NSW, comprised of Spotted Gum, Coastal Blackbutt, Dunn's White Gum, Flooded Gum, Gympie

36 BRS 2010
37 This is said to include the pre-1994 plantations.
38 Although other official figures vary quite substantially from this, with the IFOA Implementation Report 2008/09 giving a figure of 352,300ha, and FNSW (2010b) giving a figure of 270,000 hectares. Even the exact same document FNSW 2010a, in another section gives a different, substantially larger figure.
39 DAFF 1999
40 Auditor General 2009
41 Ibid
42 Ibid
43 Derived by subtracting the pre-1994 figures from the total figure
44 FNSW 2010a
45 Ibid
46 http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/332101/Keneally-Government-acquires-7,000-hectares-of-plantation-forest-for-carbon-and-timber-benefits.pdf

Messmate[47].

Softwood plantations in State Forests are located in all of the four coastal CRA regions – Southern, Eden, Upper North East and Lower North East. However, Forests NSW manage softwood plantations on the basis of a different set of regions – Northern, Monaro, Hume and Macquarie. The distribution of softwood plantations across those four regions is provided in Table 15 below. The Hume region contains the largest area, followed closely by Macquarie. Monaro and Northern have substantially smaller, but still significant, areas. The recent TEPCO purchse of 7,000 hectares included Radiata Pine plantations on the South West and Central West Slopes.

Table 15. Net area of softwood plantations by planted forest region in NSW

Planted Forest Region	Net Area (ha)
Hume[48]	87,435
Macquarie[49]	73,719
Monaro[50]	35,900
Northern[51]	42,024
Total	**239,078**

In terms of Regional Forest Agreement regions, which are different to the planted forest regions, this equates to the majority of softwood plantations occurring in the Southern CRA region, with close to 42,500 hectares occurring in the Eden region and a similar amount in the northern regions spread more or less equally between the Upper North East and Lower North East[52].

Farm Forestry

Reliable information on the extent of farm forestry in NSW is limited[53]. URS (2007) estimates the total area of farm forestry in NSW at 27,950ha. It appears the definition of farm forestry used to derive these figures is based on plantations that form part of a working farm with other active agricultural enterprises, such as joint ventures. Therefore, it is likely that farm forestry area figures given in URS (2007) are not additional to the total plantation area figures given earlier in this document, but is likely to have been included in those figures, at least partially.

Table 16. Estimated areas of farm forestry plantations in NSW: 2007

Region	Farm forestry plantations (ha)
North Coast	7,632
Northern and Central Tablelands	2,760
Murray Valley	9,011
Southern Tablelands	7,641
South East NSW	906
Total	**27,950**

47 Ibid
48 FNSW 2008a
49 FNSW 2008b
50 FNSW 2008c
51 FNSW 2008d
52 Minister for Climate Change and Environment 2010
53 Montoya 2010

Trends in Plantation Establishment

Garrard (2010) provides an overview of plantation establishment from December 2001 to 30 June 2010. A total of 132,199 hectares new plantations were authorised over that period, with authorisations peaking in 2007/08 with the approval of 37,042 hectares. This has since dropped markedly to 13,131 in 2009/10. Hardwood plantation establishment slightly exceeded softwood plantations over the 10 year period.

One of the most significant changes in plantation establishment occurred in 2003/04, when Managed Investment Schemes (MIS) emerged as one of the major players. By June 2010, there were 286 MIS established plantations covering an area of 82,636 hectares[54]. The global financial crisis in 2009 led to the collapse of several MIS companies, including four that had invested heavily in NSW, and this is considered to be the major reason for the collapse in plantation establishment rates in NSW between 2008 and 2010. Four major MIS companies with plantations in NSW collapsed in 2009/10 – Timbercorp and Great Southern were placed into administration in 2009 and Forest Enterprises Australia and Willmott Forests went into receivership in 2010. There are concerns about the future of these plantations.

Notably, FNSW had just entered into commercial agreements with Willmot Forests and FEA whereby FNSW would establish and manage plantations on behalf of each company on State Forest land that FNSW had leased to each company[55]. The current status of these plantations is unknown.

There are recognised environmental problems with plantation establishment and management. The most notable include chemical use and water interception[56]. The effects in relation to water are particularly troublesome because they are likely to reduce water supply in coastal catchments and threaten water quality from chemical run-off. Other environmental concerns that have been identified with plantations include clearing of native vegetation for plantation establishment and impacts on soil and water from clearfall harvesting.

There have also been many concerns raised about the timber value of hardwood plantations that have been established in north-east NSW. In particular, local communities have raised concerns that the plantations have been planted mostly for pulpwood, not sawlogs; that inappropriate species have been planted (ie Dunns White Gum); and that there has been a very high rate of failure due to a range of factors including disease, frost and dieback (J.Morrison pers comm, J. Edwards pers comm).

Plantation Capability

In 2001, a detailed study of plantation capability and suitability in NSW estimated that there were 6.3M hectares of cleared land (not under intensive or urban use) that were considered capable of commercial growth rates of >12 cubic metres per ha per year[57]. When economic factors were taken into consideration, the study concluded that there were 425,000 hectares where prospective plantation returns compared favourably with estimated farm business profits and hence were likely to provide a strong economic incentive for plantation establishment. The same study estimated that, once established, 425,000 hectares of new plantations would have an estimated gross value of production of $1.5 billion. The composition and distribution of this potential plantation estate consisted of slightly more than 50% softwood plantation located in the Oberon area in the south and between Armidale and Glen Innes in the north, whilst the remainder was hardwood plantation located mostly on the north coast. If the economic competitiveness threshold was increased, such that plantations had to provide economic returns in excess of the value of agricultural land, the predicted area suitable for new plantations reduced to 160,000 hectares of which two-thirds were softwood plantations. The study found that plantation competitiveness was very sensitive to milldoor log prices, with a predicted 10%

54 Garrard 2010
55 Montoya 2010
56 Ibid
57 ABARE & BRS 2001

reduction in milldoor prices leading to a significant reduction in plantation potential. It also found that competitiveness was sensitive to the additional returns derived from potential sale of carbon credits, in a positive direction.

Species Mix

The distribution of broad forest types on State Forest tenures is provided in Table 17 below. The most extensive types include Messmate and Mixed Coastal Forests, followed by Spotted Gum, Stringybark, White Cypress and Other Inland Eucalypt Types. Blackbutt and Blue Gum Forest Types are not as extensive as these but still cover greater than 100,000 hectares each.

Table 17. Area of broad forest types on State Forest tenure[58]

Broad native forest types*	**Area (ha)**
Alpine ash forest	17 356
Blackbutt forest	112 796
Blue gum forest	126 515
Messmate forest	232 591
Mixed coastal eucalypt	220 918
Non-eucalypt forest	11 383
Non forest	65 285
Other inland eucalypt types	177 833
Other inland types	162
Rainforest	89 543
River red gum forest#	110 983
Snow gum woodland	27 509
Spotted gum forest	181 763
Stringybark forest	181 920
Unclassified	193 907
White cypress pine forest	172 385
Total	**1 922 851**

**As defined in* Forest Types in New South Wales Research Note No.17.
#Prior to recent tenure changes from State Forest to National Park

The major species grown in plantations in NSW up to 2005 is provided in

58 FNSW 2010a

Table 18. The major hardwood species planted have been Blackbutt and Dunn's White Gum, followed by Flooded Gum, Spotted Gum and Lemon-scented Gum. The vast majority of softwood plantations have been Radiata Pine.

Table 18. Tree species grown in NSW plantations in 2005[59]

Species	**Area (ha)**
Hardwood species	
Acacia spp. (Wattle)	218
Araucaria spp. (e.g. Hoop pine)	922
Corymbia maculata (Spotted gum)	4,963
Corymbia spp. (e.g. Lemon-scented gum)	4,380
Eucalyptus cloeziana (Gympie messmate)	1,264
Eucalyptus dunnii (Dunn's white gum)	12235
Eucalyptus globulus (Tasmanian blue gum)	281
Eucalyptus grandis (Flooded gum)	8,403
Eucalyptus nitens (Shining gum)	2,309
Eucalyptus pilularis (Blackbutt)	15,197
Eucalyptus regnans (Mountain Ash)	2
Other eucalyptus	5,536
Other hardwood	1,982
Softwood species	
Other Pinus	1,172
Other softwood	1,102
Pinus caribaea (Caribbean pine)	1,388
Pinus elliottii (Slash pine)	2,723
Pinus pinaster (Maritime pine)	370
Pinus radiata (Radiata pine)	259,248
Pinus taeda (Loblolly pine)	3,012
Southern pine (collective name for either Slash, Caribbean or Loblolly pine)	6,020
Other Mixed Species	7
Other Unknown	254
Total	**332,988**

59 Montoya 2010

TIMBER INDUSTRY

Sawmills

The trend in the sawmilling industry across Australia in the decade from 1996/97 to 2006/07 has been one of a rapid decline in the number of mills. The total number of broadleaved sawmills is estimated to have fallen by 43% across Australia over the last ten years, with small mills being the most heavily affected[60]. Similarly, the number of coniferous mills also fell by 58% over that time period, apparently as a result of the restructuring of that industry towards large volume production processes[61]. There was a 91% reduction in coniferous mills less than 3000 cubic metres in size and an almost 50% increase in mills greater than 45000 cubic metres in size[62].

A sawmill survey compiled for ABARE estimates that there are 184 broad-leaved sawmills and 26 coniferous sawmills in NSW in total[63]. This data was derived from a sample of sawmills, and it is difficult to ascertain its accuracy, but it is used here because it is the only such data available[64]. Table 19 provides information on the number of mills in NSW and Australia by size class in the broad-leaved and coniferous categories.

A total of 123 broad-leaved sawmills, representing some 67% of the total in NSW, fall in the smallest size class of less than 3000 m^3 of log intake per annum, and there are only 22 broad-leaved mills in NSW that would be considered large (log intake >15,000 m^3 per annum). In contrast, the coniferous mills are well distributed across size class, with only 15% in the small size class and 62% in what might be considered the large size classes, including 4 mills that process more than 100,000 m^3 per annum.

Table 19 Number of sawmills in NSW and Australia by size class[65]

Log Intake m3/year	Broad-leaved		Coniferous	
	NSW	Australia	NSW	Australia
<3000	123	337	4	13
3000 - 15000	39	101	6	41
15000 - 45000	19	55	7	21
45000 - 75000	2	7	4	8
75000 - 100000	1	1	1	3
>100000	0	1	4	22
Total	**184**	**502**	**26**	**108**

New South Wales has the largest number of broadleaved mills in Australia, followed closely by Queensland, who together account for the majority of broadleaved mills in Australia[66]. In both these states the industry is heavily weighted towards small mills, which is not the case in other states. New South Wales has the second largest number of coniferous mills in Australia, trailing Queensland and followed by South Australia, whilst Victoria has the a relatively small number of coniferous mills but the largest number processing more than 100,000 m^3 per annum[67].

60 Burns et al 2009
61 Ibid
62 Ibid
63 Ibid
64 The accuracy of the survey results is probably far greater for softwood then hardwood mills because 73% of the softwood sawmill population was sampled whilst only 21% of the hardwood population was sampled.
65 Burns et al 2009, adapted from page 5
66 Ibid
67 Ibid

It is notable that the Australian sawmill data indicates that small mills have a relatively large share of the private forest resource. The share of private broad-leaved logs, in total mill intake, across Australia is highest in mills processing less than 3000 m^3 per annum and reduces for each successive mill size category[68].

The number of mills sourcing timber from State Forests in NSW has been derived from the list of sawmill customers provided in the FNSW Supplement to the Seeing Report 2008-09[69], after amendment by the author to account for known mill closures since that time period. The results suggest that State Forests supply timber to 58 broadleaved sawmills and 32 coniferous sawmills[70], as set out in Appendix 1. Of these mills, 5 of the broadleaved mills are interstate (Victoria and Queensland) and 6 of the coniferous mills are interstate (ACT, Victoria, Queensland). Therefore, there are 53 broad-leaved mills and 26 coniferous sawmills in NSW supplied from State Forests. This indicates that public forests supply all coniferous mills and approximately 30% of broad-leaved mills in NSW.

Whilst data is not provided by FNSW on the size of mills per se, it does provide information on the capacity of each customer. In some cases, for a small number of bigger customers, this is spread across a number of mills. There are 37 broad-leaved customers supplied with a capacity of <19,999 m^3 per annum, 8 with a capacity of 20,000-99,999 m^3 per annum and 2 with a capacity of >100,000 m^3 per annum. For the coniferous timber customers, there are 15 with a capacity of <19,999 m^3 per annum, 8 with a capacity of 20,000-99,999 m^3 per annum and 9 with a capacity of >100,000 m^3 per annum.

The average log intake of hardwood sawmills in NSW is given as 6,065m^3 with a recovery rate of 40% and an average sawnwood output of 2,428 m^3, whilst the average log intake of softwood sawmills in NSW is given as 97,142m^3 with a recovery rate of 47% and an average sawnwood output of 45,798 cubic metres[71].

The distribution of all sawmills in NSW sourcing timber from State Forests is shown in Figure 3. As these maps indicate, there are three major centres for softwood processing in NSW, around Oberon/Bathurst, Tumut and Albury, although there are scattered operations across both northern and southern NSW. As far as hardwood processing is concerned, there are effectively five major centres in northern NSW around Lismore/Casino, Grafton, Coffs Harbour, Port Macquarie and Bulahdelah/Newcastle. Southern NSW has the only hardwood woodchip mill in NSW at Eden, and a relatively small number of scattered mills which are mostly along the coast north to Nowra. In Western NSW, mills are now largely restricted to five towns – Gunnedah, Baradine, Condobolin, Narrandera and Barham. More details on the major sawmills and companies processing timber in NSW is provided in following sections.

68 Ibid
69 FNSW 2009c
70 FNSW 2009c provides a list of customers, and the author has converted that to a number of mills by researching the number of mills for each of the large customers and adding those to the total.
71 Burns et al 2009

Figure 3. Distribution of Sawmills Sourcing Timber from State Forests[72]

72 Reproduced from FNSW 2009b

Employment

In the very broadest sense, the number of people employed in the NSW forest and wood products industry is estimated to be 38,140.

Table 20 People employed in the NSW forest and wood products industry[73]

Sector	Employment	% of total
Agriculture, Forestry and Fishing Support Services	27	0.1
Agriculture, Forestry and Fishing	434	1.1
Converted Paper Product Manufacturing	7	0.02
Corrugated Paperboard and Paperboard Container Manufacturing	1,803	4.7
Forestry Support Services	831	2.2
Forestry and Logging	40	0.1
Forestry	1,061	2.8
Log Sawmilling and Timber Dressing	968	2.5
Log Sawmilling	2,037	5.3
Logging	590	1.5
Other Converted Paper Product Manufacturing	255	0.7
Other Furniture Manufacturing	4,692	12.3
Other Wood Product Manufacturing	1,676	4.4
Paper Bag and Sack Manufacturing	171	0.4
Paper Product Wholesaling	4,317	11.3
Paper Stationery Manufacturing	1,760	4.6
Prefabricated Wood Building Manufacturing	75	0.2
Pulp, Paper and Converted Paper product Manufacturing	647	1.7
Pulp, Paper and Paperboard Manufacturing	1,114	2.9
Reconstituted Wood Product Manufacturing	661	1.7
Sanitary Paper Product Manufacturing	1,175	3.1
Timber Resawing and Dressing	428	1.1
Timber Wholesaling	1,446	3.8
Timber and Hardware Goods Wholesaling	55	0.1

73 Produced by Montoya 2010 from the 2006 Census

Veneer and Plywood Manufacturing	297	0.8
Wood Chipping	103	0.3
Wood Product Manufacturing	141	0.4
Wooden Furniture and Upholstered Seat Manufacturing	3,381	8.9
Wooden Structural Fitting and Component Manufacturing	7,948	20.8
Total	**38,140**	**100**

FNSW restrict employment to more direct employment in the forestry sector and derive an estimate of 12,744 jobs across NSW, of which there are 5124 jobs in forest management and harvesting, 5343 jobs in primary processing, 1446 jobs in distribution and 831 jobs in support[74]. This is considered likely to be an over-estimate, as Industry and Investment (2010) place the estimate of direct employment across all tenures in forestry and logging in NSW at 2,522 based on 2006 census data, and indirect employment at 6,113.

FNSW (2010a) further claim that 6,344 of total forestry jobs are dependent on timber from State Forests. It is notable that despite major reductions in supply of hardwood quota sawlogs over the last 15 years in NSW, there has only been a very small change in net employment figures with most of that occurring in forestry management and not in either harvesting and haulage or processing. Table 21 provides a comparison of State Forest dependent employment in the forestry industry in 1997/98 and in 2008/09.

Table 21. State Forest dependent employment in the forestry industry[75]

Employment Sector	**1997/98**	**2008/09**
Forests Management	1566	888
Harvesting and Haulage	1132	1131
Primary Processing	4328	4325
Total	**7026**	**6344**

As set out in Table 22, over that same time period, quota sawlog allocations from NSW State Forests have reduced by 55%, and yet the reduction in forestry employment of 682 jobs that has occurred over that period represents only 1.8% of the total employment in the forest and wood products industry of today, and only 5% in the NSW forestry sector. Therefore, the data shows that employment in the forest and wood products industry in NSW is not highly sensitive to major reductions in hardwood quota sawlog supply.

Table 22. Comparison of reductions in quota sawlog allocations between 1997/98 and 2008/09

Region	**Original Annual Quota Sawlog Allocation (m^3)**	**Current Annual Quota Sawlog Allocation[76] (m^3)**	**Current as Percentage of Original**
North East	523,120[77]	209,500	40%
Southern	106,750[78]	79,008	74%

74 FNSW 2010a
75 Adapted from FNSW 2010a
76 From NSW Auditor General 2009, except for Riverine figure which is from the Riverina Red Gum IFOA
77 Original allocations from 1995 for six northern subregions and one central subregion as given in RACAC 1996
78 Original allocations from 1995 for two southern subregions and Tumut as given in RACAC 1996

Eden	59,000[79]	22,080	37%
Brigalow/Nandewar	87,090[80]	46,060	53%
Riverina	31,010[81]	4,413	14%
Total	**806,970**	**361,061**	**45%**

It is also notable that the major impacts on employment have been the result of mill closures made by companies such as Boral for purely economic reasons. In fact, since the Forest Agreement was signed in 1999, at which time Boral received a major wood supply contract from the NSW Government purportedly designed to secure regional employment, Boral have closed six hardwood sawmills in NSW and displaced a large number of employees.

Boral appears to employ a policy of plant shutdowns and slowdowns whenever it experiences lower sales volume, in order to maintain profits. It proudly boasts that one of the benefits of the 'step change operational improvements' that it made in its business in 2008/09 was a 15% reduction in the workforce of its timber section[82].

In 2001 Boral closed a mill at Grafton[83], in 2006 it closed green mills at Bostobrick and Kempsey and suspended operations at its Gloucester flooring plant[84], in 2008 it closed a green mill at Walcha and a parquetry plant at Grafton[85] and in 2010 it closed a mill as Maxwells Creek, near Dungog[86]. Some 47 jobs were lost at the Bostobrick and Kempsey mills alone[87], and extrapolating that across the other mills, it seems likely that up to 200 jobs may have been lost.

There is little data available on the number of jobs directly employed in the native timber industry. ABARE (1999) conducted a detailed sawmill survey in the Southern Regional Forest Agreement region and concluded that there were 237 jobs in 15 hardwood mills in the region. The recent River Red Gum decision resulted in five quota sawmills and a number salvage mills closing in the Riverina, having a total job impact of 180 jobs[88].

Products and Markets

The total volume of sawnwood products from NSW in 2007/08 was 1.7 million cubic metres. In that year, softwood sawnwood production in NSW amounted to 1,298,500m^3 which equates to 75% of all sawnwood produced in NSW, whilst broad-leaved sawnwood production equalled 422,600m^3 which represented 25% of sawnwood produced[89]. NSW is the biggest producer of broad-leaved sawnwood in the country, contributing 39% of all broad-leaved sawnwood produced in Australia[90]. It also contributes 30% of all coniferous sawnwood produced in Australia. The volume of hardwood sawnwood produced in NSW amounts to 25% of the total volume of hardwood sawlogs harvested each year.

Table 23 provides proportional data provided by Forests NSW on sawlog product mix from NSW. The most notable aspect of this data is that it confirms the declining use of hardwood timber for house framing. Softwood has largely replaced hardwood as a product used in house framing over the last three decades. This decline in hardwood framing products is still continuing, with a reduction from 30%

79 Original allocations from 1995 for Eden as given in RACAC 1996
80 For Brigalow, original 2003 quota allocation figures (for cypress and ironbark) described in RACAC options report for 'business as usual' Option F, at http://www.racac.nsw.gov.au/pdf/Options.pdf, and for Nandewar, original 2003 cypress quota allocation from Inverell Management Plan minus the allocation to Brigalow region.
81 Allocations for original 2009 quota allocation figures for River Red Gum as reported in FNSW Environmental Impact Statement 2009
82 Annual Review 2009 http://www.boral.com.au/AnnualReview/2009/AnnualReport/review-of-operating-divisions-timber.asp?mnu=7
83 http://www.boral.com.au/Docs/Announcements/Press_Releases/Press_Releases_13012004_152148.asp
84 http://www.boral.com.au/Docs/Announcements/Press_Releases/Press_Releases_01062006_092833.asp
85 http://www.walchanewsonline.com.au/news/local/news/general/fight-to-keep-sawmill-open/1243609.aspx
86 http://www.smh.com.au/national/boral-closes-mill-that-provided-fine-timber-for-opera-house-20100907-14znj.html
87 http://www.boral.com.au/Docs/Announcements/Press_Releases/Press_Releases_01062006_092833.asp
88 DECCW 2011. Briefing: River Red Gum Implementation.
89 ABARE 2010b
90 ABARE 2010b

of all hardwood products going to framing in 1995/96 to just 14% in 2008/09[91]. In contrast, house framing accounts for some 73% of softwood sawn timber.

The other notable feature of this data is that the single major sawn product from hardwood forests in NSW is now purportedly hardwood floorboards, which amount to 48% of all hardwood sawn products according to Forests NSW[92].

Table 23. Sawnwood product mix in NSW[93]

Product Mix	**Hardwood %**		**Softwood %**	
	1995/96	**2008/09**	**1995/96**	**2008/09**
Dry Structural	21%	7%	0%	0%
Floorboards	22%	48%	3%	3%
Joinery/Furniture	1%	6%	2%	1%
Decking/panelling	4%	6%	1%	6%
House framing	30%	14%	71%	73%
Pallets	12%	9%	0%	0%
High strength structural	2%	2%	0%	0%
Fencing/landscape	8%	8%	7%	6%
Other preservation	0%	0%	1%	4%
Unseasoned	0%	0%	14%	7%

If the product mix reported by Forests NSW in the table above is applied to the total sawnwood volumes reported by ABARE[94] for 2008/09, then it is possible to derive estimates of the volume of each product. These estimates are set out in Table 24.

Table 24 Estimated sawnwood volumes produced in NSW in 2008/09

Product	**Hardwood Sawnwood Products (m^3)**	**Softwood Sawnwood Products (m^3)**
Dry Structural	30,352	0
Floorboard/Bearers/Joist#	*208,128*	*38,955*
Joinery/Furniture	*26,016*	*12,985*
Decking/panelling	*26,016*	*77,910*
House framing	60,704	947,905
Pallets	39,024	0
High strength structural	8,672	0
Fencing/landscape	34,688	77,910
Other preservation	0	51,940
Unseasoned	0	90,895
Total	**433,600**	**1,298,500**

#This category given as just 'Floorboards' for hardwood category and 'Floorboards/bearers/joists' for softwood category

There is no reliable data available with which to compare the estimates above, as neither state nor federal agencies publicly report the exact annual volumes of sawnwood products. In order to fill this gap, Ajani (2011) uses two different methods to derive an Australia wide estimate of high value appearance products. In one method, she applies an ABARE product mix percentage of 36% for appearance grade products to derive an estimate of 328,680m^3 of appearance grade sawnwood in Australia. Using another method based on data from the National Carbon Accounting System, she derives an estimate of 154,000m^3 for broad-leaved flooring products across Australia and 38,000m^3 for furniture products. These figures tend to cast some doubt on the volume estimates derived from FNSW

91 FNSW 2010a
92 FNSW 2010a
93 FNSW 2010a
94 ABARE 2010b

product mix percentages as set down in Table 24, which appear to be considerably inflated. General data on recovery rates from high quality sawlogs suggests that the volumes are likely to be considerably less than 208,128m^3 for flooring products given the current volume of available sawlogs. Nevertheless, regardless of the exact volume, it is apparent from all of the data above that NSW is highly likely to be the largest producer of appearance grade broad-leaved products in Australia.

The only data available on the NSW trade balance in timber products is that reported by ABARE in its Australian Forest and Wood Products Statistics report[95]. Unfortunately, it provides no information on the trade across state borders which makes it somewhat difficult to assess the overall status of the industry.

Ajani (2011) provides the following summary of the overall state of timber consumption and balance of trade in Australia:

"Low consumption growth and surging plantation resources characterises Australia's wood products industry. Australia's wood consumption (to make all the sawn timber, wood panels and paper we consume whether domestically produced or imported) increased by only 0.8% pa over 1990 to 2009. Domestic plantation wood supply grew by 6.3% pa over the same period. Plantations now supply 82% of the wood for solid wood products manufacturing (sawn timber and wood panels) in Australia. Production of native forest solid wood products has contracted by an average 2% pa over the past two decades. In this intense period of industry structural change, buyers have not shifted to hardwood-based imports, including from tropical regions. Instead, consumption of hardwood solid wood products, domestically produced and imported, contracted. Imports of solid wood products from tropical countries accounted for only 2% of our consumption in 2008/09".

In 2009/10, NSW imported 321,400 cubic metres of wood and forest products worth $187M[96]. Imports are predominantly value-added products and are dominated by dressed sawnwood, plywood and board products. Dressed timber accounts for 110,500 cubic metres (or 55%) of the total sawnwood and is valued at $72.2M[97].

Table 25. NSW wood and forest product imports 2009/10[98]

Imports 2009/10	**Volume (m^3)**	**Value ($'000)**
Roughsawn	90,700	46,861
Dressed sawn	110,500	72,200
Veneer	2,100	6,895
Plywood	54,800	32,246
Board Products*	63,200	29,603
Total	**321,400**	**187,810**

*Particleboard, Hardboard, Medium Density Fibreboard, Softboard and other

Table 26 provides the breakdown of sawnwood imports by type. This data indicates that in 2009/10, 184,100m^3 of sawnwood imports were coniferous which amounted to 91% of all sawnwood imports, and that some 37% of all sawnwood imports were Radiata Pine. In contrast, imports of timbers that are likely to have come from tropical regions (with a high likelihood of having being logged illegally) amount to 17,300m^3 in total, or 8% of all sawnwood imports.

Table 26. Volume of NSW sawnwood imports by type in 2009/10[99]

95 ABARE 2010b
96 See ABARE 2010b
97 ABARE 2010b, p46
98 Based on data provided in ABARE 2010b
99 Based on data provided in ABARE 2010b

Type	Roughsawn volume (m^3)	Dressed sawn volume (m^3)
Douglas Fir	26,300	18,900
Radiata Pine	43,600	31,600
Western Red Cedar	2,500	
Other Coniferous	10,200	51,000
Kapur, keruing, merbau	300	
Meranti, Iauan, Seraya	3,500	4,000
Other broad-leaved	4,400	5,100
Total	**90,700**	**110,500**

Although data is not available for NSW, it is clear from Australia wide data that New Zealand is the major supplier of both roughsawn and dressed sawnwood to Australia[100]. It is also the major Australian supplier by volume of medium density fibreboard, whilst it is second only to Germany as a major supplier of particleboard. New Zealand is the major supplier by volume of plywood, followed by China, Malaysia, Chile and Indonesia.

In contrast to imports, exports of wood and forest products from NSW are dominated by low value products, particularly roundwood and woodchips. NSW exported 579,600 cubic metres of timber in 2009/10 and 693,900 kt of woodchips[101]. This amounts to almost four times the volume of imported primary wood products. This difference is not reflected in the value, with the value of exports falling short of imports by approximately $16M.

Table 27. Volume and value of exports from NSW

Exports	Volume (m^3)	Value ('000)
Sawnwood	181,600	23,319
Roundwood#	398,000	36,529
Woodchips	693,900*	11,527
Total		**171,375**

*Bone dry kilotonnes. #Includes pulp logs.

Although detailed data is not provided for the breakdown of sawnwood exports from NSW, the Australia wide data shows that 71.6% of all sawnwood exports are coniferous, and that 94% of exports are roughsawn[102]. Similarly, whilst no further information is provided on the type of roundwood exports from NSW, the Australia wide data indicates that 82% of roundwood exported from Australia are coniferous[103]. The vast majority of woodchip exports are broad-leaved (ie hardwood eucalypt).

Therefore, NSW does not operate a major trade deficit on primary wood and forest products, but on the contrary, in 2009/10 ran a very modest deficit of $16M. Notably, NSW exports a substantially greater volume of primary wood products then it imports, but due to the low value of the exports and the value-added nature of the imports, the net result is a small value deficit.

However, when miscellaneous forest products and secondary wood products are considered, NSW is a major net importer. Miscellaneous forest products include a wide array of generally value-added products such as doors, packing cases, tools, household utensils, essential oils etc. In 2009/10, NSW imported miscellaneous forest products to the value of $163.5M and exported such products to the

100 ABARE 2010b
101 ABARE 2010b, pp 63, 76 & 77
102 ABARE 2010b, p63
103 ABARE 2010b, p66

value of only $6.3M[104]. Across Australia, the major supplier of miscellaneous forest products was China, followed by the United States, New Zealand and France, with Indonesia the major supplier of doors and mouldings.

With regard to secondary wood products, NSW imported wooden furniture to the value of $465.8M and printed articles to the value of $561.2M[105]. In contrast, it exported only $6.2M worth of wooden furniture and $128M in printed articles[106]. Although data is only available on an Australia wide basis, the vast majority of wooden furniture is sourced from China, whilst the major suppliers of printed articles are the United Kingdom, United States and China with a number of other countries supplying smaller amounts[107].

Advice from local furniture manufacturers is that they cannot compete on price with furniture produced in China. In fact, they advise that they are even out-competed on price by roundwood Mountain Ash and Radiata Pine logs exported to China, manufactured into furniture there and then re-imported into Australia. One can assume that the same is the case with miscellaneous forest products and secondary wood products. This sheds some light onto the cause of the major trade deficit in furniture and miscellaneous forest products in Australia. In short, rather than being a product of a shortage of timber supplies in NSW as sometimes claimed by the timber industry, the trade deficit is clearly the result of the fact that Australia cannot compete against cheap labour in China in the production of manufactured products, and the NSW manufacturing sector is not robust or innovative enough to overcome that impediment.

In summary, it is apparent that NSW runs only a minor trade deficit in primary wood product ($16M) in value terms but in volume terms it runs a major surplus of primary wood products exporting almost four times as much as it imports. NSW imports mostly value-added products and exports very little value-added product. Coniferous logs are the predominant primary product exported into and out of NSW, with most primary wood products sourced from New Zealand and only a relatively minor volume from tropical countries. NSW has a major trade deficit in all wood products due largely to furniture imports from China.

Economic Value

According to ABARE, the value of all log production across tenures in NSW in 2008/09 was $348 million, which was comprised of $128 million from broad-leaved native forests, $12 million from broad-leaved plantation and $208 million from coniferous plantations[108]. In 2007/08, the gross value of log production was $379 million, which amounted to 0.09% of gross state product in NSW[109]. Value of log production from broad-leaved native forests in that year was $146m[110], which represents just 0.04% of gross state product. Therefore, native forest timber operations represent an extremely minor component of the NSW economy.

For the last two years, Forests NSW has operated at a net loss – equivalent to $44.271 million in 2008/09[111] and $233.378 million in 2009/10[112]. The majority of the loss incurred in 2009/10 related to the resolution of a deferred tax liability from pre-1994 plantation establishment[113]. Native forest operations have also operated at a loss – in 2007/08 Forests NSW lost $14.4 million from native forest operations[114] and in 2008/09 they lost $8.1 million[115].

104 ABARE 2010b, pp 47, 48 & 67
105 ABARE 2010b, p78-79
106 Ibid
107 ABARE 2010b, pp78-79
108 ABARE 2010b
109 I&I 2010
110 ABARE-BRS 2010b
111 FNSW 2009b
112 FNSW 2010a
113 Ibid.
114 Auditor-General 2009
115 Minister Steve Whan, General Purpose Standing Committee No 1, Budget Estimates 2009/10, Supplementary Questions on Notice,

These losses have occurred despite substantial direct subsidies to the timber industry from NSW and Federal Governments. NSW and Federal Governments allocated a total of $140 million to the timber industry as part of a forest industry restructuring package[116], of which the majority was spent on industry development assistance. A further $19.9 million was allocated by the NSW Government to purchase private properties to supplement public timber supply and an additional $5 million was provided as harvest and haulage assistance, after the Forest Agreements were implemented[117]. The NSW Labor Government also invested $75 million in hardwood plantation establishment from 1995 onwards[118]. Combined, these investments represent a massive direct subsidy to the timber industry in NSW.

URS (2008b) provides an inter-jurisdictional comparison of economic policy settings in the timber industry across Australia and a number of the problematic factors which they identify in that review have undoubtedly been instrumental in leading to both poor financial returns and bad environmental outcomes from forest management in NSW. The key management failings in NSW, and as identified by URS (2008) have been:

1. The use of administered, rather then competitive, pricing mechanisms which lead to lower prices for timber and can result in allocation of timber to lower value uses.
2. Excessively lengthy wood supply contracts which inhibit innovation and investment and create barriers to diversification and competition in the industry.
3. Cross-subsidisation of public native forest operations from public plantation profits, exacerbated by failure to report financial results for the two sectors separately.
4. Conflation of operational responsibilities with regulatory and policy responsibilities in a single forestry agency which can lead to conflicts between short-term commercial imperatives and long-term management goals.

Administered Pricing

From 1998 to 2010, Forests NSW used an administered log pricing system titled the Log Value Pricing System (LVPS)[119] which applies a residual pricing approach to determine the relativities between high quality sawlogs of different species, size and location. This system calculates royalties as *'the residual value to a sawlog processing company after deducting all the reasonable costs of manufacturing, distribution and otherwise conducting a business, including a reasonable level of profit, from the value of end products'*[120]. URS (2008b) provided a critique of the LVPS and noted that there was a *'high risk that the system does not result in efficient pricing outcomes that accurately reflect capacity or willingness to pay'.* EcoLarge (2008) go further, describing the system as 'flawed' and noting two of the major problems with it as the distorted manner in which it handled transport costs and the subjectivity in the pricing process.

Victoria have recently commenced a transition from administered prices to the introduction of a competitive, open market auction system as the means of pricing native forest logs. URS (2008b) found that stumpage prices achieved in the largest auction held to date were 50% to 100% higher then existing administered prices supplied under existing long term supply agreements in Victoria.

It is apparent that administered pricing has resulted in similar poor financial returns to the state in NSW. A recent price review conducted of public timber prices in NSW confirmed that '*Forests NSW log prices had not kept track with market prices for logs''*[121]*.* As a result of that review and the findings of the Auditor-General, Forests NSW committed to '*a significant increase in native timber product pricing to*

116 See http://www.daff.gov.au/rfa/publications/deferred/wood-paper/fisap and http://www.racac.nsw.gov.au/overview/fisap.shtml, plus http://www.parliament.nsw.gov.au/prod/parlment/hansart.nsf/8bd91bc90780f150ca256e630010302c/ca256d11000bd3aa4a25680400177b72?OpenDocument

117 Forest Agreement for the Upper North East Region

118 See http://esvc000759.wic060u.server-web.com/rfa/northeast/fact1.shtml

119 SFNSW 1999

120 SFNSW 2000, quoted in EcoLarge 2008

121 FNSW 2010b

better reflect competitive market prices''[122]. This included a '*proposal for a structural price increase in the order of 20% to better reflect competitive market log prices*'[123] and a new administered pricing system called 'The Price System'.

'The Price System' purports to 'reflect log product market values through a more simple, transparent and understandable pricing system' and to ensure that 'pricing for all....log products will be on a commercial basis'[*124*]'. However, it is still ultimately an administered pricing system, and the negotiations with the timber industry around the promised 20% price increase which commenced in 2010 are revealing as to the problems which this system brings with it. A briefing note obtained under the Government Information Public Access Act 2009 reveals that the structural price increase described above was delayed by three months, re-profiled as six 3% increases rather than three higher increases (5%,7%,7%), and reduced by 1% after negotiations with the timber industry[125]. It also reveals that Boral was opposed to the price increase and informed Forests NSW that they might consider legal action for poor performance under the wood supply agreement if the price increase was not cancelled[126]. Therefore, the influence which the timber industry exerts in setting prices in an administered pricing system is likely to continue to undermine returns to the taxpayer under The Price System.

EcoLarge (2008) note that "*Royalty rates should....be set to include the full costs, including environmental costs, of logging operations. Royalty calculations should also be transparent and open to the public. Marsden Jacob (2001) recommend that to improve public confidence, and economic efficiency, royalties should be set by bodies "at arms length" from FNSW*". Clearly, none of these tests has yet been met by the The Price System.

Long-term Wood Supply Contracts

URS (2008b) provide a detailed critique of the problems created by long-term wood supply contracts. The major issues which they identify include:

- Lack of flexibility – especially for forest managers who can be locked in to contracts that cannot be met due to natural events such as bushfires or yield revision. This adds additional costs as managers must purchase logs elsewhere or provide compensation in order to meet obligations.
- Loss of responsiveness – long-term contracts impair responses to market changes (such as new technologies, changed demand) and can prevent resources being directed towards the most valuable products.
- Barrier to entry – long-term contracts act as a barrier to entry into the wood products industry, particularly when the supply is being reduced overall.

Each of these aspects tends to result in reduced profitability from native forest logging operations. URS (2008b) notes that the length of supply contracts in NSW are excessive, being longer than the pay-back period for sawmill investment. The costs of long-term contracts to the taxpayer are already evident in NSW. The NSW Government has spent $19.9 million for private property timber supplementation, and Forests NSW have also spent at least $500,000 on compensation for failure to supply to date[127]. As sustainable yields from State Forests continue to decline these costs will undoubtedly increase.

Cross-subsidisation from softwood plantations

URS (2008) describe the cross-subsidisation of native forest operations by softwood plantations as *'in effect a direct subsidy using taxpayer funds as the profits from plantation forestry would otherwise become direct government revenue'*. They also note that such subsidisation builds up adjustment

122 Ibid.
123 Ibid.
124 FNSW 2010c.
125 FNSW 2010b.
126 Ibid.
127 Auditor-General 2009

pressure, because the costs will be greater if/when operations are finally required to meet commercial imperatives.

The cross-subsidy is more notable as it is not transparent to the public due to the fact that the financial reports of the native forest and plantation sectors are combined in annual reports. There is no separate public accounting or reporting available for the native forest sector, and hence the scale and nature of the subsidy is usually hidden. The figures on the scale of loss-making from native forests that are available for 2007/08 were provided by the Auditor-General in his special report, and the figures for 2008/09 were provided during budget estimates in the NSW Upper House. Such figures are not generally easily available to the public.

Conflation of responsibilities

URS (2008b) note that *'public sector reforms across Australia over the past two decades have recognised that separating policy and regulation from operations provides greater clarity in objectives for each function of government and improved performance*'. They further recognise that a lack of separation between environmental, governance and commercial management in the forestry sector in particular can result in poor outcomes. This is the case in NSW, where Forests NSW are the agency responsible for undertaking and managing commercial harvesting operations, for setting sustainable harvest levels, and for meeting environmental obligations. This conflation of roles may go some way to explaining why long-term supply agreements have been set at unsustainable levels in NSW, because, as noted by URS (2008b) *'it may be in the short to medium term interests of a commercial forest manager to increase harvest volumes above long-term sustainable yields to maximise profit'*.

Summary

The major impact of this poor economic management of public native forests in NSW has been that cheap, subsidised timber from public lands committed in long-term contracts has led to market distortions, such that private hardwood plantation operations cannot compete. It has thus stifled the development of a sawlog-driven hardwood plantation sector on freehold land - hindering the long-term future of the timber industry whilst in the short-term allowing it to degrade our valuable natural assets.

EcoLarge (2008) in their socio-economic analysis of River Red Gum forestry in the Riverina highlight the obstacles faced by plantations and farm forestry as a result of cheap timber available from native forests. They note that "*Growers must pay costs for land, pay to prepare soil, plant trees, costs of establishment and management of plantations and consider the opportunity cost of other land uses. None of these costs are considered to be incurred by timber operations in State Forests..... It is a considerable barrier to the expansion of this industry in the Riverina region that it is forced to compete against a supplier that pays none of these costs.....With cheap, public timber available to them, there is little incentive for mills to encourage the plantation industry (Scott, 2008)"*.

Marsden Jacobs (2001)[128] explored the lack of competitive neutrality between private forestry activities and publicly-managed forests and concluded that it makes private investment in plantations less attractive and thus:

- *Distorts the allocation of wood sources within the forest sector;*
- *Encourages greater exploitation of public native forests in each State;*
- *Undercuts competing uses of public native forests; and*
- *Worsens the state of the environment and resource base.*

As noted by Ajani (2011) the solution is not in more government funding for long lead-time plantations. Rather, "*investors in long rotation plantations require higher returns to compensate for the increased risk. Hardwood sawmillers, however, appear unwilling to pay the higher wood prices to attract the plantation investment and expect the public to keep subsidising their wood costs"*. She notes that what is required is to *'completely free the market of state-subsidised native forest competition and stop unending plantation*

128 Quoted in EcoLarge 2008

expansion via tax-based subsidies devoid of rigorous market analysis". The primary objective of forest policy, says Ajani, should be to encourage *'commercially viable domestic plantation processing*'.

Furthermore, as a result of poor economic management, the forestry agency has not even recovered the costs of log production and has certainly not delivered a resource rent to the public from use of native forests[129]. Therefore, the community incurs the long-term cost of the environmental impacts of forestry practices without securing any return. Unsustainable logging practices have led to major environmental impacts and now threaten to cause major social impacts as a result of the looming adjustment shock from rapidly declining yields and increasingly inevitable structural changes.

129 See URS 2008a

NATIVE FOREST YIELDS

Overview

The generally accepted definition of 'sustained yield' is the volume of timber that can be obtained from an area in perpetuity, such that the volume removed does not exceed the volume that is harvested in either the short or long-term. This is different from the 'ecologically sustainable yield' which is better considered as the volume of timber that can be removed in perpetuity whilst maintaining the full suite of environmental values.

Each region of NSW is assessed below in relation to the best current estimates of sustained yield, and how they compare both to wood supply agreements and actual volumes that are harvested annually. Estimates of sustained yield are provided separately for each region for public native forests, private native forests and plantation forests (both hardwood and softwood).

Wood Supply Agreements are contracts signed between Forests NSW and sawmillers in NSW to provide a specified volume of timber for a given length of time. The practice of signing long-term wood supply agreements (ie 20 years) appears to have commenced in the late 1980s. Since that time period, there has been a trend towards reduced flexibility for Forests NSW in wood supply contracts and increased security for sawmillers, such that current contracts provide very few avenues for Forests NSW to reduce supply without paying substantial compensation to affected millers. This is particularly the case with contracts for HQL sawlogs and large volumes of pulp, whilst contracts for other products tend to be more flexible. It is notable that through this process public timber assets are basically privatised at no cost to the sawmillers, such that if the public seeks to have its forests managed to maximise values other then timber (such as biodiversity, carbon and water) it will be forced to pay compensation to sawmillers for the wood supply contracts which the sawmillers received for free.

In 2007-08, Forests NSW sawlog commitments totalled 942,216m^3 and pulp commitments were 521,450m^3 [130]. Table 28 provides a break-down of commitments by region.

Table 28 Wood Supply Agreements for 2007/08[131]

Region	HQL (m^3)	HQS (m^3)	LQ (m^3)	Other (m^3)	Total Sawlog (m^3)	Pulp (t)
North Coast	209,500	63,772	330,544	28,850	632,666	165,000
South Coast	46,000	4,650	32,000	Nil	82,700	63,050
Tumut	33,008	6,240	20,062	Nil	59,310	20,000
Eden	22,080	1,920	23,000	Nil	47,000	273,400
Western	90,590	NA	28,000	2,000	120,590	
Total	**401,178**	**76,582**	**433,606**	**30,850**	**942,216**	**521,450**

Source: Forests NSW
Notes: Other means poles and piles for the north coast, and ironbark for western region. Around a third of poles and piles supplied meet the specifications of a high quality large sawlog. Girders and veneer logs are included in the high quality large sawlogs.
NB The Red Gum IFOA commits to the supply of 4,413m^3 of high quality logs and 17,533m^3 of residue logs and residue for 20 years. However, there is no formal information as to if, or how, these volumes may have been incorporated into supply agreements.

130 NSW Auditor-General 2009
131 NSW Auditor-General 2009

According to the NSW Auditor General, there are six types of wood supply agreements for the north coast:

- Type A - Fixed volumes for 20 years generally for high quality large logs, although a proportion can be substituted with high quality small logs. Contracts expire 2023.
- Type B - 75 per cent of volume is fixed for the first 10 years, with share of production for the remaining 25 per cent. This means the available wood is shared between customers. Mainly high quality small sawlog, poles, piles and girders. Resource review to occur at year 10 and 15. Contracts expire 2023.
- Type C - Volume is based on share of production. Mainly used for low quality logs (also called salvage logs). Contracts expire 2023.
- Type D - Same specifications as C agreements except contracts expire in 2015.
- Annual - Annual Timber allocation based on share of production and are renewed each year. Can be sawlog or pulpwood.
- Pulp - Pulp agreements vary from fixed term contracts to annual allocations.

Wood supply agreements on the south coast generally contain commitments for more than one product and expire in 2020.

The NSW Auditor General describes the way wood supply contracts are managed as follows:

"*Under a wood supply agreement, Forests NSW can vary the volume of timber supplied to a customer by up to ten per cent. However, the cumulative value of the over or under supply cannot be greater than ten per cent of the annual commitment. There are around 300 wood supply agreements in total. Regions monitor the wood supplied to each customer against their allocations, including monthly and annual targets. The Commercial Services unit also centrally monitors wood supplied to customers for high quality large logs*".

There is very little flexibility for FNSW with regard to supplying HQL logs, but considerable flexibility for most other products. The NSW Auditor-General describes the situation as follows:

"*Although Forests NSW is committed to providing these volumes, in practice it has some flexibility if the timber is not available. For example, Forests NSW must supply a fixed timber volume of around 464,000m3 or about 50 per cent of total sawlog, most of which is high quality sawlog. The balance is based on share of available supply. Large high quality sawlog commitments are fixed although Forests NSW are allowed to substitute a proportion of high quality large for high quality small logs under some agreements*".

There is little information provided on current wood supply contracts for softwood timber by Forests NSW. However, some information is available in ESFM Plans by Forests NSW, as follows:

- Macquarie region – contracts for 490,000-645,000t sawlog and 486,000-650,000t pulp and non-structural
- Monaro region – ten year contracts for approximately 575,000 cubic metres of roundwood.
- Northern region – contracts for veneer and sawlogs of 280,000m3 and 20,000m3 pulp

In NSW, Forests NSW have rarely harvested native forest timber on a sustained yield basis, and many would argue have never harvested native forest timber on an ecologically sustainable basis. Across NSW, it is notable that contracted wood supply commitments for native forests are currently not being met, either with regard to all sawlogs or with regard to high quality large sawlogs. A comparison of harvested volume and contracted volume is presented in

Figure 4 and Figure 5.

Figure 4. Harvesting results for total sawlog in NSW

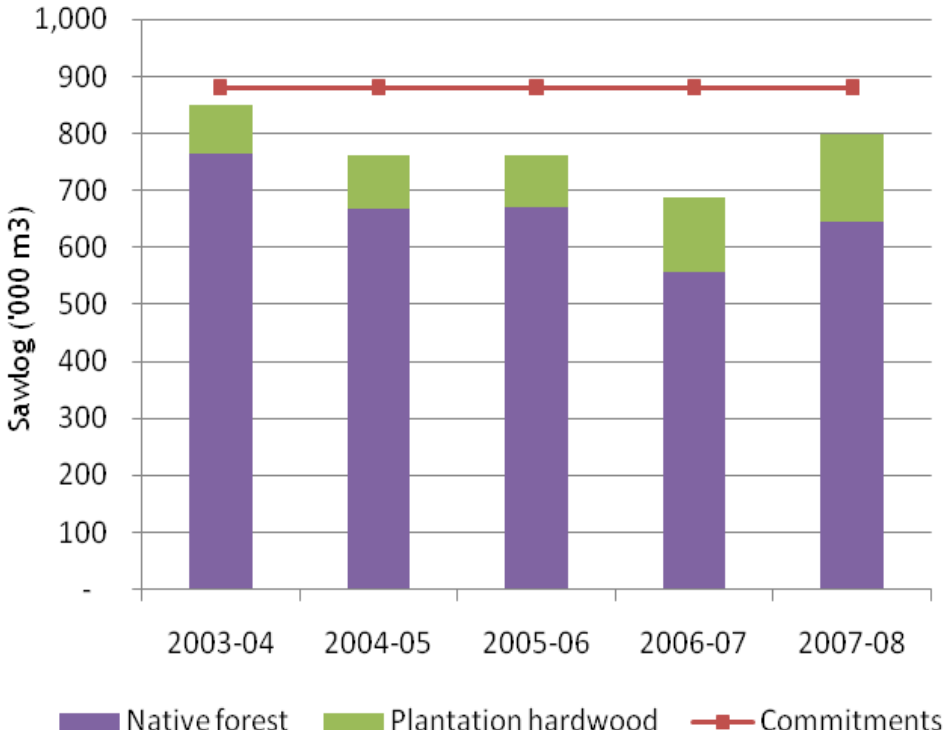
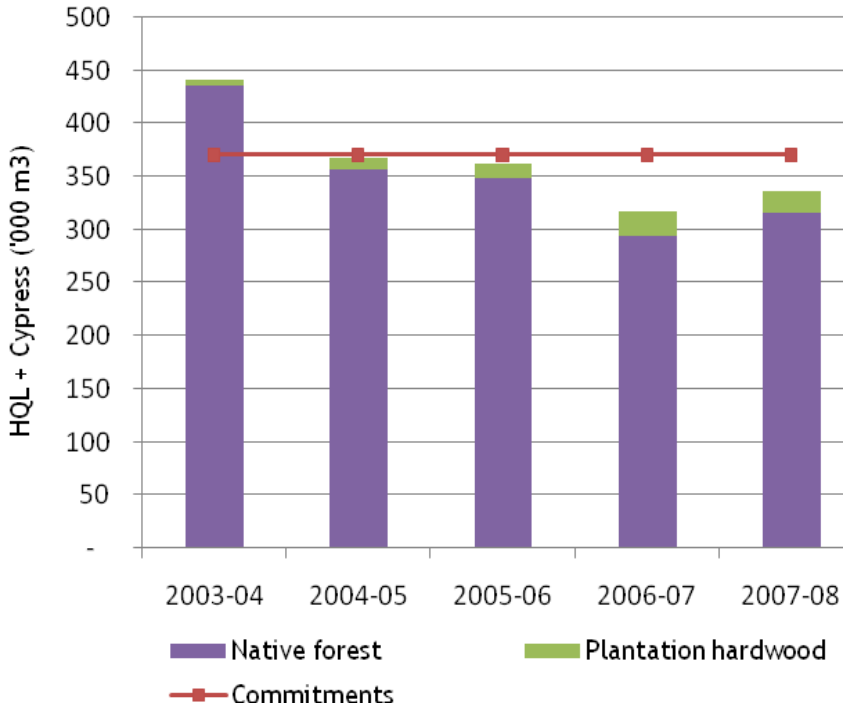


Figure 5. Harvesting results for high quality large sawlogs



North-eastern NSW

Public Resources

Forests NSW do not log hardwood timber on a sustained yield basis in north-east NSW. Instead, they have instituted a policy of maximising the supply of large, high quality logs in the short-term and then accepting substantial reductions in timber thereafter. This is described well by the NSW Auditor-General (2009), as follows:

"*To meet wood supply commitments, the native forest managed by Forests NSW on the north coast is being cut faster than it is growing back. This is especially the case for the blackbutt species. This does not mean that the forest will not regrow but there will be a reduction in yield in the future. After the current agreements cease, Forests NSW plans to fill the shortfall on the north coast with plantation hardwood. However, we found it is currently sourcing significantly more from plantations than anticipated to meet its commitments, which may place this strategy at risk*".

Forests NSW recognise their problems in meeting HQL supply and their intention to make a transition to plantations themselves in their ESFM plan when they state that "*FRAMES modelling shows that a large proportion of the HQL commitment over the next 20 years will be sourced from areas that are difficult and expensive to access.....Continued supply of HQL sawlogs from forests in the north east will require an increasing shift from native forest to plantation and smaller logs in the medium to long-term. Over the next year, Forests NSW will investigate, the timing of this transition and any scheduling of thinning operations that may be necessary in the shorter term to accelerate growth into larger sizes*".

Therefore, and as explained in detail below, Forests NSW is already engaged in a form of transition from native forests to plantations in north-east NSW, such that the emphasis on timber supply has started shifting, and will shift much further over the next 10 years, from native forests to hardwood plantations.

In 1999, Forests NSW utilised their Forest Resource and Management Evaluation System (FRAMES) to estimate that 269,000m^3 of high quality large (HQL) sawlogs could be harvested each year until 2018, dropping to an estimated 183,500m^3 per annum thereafter[132]. Twenty year wood supply agreements were set at the level of 269,000 m^3 per annum of HQL sawlogs and signed in 1999, timed to end at the same time as the NSW Forest Agreements in 2018.

Therefore, Forests NSW were operating on the basis of substantial over-cutting of the forest resource for a 20 year period with a substantial drop in volumes for the following 80 years. At the time, Pugh & Flint (1999) conducted a detailed analysis of timber resource data for the region and concluded that the committed supply to 2018 was a dramatic overestimate of achievable yield, and instead predicted that as little as 135,000 cubic metres per annum was deliverable from the region. The over-cutting that has occurred over the last 12 years since that estimate was derived has undoubtedly compromised the long-term yields even further, with step-change declines now expected to occur sooner.

Since the wood supply agreements were first signed in 1999 there has been a progressive reduction in the annual yields of HQL sawlogs harvested in north-east NSW, and in response Forests NSW have retired, purchased and renegotiated wood supply contracts downwards and created and taken opportunities to substitute small logs for large logs in supply contracts. There is no doubt this is a result of the markedly unsustainable levels at which the wood supply agreements were first set which has meant that they simply cannot be met.

This decline has occurred despite the fact that Forests NSW has, since 1999, undertaken a timber supplementation strategy which has included the purchase of 11 properties covering 13,000ha of land

132 Commonwealth of Australia & NSW Government 2000

with 141,439m³ of HQL quota sawlogs[133]. The strategy has also involved on-going pursuit of timber purchase agreements for additional logs from private land, although the volume achieved appears to have been relatively limited with only 10,962m³ of HQL sawlogs in total purchased in the seven year period up to 2005[134] and 54,000m³ of all sawlogs in total having been purchased in the five year period to 2009[135]. In 2009/10 only 554m³ of sawlogs were purchased by FNSW[136]. This is in contrast to the target of 30,000m³ per annum of sawlogs that has been set by Forests NSW[137].

In 2003, wood supply contracts were re-negotiated downwards to a total of 223,077m³ of HQL sawlogs[138]. At the same time, an additional 65,000 hectares of forests were protected in National Parks and special management zones, whilst some 15,000m³ of quota was retired and restrictions on falling trees into buffers were loosened slightly which Forests NSW had expected to provide additional timber. However, the duration of the supply contracts were effectively re-set for another 20 years, meaning that they now went out beyond the end of the Regional Forest Agreement to 2023. Furthermore, clauses that allowed volumes to be reviewed and, if necessary, subsequently reduced without Forests NSW paying compensation to sawmillers were removed[139]. In addition, at time the provision of wood supply contracts was expanded out to cover all other wood products, rather then just HQL sawlogs as had been the case previously.

Therefore, the compensation risk to the taxpayer was substantially increased on two fronts - the loss of the non-compensable review clause for HQL contracts and the expansion of risk across all wood products (albeit with some more flexibility then was contained in HQL contracts). Since that time, wood supply contracts for HQL logs have been reduced further through purchase of agreements by Forests NSW, and as at 2007/08, the total volume committed stood at 209,500m³ per annum of HQL until 2023[140].

Reductions and changes in wood supply agreements that are known to have occurred since they were first signed in 1999 have included the following:

- Retirement of 15,000m³ of quota in 2002/03
- Renegotiation in wood supply contracts down to 223,077m³ in 2003
- Increased substitution of high quality small (HQS) logs for HQL logs in 2003
- Compensation of $550,000 to a customer for non-supply of 34,000m³ of HQL logs in 2004-2006
- Buying out 13,403m³ in wood supply allocations from two customers in 2006/07
- Reduction in wood supply contracts to 209,500m³ in 2007/08

However, this is just the information that is publicly available, and as noted by the Auditor-General, Forests NSW *'has not provided data on the total volume and value of allocations bought back and compensation payments made since the wood supply agreements were signed*'.

Despite these progressive reductions in commitments, Forests NSW have still not been able to meet wood supply contracts in north-eastern NSW. A graph produced by the NSW Auditor-General (2009) comparing current contracted wood supply volumes with actual volumes harvested for HQL logs from 2003/04 to 2007/08 is provided as Figure 6. Harvest results for North Coast large high quality logs[141]. It reveals a trend of progressive decline in volumes harvested and a substantial shortfall in meeting supply contracts. This trend has continued into 2008/09 with an actual harvest of only 173,475m³ of HQL logs which represents a shortfall of 36,025m³ or 17% of the contracted volume[142]. In 2008/09, the

133 DECCW 2010
134 Figures for quota sawlog volume only up to 2005 provided in DECCW 2010 (IFOA/FA Report)
135 Figures claimed by Forests NSW Acting CEO in letter to NSW Auditor-General 2009
136 Minister for Mineral and Forest Resources 2010
137 NSW Auditor-General 2009
138 FNSW 2005a & FNSW 2005b
139 NSW Auditor-General 2009
140 Ibid
141 Ibid
142 NSW Minister for Climate Change and Environment 2010b, although DECCW 2010 gives an alternative figure of 157,234m³ (which possibly does not include the plantation volumes but is not clearly explained)

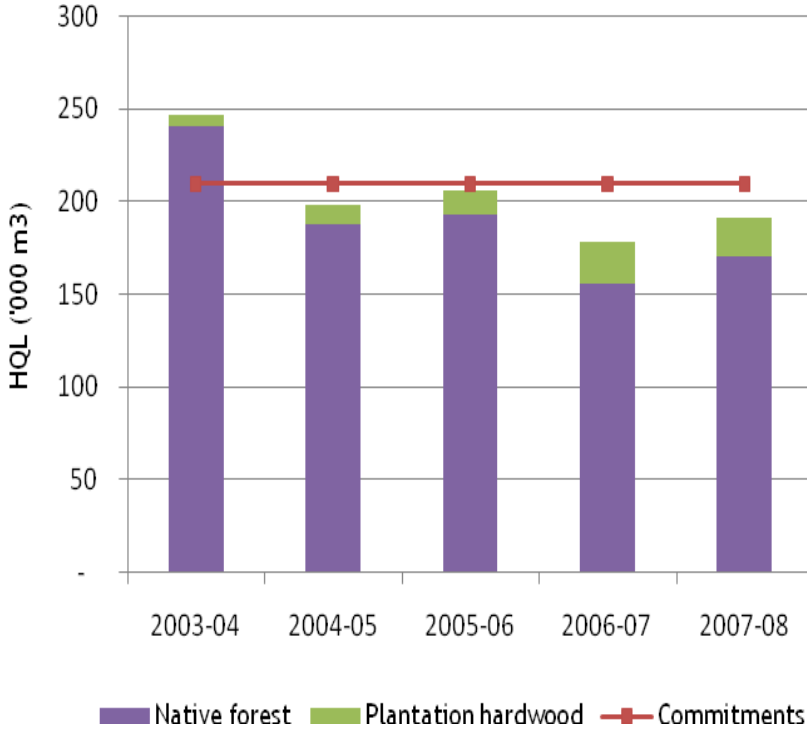
overall volume supplied from public forests was 173,475m³ of high quality large sawlogs, 63,845m³ of high quality small sawlogs, 232,236m³ of low quality sawlogs, 30,904m³ of poles, piles and girders, and 210,058m³ of pulpwood/chipwood[143].

This shortfall in timber supply is presumably being met either by substituting high quality small (HQS) sawlogs to fill the gap or by payment of compensation by Forests NSW to sawmillers. The extent of the wood supply crisis in north-east NSW is underscored by the fact that in September 2010 Boral Timber commenced legal proceedings against Forests NSW for failure to supply. The case is still underway.

Figure 6 also reveals that to meet supply contracts for HQL logs Forests NSW has had to increase the volumes harvested from plantations. The Auditor-General (2009) raises concerns that hardwood plantations are being cut early, stating that a total of 153,000m³ (which amounts to 24% of all sawlogs harvested on the north coast), was sourced from plantations in 2007-08 which was substantially more than its annual target of 89,700m³. In terms of HQL sawlogs, 6% were sourced from hardwood plantations in 2007/08, which compares with 1% in 2003/04[144]. The 6% harvested in 2007/08 amounts to approx 11,181m³ of HQL sawlogs sourced from hardwood plantations.

Therefore, despite the fact that committed supply volumes have been reduced downwards, small logs have been substituted for large logs, a private property timber supplementation strategy has been put in place and increasing volumes have been sought from plantations, Forests NSW still cannot meet its wood supply contracts for HQL logs in NSW. The Auditor-General (2009) states that *'these issues indicate that Forests NSW faces difficulties managing supply especially for large, high quality sawlogs'*.

Figure 6. Harvest results for North Coast large high quality logs



Furthermore, as noted by both the Auditor-General (2009) and Forests NSW (2009d), species mix is also problematic with inadequate supplies of preferred commercial species such as Blackbutt and an over-supply of less sought after species such as Grey Gum, White Mahogany and Tableland species. Lastly, harvesting is becoming more difficult and more expensive, with increased harvest and haulage

143 NSW Minister for Climate Change and Environment 2010b, although DECCW 2010 gives an alternative figure of 157,234m³ for high quality large sawlogs (all other figures provided in DECCW 2010 match well with MCCE 2010b)
144 NSW Auditor-General 2009

prices, as timber is sought in more remote areas with lower yield per hectare and steeper terrain[145]. In fact, Forests NSW estimate that approximately 60% of available timber is now in difficult terrain in northern NSW[146].

The trend of reducing volumes and increasing cost is undoubtedly set to continue in north-eastern NSW. Estimates of sustained yield by Forests NSW are analysed below with a view to identifying the point at which the HQL volumes from native forests will largely collapse and an enforced transition to plantation forests and other alternatives will occur regardless of the policy settings adopted by the NSW Government.

Over the period from 1999 onwards, as both the actual volumes of quota sawlogs harvested and the wood supply commitments have progressively fallen, there have been numerous different long-term yield estimates produced by Forests NSW. These are summarised for the first 20 year period, and the subsequent 80 year period, for each of the studies in Table 29. Note that the start dates for each study are different, and thus the 20 year and 80 time periods are different for each estimate, but the illustration in Figure 7 harmonises the dates so that a direct comparison can be made[147].

Table 29. Long-term yield estimates provided by Forests NSW for north-east NSW

Estimate	**Year**	**Short-term Yield: 20 yrs (m^3)**	**Average Long-term Yield: 21-100yrs (m^3)**
Original FRAMES[148]	1999	269,000	183,500
North Coast Timber Study[149]	2002	220,000	175,000 yrs 21-40 110,000 yrs 41-100
Review of Wood Resources on NSW North Coast[150]	2004	187,000 years 1-5# 170,000 years 6-20#	55,250 yrs 21-100#
Yield Estimates for Native Forest Regions[151]	2010	160,000 years 1-10* 130,000 years 11-15* 95,000 years 16-20*	95,000 yrs 21-60* 65,000 yrs 61-100*

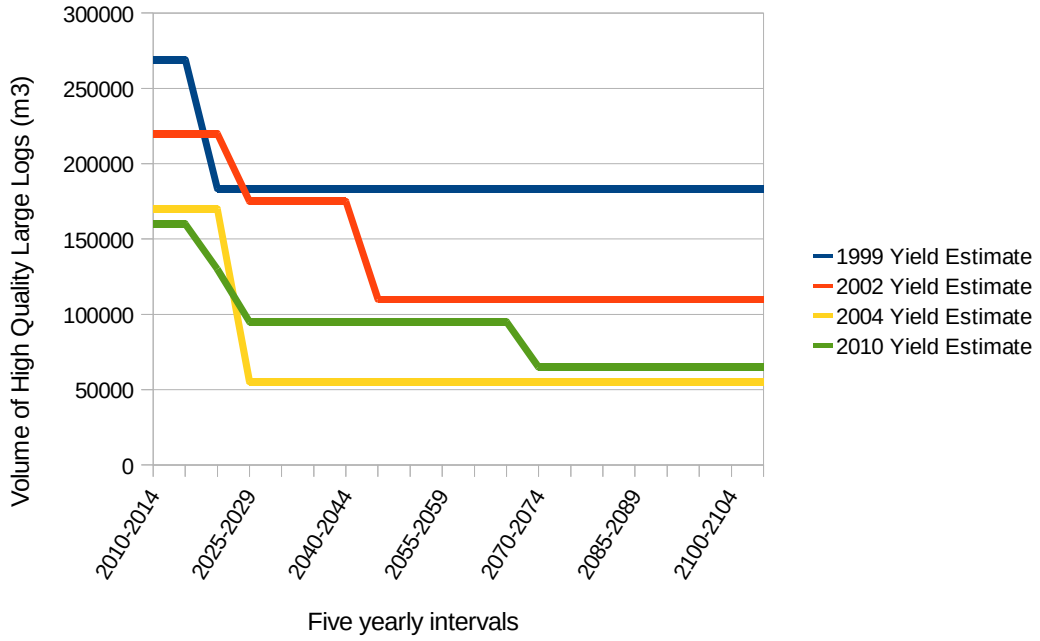
*Figures read off graphs (because raw data not provided) which may contain slight inaccuracies
#Figures read off graphs and a reduction of 15% applied to total figures based on statement in report that '*the modelled outcome is generally 10-15% above the likely outcome*'

Plantation is not included in the estimates for 2010 or 2004, but is included in the estimates for 2002 and 1999. However, in both of the earlier estimates, the yield scheduling did not predict substantial logging of the plantation resource until the second 50 year period, so the comparison is still considered valid.

As this data indicates, yield estimates by Forests NSW are highly variable and largely lacking in credibility. Pugh (2011) provides a more detailed comparison and critique of each which can only lead to the conclusion that the yield modelling process and the way it is applied by Forests NSW in northern NSW is deeply flawed. The only thing which may be said for the yield estimates is that they have been more or less reducing over time which is the same trend that is occurring with actual harvest volumes. However, it is apparent that they all seem to represent a dramatic overestimate of the actual resource both in the short-term and over the long-term. It is notable, for example, that the 1999 estimate predicted that after 2018 there would be 183,500m^3 available per annum, but that current actual volumes from native forests have already fallen below that 10 years earlier than expected.

145 NSW Auditor-General 2009
146 FNSW 2009d
147 The five-year reporting periods did not align exactly for all estimates, so in some cases approximations had to be made to account for that
148 CoA & NSW Govt 2000
149 As documented in Vanclay 2002
150 FNSW 2004
151 Forests NSW 2010c

Figure 7 Comparison of Forests NSW Sustained Yield Estimates for North-east NSW[152]



To gain anything useful from these yield estimates, it is probably most reasonable to take the lowest estimate, and then reduce it further based on the trends shown in the actual yields. Therefore, the author has taken the lowest short-term yield estimate of 160,000m³ from the 2010 estimate, and applied the annual proportional reduction in yields which has actually occurred over the last 10 years. Over the 10 years from 1999/2000 to 2008/2009, native forest yields have reduced from approximately 285,973m³ per annum to 163,067m³ [153]. That amounts to a reduction of 122,906m³ in total and 12,291m³ per annum. Modelling that same reduction out over the forward 10 year period suggests that by 2018/2019, native forest yield will have reduced to approximately 40,161m³ of HQL sawlogs per annum. This is very similar to the long-term yield prediction from the 2004 estimate by Forests NSW, which appears to be one of their more honest appraisals of wood resource, although they still attempt to extend the short-term yield at higher levels out to 2025 which is clearly not going to be achievable.

As far as other timber products go in north east NSW, actual volumes of HQS sawlogs harvested have generally been commensurate with supply contracts. It is notable that there are major discrepancies in reporting for volumes of HQS in 2007/08, with the volumes supplied in Auditor-General 2009 differing by approximately 40,000m³ from the volumes supplied in the IFOA/FA Implementation report.

It is important to note that there is an ongoing shift occurring from large sawlogs to small sawlogs, which has been triggered by the dearth of large logs produced by long-term over-cutting of forests. It is trend that is being seen across Australia and Asia. In short, in north-east NSW the concept of the high quality large log has gradually eroded over time and its role as the traditional mainstay of the north coast hardwood industry has all but ended. The distinction of high quality logs on the basis of size is no longer valid.

As far as other products are concerned, low quality sawlogs have consistently shown a 100,000m³ deficit

152 This graph was derived by the author using data provided by Forests NSW, as set out in Table 30. Some figures had to be derived from graphs provided by Forests NSW, rather than direct numbers, so may contain slight inaccuracies.

153 This is based on the well-founded assumption that hardwood plantation harvesting was negligible in 1999/2000 and that in 2008/09 it was at a similar level of 6% as reported for the previous year of 2007/08. The overall HQL sawlog volume of 173,475m³ for the north-east was derived from the 2008/09 IFOA/Forest Agreement Implementation Report, and then reduced by 6% to remove plantation supply.

between actual volumes and contracted volumes, pulp/chip has been generally 30,000m³ short of contracted volumes and piles and poles have generally met or exceeded commitments. Forests NSW latest yield estimates generally predict drops in yield of all other products over the next decade to 2020, at which time they estimate approximately 50,000m³ of small sawlogs, 180,000m³ of low quality sawlogs and 90,000m³ of pulp. It is difficult to ascertain the reliability of these estimates, particularly given the lack of explanatory information as to how they were derived, but it can only be assumed given the history of FNSW over-estimation provided above that they are optimistic figures, although perhaps not quite as overly optimistic as the HQL sawlog predictions.

Freehold Resources

There is very little reliable information available on timber yields available from native forests on private land in north-east NSW. In 2002, a study by Northern NSW Forestry Services estimated that there was 360,363m³ of sawlogs and 465,534m³ of pulpwood harvestable per annum available in the area extending from Nambucca Heads north to the Queensland border and west to the Tablelands. This is roughly equivalent to a slightly expanded Upper North East Forest Agreement region. As far as sawlogs were concerned, estimates for different classes were as follows:

Large Sawlogs –	144,146m³ per annum
Small Sawlogs –	72,073m³ per annum
Salvage Sawlogs –	54,054m³ per annum
Veneer Logs –	54,054m³ per annum
Poles, Piles and Girders –	36,036m³ per annum

The study was based on an estimated net harvest area of 363,210ha of forest, which was then delineated into one of three site qualities – low, medium and high. Growth rates were then applied to each site quality/broad forest type to derive an estimate annual yield. Growth rates which were used ranged from 1-2.4m³/ha/year for low site quality areas, to 3.1-3.8m³/ha/yr for medium site qualities and 4.5m³/ha/yr for high site quality.

There is no information currently available to indicate whether these yield estimates are likely to be reliable. Given that the region assessed amounts to approximately half of all forests on the North Coast of NSW, it is likely that the estimated volumes could be doubled to predict the total volume available from the full region. Therefore, this would lead to an estimate of approx 300,000m³ per annum of large sawlogs, 140,000m³ of small sawlogs and close to 900,000m³ of pulpwood. If this is a fair estimate, it suggests that the potential yield of large sawlogs on private land is now greater than the yields actually being achieved from public land by almost 100,000m³. Certainly, the area approved for logging on private land overall in the last 3 years and the annual volume that has been logged are both comparable with the total areas and annual areas harvested on State Forests in northern NSW.

According to URS (2008), a later survey of processors by Northern Rivers Private Forestry in 2005 estimated a harvest volume of 586,000m³ per annum for private forests across NSW.

South-eastern NSW

Public Resources

The Forest Agreement and Regional Forest Agreement specify the supply of 48,500m³ of HQL sawlogs and 97,000 tonnes of pulp per annum from the South Coast Sub Region, plus 48,000m³ of HQL from the Tumut subregion. The Tumut volume was intended to be comprised of 18,500m³ of Ash and 29,500m³ of mixed hardwood logs[154]. An additional 1,000m³ of HQL per annum was to be supplied to the Eden

154 Regional Forest Agreement for Southern NSW between the CoA and the State of NSW, 2001.

Region from Tumut.

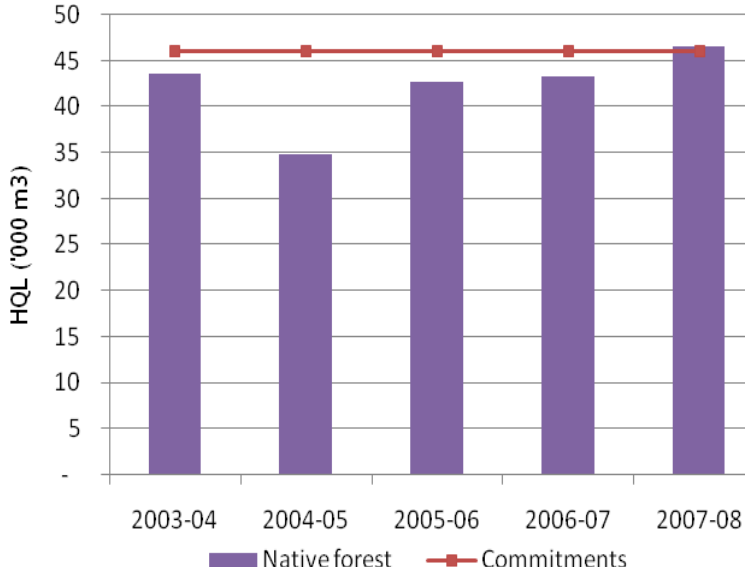
The timber volume from both the South Coast and Tumut sub-regions were supposed to be based on a 100 year non-declining Sustainable Yield basis, however in the South Coast region that could not be achieved from State Forest tenures and required a range of additional measures including silvicultural investment, private property purchases, private property timber rights and plantation establishment[155]. Five million dollars was allocated to supplement timber supplies through these avenues. The actual sustainable yield from State Forests was predicted to be 42,000m^3, and without the additional sources of timber specified above, logging at 48,5000 was predicted to lead to a decline in yield in 50 years[156].

Wood supply contracts (as they were at 2007/08) commit Forests NSW to somewhat less then the volumes specified in the forest agreements as follows:

- 46,000m3 of HQL sawlogs from the South Coast subregion
- 33,008m3 of HQL sawlogs from the Tumut subregion
- 63,050t of pulpwood from the South Coast subregion
- 20,000t of pulpwood from the Tumut subregion

The pulpwood contract for Tumut consists of supply of 20,000t per annum of thinnings from the hardwood regrowth forests in the Tumut/Tumbarumba subregion to Midway Pty Ltd[157]. That contract was due to expire on 1st September 2010, and it is unclear at this point as to whether it has been extended.

Figure 8. Harvesting results for South Coast large high quality sawlogs[158]

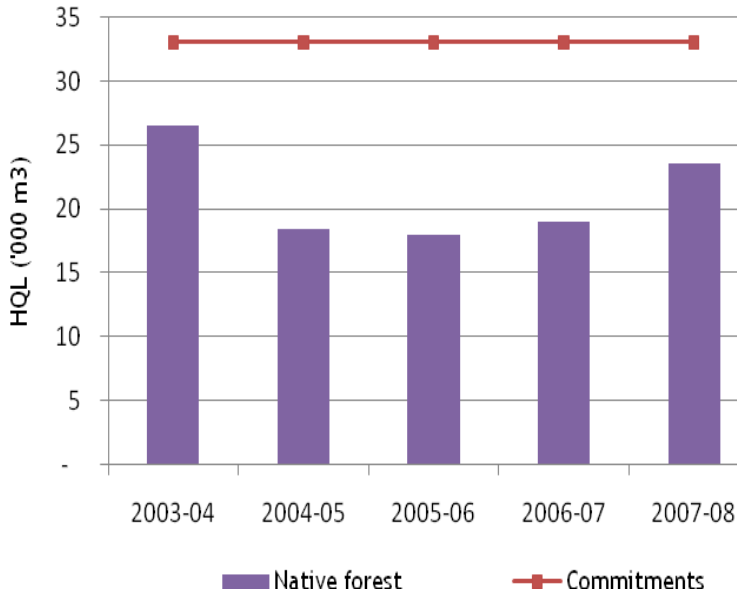


Together, Figure 8 and Figure 9 indicate that Forests NSW has struggled to meet wood supply commitments for HQL sawlogs from the Southern region. The problems have been predominantly in the Tumut subregion but there have also been some undercuts in the South Coast subregion. The Tumut HQL volumes have fallen as low as 50% of the contracted volumes, which amounts to only 36% of the HQL volumes set down in the forest agreements. This progressive decline in commitments and estimates suggests that HQL sawlog supply in the Tumut region is substantially less then estimated by

155 NSW Forest Agreement for Southern NSW
156 FRAMES Model Run Output from 2001
157 DECCW 2010
158 Graph reproduced rrom NSW Auditor-General 2009

Forests NSW and that future yields will be far less than predicted. However, Forests NSW claim that the shortfall in volumes compared to allocation is the result of a 'downturn in demand' and failure of mills to accept the full allocation, rather than any constraints on their ability to supply[159].

Figure 9. Harvesting results for Tumut large high quality sawlogs[160]



Forests NSW was required to complete a review of timber supply estimates in 2006 but such reviews have still not been completed[161]. Instead, Forests NSW have released a document which provides a graph of estimated yields for each of the South Coast and Tumut subregions without any explanation as to how the revised wood supply estimates were derived[162]. Those estimates predict 30,000-34,000m^3 per annum of HQL sawlogs for the Tumut subregion, which is only 60% of the 2001 estimates, but still close to double actual volumes that have been supplied in recent years. For the South Coast region, the 2010 estimates predict that 50,000m^3 is available for the next 10 years, but that supplies will then drop to only 35,000m^3 in 2025-2029. This differs substantially from the 2001 estimate of 42,000m^3 of non-declining yield over 200 years from State Forests and 48,500m^3 with top-ups from other sources. We have been advised that promised silvicultural treatments have not been implemented and very little land has been bought to supplement public supply (S. Daines pers comm).

Pulp volumes for the South Coast subregion are highly variable but recently have involved the supply contracts being substantially exceeded and in 2007/08 the volumes reached 105,172t. Similarly, pulp volumes in the Tumut subregion have also frequently exceeded commitments. High quality small contracts have been met for both subregions and only low quality sawlogs have not been met for the Tumut subregion.

The Forest Agreement and Regional Forest Agreement for the Eden region committed to the supply of 23,000m^3 of high quality large sawlogs and 345,000t of pulplogs from the region, of which some 23,000m^3 was supposed to be made available as low quality sawlog and redirected to the sawmill. Some 46,000t per annum of the pulpwood volume was supposed to be sourced from thinning operations.

However, in practice, the 345,000t of pulpwood has been only partially supplied from Eden, for which there is a current wood supply agreement with South East Fibre Exports for 273,400m^3, and the remainder of the original 345,000t promised is supplied largely from the South Coast region. Some

159 NSW Auditor-General 2009
160 Graph reproduced from NSW Auditor-General 2009
161 NSW Auditor General 2009
162 FNSW 2010d

22,080m^3 of HQL sawlogs are committed in a wood supply agreement with Blue Ridge timbers at Eden, plus 1,920m^3 in HQS sawlogs, and there is also a supply commitment for 23,000m^3 of low quality sawlogs.

Commitments for supply in Eden have generally been met for most of the last 5 years in most log categories, with pulpwood commitments mostly exceeded on an annual basis by up to 40,000m^3[163].

Estimates of sustained yield for the Eden region were based on a 40 year planning horizon, and predicted 23,000m^3 of sawlogs were sustainable for the first 20 years and 26,000m^3 for the second 20 year period[164]. The intention in the first 20 years was to complete the clear-felling of all mixed aged forests in order to meet supply. However, FNSW have recently indicated that the mixed age forests will be cut out earlier then this and may be exhausted within the next 3 years (S.Daines pers comm). In such circumstances, questions have been raised as to whether the sawlog volumes will be maintained.

Forests NSW was required to complete a review of timber supply estimates in 2006 but such reviews have still not been completed[165]. Instead, Forests NSW have released a document which provides a graph of estimated yields for the Eden region without any explanation as to how the revised wood supply estimates were derived[166]. Although it is difficult to read exact figures from the Eden graph, it does seem to predict that HQL logs will drop from 2015 to approximately 15,000m^3 for a 10 year period before recovering to current volumes in 2025 and then increasing thereafter[167]. It also predicts a substantially lower volume of pulpwood throughout the term of the wood supply contract, estimating that approx 195,000m^3 will be available from 2010-2014, and then only approx 165,000m^3 from 2015 for 10 years until 2025, with a gradual recovery thereafter. These predictions, for both sawlogs and pulpwood, represent major reductions from the volumes currently supplied under wood supply contracts.

Freehold Resources

As far as private land volumes are concerned, there is little information available. However, in 1997/98, a detailed study found that 30,700m^3 of sawlogs was harvested from private land[168].

PLANTATION YIELDS

North-eastern NSW

There is scanty information available on yield predictions for hardwood plantations on State Forests in northern NSW. The Auditor General reports that "*Forests NSW have advised that plantation yield estimates are somewhat speculative due to variations in the growth potential of different sites and species mixes*".

The FRAMES predictions in 1999 estimated an average of only 9,601m^3 per annum of HQL from plantations in the region in the first 20 years, with approximately two-thirds predicted from the Lower North East Region and one third from the Upper North East region[169]. The long-term average estimate for the years 21-100 was 36,178m^3 per annum of HQL, with a fairly similar break-down between the two regions. However, most of the volume was not predicted to come on line for 45 years, with

163 NSW Auditor General 2009
164 Eden Forest Agreement
165 NSW Auditor General 2009
166 FNSW 2010d
167 FNSW 2010c
168 ABARE 1999
169 Derived from FRAMES model outputs from 1999

estimates in the first 45 years being an average of 6,800m³ HQL per annum and in the last 55 years an average of 50,550m³ HQL per annum.

The Regional ESFM Plans by Forests NSW provide a very different logging schedule for hardwood plantations, as set out in the Figure 10 below and depicted in Figure 11.

Figure 10. Sawlog availability schedule extracted from Regional ESFM Plans[170]

Table 11 – Indicative schedule of modelled sawlog availability for LNE and UNE Regions from 2004

Year	Native Forest ($m^3 year^{-1}$)	Plantation ($m^3 year^{-1}$)	Total ($m^3 year^{-1}$)
1-5	477,400	89,700	567,100
6-10	448,200	58,300	506,500
11-15	477,600	106,300	583,900
16-20	503,800	288,800	792,600
21-25	207,600	534,100	741,700
26-30	218,500	303,300	521,800
31-35	221,000	139,400	360,400
36-40	229,200	247,700	476,900
41-45	225,600	226,500	452,100
46-50	225,200	284,900	510,100
51-55	231,900	268,300	500,200
56-60	224,700	285,300	510,000
60-65	200,500	317,300	517,800
66-70	216,600	335,600	552,200
71-75	225,500	326,100	551,600
76-80	204,600	312,800	517,400
81-85	203,100	314,500	517,600
86-90	207,600	318,700	526,300
91-95	208,000	330,400	538,400
96-100	190,300	338,700	529,000

Note: Actual yields will be limited by the conditions of Wood Supply Agreements (WSA) and demand by customers to supply market place requirements. Timber over and above WSA commitments in periods of apparent oversupply is required to remain in the forest to meet WSA commitments in periods of apparent undersupply.

This table indicates that FNSW intend to harvest an average of 106,300m³ per annum of hardwood plantation logs from 2015-2020, and then 288,800m³ per annum in the following five years. By 2025, FNSW intend to harvest 531,400m³ from plantations and just 207,600m³ from native forests.

170 FNSW 2008d

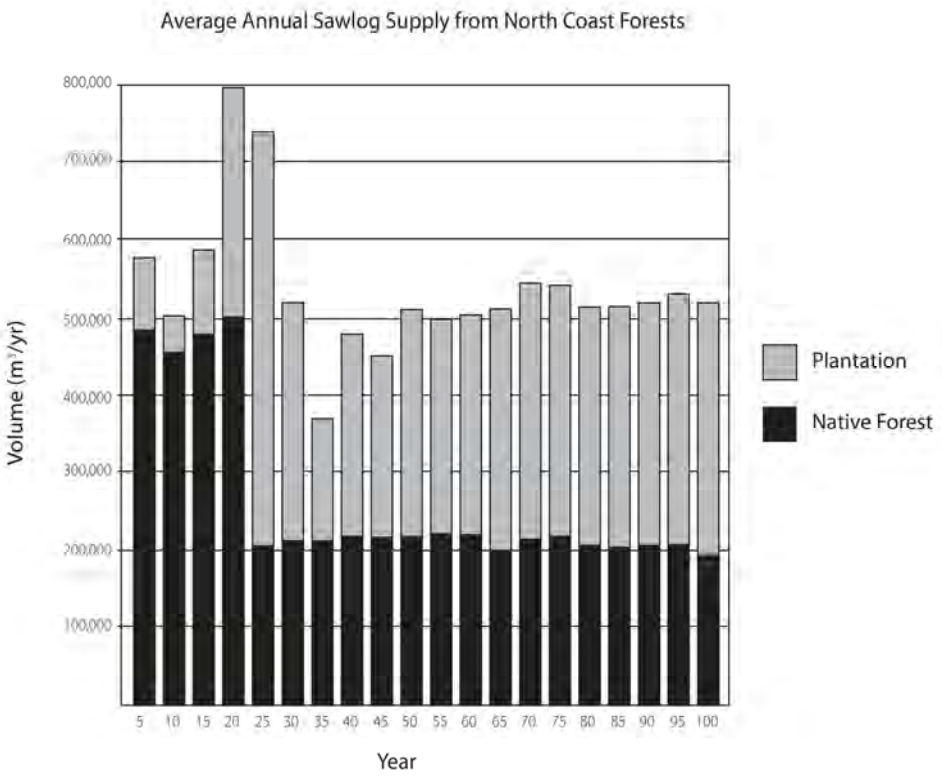
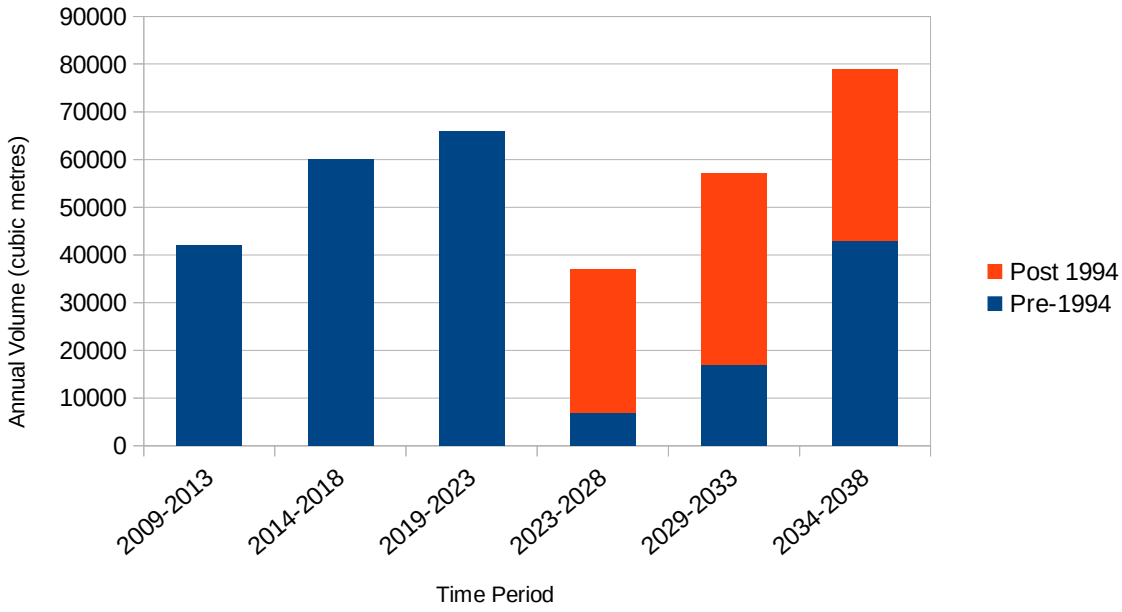


Figure 11. FNSW predictions for future sawlog yields

The 2002, 2004 and 2010 estimates do not provide any further information on yield estimates or yield scheduling proposed by Forests NSW in relation to plantations. However, a 2009 internal presentation by FNSW does reveal some information as to their plans and estimates for high quality sawlogs from plantations. The document, titled 'North Coast Timber Supply Strategy, 2009 Update'[171] provides separate project yield estimates for the pre-1994 and post-1994 plantations. These projections are for high quality sawlogs, which includes both large and small sawlogs. No information is given on the projected breakdown between large and small logs. The plantation yield projections by FNSW (2009d) have been presented by the author in graphical form in Figure 12.

171 FNSW 2009d

Figure 12. Projected Yield of High Quality Sawlogs from North East NSW Plantations[172]



172 FNSW 2009d

Therefore, all of the above information taken together, suggests that FNSW intend to dramatically increase volumes of high quality sawlogs and all sawlogs from plantations over the next decade whilst native forest sawlogs decline. Furthermore, this change is already more advanced then even predicted in these estimates, with 153,000m^3 of all sawlogs and 11,181m^3 of HQL harvested from plantations in 2007/08[173]. By about 2019, approximately 60,000m^3 of high quality sawlogs and 288,000m^3 total logs will be sourced from plantations, with this set to increase dramatically after 2025 for all sawlogs, but with a predicted drop in high quality logs.

However, there are two risks to be identified with these predictions and the trend they reveal. The first risk is that FNSW estimates are extremely optimistic, as their native forest predictions have been shown to be, and will not be realised. For example, the initial FRAMES estimate from 1999 predicted 6,800m^3 of high quality large sawlogs available from plantations for the first 45 years (ie until about 2045), but FNSW current estimates predict 10 times that volume will be available annually by 2019. It is also notable that the Timber Supply Strategy referenced above seems to be based on plantations yielding high quality sawlogs within 30 years after establishment, which seems unlikely. Secondly, there is a risk that, in their desperation to meet current supply contracts, FNSW are already cutting the plantation resource too early, and will as a result severely compromise the long-term volume that will be available, exactly as they have done with native forests.

The most recent forecasts of Australia's plantation log supply[174] estimate that timber production from hardwood plantations across all tenures in northern NSW will double in the period 2010-2014 to a total of 206,000m^3 per annum, of which 78,000m^3 will be sawlogs. In the year 2020 it is predicted that sawlog volumes will double to an estimated 144,000m^3 per annum and total supply will reach 342,000m^3. This appears to be in keeping with what would be expected with the volumes predicted by Forests NSW plus additional volumes from private plantations. By 2030, volumes are predicted to rocket to 509,00m^3 of sawlog and 758,000m^3 total. The predicted trend is illustrated in Figure 13.

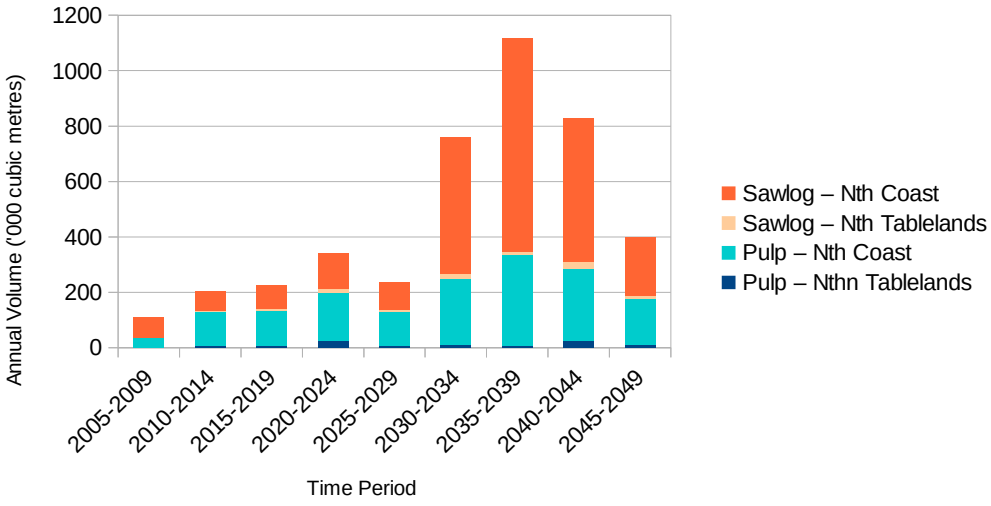
The plantation log supply study notes that all of the Northern Tablelands hardwood plantations and approximately 90% of the North Coast hardwood plantations are managed for sawlog production and that a proportion of pulpwood production is from thinning the plantations. In the adjoining South East Queensland region, the study indicates that approximately 37% of plantations are managed for sawlog production and the remainder for pulp. Although these plantations are predicted to produce 405,000m^3 of pulp from 2010, sawlogs are predicted to be relatively limited until 2030 with harvesting predicted to commence for some sawlogs in 2025. The plantations were largely established post-1995 with a view to replacing public native forest volumes, and with some claiming that the sustainable yield will be substantially less than the current yield from public forests[175] it is probably unlikely that large volumes will be available for utilisation in northern NSW.

173 NSW Auditor General 2009 provides a figure of 6% of HQL from plantation, and this is applied to the total HQL volume given in IFOA/FA Implementation Report.

174 Parsons et al 2007

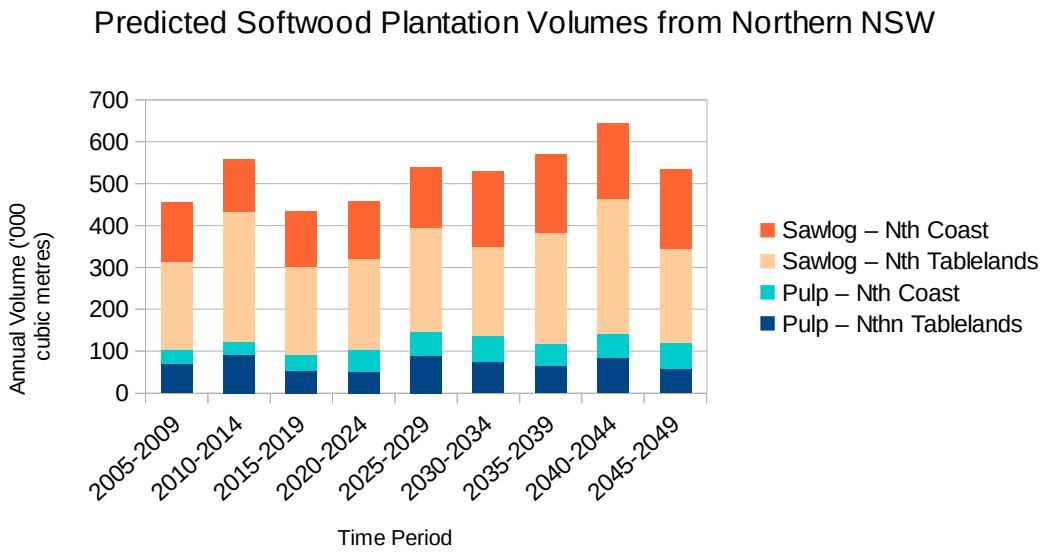
175 Parsons et al 2007

Figure 13. Predicted Hardwood Plantation Volumes for Northern NSW[176]



Estate modelling for softwood yields from State Forest plantations in the Northern planted forest region is for 300,000m^3 of sawlogs and 75,000 tonnes of pulpwood[177]. The most recent forecasts of Australia's plantation log supply[178] across all tenures estimate a substantial increase in supply for the five year period from 2010 to approx 550,000m^3 in total, of which approx 450,000m^3 is sawlog. In addition, over the decade from 2010-2020, the adjoining South East Queensland region is predicted to produce approx 300,000m^3 of softwood pulplogs and 1,724,000m^3 of sawlogs and to gradually increase production thereafter over time.

Figure 14. Predicted Softwood Plantation Volumes in North-east NSW[179]



176 Graph produced by the author using data provided in Parsons et al 2007
177 FNSW 2008d
178 Parsons et al 2007
179 Graph produced by the author using data provided in Parsons et al 2007

South-eastern NSW

The current predicted yields from State Forest softwood plantations derived from estate modelling by Forests NSW are set down in Table 30.

Table 30 Predicted yields from State Forest softwood plantations

Planted Forest Region	Net Area (ha)	Veneer & Sawlogs	Pulpwood	Total Timber
Hume[180]	87435	950000m^3	600000m^3	1550000 m^3
Macquarie[181]	73719	632500t	517500t	1150000 t
Monaro[182]	35900	na	na	600000 m^3

The Macquarie planted region covers softwood plantations around Bathurst and Oberon, the Hume region covers plantations extending from Albury to Yass, and the Monaro planted region covers remaining softwood plantations from Eden north to Moss Vale. There are additional substantial softwood resources on private land, with about 25% of current supply to processors from private land in Hume region and 20% in Macquarie[183].

An analysis of southern planted forests conducted in 1997[184] and covering the Hume and Monaro planted regions predicted that the potential 2020 yield of softwood sawlogs was 2.087M m^3 and the potential 2020 yield of pulpwood was 1.912 M m^3. Similarly, the most recent forecast of Australia's plantation log supply reveals that there is a major increase of softwood supply predicted to come on line in southern NSW from 2010-2020. Overall, for the four National Plantation Inventory regions of Murray Valley, East Gippsland-Bombala, Central Tablelands and Southern Tablelands, the total predicted softwood supply is approx 5.5M m^3 or greater for 10 years from 2010. The vast majority of this volume will be from NSW, with only approximately 1/3 of the Murray Valley softwood located in Victoria and only a tiny fraction of East Gippsland/Bombala. This represents a substantial increase in softwood availability from the 3.6M m^3 that was harvested in NSW in 2008/09.

Parsons et al (2007) note in their predictions of future plantation log supply that in both the Murray Valley and the East Gippsland-Bombala regions, pulpwood supply will increase significantly from 2010 as a resulting of unthinned privately owned plantations reaching maturity and being harvested and other immature plantations requiring substantial thinning. Therefore, there is a major surplus predicted in softwood pulp volumes amounting to an average of 2.3M m^3 per annum in total and 1.7M m^3 from the three southern regions (excluding the Central Tablelands). This represents a very substantial increase from the total of 1.2M tonnes of pulpwood harvested in 2009/10 in NSW.

Softwood plantations in southern and central NSW are also supplying an increasing volume of sawlogs. This is predicted to increase from 2010 to 3.18M cubic metres and from 2015 to 3.4M cubic metres for the four National Plantation Inventory regions. This includes a predicted increase in yield of 100,000 m^3 per annum from 2010 in the East Gippsland-Bombala region, and an increase of approximately 300,000 m^3 per annum from 2015 for the Murray Valley region. The volume of sawlogs harvested in NSW in 2009/10 was 2.1M cubic metres.

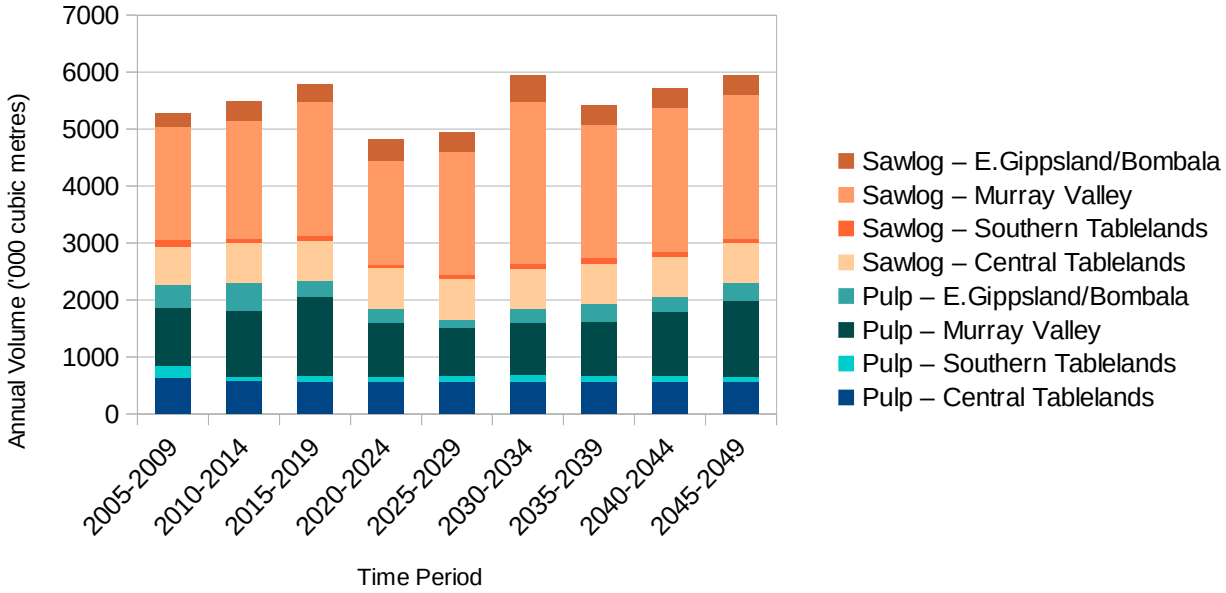
The only other plantation region that is within a moderate distance from southern NSW is the Central Gippsland region in Victoria. It extends eastward from Melbourne to Bairnsdale and northwards to the Great Dividing Range. The softwood plantations supply several sawmills and a pulp and paper mill in

180 FNSW 2008a
181 FNSW 2008b
182 FNSW 2008c
183 FNSW 2008a & 2008b
184 Margules Poyry Pty Ltd 1997

Victoria, and are estimated to provide approx 700,000m³ sawlogs per annum and approx 450,000m³ pulpwood per annum for the next 15 years, with increases thereafter[185].

The hardwood plantations in Central Gippsland currently supply sawlogs to sawmills at Morwell and elsewhere. Hardwood pulpwood volumes are estimated around 300,000m³ for the foreseeable future, with sawlogs predicted to produce 70,000m³ in 2010, then drop to 20-30,000m³ in 2015-2025, before then recovering to approx 80,000m³ [186].

Figure 15. Predicted Softwood Plantation Volumes from Southern NSW[187]



185 Parsons et al 2007
186 Ibid
187 Graph produced by the author using data from Parsons et al 2007

THE FUTURE

North-eastern NSW

The net harvestable area of native forests on State Forest tenure in north-east NSW is 446,736 hectares and the area currently approved for Private Native Forestry operations on freehold land is 240,724 hectares. There are 88,229 hectares of hardwood plantations in the region, of which 49,650 hectares occurs on State Forests, and 42,024 hectares of softwood plantations of which the great majority occurs on State Forests.

Current wood supply contracts in the north-east commit the NSW Government to supply the following annual volumes until 2023:

High quality large logs	209,500m^3
High quality small logs	63,772m^3
Low quality sawlogs	330,544m^3
Other logs	28,850m^3
Pulp	165,000t

In 2008/09, the actual volume supplied from public forests was 506,424m^3, comprised of 173,475m^3 of high quality large sawlogs, 63,845m^3 of high quality small sawlogs, 232,236m^3 of low quality sawlogs, 30,904m^3 of poles, piles and girders, and 210,058m^3 of pulpwood/chipwood[188]. Some 30% of this total volume, amounting to 204,094m^3, was supplied from hardwood plantations, ranging from an estimated 6% of high quality large sawlogs to 55% of pulpwood.

Softwood yield planning indicates a potential harvest of approximately 300,000m^3 of sawlog and veneer and 75,000m^3 of pulpwood is available in north-east NSW. Actual volumes harvested in 2007/08 were 151,330m^3 of sawlog and veneer and 7,255m^3 pulp. In 2008/09, an additional 30,000m^3 of softwood sawlogs were committed in contracts for supply as roundwood exports through Newcastle.

In north-eastern NSW, the future of the industry is characterised by a combination of a rapidly declining large high quality log resource from native forests, with a virtually irreversible collapse expected by 2018, and a substantial and still maturing high quality hardwood plantation resource, supplemented by a strong, mature softwood resource.

The likely timber supply situation in north-east NSW in early 2019 (as the Forest Agreements end) will, on the basis of the analysis provided above and assuming that the current plans for the region continue to be implemented, look something like this:

- Public native forests capable of supplying 40,161m^3 of HQL sawlogs, and up to 50,000m^3 HQS sawlogs, 180,000m^3 of low quality logs and 90,000m^3 of pulp.
- Private native forests capable of supplying 144,146m^3 HQL, 360,363-586,000m^3 total sawlogs and 465,534m^3 pulp
- Hardwood plantations capable of supplying 60,000m^3 of high quality sawlogs (large and small), 144,000-288,800m^3 total sawlogs and 198,000m^3 pulp
- Softwood plantations capable of supplying 300,000-355,000m^3 sawlog and 75,000-104,000t pulp.

It is apparent that it is not possible to make an immediate transition from native forests to hardwood plantations in north-eastern NSW, in full, at the volumes that are currently committed. However, it would be possible to implement a transition from public forests to plantations and other alternatives at reduced volumes, and for this to occur in a staged manner. Furthermore, the large and apparently

188 NSW Minister for Climate Change and Environment 2010b, although DECCW 2010 gives an alternative figure of 157,234m^3 for high quality large sawlogs (all other figures provided in DECCW 2010 match well with MCCE 2010b)

increasing volume of sawlog resource available from softwood plantations, if utilised well, can also contribute to a transition.

Notably, and as covered in detail above, Forests NSW are already planning a substantial transition from native forests to plantation hardwoods in the medium term due to rapidly declining supplies from native forests and increasing costs of accessing them. The analysis presented above indicates that the planned transition is undoubtedly going to occur far more rapidly than predicted by Forests NSW, due to the rapidly declining nature of the resource, particularly the HQL sawlog resource.

This inevitable transition should not be left unmanaged because if so it will undoubtedly have major negative impacts on both the environment and the communities of north-eastern NSW. A dramatic adjustment shock can be expected in 2019 if NSW and Federal Governments do not take action now and prepare for the transition in a staged manner. In this context, the transition that has been forced onto the industry through unsustainable logging can now be seen to also provide an opportunity to protect public native forests, rather than waiting until the native forests are entirely logged out and degraded.

The analysis in this report shows that supply of HQL sawlogs will have effectively collapsed by 2019, which is earlier then predicted by Forests NSW, and supply of other products will also show substantial reduction. It would be possible to transition to hardwood plantations albeit at a substantially reduced volume from that currently set down in wood supply contracts, commencing now with a view to a full transition in early 2019. Available estimates indicate that in 2019 plantations may be able to supply 60,000m^3 of high quality sawlogs and 84,000-228,000m^3 of other sawlogs and up to 198,000m^3 of pulpwood/chipwood. Additional substantial timber volumes will remain in native forests on private land and in softwood plantations. Softwood plantations in particular may yield large volumes of sawlogs, and the emphasis should be on utilising these to assist the transition out of native forests by ensuring they are utilised so as to maximise regional employment.

Hypothetical scenario: Stepwise transition out of public native forest logging

To estimate costs associated with a transition away from native forest logging on public land in north east NSW, the author used publicly available information to estimate the costs associated with a stepwise reduction in native forest logging from 2012 to 2019.

The proposed step-down transition, commencing in 2012, reduces native forest volume by an equal amount each year until 2019 when volumes are terminated from public native forests. Using the actual volume logged from native forests in 2008/09 as the starting point, this would involve annual reductions of 23,295m^3 in high quality large sawlogs, 7,126m^3 in high quality small sawlogs, 2,974m^3 in poles, piles and girders, 21,586m^3 in low quality sawlogs and 17,363m^3 of pulpwood/chipwood.

Table 31 A proposed transition scenario for reducing native forest timber supplies from north-eastern NSW to 2019

Transition	Native Forest HQL (m^3)	Native Forest HQS (m^3)	Native Forest PPG (m^3)	Native Forest LQ (m^3)	Native Forest Pulp/Chip (m^3)
2012	163,067	49,885	20,821	151,104	121,547
2013	139,771	42,758	17,846	129,517	104,183
2014	116,476	35,632	14,872	107,931	86,819
2015	93,181	28,505	11,897	86,345	69,455
2016	69,885	21,379	8,923	64,758	52,091
2017	46,590	14,252	5,948	43,172	34,727
2018	23,295	7,126	2,974	21,586	17,363
2019	0	0	0	0	0

Over this time period, the supply of plantation timber is expected to increase from the current volume

of 204,094m3 in total, to at least 342,000m^3 and up to 486,000m^3.

Whilst the Forest Agreement terminates in 2019, the wood supply contracts do not terminate until 2023. The transition proposed above may incur compensation costs under the wood supply agreements for the last four years of the contracts and for the earlier phase down in contracts to 2019. However, substantial compensation costs are likely to be incurred regardless of whether the transition is pursued or not, due to the decline in timber availability as a result of over-cutting and dwindling resources.

In order to gauge a potential estimate for the cost of compensation, the only information that is available is the payment of $550,000 in compensation for non-supply of 34,000m^3 of high quality large logs during 2004-2006[189]. Two assumptions have to be made in order to utilise this data here - one, that the failure to supply was in the north-east of NSW, and two, that it was a failure to supply that full amount across the two year period. On the basis of those two assumptions, the compensation cost of failure to supply is $16 per cubic metre of high quality logs for any given year.

This information can be used to derive an estimate of the potential compensation cost of the transition proposed above. This is derived by identifying the shortfall in meeting HQL contract volumes for each year of the proposed transition, from 2013 when the step-downs commence. The results are set out in

Table 32.

Table 32 Estimated Shortfalls in Wood Supply Volumes under Transition Scenario

Year	HQL Volume Supplied	Plantation HQL Volume Supplied	Shortfall on WSA HQL Volumes
2013	139771	10480	59249
2014	116476	18745	74279
2015	93181	27010	89309
2016	69885	35275	104340
2017	46590	43540	119370
2018	23295	51805	134400
2019	0	60000	149500
2020	0	65000	144500
2021	0	70000	139500
2022	0	75000	134500
2023	0	80000	129500
Total	**489198**	**536855**	**1278447**

NB. This is based on the assumption that there will likely be some HQS substitution for HQL from plantations. It also assumes that starting volume of HQL from plantations is 10,489m^3 which is 6% of 2008/09 HQL. It presumes a lower growth in plantation log volumes from 2019 onwards.

Therefore, this represents a total shortfall over the period to 2023 of 1,278,447m^3 of high quality large sawlogs, which at $16/m^3 in compensation costs would equate to $20.4 million. It is assumed that no compensation costs will be incurred for the wood supply contracts for other products, because they have more flexibility and additional wood review clauses contained in them (some of which appear due in 2013) which can be used to reduce volume in line with dwindling supplies. The compensation cost of $20.4 million is not a prohibitive amount by any measure, given the vast sums of public subsidies that have been spent on propping up the timber industry in the region over the years. Additional funds should be allocated to support the transition through business exit and worker assistance funds, and through investment in diversifying affected towns and communities. There should be an emphasis on

189 NSW Auditor-General 2009

policies which will encourage commercially viable domestic plantation processing and the development of the most environmentally-friendly alternatives to timber. Undoubtedly the most useful measure in promoting this outcome will be ending the supply of cheap, subsidised timber from native forests.

There will be market consequences to this transition. However, these consequences are considered largely inevitable anyway due to the wood supply crisis in north-east NSW. The most notable impact will be on the supply of appearance grade eucalypt timber, particularly hardwood floorboards. As noted elsewhere, north-eastern NSW appears to be the most significant supplier of this product in Australia at present. There are a number of measures which can be taken, however, to improve the recovery of appearance grade timber from small sawlogs and plantations and to develop alternative products. These are discussed below. They will not immediately and fully offset the impact of the decline in volume of appearance grade products, but will mitigate those impacts substantially.

An alternative transition approach in the north-east could involve the exit of the major industry player in the form of Boral, the protection of high conservation value areas and on-going access for high value specialty products for those remaining in the industry in remaining areas of State Forest tenure.

Other consequences of these options that should be considered include the potential for increased pressure on private native forest resources and the environmental impacts of likely alternative materials. It is apparent that there is escalating pressure on native forest resources, as evidenced by the commitment in the NSW Budget to approve a further 300 Private Native Forestry Property Vegetation Plans over the next year. This increase in pressure is undoubtedly the consequence of the decline in public forest resources. Therefore, this trend is evident regardless of the proposed transition. Nevertheless, there is a strong argument for much improved management of private logging operations to better control environmental impacts.

As far as plantation establishment and management are concerned, there are major improvements that should be sought as part of a transition to substantially reduce its environmental impact. A thorough environmental audit is required of plantation management to identify changes that can be introduced to reduce negative impacts. Some of the types of reforms that are needed include changes to less intensive harvesting practices to reduce impacts on soil and water, far stronger protection for native vegetation remnants during establishment, much reduced chemical use, more diverse plantings, and better riparian protection.

The other two preferred alternatives to hardwood flooring analysed in this document are Australian grown bamboo and recycled plastic. Recycled timber should also be considered as a high priority alternative. These alternatives were all chosen for inclusion here because they minimise environmental impacts compared to other non-wood alternatives. However, there will still be impacts associated with chemical and energy use, and for bamboo there are potential issues associated with intensive agriculture. However, we believe that these impacts can be minimised in each case.

Overall, it is believed that on balance the benefits of ending the severe environmental impacts of over-cutting native forests will substantially outweigh any environmental impacts from the alternatives. There is always a role for detailed comparative assessment of the environmental impacts of various building products, and this should be considered an on-going and important part of any transition program.

The additional measures that are proposed to support a transition out of public native forests in north-eastern NSW include action being taken to:

- Conduct a program of early thinning of younger plantations to increase current supplies of small logs and future supplies of high quality sawlogs.
- Put in place an MIS plantation recovery program to ensure that established MIS plantations are not neglected, degraded or destroyed, but instead are managed to maximise sawlog production.
- Gradually remove the distinction between large and small high quality logs so that high quality

logs are no longer committed on the basis of size.

- Immediately undertake a detailed feasibility study into the development of replacement products for hardwood flooring and decking. Priorities should be on the feasibility of a bamboo flooring mill and plantation estate in north-east NSW, and a recycled plastic decking plant.
- Provide additional policy support for furniture manufacture, particularly from small and low quality sawlog products.
- Promote use of milling techniques that maximise the production of premium products from low quality and small sawlogs, particularly rotary veneer peelers and radial milling.
- Investigate the potential for increased production of engineered wood products from plantation resources
- Maximise value-adding and employment from softwood sawlogs in northern NSW, and utilise all timber rather than exporting roundwood.

South-eastern NSW

The net harvestable area of native forests on State Forest tenure in south-east NSW is 294,104 hectares and the area currently approved for Private Native Forestry operations on freehold land is 17,296 hectares. There are 197,054 hectares of softwood plantations on State Forests and substantial additional areas on freehold land.

Current hardwood wood supply contracts in the south-east commit the NSW Government to supply the following annual volumes until 2023:

High quality large logs	101,088m^3
High quality small logs	12,810m^3
Low quality sawlogs	75,062m^3
Pulplogs	356,450t

In 2008/09, the actual hardwood volume supplied from public forests was 466,973m^3, comprised of 81,192m^3 of high quality large sawlogs, 7,861m^3 of high quality small sawlogs, 36,299m^3 of low quality sawlogs and 341,621m^3 of pulpwood/chipwood[190].

Current annual softwood yields estimated in the Hume and Monaro regions amount to 1,525,000m^3 of veneer and sawlogs and 600,000m^3 of pulpwood[191]. Actual volumes logged on State Forests in the south-east region in 2007/08 were 639,588m^3 of veneer and high quality sawlogs, 39,866m^3 of low quality sawlogs, 25,998m^3 of preservation timber and 474,718t of pulpwood[192].

There have been problems meeting wood supply contracts for sawlogs from South Coast and Tumut regions, with Tumut in particular often only supplying only 50% of committed volumes and South Coast volumes predicted to drop after 2025. Pulp volumes, however, have regularly exceeded contracted amounts. Supply commitments in Eden are currently being met, however the yields are not sustainable and FNSW modelling predicts a drop in sawlog and pulpwood yields from 2015.

These declines and problems with hardwood supply are reversed in relation to softwood supply. In southern NSW and adjacent areas in Victoria there are major increases predicted in softwood timber supply from 2010-2020 with a total estimated yield prediction of 5.5million m^3. Pulpwood availability is predicted to rise from 1.2million m^3 currently to 2.3million m^3 of which 1.7million m^3 will be located in southern NSW. Sawlogs are predicted to rise from 2.1million m^3 to 3.2 million m^3.

It is possible to immediately discontinue supply of native timber from NSW public forests to the Eden

190 NSW Minister for Climate Change and Environment 2010b, although DECCW 2010 gives an alternative figure of 157,234m^3 for high quality large sawlogs (all other figures provided in DECCW 2010 match well with MCCE 2010b)

191 FNSW 2008a and 2008c

192 NSW Minsiter for Cilmate Change and Environment 2010a

woodchip mill. Only 329,000m3, amounting to 40% of SEFEs total log input is sourced from native forests in NSW, with 50% sourced from Victoria and 10% from private forests. If NSW hardwoods supply were discontinued, SEFE would continue to operate albeit with lower throughput but arguably without effecting viability or employment. However, direct discontinuation of pulplog supply is likely to incur compensation costs payable under the Wood Supply Agreement between Forests NSW and SEFE.

An alternative and equally feasible option is to replace supply of native timber from NSW public forests to the Eden woodchip mill with softwood pulpwood supply. SEFE currently chips over 1M tonnes in total of pulplogs at its Eden mill and runs both a hardwood and a softwood chip line. Pulplogs from NSW native forests could be replaced directly with an equivalent volume of softwood pulplogs. Forests NSW latest estimates indicate that the hardwood pulpwood resource from the Eden region is in decline. In contrast, softwood pulpwood in southern NSW and northern Victoria is predicted to increase dramatically over the ten year period from 2010. There is currently a very strong market in Radiata Pine exports for both woodchips and roundwood to China. The drawback is that there is a growing demand for softwood pulpwood at the Visy pulp and paper mill at Tumut, and that it is preferable for timber to be value-added in NSW rather than exported to China. However, estimates of yield appear to indicate that there will be more than enough softwood pulp over the next 10 years to continue to supply Visy and to supply the chipmill. Replacing the hardwood volume with softwood is likely to be possible through a re-negotiation of the wood supply contract, and may thus avoid incurring any compensation costs.

As far as hardwood sawlogs are concerned, there are no options available for direct replacement of hardwood timber to sawlog mills in the short or medium term. However, there are sufficient increases in softwood sawlogs predicted in the region to completely offset the volumes lost if hardwood supplies are discontinued, although these will be supplied to softwood mills and will not represent a direct product substitution. There are two options available for a transition away from hardwood sawlogs - an immediate cessation of supply or a staged transition with a specified end date.

Any transition which occurs prior to the end of the wood supply contract is likely to incur compensation costs. However, due to the more limited volumes committed and the shorter run time on contracts, these costs are not likely to be prohibitive.

Most importantly, the evidence suggests that it is possible to conduct a transition without causing a net loss in economic value or employment in the region, due to the small size of the hardwood sector in the region and the many opportunities that exist to expand the softwood timber industry with increasing sawlog and pulp supplies.

In order to maximise the economic and employment outcomes, the NSW Government should provide as much support as possible to promote the mooted expansion of the Bombala softwood mill and the associated quadrupling of softwood supply to the mill. The volume of sawlogs proposed to be supplied under the Bombala expansion equates to almost 3 times the volume of sawlogs that would be forfeited if public native forest logging is ended. Other options should be investigated and supported to add value to softwood timber at Bombala, and to investigate if there are any other options for specialist niche processing options from small volumes of softwood timber around areas between Batemans Bay and Nowra.

It is notable that most employment in the current hardwood sector in the south-east region is not secure anyway, because Boral has three of the four major mills and they have a policy and history of centralisation and mill closure. Therefore, it is likely that at least two of the three Boral mills are likely to be closed even without any changes in timber supply, especially given that they are not equipped for any substantial value-adding. It is also notable that some small hardwood mills in the region may continue utilising non-public native forest resource, although this resource appears extremely limited.

REFERENCES

ABARE. 1999. *Sawmill Survey: Southern Region*. A project undertaken for the Joint Commonwealth NSW Regional Forest Agreement Steering Committee as part of the NSW Comprehensive Regional Assessments project number NS 21/ES.

ABARE & BRS 2001. An assessment of the potential for Forest Plantations in New South Wales. Report to the NSW Plantation Taskforce Steering Committee on Plantation Capability and Suitability.

ABARE 2010a, *Australian forest and wood products statistics*, September and December quarters 2009, Canberra, May.

ABARE 2010b, *Australian forest and wood products statistics*, March and June quarters 2010, Canberra, November.

ABARE 2010c. Future Directions for the Australian Forest Industry, March 2010. Commonwealth of Australia, Canberra.

Adroit Website 2011, *Commercial - EcoTuff™ Composite Decking,* Retrieved 26th February 2011 from http://www.adroit.com.au/products/adroit-decking/commercial-ecotuff-composite-decking

Ajani, Judith. 2008. Australia's Transition from Native Forests to Plantations: The Implications for Woodchips, Pulpmills, Tax Breaks and Climate Change. *Agenda*, Volume 15, Number 3, 2008.

Ajani, Judith. February 2011. Australia's Wood and Wood Products Industry Situation and Outlook - Working Paper.

American Chemistry Council Inc. 2010, Plastics Division – Recycled Plastic Lumber. Retrieved 26th February 2011 from http://www.americanchemistry.com/plastics/sec_content.asp?CID=1582&DID=5987

Bamboo Flooring 2011, Bamboo Flooring Website. Retrieved 21st February 2011 from http://www.bamboofloors.com.au/Bamboo Flooring

Bamboozle 2011, Bamboozle Website. Retrieved 21st February from http://www.bamboozle.com.au/flooring/wood-flooring.aspx

Bowyer, J., Howe, J., Guillery, P., & Fernholz, K. 2005, *Bamboo Flooring: Environmental Silver Bullet of Faux Saviour?* Dovetail Partners Inc. Retieved 24th February 2011 from INFO@DOVETAILINC.ORG

Boral Timber 2004. NSW Site Tour 1-2 July 2004. Peter Boyd and Paul Cotton.

Bureau of Rural Sciences. 2010. Australia's Plantations. 2010 Inventory Update.

Burns, K., Sledge, P., and Wicks, S. 2009. ABARE 2007 Sawmill Survey Report. ABARE report to the Australian Government Department of Agriculture, Fisheries and Forestry and Forest Wood Products Australia. Canberra.

Commonwealth of Australia and the State of New South Wales (2000) Regional Forest Agreement for North East New South Wales (Upper North East and Lower North East Regions).

Cosset Website 2009, Australian Recycled Plastic Product Designer and Manufacturer, Retrieved 26th February 2011 from http://www.cosset.com.au/index.wt1

Department of Agriculture, Fisheries and Forestry. 1999. A Report on Forest Wood Resources for the

Upper North East and Lower North East CRA Regions. A report undertaken for the NSW CRA/RFA Steering Committee project number NA52/ES

Department of Environment, Climate Change and Water NSW (2010) Review of NSW Forest Agreements and Integrated Forestry Operations Approvals: Upper North East, Lower North East, Eden and Southern regions

Department of Environment and Conservation. 2005. *Guidelines for the Burning of Bio-material* Record Keeping and Reporting Requirements for Electricity Generating Facilities (2005). NSW Government Gazette No. 38, 1st April 2005.

Economists at Large. 2008. River Red Gum Forestry in the NSW Riverina: Seeing the Value for the Trees. A report prepared for the National Parks Association of NSW and The Wilderness Society. Prepared by Economists at Large and Associates.

Forests NSW. 2004. A Review of Wood Resources on the North Coast of New South Wales.

Forests NSW 2005a. Ecologically Sustainable Forest Management Plan, Upper North East NSW. FNSW Sydney.

Forests NSW 2005b. Ecologically Sustainable Forest Management Plan, Lower North East NSW. FNSW Sydney.

Forests NSW 2008a. Ecologically Sustainable Forest Management Plan, Hume Region NSW. FNSW Sydney.

Forests NSW 2008b. Ecologically Sustainable Forest Management Plan, Macquarie Region NSW. FNSW Sydney.

Forests NSW 2008c. Ecologically Sustainable Forest Management Plan, Monaro Region NSW. FNSW Sydney.

Forests NSW 2008d. Ecologically Sustainable Forest Management Plan, Northern Region NSW. FNSW Sydney.

Forests NSW 2008e. Ecologically Sustainable Forest Management Plan, Riverina Region NSW. FNSW Sydney.

Forests NSW 2008f. Ecologically Sustainable Forest Management Plan, Western Region NSW. FNSW Sydney.

Forests NSW. 2009a. Volume information as per NPA request 22 April 2009. Document provided to the National Parks Association on the 1/5/2009.

Forests NSW. 2009b. Forests NSW Annual Report 2008-2009. Social, environmental and economic performance. Sydney, NSW.

Forests NSW. 2009c. Forests NSW Seeing Report Supplement 2009-2009. Sydney, NSW.

Forests NSW. 2009d. 'North Coast Timber Supply Strategy, 2009 Update.

Forests NSW. 2010a. Forests NSW Annual Report 2009-10. Social, environmental and economic performance. Sydney, NSW.

Forests NSW. 2010b. Rationale for NSW public native forests and hardwood plantation log price increases. Ministerial Briefing.

Forests NSW 2010b. Forests NSW Facts & Figures 2009/10.

Forests NSW 2010c. Forests NSW Yield Estimates for Native Forest Regions. November.

Forests NSW. 2010d. The Price System: NSW Native Forest and Hardwood Plantation Pricing System.

Forest Productions Association of NSW. 2010. Initial Submission with respect to Cypress Forests. Submission to the NSW Natural Resources Commission. http://www.nrc.nsw.gov.au/content/documents/Forest%20assessment%20-%20Submission%20-%20Cypress%20-%20NSW%20Forest%20Products%20Association.pdf

Garrard, W., October 2010. *Profile of plantation authorisations: 1 December 2001 to 30 June 2010*, Industry & Investment NSW, Wollongbar Primary Industries Institute.

Gavran, M and Parsons, M. 2010. *Australia's Plantations 2010 Inventory Update,* National Plantation Inventory, Bureau of Rural Sciences.

Geoscience Australia and ABARE. 2010. Australian Energy Resource Assessment. Canberra.

Goble, D., & C., Jarvis. 2007. Opportunities for using sawmill residues in Australia. A report prepared for Forests and Wood Products Australia. Melbourne.

Gombya, I. 2008, Suitability of Bamboo for Construction and Environmental Preservation, *Journal of Civil Engineering Research and Practice,* vol. 5 (1), 43-51, Uganda. Retrieved 25th February 2011 from http://en.scientificcommons.org/35587685

Grants Holdings Sawmilling Co Pty Ltd. 2010. Submission to Natural Resources Commission of NSW on the Regional Forest Assessment for the South-Western Cypress State Forests. http://www.nrc.nsw.gov.au/content/documents/Forest%20Assessment%20-%20Submission%20-%20Cypress%20-%20Grants%20Holdings.pdf

Growns, Jane. 2009. Biomass Energy and the Mandatory Renewable Energy Target. Briefing Paper for Senator Christine Milne. July 2009. http://greensmps.org.au/webfm_send/163

Honan, K. 2008, Growing bamboo for shoots and timber, ABC website. Retrieved 21st February 2011 from http://www.abc.net.au/rural/content/2008/s2258619.htm

Hubpages Website 2011, Tongue and Groove Porch Flooring - PVC or Recycled Plastic are Great Choices. Retrieved 26th February 2011 from http://hubpages.com/hub/Tongue-and-Groove-Porch-Flooring-PVC-or-Recycled-Plastic-are-Great-Choices

Industry and Investment. 2010. The Contribution of Primary Industries to the NSW Economy: Key Data 2010.

Low, Kah and Mahendrarajah, Sinniah. 2010. Issues Insights 10.1: Future Directions for the Australian Forest Industry. ABARE, Canberra.

Margules Poyry Pty Ltd. 1997. Industry Development Opportunities for the Southern NSW Forest Industry to 2010 and 2020. A report undertaken for the NSW CRA/RFA Steering Committee.

Midmore, D.J. (ed.) 2009, Silvicultural Management of Bamboo in the Philippines and Australia : Proceedings of a workshop held in Los Banos, the Philippines, 22–23 November 2006. Australian Centre for International Agricultural Research. Retrieved 21st February 2011 from http://aciar.gov.au/publication/PR129

Midmore DJ (2009). Bamboo in the global and Australian contexts, in *Silvicultural Management of Bamboo in the Philippines and Australia* Retrieved 21st February 2011 from http://aciar.gov.au/publication/PR129

Montreal Process Implementation Group for Australia. 2008. Australia's State of the Forests Report. Prepared for the Australian, state and territory governments.

Minister for Climate Change and Environment. 2010a. NSW Forest Agreements Implementation Report 2007–2008: Upper North East, Lower North East, Eden and Southern regions. A report prepared by the Minister for Climate Change and the Environment as part of the implementation of the NSW forest agreements and integrated forestry operations approvals. Forest Policy and Regulation Section, Department of Environment, Climate Change and Water NSW, Sydney.

Minister for Climate Change and Environment. 2010b. NSW Forest Agreements Implementation Report 2008–2009: Upper North East, Lower North East, Eden and Southern regions. A report prepared by the Minister for Climate Change and the Environment as part of the implementation of the NSW forest agreements and integrated forestry operations approvals. Forest Policy and Regulation Section, Department of Environment, Climate Change and Water NSW, Sydney.

Modwood technologies 2011, Modwood Decking- the Sustainable Alternative. Retrieved 26th February 2011 from http://www.modwood.com.au/

Montoya, Daniel. 2010. Plantation forestry in NSW: regulatory regimes and future prospects. Briefing Paper No 12/2010. NSW Parliamentary Library Research Service.

Montreal Process Implementation Group for Australia 2008, *Australia's State of the Forests Report 2008,* National Forest Inventory, Bureau of Rural Sciences*, Canberra*.

Natural Resources Commission. 2009. Final Assessment Report: Riverina Bioregion Regional Forest Assessment, River Red Gums and Woodland Forests. Sydney, NSW.

Natural Resources Commission. 2010. Assessment Report: Regional Forest Assessment, South-Western Cypress State Forests. Sydney, NSW.

Natural Resources Commission. 2010b. River Red Gum Assessment: Advice on long-term sustainable wood yields and standing stock volumes of quote sawlogs.

NSW Auditor-General. 2009. Performance Audit: Sustaining Native Forest Operations. Audit Office of NSW, Sydney.

NineMSM 2011, Our house fact sheets. Retrieved 21st February 2011 from http://ourhouse.ninemsn.com.au/ourhouse/factsheets/db/makeovers/01/113.aspBamboo Floor

Northern NSW Forestry Services. 2002. The Private Native Forest and Plantation Resource of the NSW North Coast. A report prepared for Northern Rivers Private Forestry.

Northern NSW Forestry Services. 2008. Commercial development of native forest, plantation and processing residues in Northern NSW. A report prepared for the Northern Rivers Private Forestry Committee.

Northern Rivers Regional Development Board. Undated. Forest Residue Opportunities in the Northern Rivers Region.

Parsons Brinckerhoff. 2007. Condong Co-generation Facility: Fuel Plan. Prepared for the Sunshine Electricity Joint Venture.

Parsons, M., Frakes, I., and Gavran, M. 2007. Australia's Plantation Log Supply: 2005-2049. A report prepared for the Department of Agriculture, Fisheries and Forestry. BRS Publication, Canberra.

Parr J, Leigh S, Chen B, Yew G and Zheng W (2009). Carbon bio-sequestration within the phytoliths of economic bamboo species, *Global Change Biology*, Retrieved 21st February 2011 from http://dx.doi.org/10.1111/j.1365-2486.2009.02118.x

Platt, B., Lent, T. & Walsh, B. 2005, The Healthy Building Networks Guide to Plastic Lumber, Healthy Building Network Institute for Local Self-Reliance, Washington DC. Retrieved 26th February 2011 from *www.healthybuilding.net/pdf/gtpl/**guide_to_plastic_lumber**.pdf*
Woodworking Projects Website 2011, *Recycled Plastic Decking Offers Better Appearance*. Retrieved 26th February 2011 from
http://www.woodworkingprojects.org/WoodWorkingProjects/DeckingArticles/Recycled-Plastic-Decking-Offers-Better-Appearance.html

Pugh, D.and Flint, C. (1999) The Magic Pudding, The Cut-an-Come-Again Forests. A Preliminary Appraisal of State Forests Forest Resource and Management System (FRAMES). North East Forest Alliance.

RACAC 1996. Draft Interim Forestry Assessment Report. Resource and Conservation Assessment Council, NSW Government.

Ruiz Perez, M., Belcher, B., Fu, Maoyu, & Yang Xiaosheng 2004, Looking through the bamboo curtain: an analysis of the changing role of forest and farm income in rural livelihoods in China, *International Forestry Review Vol. **6**(3-4).* Retrieved 25th February 2011 from
http://www.cifor.cgiar.org/ntfpcd/pdf/journal37.pdf

Sabto, M. 2010, Australian bamboo takes a stand, ECOS Magazine, 5th October 2010,. Retrieved 21st February 2011 from http://www.sciencealert.com.au/features/20100510-21385.html

South East Fibre Exports Pty Ltd. 2011. Pilot Wood Pellet Plant Statement of Environmental Effects.

State Forests of NSW. 1999. The Hardwood Log Value Pricing System.

Traynor M and Midmore D (2009). Cultivated bamboo in the Northern Territory of Australia, in *Silvicultural Management of Bamboo in the Philippines and Australia* Retrieved 21st February 2011 from http://aciar.gov.au/publication/PR129

URS Australia, December 2007. *Australia's forest industry in the year 2020*, Prepared for the Department of Agriculture, Fisheries and Forestry, Canberra.

URS Forestry, July 2008. *Farm Forestry Area and Resources in Australia*, RIRDC publication No 08/104.

URS 2008. Economic Policy Settings in the Forest and Timber Industry: An Inter-jurisdictional Comparison. Prepared for the Department of Primary Industries. Victoria.

URS 2010. Environmental Assessment: South East Fibre Exports 5.5MW Biomass Power Plant. Volume 1, Main Report. March 2010.

Vanclay J. (2002) Review of Projected Timber Yields for the NSW North Coast. Southern Cross University.

van der Lugt, P., van den Dobbelsteen, A.A.J.F., &. Janssen, J.J.A 2006, An environmental, economic and practical assessment of bamboo as a building material for supporting structures, *Construction and Building Materials,* vol. 20 (9), 648. Retrieved 24th February from

http://infotrac.galegroup.com.ezproxy.une.edu.au/itw/infomark/83/278/140551649w16/purl=rc1_BCPM_0_A149461085&dyn=5!xrn_1_0_A149461085?sw_aep=dixson

Zhu, G. X., Ockerby, S., White, D.T. & Midmore, D.J 2009, Identifying agricultural practices to sustain bamboo production in Queensland, Australia, in *Silvicultural Management of Bamboo in the Philippines and Australia* Retrieved 21st February 2011 from http://aciar.gov.au/publication/PR129

APPENDIX 1

Forests NSW Hardwood Customers

Type	Customer name	Capacity
Hardwood Sawmill/roundwood	Albert Johnson Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Arbuthnot Sawmill Pty Ltd Victoria	<19,999
Hardwood Reconstituted board	Australian Hardboards Queensland	<19,999
Hardwood Sawmill/roundwood	Australian Ironwood Antique Timbers Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	B&S Timbers Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Coffs Harbour Hardwoods trading Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	C.J. & A Woods Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	C.J. & A Woods Pty Ltd trading as Newville Hardwoods NSW	<19,999
Hardwood Sawmill/roundwood	Grafton Sawmilling Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Hardwood Resources NSW	<19,999
Hardwood Sawmill/roundwood	Hayden Timbers Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Hurfords Building Supplies Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	ITC Timber Pty Ltd Victoria	<19,999
Hardwood Sawmill/roundwood	J Notaras & Sons Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Jamieson Bros. Pty Ltd Victoria	<19,999
Hardwood Sawmill/roundwood	Kempsey Timbers Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Kilmore (Nymboida) Holdings Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Koppers Wood Products Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Leonard J Williams (Timber) Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	M & B Dyer Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Machins Sawmill Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	MecTech Cartage Pty Ltd Victoria	<19,999
Hardwood Sawmill/roundwood	Midway Pty Ltd Victoria	<19,999
Hardwood Sawmill/roundwood	Niewee Creek Sawmill Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	North Coast Hardwoods Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	O'Brien Redgum Sawmills Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Outback Timbers Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Paul Herbert Timber Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Peter John Mather NSW	<19,999
Hardwood Sawmill/roundwood	R.A. Sweetman & Son Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Romney Park Sawmill Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Tedavis Sawmilling Ltd Pty NSW	<19,999
Hardwood Sawmill/roundwood	Thomas Charles Osmond NSW	<19,999
Hardwood Sawmill/roundwood	Thomas Patrick O'Connor NSW	<19,999
Hardwood Sawmill/roundwood	W.J. Treseder & Co Pty Ltd NSW	<19,999
Hardwood Reconstituted board	Weathertex Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Wyong North Sawmill Pty Ltd NSW	<19,999
Hardwood Sawmill/roundwood	Boral Ltd NSW	100,000>
Hardwood Sawmill/roundwood	South East Fibre Exports Pty Ltd NSW	100,000>
Hardwood Sawmill/roundwood	A.S. Nicholas & Sons Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood	Adams Sawmill Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood	Aquafern Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood & veneer/plywood	Big River Timbers Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood	Blue Ridge Hardwoods Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood	S.A. Relf & Son NSW	20,000-99,999
Hardwood Sawmill/roundwood	Thora Sawmilling Pty Ltd NSW	20,000-99,999
Hardwood Sawmill/roundwood	Newell Creek Sawmilling Co. Pty Ltd NSW	20,000-99,999

Forests NSW Softwood Customers

Type	Customer name	Capacity
Native Cypress Sawmill/roundwood	Grants Timber Pty Ltd NSW	<19,999
Native Cypress Sawmill/roundwood	Gunnedah Timbers Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	Walkers Sawmill Victoria	<19,999
Softwood Sawmill/roundwood	Braidwood Sawmill NSW	<19,999
Softwood Sawmill/roundwood	Blayney Treated Pine NSW	<19,999
Softwood Sawmill/roundwood	Correctional Services Industries NSW	<19,999
Softwood Sawmill/roundwood	Dale & Meyers Operations Pty Ltd Queensland	<19,999
Softwood Sawmill/roundwood	Hensons Sawmills Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	Humula Timbers Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	L.M. Hayter & Sons Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	Pacpine Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	Queensland Commodity Exports Pty Ltd Queensland	<19,999
Softwood Sawmill/roundwood	Riamukka Sawmill Pty Ltd NSW	<19,999
Softwood Sawmill/roundwood	Tarn Pty Ltd NSW	<19,999
Softwood Pulp and paper	Visy Industries Pty Ltd NSW	100,000>
Softwood Sawmill/roundwood	Willmott Forests Pty Ltd NSW	100,000>
Softwood Sawmill/roundwood	Allied Timber Products NSW	100,000>
Softwood Sawmill/roundwood & reconstituted board	Carter Holt Harvey Ltd NSW	100,000>
Softwood Sawmill/roundwood	Highland Pine Products Pty Ltd NSW	100,000>
Softwood Sawmill/roundwood	Hyne & Sons Pty Ltd NSW	100,000>
Softwood Sawmill/roundwood	McVicars Timber Group NSW	100,000>
Softwood Pulp and paper	Norske Skog Paper Mills (Australia) Ltd NSW	100,000>
Softwood Sawmill/roundwood	Pentarch Forest Products Ltd NSW	100,000>
Hardwood Sawmill/roundwood	Baradine Sawmilling Company Pty Ltd NSW	20,000-99,999
Softwood Veneer/plywood	BRT trading as Ausply Pty ITD NSW	20,000-99,999
Softwood Sawmill/roundwood	Auswest Timbers (ACT) Pty Ltd ACT	20,000-99,999
Softwood Veneer/plywood	Carter Holt Harvey Ltd Victoria	20,000-99,999
Softwood Sawmill/roundwood	Colenden Pty Ltd NSW	20,000-99,999
Softwood Sawmill/roundwood	D & R Henderson Pty Ltd Victoria	20,000-99,999
Softwood Sawmill/roundwood	Penrose Pine Products Pty Ltd NSW	20,000-99,999
Softwood Sawmill/roundwood	Tarmac Sawmilling Pty Ltd NSW	20,000-99,999