

North East Forest Alliance submission to Inquiry into the Australian forestry industry

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This submission addresses aspects of the following terms of reference of your committee:

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This submission relates specifically to north-east NSW and comments herein, unless otherwise stated, are specific to the North East Regional Forest Agreement region.

This submission relies upon recent audits undertaken by the North East Forest Alliance, notably:

Pugh, D. (2009) Preliminary Audit of Yabbra State Forest Compartments 162 and 163. North East Forest Alliance, December 2009.

http://nefa.org.au/wp-content/uploads/2011/02/Audit_Yabbra_Dec2009.pdf

Pugh, D. (2010a) Preliminary Audit of Yabbra State Forest, Compartments 162 and 163', Supplementary Report. North East Forest Alliance, 1February 2010.

http://nefa.org.au/wp-content/uploads/2011/02/Audit_Yabbra_Supp1_2010.pdf

Pugh, D. (2010b) Preliminary Audit of Doubleduke State Forest Compartments 144, 145 and 146. North East Forest Alliance, June 2010.

http://nefa.org.au/audit/Doubleduke/Prelim_Audit_Doubleduke_SF_1.pdf

Pugh, D. (2010c) Preliminary Audit of Doubleduke State Forest Compartments 144, 145 and 146, Supplementary Report. North East Forest Alliance, November 2010

http://nefa.org.au/wp-content/uploads/2011/02/Audit_Doubleduke_Supp1_Nov_2010.pdf

Pugh, D. (2010d) Preliminary Audit of Girard State Forest Compartments 44, 45, 46, 54, 55 and 56. North East Forest Alliance, August 2010.

http://nefa.org.au/audit/Girard/Preliminary_Audit_of_Girard_State_Forest_1.pdf

Pugh, D. (2011) Audit of Compliance of Forestry Operations in the Upper North East NSW Forest Agreement Region. North East Forest Alliance, February 2011.

http://nefa.org.au/wp-content/uploads/2011/02/Audit_UNE_Forests_Feb2011.pdf

Sparkes, M (2010) Five Years of Proven Forestry Breaches. North East Forest Alliance, September 2010 .

http://nefa.org.au/wp-content/uploads/2011/02/Sparkes_Forestry_Breaches_2010.pdf

RECOMMENDATIONS

- 1) **The Inquiry needs to reassert that the establishment of comprehensive, adequate and representative reserve systems that satisfy the national criteria (JANIS 1997) is the primary requirement for Ecologically Sustainable Forest Management. The inquiry needs to recognise that the forest reserve system in north east NSW does not satisfy the national criteria. To improve compliance with the national reserve criteria and the North East Regional Forest Agreement it is requested that the Inquiry:**
 - i) **Report on the current shortfalls in attainment of the JANIS reserve criteria in north-east NSW and identify means of redressing gross deficiencies;**
 - ii) **Investigate the failure of the Commonwealth to ensure accurate and timely reporting on sustainability criteria and indicators; and**
 - iii) **Review compliance with all clauses of the RFA and identify actions to remedy failures.**

- 2) **The Inquiry needs to reassert that that the management of native forests on a sustainable yield basis, and within ecological constraints, is a fundamental requirement for Ecologically Sustainable Forest Management. The inquiry needs to recognise that public native forests in north east NSW are not being managed on a sustainable yield basis. In order to satisfy the RFA's requirement to review sustainable yields in 2006, reduce commitments in line with timber reviews and cease unsustainable logging of native forests as soon as possible, it is requested that the Inquiry:**
 - i) **Investigate the failure of the Commonwealth to document, consider and account for identified criticisms of FRAMES wood assessments;**

- ii) Investigate and remedy the failure by NSW to annually report on actual versus predicted yields as required by the RFA;
 - iii) Investigate the expenditure of Commonwealth funds provided for the enhancement of FRAMES and long-term timber supplies;
 - iv) Investigate the decision to entrench and extend unsustainable logging for a further 5 years in contravention of the RFA, and for 3 years beyond the expiry of the RFA;
 - v) Investigate the failure of Forests NSW to satisfy current Wood Supply Agreements;
 - vi) Require an immediate independent review of the new FRAMES wood assessments that accounts for previous criticisms and specifically identifies the sustainable yield from native forests; and,
 - vii) Identify means of reducing the logging of native forests to a sustainable level as soon as possible.
- 3) It is suggested that the Inquiry consider the issue of public forest management arrangements and consider recommending separating policy and regulation from operations. Any such system would be enhanced by allowing members of the public third party appeal rights.
- 4) The inquiry needs to recognise that forestry operations can and do have significant impacts on inadequately reserved, rare and endangered ecosystems. In order to appropriately protect inadequately reserved, rare and endangered ecosystems, it is requested that the Inquiry:
 - i) Require the identification of the reservation status of all forest ecosystems in accordance with the RFA;
 - ii) Review the management arrangements for values protected in informal reserves and by prescription;
 - iii) Review the poor management of forest ecosystems intended to be excluded from logging; and,
 - iv) Identify appropriate management arrangements for each inadequately reserved, rare and/or endangered ecosystem.
- 5) The inquiry needs to recognise that forestry operations can and do have significant impacts on a range of native plants and animals and that many current prescriptions are inadequate and inadequately applied. In order to appropriately protect nationally rare and endangered plant and animal species, it is requested that the Inquiry:
 - i) Identify the reservation status of all nationally threatened species;
 - ii) Engage appropriate experts to review the adequacy of prescriptions applied to safeguard threatened species in logging operations; and,
 - iii) Review the application of prescriptions in logging operations and identify means to improve their implementation.
- 6) The Inquiry needs to recognise that forestry operations do cause soil erosion and do have a significant impact on streams, and that Forests NSW go out of their way to avoid external regulation and the application of Best Management Practices to protect stream quality. To ensure the application of best management practices to minimise the impacts of forestry operations on soil erosion and streams it is requested that the Inquiry:
 - i) Engage appropriate experts to identify performance standards and review the adequacy of prescriptions applied to safeguard streams and water quality in logging operations;
 - ii) Ensure independent regulation by requiring application of Environmental Protection Licences to all logging operations;
 - iii) Ensure that Forests NSW comply with the requirement to assign FMZ8 areas to the appropriate protection zone; and,

- iv) Identify measures needed to improve compliance with requirements.
- 7) The Inquiry needs to recognise that logging has significant impacts on water yields from native forests, such that:
- i) Reduction of mature and oldgrowth forest to younger growth stages will cause a significant reduction in water yields;
 - ii) Water yields will increase with increasing forest maturity; and,
 - iii) Logging should be excluded from significant water catchments.
- 8) The Inquiry needs to recognise that Bell Miner Associated Dieback is a significant threat to native forests and that appropriate management involves:
- i) Identifying and mapping all affected and susceptible areas;
 - ii) Placing all affected and susceptible areas under a logging moratorium until such time as appropriate management responses that maintain ecosystem functioning are identified; and,
 - iii) Undertaking rehabilitation works (i.e. weed control) in affected stands.
- 9) The Inquiry needs to recognise that logging has significant impacts on carbon storage in native forests, such that:
- i) Reduction of mature and oldgrowth forest to younger growth stages will cause a significant reduction in carbon storage in forest;
 - ii) Carbon storage will increase with increasing forest maturity;
 - iii) Large trees are particularly important for carbon storage; and,
 - iv) Forests should be managed so that they are carbon sinks.
- 10) The Inquiry needs to recognise that NSW's Wood Supply Agreements distort the hardwood sawlog market and are for excessively long periods. The Inquiry needs to recommend that every opportunity should be taken to reduce the volumes committed and reduce the length of the agreements.
- 11) It is requested that the Inquiry recognise the market distortions and lack of transparency caused by NSW's amalgamation of plantations and native forests for resource allocation and reporting and recommend separate reporting of native forests.
- 12) The Inquiry should recognise that the accreditation of timber being obtained from north-east NSW's forests as coming from ecologically sustainably managed forests and legal sources risks Australia's international reputation and credibility of its accreditation programs.
- 13) The Inquiry needs to recognise that forests have both use and non-use values that need to be taken into account when identifying the costs and benefits to the community from use of public forests. Use values include timber, water supply, carbon storage, recreation and tourism, all of which are usually compatible except logging. Non-use values include aesthetics, wildlife, ecological function value, option value, existence value and bequest value.
- 14) The Inquiry needs to acknowledge that logging of public native forests in NSW does not pay a resource rent to the community and is operating at a considerable financial loss. It also needs to be recognised that costs are rapidly escalating and timber volumes declining. The Inquiry needs to identify means of removing public subsidies to the timber industry and returning a resource rent to the community from the commercial use of public resources.

1. Opportunities for and constraints upon production

NEFA considers that management of native forests has to be in accordance with the principles of Ecologically Sustainable Forest Management and the agreed national framework for forest management. Full and proper compliance with these requirements has to be the primary constraint upon production. This entails:

1. Establishment of a comprehensive, adequate and representative reserve system in accordance with JANIS targets as a minimum;
2. Implementation of adequate off-reserve management to adequately protect fauna, flora, soils and streams, including by application of Best Management Practices as a minimum;
3. Limitation of logging from native forests to a sustainable yield within the proceeding constraints.

Points 1 and 3 are dealt with in the following sections 1.1 and 1.2 respectively. Off-reserve management is dealt with in Section 2 of this submission.

1.1. Regional Forest Agreements

The concept of 'ecologically sustainable development' has been adopted by the world community as the solution to our rapidly deteriorating global environment. The generally accepted definition of 'sustainable development' is that provided by the World Commission on Environment and Development: development that *"meets the needs of the present without compromising the ability of future generations to meet their own needs"* (WCD 1987).

The National Strategy for Ecologically Sustainable Development (1992) includes

Objective 3.2

to maintain ecological processes within the forests, maintain biodiversity, and optimise benefits to the community from all uses, within ecological constraints
Governments will:

- *determine agreed criteria for a comprehensive and representative reservation system*
- *protect old growth forest in a representative reserve system as the primary means of protection, supported by complementary management outside reserves*
- *protect all forest wilderness areas in reserves*
- *develop a dedicated and secure nature conservation reserve system, containing comprehensive, replicated, adequate and representative areas of all major native forest ecosystems and other listed values*
- *address biological threats to forests; ...*

The National Forest Policy Statement (CoA 1992) was signed by the then Prime Minister and Premiers of all the mainland states in 1992. In signing the National Forest Policy Statement (NFPS) the States committed themselves to establishing a comprehensive, adequate and representative (CAR) reservation system by the end of 1995 for public lands (with the inclusion of necessary forest from private land by 1998) and developing codes of practice for logging based on consistent nationwide baseline environmental standards (CoA 1992).

It took NSW until 1998 to establish a reserve system for public lands in north east NSW that falls well short on the CAR criteria. The baseline environmental standards were abandoned by the forestry agencies before they were finished being developed. While NSW still does not have quantifiable performance standards it does have a suite of logging protocols for public lands.

The National Forest Policy Statement (CoA 1992) states:

The nature conservation objectives are being pursued in three ways. First, parts of the public native forest estate will continue to be set aside in dedicated nature conservation reserve systems to protect native forest communities, based on the principles of comprehensiveness, adequacy and representativeness. The reserve system will safeguard endangered and vulnerable species and communities. Other areas of forest will also be protected to safeguard special areas and to provide links where possible between reserves or other protected areas. Nature conservation reserves will be managed so as to protect their values. Second, there will be complementary management outside reserves, in public native forests that are available for wood production and other commercial uses and in forests on unallocated or leased Crown land. Third, the management of private forests in sympathy with nature conservation goals will be promoted.

...
Ecologically sustainable forest management will be given effect through the continued development of integrated planning processes, through codes of practice and environmental prescriptions, and through management plans that, among other things, incorporate sustainable-yield harvesting practices.

Forests NSW (2005) ESFM Plan notes:

The National Forest Policy Statement (NFPS) identifies protection of the full range of forest ecosystems and other environmental values as being fundamental to ecological sustainability. This entails the maintenance of ecological processes, biodiversity and the protection of water quality.

The principal biodiversity conservation outcome of the NFPS was the establishment of the principles of 'comprehensiveness', 'adequacy' and 'representativeness' as the basis for developing reserve criteria from which to review and establish reserve systems to protect the conservation values of forests. These three key words are defined in the NFPS as:

- *comprehensiveness - includes the full range of forest communities recognised by an agreed national scientific classification at appropriate hierarchical levels;*
- *adequacy - the maintenance of ecological viability and integrity of populations, species and communities;*
- *representativeness - those sampled areas of the forest that are selected for inclusion in reserves should reasonably reflect the biotic diversity of the communities (CoA 1992).*

The NFPS also precipitated the development of nationally agreed criteria for the establishment of conservation reserves. It was not until 1997 that agreement was achieved on national reserve criteria called the *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia* (JANIS 1997).

Comprehensive Regional Assessments (CRAs) were to be undertaken to identify Comprehensive, Adequate and Representative (CAR) reserve systems as a basis for developing Regional Forest Agreements (RFAs). The purposes of the RFAs are claimed to be:

- (a) identify areas in the region or regions that the parties believe are required for the purposes of a Comprehensive, Adequate and Representative Reserve System, and provide for the conservation of those areas*
- (b) provide for the ecologically sustainable management and use of forested areas in the regions*
- (c) provide for the long-term stability of forests and forest industries, and*
- (d) have regard to studies and projects carried out in relation to all of the following matters that are relevant to the regions:*
 - (i) environmental values, including old-growth, wilderness, endangered species, National Estate values and World Heritage values;*

- (ii) indigenous heritage values*
- (iii) economic values of forested areas and forest industries*
- (iv) social values (including community needs), and*
- (v) Principles of Ecologically Sustainable Forest Management.*

In NSW the CRA process commenced in 1996 under the auspices of Resource and Conservation Assessment Council (RACAC). A Joint Steering Committee was formed by the State and Commonwealth to oversee the process. Two of the 5 regions assessed were the Upper North East (UNE) and Lower North East. (LNE)

When negotiations commenced for north-east NSW (UNE and LNE), the Commonwealth withdrew from the process. In their negotiations for north east NSW, the NSW State agencies identified an option, which maximised the achievement of the reserve targets, subject to an artificial 'political' cut-off point of no more than 70% of the State Forest estate, even though this meant that many reservation targets were not met. With this constraint applied, the outcome identified over 1 million hectares of public land in north-east NSW as required for addition to the reserve system to best satisfy the national reserve criteria. Conservationists then applied the data without the political constraint, and identified 1.2 million hectares as required to reasonably establish a CAR reserve system for public lands in the region (Flint, Pugh and Beaver 2004).

The NSW Government Agencies were then instructed by the Government to limit the reserve system to allow the supply of 270,000 cubic metres of sawlogs per annum for 20 years, with reductions in supply volume allowable thereafter. The outcome of the State agency negotiation in early November 1998 was the finalisation of a 'State Agency position' on reserves that identified approximately 554,000 hectares of land for reservation. This included 390,447 hectares for immediate reservation as National Parks, Nature Reserves or Flora Reserves, 20,161 hectares for reservation in a new form of Crown reserve, a further 76,106 hectares of State Forests for later reservation following resolution of mineral and leasehold interests, and 67,000 hectares of vacant Crown land for later reservation following resolution of other interests and impediments. This outcome met the specified political constraint of maintaining current timber commitments for the next 20 years. (Flint, Pugh and Beaver 2004).

The NSW Government finally decided to broadly implement the negotiated 'State Agency position', although it was reduced by 76,106ha to exclude the State Forest areas that were previously earmarked for later reservation, and a further 15 logging compartments chosen specifically by the timber industry were also removed from the position. The 67,000 hectares of vacant Crown land remained earmarked for potential later reservation, though with somewhat less emphasis than in the original position. (Flint, Pugh and Beaver 2004).

On the 12 November 1998, NSW Premier Bob Carr announced the creation of 386,627 hectares of new NPWS reserves, 3,820 hectares of new SFNSW Flora Reserves and 20,100 hectares of new Crown reserves in north-east NSW. The decision also resulted in the protection of a subset of oldgrowth forests designated as 'high conservation value', all mapped rainforest, and steep and non-commercial areas in 370,000 hectares of protected Forest Management Zones in late 1999. The outcome also included a revised set of licence conditions for Threatened species, erosion control and stream protection for off-reserve management of State Forests. The revised conditions were negotiated between State Government agencies without proper independent scientific review or any assessment of their effectiveness.

At the same time, the Government signed wood supply agreements with the timber industry committing to supply 269,000 cubic metres of large quota sawlogs for 20 years. This represented 50% of 1995 levels, and the annual volumes were phased down to this level by the year 2000. The new 20-year contracts removed existing clauses for value adding,

though included a clause that required a review of the available timber resource and sustainable yield to be undertaken by December 2006.

The decision also included major freeing of forestry operations from legislative controls by enactment of the Forestry and National Park Estate Act 1998. Existing legislation was amended so that Forests NSW's forestry operations were exempted from the *Environmental Planning and Assessment Act 1979*, thereby removing the requirement for Environmental Impact Statements and Species Impact Statements. The Act introduced ministerial discretion into the implementation of the *Threatened Species Conservation Act 1995* and the *Protection of the Environment Operations Act 1997*, prevented the application of stop work orders to forestry operations, removed third party appeal rights on forestry activities and exempted forestry from most other relevant environmental legislation including the *Wilderness Act 1987*. These changes represented a fundamental erosion of the most important legislative controls on forestry in NSW. They were implemented without any community consultation, were opposed by the conservation movement, and directly contradicted the ALPs own 1995 election policy.

NSW Forest Agreements were made between the NSW Ministers for the Upper North East (UNE) and Lower North East (LNE) in March 1999 for a period of 20 years until March 2019. They are enacted through the Integrated Forestry Operations Approvals granted under the Forestry and National Park Estate Act 1998. Regional Forest Agreements between the Commonwealth and State governments were signed for UNE and LNE in March 2000.

1.1.1. Satisfaction of Criteria

Our analyses (based on figures given in NE Regional Forest Agreement 2000) show that the 1998 decision increased the number of ecosystems achieving targets to 52 (32%), though with the inclusion of Informal Reserves and values Protected by Prescription this increased to 73 (45%). Of the total areal target, 51% was achieved in Dedicated Reserves leaving a shortfall of 372,258ha. With the inclusion of Informal Reserves and values Protected by Prescription 61% of areal targets are achieved, leaving a shortfall of 299,222 ha.

It is astounding that with 300,000 (39%) of the forest ecosystem areal targets required to be satisfied to establish a CAR reserve system in UNE remaining unmet (along with numerous other targets), both the NSW and Commonwealth Governments (Premier Bob Carr and Prime Minister John Howard) signed that reserve requirements had been met. The North East Regional Forest Agreement (RFA 66) states:

Parties agree that the CAR Reserve System as identified on Map 1(A) and Map 1(B) and presented in Attachment 1(A), Attachment 1(B) and Attachment 2, satisfies the JANIS Reserve Criteria.

While it may have satisfied their respective political agendas, it clearly did not satisfy the criteria.

UNE FOREST ECOSYSTEM TARGET ACHIEVEMENT

		Ecosystem Target Achievement (no)					Areal target Achieved (%)	Areal extent of Unmet Targets (ha)
		<25%	25-49%	50-74%	75-99%	>100%		
1998	Dedicated Reserves	52	23	17	18	52	51%	372258
	Dedicated and Informal Reserves and Prescriptions	34	24	11	20	73	61%	299222
2004	Dedicated Reserves	38	22	16	19	67	58%	322675

Based on GIS reporting we updated the achievement of targets in Dedicated Reserves to take into account reserve additions up to 2004, the number of ecosystems achieving targets has only increased to 67 (41%), leaving 95 (59%) below target. 60 ecosystems (37%) have

less than half their targeted areas reserved, with 21 ecosystems (13%) achieving less than 10% of their targeted areas. 70 of the 95 forest ecosystems under target have been identified as high priorities for inclusion in the reserve system (1 and 2) in the expert workshops. 35 have been classed as rare and endangered, and 20 as vulnerable, in accordance with the JANIS criteria. This represents 90% of all rare, endangered and vulnerable ecosystems in the UNE. There are still 322,675 hectares of 95 forest ecosystems requiring reservation in formal reserves to satisfy the national reserve targets.

Due to the complexities we were not able to assess Informal Reserve and Values Protected by Prescription as at 2004, though as many of the additional reservations came from these categories the overall target achievement will not be proportionally improved.

Some 130,500 hectares of the ecosystems requiring reservation occur on public lands that remain available for the NSW government to include in Dedicated Reserves or to fully protect off reserve. It is indeed both possible and practicable for the NSW Government to increase the inclusion of required forest ecosystems in the CAR reserve system but at present there appears no will to achieve this.

The NSW and Commonwealth Governments appear intent on obscuring the extremely poor reservation outcomes in north-east NSW by failing to reveal the relevant figures. The NE Regional Forest Agreement fails to consider forest ecosystems in relation to JANIS reserve targets, referring instead to original extent.

For plant and animal species, the national reserve criteria (JANIS 1997) establishes that:

The reserve system should seek to maximise the area of high quality habitat for all known elements of biodiversity wherever practicable, but with particular reference to:

- *the special needs of rare, vulnerable or endangered species;*
- *special groups of organisms, for example species with complex habitat requirements, or migratory or mobile species;*
- *areas of high species diversity, natural refugia for flora and fauna, and centres of endemism; and*
- *those species whose distributions and habitat requirements are not well correlated with any particular forest ecosystem.*

Reserves should be large enough to sustain the viability, quality and integrity of populations.

Flint, Pugh and Beaver (2004) analysed the adequacy of the reserve system for fauna in 2004, finding;

A binary target assessment of all 710 fauna populations under consideration (excluding targets for bat roosts) reveals that only 217 (31% of all populations) have met conservation targets. Seventy-two of the 139 species (or 52% of species) with targets set have failed to meet target for any of their populations. Only 17 species have met target for all their populations, while the remaining 50 species have met target for at least one but not all populations.

A proportional target analysis indicates that only 45% of fauna populations have sufficient habitat reserved to achieve 50% or more target fulfilment, and 20% of fauna populations are yet to achieve even 10% of the habitat required to meet targets. The mean target achievement for all populations across all tenures is 49%, and the target area index is 33%. The mean target achievement for public lands is 76% and the target area index is 70%.

...

Of the 38 fauna species ranked by the expert panel as having the highest vulnerability to threatening processes (vulnerability 1), 30 do not attain targets for any populations, and none attain targets for all populations. Only 8 species attain targets for one or more populations. Therefore, species with the highest vulnerability to threatening processes remain very poorly reserved.

Examples of the achievement of reservation targets for particular species (Flint, Pugh and Beaver 2004) in north-east NSW (UNE and LNE) were:

- **Hastings River Mouse**, a nationally Endangered species; target was 33,969 breeding females distributed across 8 populations (of up to 4,251 females each). The outcome was the reservation of a total of 2,863 breeding females, with 8% of the mean target achieved (1-29%).
- **Spotted-tailed Quoll**, a nationally Vulnerable species; target was 4536 breeding females distributed across 4 populations (of up to 1,800 females each). The outcome was the reservation of a total of 1,201 breeding females, with 25% of the mean target achieved (10-55%)
- **Barking Owl**, a State Vulnerable species; target was 1,610 breeding females distributed across 2 populations (of up to 805 females each). The outcome was the reservation of a total of 466 breeding females, with 61% of the mean target achieved (44-79%)
- **Powerful Owl**, a State Vulnerable species; target was 756 breeding females distributed across 2 populations (of 378 females each). The outcome was the reservation of a total of 234 breeding females, with 14% of the mean target achieved (11-18%)
- **Yellow-bellied Glider**, a State Vulnerable species; target was 9,240 breeding females distributed across 8 populations (of 1,155 females each). The outcome was the reservation of a total of 1,636 breeding females, with 18% of the mean target achieved (6-33%)

These outcomes highlight the failure of the RFA to satisfy national reserve criteria and deliver on the promise of an adequate reserve system sufficient to maintain the ecological viability and integrity of fauna populations. The extremely poor reservation status of many threatened fauna species in north-east NSW emphasises the need for substantial additions to the reserve system to improve fauna conservation, as well as the strict application of strengthened logging protocols that take into account the poor reservation outcomes. Evidence from NEFA's audits is that off-reserve management prescriptions for fauna are frequently not being applied, are inadequately implemented or are negated by other forestry practices.

1.1.2. The Process is a Sham

The Regional Forest Agreement process has become a sham with numerous commitments and timelines simply ignored. The 1999 NSW Forest Agreements and 2000 North East Regional Forest Agreement identify numerous milestones that have not yet been achieved.

There are numerous examples of failures of the NSW Government and Forests NSW to deliver on commitments in a timely manner (i.e. Spencer 2009), for example the Commonwealth put great emphasis on the need for Forests NSW to complete and publish a Regional ESFM Plan for the UNE by June 2000, with failure to do so considered as grounds for annulling the agreement, yet the UNE plan was not completed until 2005

The annual implementation reports are often many years late and the 5-year reviews are 5 years late, and they often do not report on the required parameters. This is best illustrated by the flurry of activity in 2009 when the annual NSW Forest Agreements (IFOA) Implementation Reports for 2004/05, 2005/06, and 2006/07 were prepared in one go (the 2007/08, 2008/09, 2009/10 reports are still missing), the 5 year NSW Forest Agreement review was prepared five years late and subsequently expanded to also constitute the 10 year review without most information being updated, and the 5 year Regional Forest Agreement (RFA) review was undertaken four years late. These rushed generic reviews are generally superficial and simplistic tick-the-box exercises. Which play no meaningful role in ongoing implementation

In relation to the 5 year RFA review Spencer (2009) notes:

However, fundamentally, the first reviews should have been completed in the 2004-2006 period, i.e. five years from their initialisation. That fact these reviews have been delayed 3-4 years is of considerable concern, has reduced public confidence in the outcomes and seriously distorts the process for the future.

...

It also is the case that many of the specific milestones required by the RFAs simply were not delivered in the timeframe required by the RFAs. While most are now either completed or underway, unless there is a real improvement in delivery, public confidence in the RFAs is at risk.

Forest Ecosystem Reporting

The UNE Forest Agreement 2.11.2 identifies the need to report annually on the reserve status of forest ecosystems as a *Criteria and Indicators for ESFM*. Appendix 9 states (forest type is as defined in the RFA data):

Indicator 1.1.a Extent of area by forest type and tenure

Rationale

To monitor the change in forest type cover for the entire forest estate within the region against targets set for retention of forest types. This indicator aims to identify which forest types are increasing or decreasing in area, as a basis for adaptive management.*

...

Reporting

Area (ha) for each forest type by tenure (where available). Add narrative to describe how much of the total forest area the data refers, and to identify tenures that are not mapped or poorly known.

The “annual” Forest Agreement Implementation Reports generally have a vague discussion regarding additions of forest ecosystems to reserves, no details of improvements in reserve targets, no mention of reserve status in State Forests and no information on private lands. As undertaken, reporting on this criterion is meaningless.

We have found that Forests NSW’s planning system and Harvesting Plans ignore the CRA forest ecosystem classification and, aside from providing protection to specified “Rare Non-commercial Forest Types” give no regard to the reservation status of commercial forest types or ecosystems.

Oldgrowth Reporting

One of the CRA indicators used for reporting is “1.1.b: Area of forest type by growth stage distribution by tenure” This is meant to be reported on annually and in the 5 and 10 year reviews as a key indicator of Ecologically Sustainable Forest Management. The NE Forest Agreement (2.11.2) requires annual reporting of this attribute. Appendix 9 elaborates:

Rationale

Ecological processes and the species associated with those processes, within any forest ecosystem or forest type, are associated with vegetative structures and developmental stages.

...

Data requirements and Monitoring methodology

Baseline data will be used from the RFA forest type data sets.

Ongoing data from SFNSW tenure will be provided through operational updates to a forest management database. Ongoing data from NPWS will be provided by mapping disturbance (e.g., fire).

Regional Vegetation Management Plans and applications for clearing licences may provide relevant information for private and leasehold land.

Re-inventory using remotely sensed imagery may be possible across all tenures if appropriate resourcing is available.

Reporting

Report on the percent of forest estate with a mix of early, mid and late age classes.

Record by the same forest types as used in Indicator 1.1.a. Report forest stands as:

- *Regeneration stands - defined as stands where the most abundant crown form is regeneration and or the year of origin indicates that the majority of trees within the stand are less than 20 years of age.*
- *Regrowth stands - defined as stands where the most abundant crown form is regrowth and or the year of origin indicates that the majority of trees within the stand are between 20 and 80 years of age.*
- *Mature stands - defined as stands where the most abundant crown form is regular and or the year of origin indicates that the majority of trees within the stand are greater than 80 years of age.*
- *Overmature stands - defined as stands where the most abundant crown form is irregular and this has been determined to be due to age.*

Changes in area over time related to forest management objectives.

In the CRA process the condition of forests was mapped from aerial photographs and assigned to the categories; Rainforest, Candidate Old Growth Forest, Disturbed Old Growth Forest, Mature Forest, Disturbed Mature Forest, Regrowth and Recently Logged. In the agency negotiations it was agreed to classify a subset of the Candidate Old Growth Forest as High Conservation Value Old Growth (HCVOG) based on limited criteria and a timber supply constraint.

The reporting on this indicator now assumes that the growth stages as applied in the CRA remain static. Since the RFA, according to Forests NSW's interpretation it is now possible to clearfell an oldgrowth forest without affecting its growth stage. The 2002/3 Forest Agreement implementation report states:

Growth stages within the NPWS estate and State forests have remained relatively stable. As with the previous indicator, changes have been the result of land additions and revocations.

...

The extent of growth stages within State forests has not changed significantly since 1999/2000.

The Commonwealth realised this was an absurdity and included a reference to the fact that logging affects growth stages, though they did not fix the problem. As an example the NSW&CoA (2009) 5 year RFA review comments:

The spread of age classes across forest communities is a measure of ecosystem diversity, since the structure and species composition of forest change as the forest grows older. Sustainable forest management requires the maintenance of a full range of age classes across the Forests NSW forest estate. Old-growth forest is a priority.

Forests are not rapidly changing systems, so monitoring of forest growth stages will not show large variations from year to year. The value of this indicator will be determined over time as the volume of data increases and trends can be identified. At this stage, any changes recorded from year to year will be primarily due to changes in land tenure and timber harvesting activities.

There are two broad criteria that determine growth stage classes within forests – ecological maturity (i.e. dominant age class of trees and characteristics of understorey) and level of disturbance (i.e. logging and clearing) (NPWS 1999c).

Areas of forest categorised as old-growth are areas of ecologically mature forest where the effects of disturbances are now negligible (JANIS 1997).

...

Approximately 50% of state forest tenure is excluded from timber harvesting. The remaining 50% is available for harvest and the growth stages will change to mature forest that has been recently disturbed, mature forest and young forest as operations proceed. ...

The extent of growth stages in state forests and DECC reserves remained relatively stable between 1999–2000 and 2001–02. Following the completion of the FMZ assessment in the UNE and LNE regions in late 2002, some larger changes in forest type extent and growth stage have subsequently been recorded in 2002–03 and 2003–04. The largest increases in growth stage extent were recorded on DECC reserves following the gazettal of a number of land transfers resulting from the National Park Estate (Reservations) Act 2002 and the National Park Estate (Reservations) Act 2003....

Growth stage distribution in the Forests NSW forest estate. Source NSW&CoA (2009). Mature forest includes mature, disturbed mature and candidate old growth; regrowth forest includes young forest; young regeneration includes recently disturbed forest; 'unassigned' represents no growth stage assigned.

Table 5.3: Growth stage distribution – Upper North East region

	2001–02	2002–03	2003–04	2004–05	2005–06
Forests NSW forest estate	Hectares	Hectares	Hectares	Hectares	Hectares
Rainforest	31,685	31,631	28,475	28,259	28,253
High-conservation-value old-growth	68,029	67,971	55,328	55,225	55,231
Mature forest	231,420	231,406	211,324	212,027	211,975
Regrowth forest	38,837	38,893	37,268	37,307	37,289
Young regeneration	53,670	53,667	51,742	51,758	51,798
Un-assigned	7338	7149	6302	412	6351
Totals	430,979	430,717	390,439	390,988	390,897

During the period covered by the above table, in the UNE 65,799ha was transferred to National Parks on 1/01/2003 as part of the resolution of FMZs and Wilderness and 14,573ha was transferred to National Parks on 1/07/2003 as part of the Forest Icon areas. These changes are presumably responsible for the changes belatedly identified by NSW&CoA (2009) for 2003/4, though they only appear to have been partially considered. Apart from the surprising increase in mature forest in 2004/5, and the mysterious disappearance of 6,000 ha of un-assigned forest for two years, logging appears to have had no significant impact on growth stages. There appears to be no correspondence between the data provided by DECCW and Forests NSW.

There should be discernable declines in mature forest and corresponding increases in young regeneration if logging is taken into account. It is apparent that reporting on changes in the extent of growth stages has become a meaningless exercise that demonstrates a total lack of commitment to achieving agreed outcomes and providing transparent, unambiguous accounting of the process.

Changes in extent of growth stages on State Forests and NPWS reserves. Adapted from NSW&CoA (2009) for State Forests and relevant FA implementation reports for National Parks and reserves. Note that Forests NSW do not report on candidate oldgrowth.

	2001/2 to 2002/3 (ha)		2002/3 to 2003/4 (ha)		2003/4 to 2004/5 (ha)		2004/5 to 2005/6 (ha)	
	SF	NP	SF	NP	SF	NP	SF	NP
Rainforest	-54ha	?	-3156		-216	+347	-6	
High-conservation value old-growth	-58ha	?	-12,643	+1701	-103		+6	0
Candidate oldgrowth		?		+2 093		+7.970		+839
Mature forest	-14ha	?	-20,082	?	+703	+1,641	-52	+989
Regrowth forest	+56	?	-1,625	?	+9	+213	-18	+341
Young Regeneration	-3	?	-1,925	?	+16	+16	+40	0
Un-assigned	-189	?	-847	?	-5,890?	+1,704	+5,939?	+231
Totals	-262	?	-40278	?	+549	+11,891	+91	+2,464

The reporting of changes in growth stages is a meaningful measure of the status of forest structure but only if it takes into account the affects of fires and logging on those growth stages, is consistently and reliably reported and identifies oldgrowth forests. Reporting on this criterion for each forest type would significantly increase its usefulness, and this appears to be the intent. Unfortunately there is no reporting of growth stages for each forest type, which should at least be presented and discussed, with any significant changes highlighted.

Carbon Storage Reporting

Reporting on carbon storage in forests by forest type, age class, and successional stages is a key requirement of the Regional Forest Agreements (NE RFA s. 2.11.2(5.1a, 5.1c)) and essential for Australia to satisfy its international obligations. Despite this explicit requirement the State and Commonwealth Governments refuse to consider carbon storage and sequestration in native forests and instead only consider carbon sequestration in plantations. This is a deliberate failing, as the Governments do not want to admit that logging reduces the carbon stored in native forests and account for this loss.

One of the requirements of the UNE Forest Agreement (2.11.2) is annual reporting on carbon storage in forests:

5.1a: Total forest ecosystem biomass and carbon pool, and if appropriate, by forest type, age class, and successional stages

...

5.1c Contribution of forest products to the global carbon budget.

In Appendix 9 to the Agreement 5.1a is elaborated upon:

Rationale

Forests can undergo significant changes of carbon storage associated with natural mortality, thinning, fire, harvesting and regrowth. This indicator is compatible with the National Carbon Accounting System which will meet Australia's obligations to track changes in national Carbon stocks under the Kyoto Protocol.

Indicative target

Maintenance of the total carbon stored in the forest.

Data requirements and Monitoring methodology

Data on wood loss by natural mortality, thinning, fire and harvesting can be balanced against regrowth data to indicate positive or negative changes to carbon across the region.

Partial reporting of this indicator can be derived from wood volume and age class data in Indicators 1.1.a and 1.1.b, provided that appropriate biometric relationships have been established. SFNSW will develop these biometric relationships based on FRAMES and will provide these to other agencies.

Reporting

Changes in Carbon held in above-ground wood volumes will be reported once biometric relationships are established. This must be interpreted as a surrogate for total forest contribution to global carbon.

The NSW&CoA (2009) five year RFA review states:

This criterion addresses the contribution to the global carbon pool of carbon from forest and forest products and contributes to Australia's obligations under the Kyoto Protocol.

...

The Kyoto Protocol requires Australia to track changes in national carbon stocks from deforestation, reforestation and afforestation activities initiated since 1990. This indicator monitors any increases or decreases in the amount of carbon stored within forest areas, forest age class and successional stage. It provides information on the changing structure of forests, eg regeneration, maturity.

...

Carbon sequestered in Forests NSW hardwood and softwood plantations is calculated for the net stocked area only. All environmental exclusions and retained native vegetation are excluded from the calculations, providing a more accurate estimation of the amount of sequestered carbon.

The amount of carbon sequestered is dependant on the area of plantation. This area changes each year because of harvesting and new plantings.

The RFA reviews only consider sequestration of carbon in plantations, they make no attempt to identify or measure changes in the native forest carbon pool due to emissions from logging and burning.

World Heritage Identification

Contrary to the 'Scoping Agreement', identification of World Heritage values were not specifically considered in the NE CRA process and their consideration was limited to future actions in the NE RFA. The NSW Forest Agreement identified that extensions to the World Heritage CERRA property based on the existing rainforest theme would be completed by April 2001, and the documentation of the themes of eucalypts, passive marginal swells, and Aboriginal sites by April 2002. However work on the renomination did not start until 2003 and appears to have made little progress to even expand on the rainforest theme to date.

The World Heritage listed Gondwana Rainforests of Australia (formerly Central Eastern Rainforest Reserves (Australia)CERRA) is located on the central east coast of Australia, generally occurring in disjunct reserves scattered along the Great Escarpment from near Newcastle in the state of New South Wales to near Brisbane in the state of Queensland. They have primarily been recognised for their unique array of rainforests, exceptional biodiversity, and ancient species.

The Scoping Agreement for New South Wales Regional Forest Agreements between the Commonwealth of Australia, and the State of New South Wales states:

1. The Governments recognise each other's statutory, international and policy responsibilities in regard to forests. For the purposes of each Regional Forest Agreement (RFA), both Governments agree to undertake jointly the following regional assessments:

...

(f) World Heritage values

This assessment will allow the Commonwealth to meet its obligations arising both from it being a State Party to the World Heritage Convention and from its own statutory requirements as set out in the World Heritage Properties Conservation Act 1983. The output from this assessment will be an assessment of World Heritage values of the forested areas of New South Wales.

In 1998 Australia established a 'World Heritage Expert Panel' to identify places of possible outstanding universal values in forested areas as part of its Regional Forest Agreement process. The panel identified that *Eucalyptus* dominated vegetation in Australia is an outstanding example on a continental scale of forest and woodland vegetation dominated by a single genus. This vegetation has evolved under stress, including conditions of high climatic variability, nutrient deficiency, and high fire frequency.

The panel identified that:

- There are two major peaks of eucalypt species richness in the eucalypt forests of the Australian continent – one in the Blue Mountains and the other in north east NSW extending into south-east Queensland.
- All major ecological types of eucalypt forest, except monsoon forest, are well represented in these two areas.
- Two of the eucalypt subgenera, *Monocalyptus* and *Symphyomyrtus*, and the genus *Angophora* are most diverse within these two areas.
- The emphasis should be on inclusion of large natural areas of eucalypt forests.
- CERRA was designed for rainforest representation and does not cover the variety of eucalypt species and forest types in the region.
- To adequately encompass the eucalypt theme, CERRA needs to be expanded to include adjoining areas of National Parks, State Forests and private property.
- Supporting values include representation of passive marginal swells and Aboriginal ceremonial sites.

In 1999 the NSW Government removed large areas of rainforests and eucalypt forests on public lands from potential timber production and added them to the reserve system as part of the Regional Forest Agreement process. This includes many areas adjoining, surrounding and linking the existing World Heritage areas. The UNE Forest Agreement (2.7) signed by the NSW Ministers on 5 March 1999 states:

The rainforest values contained in existing reserves, which have been recognised internationally by being listed as World Heritage Areas, must be protected. These areas are collectively known as Central Eastern Rainforest Reserves, Australia (CERRA).

As a result of the UNE agreement, substantial new rainforest areas have been added to existing reserves. The Ministers agree to undertake studies in the new dedicated reserve* areas, and if they meet World Heritage criteria, to nominate additional areas for World Heritage Listing as extensions to CERRA, by 1 April 2001.*

The Ministers also recognise that the forests of the UNE Region may potentially contain other outstanding universal World Heritage values apart from rainforests. These other potential values may include Eucalypt dominated vegetation and religious beliefs embodied in the landscape (Aboriginal dreaming sites and bora grounds). The Ministers* agree to further studies being undertaken in the forests of the dedicated reserve* areas of the UNE Region by 1 April 2002, to investigate and document other potential World Heritage values. If areas are demonstrated to be of outstanding universal significance on the basis of these values, the Ministers* agree to put them to the Government for consideration of their protection and nomination for World Heritage Listing.*

In March 2000 the NSW and Commonwealth governments signed Regional Forest Agreements for north-east NSW which committed them to (clause 27):

Parties agree to actively investigate, and jointly participate in the further World Heritage assessment of the relevant Australia-wide themes specified in Section 3.4.2 (Table 17) of the World Heritage Expert Panel report, including any potential contribution from the Upper North East and Lower North East regions.

Immediately after signing the RFA the Governments apparently abandoned any intent to assess the eucalypt values of north-east NSW, or the supporting value of “passive marginal swells”, and instead decided to only consider the existing value of “rainforest” and the supporting value of “Aboriginal ceremonial sites”. The November 2000 “Strategic Overview for Management” states:

Recent additions have been made to the reserve system in NSW and Queensland, including some significant additions to existing reserves included in CERRA. These include many suitable areas identified by the IUCN in 1993 and improve the integrity and decrease the fragmentation for the property. There are also some other significant areas of rainforest that have been reserved. Other reserves may also warrant consideration, following the recommendations of the Comprehensive Regional Assessment (CRA) World Heritage Expert Panel. Potential additions also exist in the increasing number of protected areas on private lands (subject to conservation agreements) and reserves managed by local government authorities.

The CRA World Heritage Expert Panel also identified the potential for the forests of north-east NSW and south-east Queensland, including CERRA, to contain outstanding universal cultural values, in relation to its use by and significance to local Aboriginal peoples. The indigenous cultural values of CERRA are poorly known.

Rather than completing the renomination by 2001 DECCW (2010) note that they didn't start until 2003–04 and limited consideration to “its current rainforest theme”. NEFA understands that even then the assessment was limited to minor additions so as not to have to undertake a renomination.

DECCW (2010) note:

In the UNE and LNE regions, a consultant's report commissioned by the then Commonwealth Department of Environment and Heritage (DEH) and completed in mid-2005, identified potential sites of national significance in the broader CERRA region based on the following themes: Aboriginal earthen ceremonial initiation sites ('bora rings'), stone arrangements, Dreaming/creation places, working together and resistance.

The combined 5 and 10 year review of the NSW Forest Agreements and IFOA (DECCW 2010) identify that objective criteria to identify and score protected areas for inclusion were developed by the CERRA Technical and Scientific Advisory Committee (TSAC), though were again apparently limited to the rainforest theme:

In 2005, TSAC provided a ranked list of potential sites to the CERRA Ministerial Council as the recommended starting point to expand CERRA on its current rainforest theme. These sites will more than double the existing area and include those that form part of existing parks in CERRA, those that have been previously recommended by the International Union of Conservation of Nature (IUCN) and those that scored highly when assessed against criteria linked to CERRA's World Heritage values. DECCW provided assistance in refining and applying these criteria to potential reserves.

The Commonwealth Minister has declined to coordinate a process to develop a nomination to extend CERRA, until he receives a formal approach from both relevant NSW and Queensland State Ministers. As at the end of the five-year review period, DECCW was reviewing the TSAC list (to ensure that regional issues and management implications were considered) and working with the NSW Department of

Premier and Cabinet in determining statewide priorities consistent with Government priorities.

...

Other themes, such as eucalypt dominant vegetation or cultural-related issues, may be considered after the current nominations are finalised over the next few years. Any future sites or new criteria for existing sites proposed for World Heritage listing would require considerable research and data collection, including the development of a comprehensive nomination document describing how the sites meet World Heritage criteria.

Note that while the 5 year review was expanded to also become the 10 year review, this entry (along with many others) was apparently not updated.

In 2007 the name was changed to Gondwana Rainforests of Australia.

Contrary to the 'Scoping Agreement', identification of World Heritage values were not specifically considered in the CRA process and their consideration was limited to future actions in the RFA. The NSW Forest Agreement identified that that extensions to the CERRA property based on the existing rainforest theme would be completed by April 2001, and the documentation of the themes of eucalypts, passive marginal swells, and Aboriginal sites by April 2002. Though work on the renomination did not even start until 2003 and appears to have made little progress to even expand on the rainforest theme since.

The Inquiry needs to reassert that the establishment of comprehensive, adequate and representative reserve systems that satisfy the national criteria (JANIS 1997) is the primary requirement for Ecologically Sustainable Forest Management. The inquiry needs to recognise that the forest reserve system in north east NSW does not satisfy the national criteria. To improve compliance with the national reserve criteria and the North East Regional Forest Agreement it is requested that the Inquiry:

- a. Report on the current shortfalls in attainment of the JANIS reserve criteria in north-east NSW and identify means of redressing gross deficiencies;**
- b. Investigate the failure of the Commonwealth to ensure accurate and timely reporting on sustainability criteria and indicators; and**
- c. Review compliance with all clauses of the RFA and identify actions to remedy failures.**

1.2. Sustainable Yield

The National Forest Policy Statement (CoA 1992) states:

Ecologically sustainable forest management and codes of practice

Ecologically sustainable forest management will be given effect through the continued development of integrated planning processes, through codes of practice and environmental prescriptions, and through management plans that, among other things, incorporate sustainable-yield harvesting practices.

...

4.2 Wood production and industry development

Sustainable economic use of native forests and plantations is one of the principal objectives of this Statement.

...

The Commonwealth-State regional agreement resulting from the assessment will also cover guidelines for all aspects of ecologically sustainable management of the forests ... In this respect, the guidelines will cover, for example, management for sustainable yield, the application and reporting of codes of practice, and the protection of rare and endangered species and national estate values.

The NE Forest Agreement (2.11.2) requires annual reporting of:

2.1.d Annual removal of wood products compared to sustainable volume.

The Regional Forest Agreements (Commonwealth of Australia and the State of New South Wales 2000) state:

“Sustainable Yield” *means the long term estimated wood yield from forests that can be maintained from a given region in perpetuity under a given management strategy and suite of sustainable use objectives*

This section only considers sustainable yield in the context of timber supply from public forests and focuses on of quota sawlog volumes. Quota sawlogs are generally taken to be large high quality sawlogs with minimal defect and a centre diameter of 40 cm, and until relatively recently were annual commitments. Since the NSW Government first introduced Wood Supply Agreements in 1988 these annual commitments have slowly been converted to term agreements for periods of from 10 to 20 years. While these long-term tradeable rights are worth a lot, they are given at no cost to the loggers.

After the creation of the new (1998) national parks, and with the protection of the Government’s HCV oldgrowth forest, rainforest, streams and allowance for threatened species protocols, Forests NSW’s 1998 Forest Resource and Management System (FRAMES) identified the 100 year sustainable yields of *High Quality Large Sawlogs* as 80,319 m³ gross of high quality large sawlogs per annum for the Upper North East CRA region (UNE) and 136,902 m³ per annum in the Lower North East (LNE).

The NSW Government subsequently decided to increase 20 year volumes and guarantee them in Wood Supply Agreements, at the expense of long-term yields, thereby committing NSW to unsustainable logging. In clear recognition of the failure to apply sustainable yield in north-east NSW, the Regional Forest Agreements (Commonwealth of Australia and the State of New South Wales 2000) now claim to be implementing a strategy:

“Sustainable Wood Supply Strategy” *means the intent to manage yields of High Quality Large Sawlogs and Large Veneer Logs from the forest at a specific and constant level for twenty years under a given management strategy and suite of sustainable use objectives. It recognises that a transition to long term Sustainable Yield will be phased in to accommodate social and economic considerations;*

The strategy was to go on logging at unsustainable rates, and to supplement this by purchasing private properties with existing resources and for establishment of new plantations to attempt to increase future timber availability. However the strategy has not fulfilled its aims and the resource assessments it is based on have been found to be inflated and fundamentally flawed.

The 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). States:

Under the Sustainable Wood Supply Strategy, NSW agrees to supply 129,000m³ per annum for 20 years in the Upper North East Region and 140,000 m³ per annum in the Lower North East Region of High Quality Large Sawlogs and Large Veneer Logs. Annually, approximately 20,000 m³ of High Quality Large Sawlogs and Large Veneer Logs allocated in the Upper North East Region will be sourced from the Lower North East Region over the period of the Agreement.

...

... It is estimated that the 100 year supply levels after 2018 will average approximately 70,000 m³ per annum in the Upper North East Region and 113,500 m³ per annum in the Lower North East Region of High Quality Large Sawlogs and Large Veneer Logs from existing native forests and Plantations on State forests and other land owned by SFNSW, assuming harvesting under existing terms and conditions.

...

Both Governments aim to provide additional sawlog and other wood products that will become available through purchase by SFNSW of private native forest property and through Plantations established on purchased land or as joint ventures. These measures are currently predicted to bring the average annual available High Quality Large Sawlog and Large Veneer Log yield from State forests beyond the 20 years of this Agreement to within approximately 15 per cent of the 20 year contracted levels for Upper North East Region and Lower North East Region.

In 2009 the NSW Auditor-General, Peter Achterstraat, prepared the report "Sustaining Native Forest Operations: Forests NSW". He reached the obvious conclusion that "current yield from native forests in the north coast is not sustainable in the long term" stating:

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.

The UNE Forest Agreement (3.5) requires that monitoring be used to improve FRAMES, noting:

Monitoring of FRAMES performance will also comprise comparison of actual and predicted volume each 12 month period at the RFA Region level, and assessment of the progressive 20 year supply at the RFA Region level.

The results of resource inventory and annual monitoring must be used to review the performance in achieving the implementation of sustainable yield of timber products.

Milestone 16.4 for the UNE RFA is:

Monitoring FRAMES through comparison of actual versus predicted volumes

Initially Forests NSW complied with this requirement. This was until Forests NSW's 2002 North Coast Timber Supply Monitoring Estimate *showed that actual yield was 87 per cent of predicted.* In contravention of the Regional Forest Agreement, Forests NSW's response was to stop collecting data on actual versus predicted yields.

In 2002 Vanclay's "Review of Projected Timber Yields for the NSW North Coast" applied this to identify that "*it is evident that the harvest able to be sustained during the next 20 years is 220,000 m³/year at most ... In the longer term (21-100 years), production from native forests is expected to range between 175 and 110,000 m³/year*". This reduction in predicted short-term unsustainable log volumes by 18% and long-term sustainable volumes by 5–40% is significant.

In July 2004 Forests NSW prepared a report "State of the Resource, A Review of Wood Resources on the North Coast of NSW. This document is not available on the web and has not apparently been referenced in the various RFA reports or yield reviews, though a subsequent report by Partington and Stevenson (Forests NSW 2004b) consider that it "*clearly described*" the deficiencies with the "*process of estimating merchantable volume*"; stating that:

... for some time there has been concern about actual volumes being less than those predicted by the FRAMES process. And recently a report by State Forests highlighted deficiencies in just about every aspect of the process of estimating merchantable volume ...

...

The deficiencies described include the following: merchantable classification of species that are never harvested; inaccurate estimates from some of the tree volume, taper, and height equations; problems of consistency, reliability and ease of use in relation to tree proportionment, issues in relation to defect modifiers and the division of losses due to inherent defect and those due to sub-optimal log making practices; the limitations of the GIS system in adequately handling the complexity of net harvest area analysis and the difficulty of verifying the results of such analysis; technical problems with the net harvest area modifiers, their lack of currency and the small sample sizes on which the defect modifiers are based; a single strike rate is used but studies suggest different strike rates apply in different areas; growth models and the records on which they are based need to be overhauled; and most importantly the inventory data was no longer considered a reliable description of the resource due to the effect of harvesting and a lack of replacements for the harvested inventory plots.

In 2004 Forests NSW released the simplistic report “A Review of Wood Resources on the North Coast of New South Wales”, which it is assumed would have been available to the Government when they issued the WSAs. Unfortunately only bits of data are poorly presented in a confusing and contradictory manner that appears designed to make it hard to interpret.

Interestingly, compared to the 2002 NCTS this new study was based on a reduction in gross area of 100,600 ha (11%) but, due to different assumptions, an increase in net harvest area of 700ha.

The outcome of the revised modelling for large quota sawlogs applying a set “*high level of cut in the next 20 years*” was “*220,000m³ per annum of HQL for the first five years, decreasing to 200,000m³ per annum for years six to twenty*”. The graph indicates that this drops to a “sustainable” yield of something like 63,500m³ per annum after year twenty, though no details of this dramatic reduction in long-term sustainable yield are provided or discussed.

Though the new assessment cautions that:

Interpretation of these results and their translation into management actions requires some care. In particular, the modelled outcome is generally 10-15% above the likely outcome due to factors that cannot be incorporated for practical reasons or cannot be adequately represented mathematically.

This caveat was subsequently ignored by both the NSW and Commonwealth Governments. If allowance is made for a 15% over-estimation, as a precautionary approach demands, then the 5 year cut is reduced to 187,000m³ per annum and the 6-20 year cut is reduced to 170,000 m³ per annum. There is an identified major reduction in large high quality (LHQ) sawlogs from Native Forests after year 20, though the corresponding information from plantations is not provided, which intentionally prevents any identification of the 100 year sustainable yield of LHQ sawlogs.

Given that these revised estimates are based on a similar nett harvest area to the NCTS, they represent yet another significant reduction in estimates of yields per hectare. Basically, when compared to Vanclay’s (2002) assessment that 220,000 m³/yr could be sustained for 20 years and 175,000-110,000 m³/yr for the next 80 years, the new modelling shows significantly reduced timber volumes, and brings a higher proportion of that available forward for logging within 20 years at the cost of increased reductions in yields thereafter. This effectively increases the rate of unsustainable logging.

Partington and Stevenson (Forests NSW 2004b) undertook a review for the NSW Auditor General - ‘Forests NSW: Review of North Coast Standing Volumes for the 2004 Valuation’ which reached significantly different conclusions than Vanclay, stating “*it has been clear for some considerable time that the timber volumes predicted by the FRAMES process are*

proving difficult to achieve. This naturally creates a question-mark over valuations derived from the FRAMES data.”

Partington and Stevenson (Forests NSW 2004b) found that the FRAMES data was in disarray for many reasons, including that 500 of the 2000 inventory plots had been logged, noting:

Unfortunately, following the FRAMES process the intensity of effort that went into inventory management diminished. The responsibility for inventory management was allocated to the regions until this was changed in 2003. During this time, about 500 of the original 2000 or so north coast inventory plots were lost to harvesting. Many of these plots were not replaced. We are not critical of this; it may have been an entirely appropriate choice by regional management to invest their resources in other areas that they saw as more important. However, the consequences in Forests NSW own words, was that, “The inventory data can no longer be considered a reliable description of the resource due to the level of harvesting over the last five years and the lack of a replacement programme for harvested plots.”¹

There were also a number of other issues requiring attention including the need for a new system of management for the area records, the limited data on which estimates of the net harvest area modifier were based, variation in strike rates across the region, a need for new growth and product proportionment models, and various other issues that needed to be addressed. In short a complete overhaul of the native forest and hardwood plantation inventory was required.

... There will be a need for assessment and review and recalibration of some of the modelling. It is also apparent that the rebuilding of the inventory system is a work-in-progress. We think directions that are being taken are generally appropriate and the effort is admirable, but there is still some way to go.

It is also apparent that a number of interim measures have been employed in bridging the gap between the old system and the full implementation of the new system. This has been necessary in order to derive a set of numbers for the current valuation. For, example a single height diameter model was applied, irrespective of species, in order to estimate the height of trees from their diameter. Neither, with the functionality of the current system, was it possible to grow the forest forward from the date of original measurement of inventory plots. ...

There are also some technical sampling issues. ...

It is interesting that the North East RFA “Attachment 12, Long-term Timber Supply Strategy and Sustainable Yield Systems and Processes, Part E FRAMES, Sustainable Yield Systems and Processes”, requires that Forests NSW:

Undertake additional inventory plot measurement consistent with FRAMES principles to improve the accuracy of volume estimates at the Regional Level, funded at \$500,000 per year for the first five years of this Agreement.

The draft NSW CoA (2009) 5 year RFA review identifies that from 1997 to 2003 there were 127 new plots established. It is hard to fathom how this marries with Forests NSW’s logging of over 25% of their existing plots over this period. And it is surprising that this is not mentioned in the RFA reviews.

Partington and Stevenson (Forests NSW 2004) identified that Forests NSW were in the process of rebuilding the inventory system “*but there is still some way to go*”, noting:

There was limited time to conduct a detailed statistical analysis of the inventory data and in our judgement little need to do so since it was clear that the prior basis of

valuation had to be changed and that the new basis was still a work-in-progress the reliability of which could not be cost effectively determined. Consequently, we concluded that the 2004 valuation could differ substantially from the true value, and, in our judgement, none of the possible statistical analyses were going to change that conclusion.

Partington and Stevenson (Forests NSW 2004) did identify a variety of problems with the work to date, such as errors in the data, inadequate data on some species, inadequate height models, poor estimates of loggable areas, flawed growth models, poorly specified models for estimating Total Standing Volume, etc., noting:

For example, in the inventory plot data that we received there are 304 trees which are reported as each having a total standing volume (TSV) in excess of 100 cubic metres, and there is one remarkable tree with a TSV of 597 cubic metres! [1.6 cubic metres is considered the average per tree]

...

In past valuations height was modelled according to species group as a function of site and Dbhob. In the current valuation the height is estimated by a single model for all species as a function of Dbhob. ... This use of a single model across all species is a weakness in the valuation modelling and is only acceptable as an interim measure. We anticipate that when a wider range of models are implemented next year that volumes may change significantly as a result.

...

Another complicating issue is that areas previously considered unmerchantable are now being reclassified as merchantable as the constraints on available timber become more severe.

Partington and Stevenson (Forests NSW 2004) conclude:

In our opinion the comprehensive improvement of the hardwood inventory is highly desirable, and we believe that good work is being done. However, it is clear that the process is incomplete with many of the new models untested, and some models are still under development. Consequently, while it is feasible to conclude that this year's estimate of value represents the best estimate currently available, it must also be concluded that there is the potential for the value estimated to differ substantially from the true value.

Faced with damning yield reviews in 2004 the NSW Government decided to ignore them, expand Wood Supply Agreements by 260% to include small and low quality sawlogs, remove review clauses, and extend them for a further 5 years. Based on Vanclay's assessment, in 2004 the NSW Government issued new Wood Supply Agreements to north coast sawmillers for quota, small and low quality sawlogs and extended them for 5 years (until 2003) past the expiry of the NSW Forest Agreements. Most significantly the NSW Government removed the clause that allowed for a non-compensable reduction in commitment following a review of available timber resources.

Even though the seriously flawed yield assessments identified that commitments of large quota sawlogs should be limited to 187,000m³ per annum for 5 years and then reduced to 170,000 m³ per annum for years 6-20 the NSW Government issued new tradeable and compensational WSAs for 215,422m³ per annum for 20 years until 2023. This results in firm commitments for a total supply of 4,365,852m³, and tentative commitments for a further 95,687m³. At the time the new WSA were made there were remaining commitments of 269,000m³ of quota sawlogs for 15 years, which is a total of 4,035,000m³. These new WSAs thus resulted in an increase in committed volumes of large quota sawlogs of 330,062-426,549m³ - not a bad windfall.

The Government was even more generous, giving millers commitments of up to 1,777,180m³ of high quality small sawlogs and 4,097,940 m³ of low quality sawlogs,

increasing the total volume of sawlogs committed in WSAs by up to 260%. While such commitments of tradeable timber rights are worth a fortune to the millers, they were given freely.

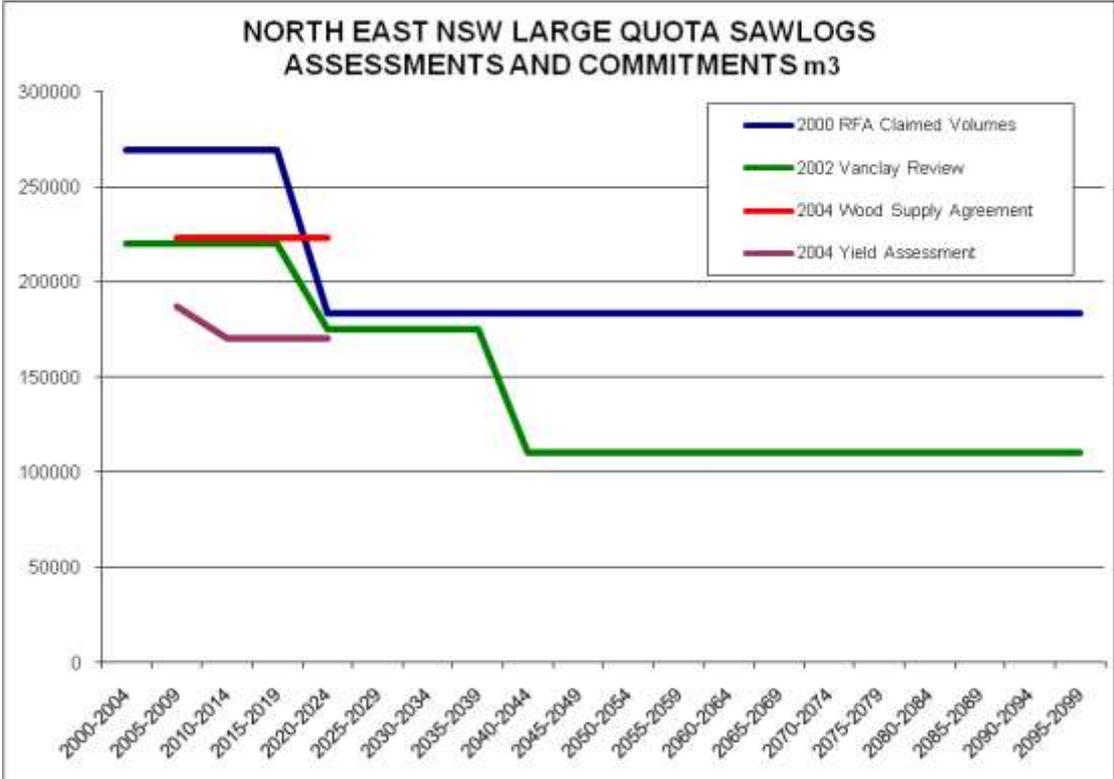
Forests NSW's (2005) ESFM Plan provides the details of Wood Supply Agreements for north east NSW.

Table 9. 2004 Wood Supply Agreement Strategy. From Forests NSW ESFM Plan (2005)

Product	WSA Volume	WSA Type
High-quality large Products	215,422	A
	7,655	B
High-quality small Products	57,759	A
	31,100	B
Low Quality Sawlogs	14,897	A&B
	190,000	C
Total Volume	516,833	

The Auditor General (2009) comments:

In this new agreement, the Government waived its rights to reduce commitments without compensating industry for any loss. This removed Forests NSW's ability to better manage supply risks by adjusting commitments. In addition, timber volumes were more or less maintained despite the loss of forest estate to national park and reserves.



Thus the NSW Government further entrenched unsustainable logging in contravention of the Regional Forest Agreement. Though Forests NSW can not satisfy the commitments and has already had to buy back quota and compensate mills for their failure to supply. The situation is rapidly deteriorating.

1.2.1 Coming to Grips with Sustainability

The Auditor General (2009, p23) relies upon the 2004 Forests NSW's "A Review of Wood Resources on the North Coast of New South Wales", though fails to consider the need

identified in that assessment to reduce modelled estimates by 10-15%, and fails to acknowledge or consider the damning Partington and Stevenson (2004) report specifically prepared for the NSW Auditor General and the July 2004 report. It is perplexing why the 2004 report prepared for the Auditor General is not cited and, judging by comments, apparently not considered, particularly as the resource assessment the auditor now relies upon was found to have numerous significant flaws and “*concluded that there is the potential for the value estimated to differ substantially from the true value*”.

In their 2003/04, 2004/5, 2005/06, and 2006/07 Forest Agreement Implementation reports, the New South Wales Government (2007) fails to identify the revised Wood Supply Agreements or acknowledge any of the 2004 yield reviews assessments, instead (i.e. New South Wales Government 2009c) extolling the virtues of Vanclay’s (2002) outdated “*extensive independent review of FRAMES*”.

Similarly the combined 5 and 10 year reviews of Forest Agreements DECCW (2010) and the draft NSW & CoA (2009) 5 year review of the Regional Forest Agreement extol Vanclay’s “*independent review*”, pay cursory attention to the 2004 review (with no mention of the reduced yields it identified and the need for a 15% discount), and fail to acknowledge the existence of the Partington and Stevenson review or the July 2004 review. This is particularly strange as the link (www.dpi.nsw.gov.au/forests/management/reporting/rfa-review-report) to Vanclay’s report includes the Partington and Stevenson review.

Similarly for his 5-year review of the RFA Spencer (2009) seems ignorant of the 2004 reviews and fails to consider the reduced yields and numerous problems they identify, instead only referring to Vanclay’s review:

However there has been independent review of the system and to this extent there would appear to be compliance with RFA requirements. Nevertheless the last independent consideration of the system was at least 7 years ago. There have been a number of enhancements since that date and new data are presumably available.

While Spencer appeared unaware, the 2004 data were available. For his review Spencer (2009) sought additional information from Forests NSW who once again only referred to Vanclay’s (2002) redundant study.

This total failure of recent agency reviews to consider and address the numerous specific issues and problems identified in Forests NSW July 2004 review and by Partington and Stevenson (2004) is professional negligence and requires investigation. Of most concern is that there can be no assurance that the identified failings of the modified FRAMES have been satisfactorily dealt with, and no subsequent reports on remodelling of volumes based on the significantly changed attributes have been made public (Forests NSW did recently present graphs of new yield estimates for native forests, though with no supporting report their veracity can not be ascertained, though the results seem uncreditable).

Despite the clear requirements to annually monitor actual versus predicted yields established by the RFA, and the repeated requests that they should do so (ie Auditor General 2009, Spencer 2009), Forests NSW, with the support of the NSW Government, continues to avoid this requirement at any resolution. It is absolutely astounding that the NSW Government has managed to get away without comparing predicted and actual volumes since the unfavourable comparisons in 2002. Forests NSW can fiddle with their models all they like, but if there is no reality check they can not be considered as anything other than fantasy.

The draft NSW & CoA (2009) 5 year RFA review accepts NSW’s claims, going so far as to pretend that “*The RFA requirement to monitor timber off-take and compare it against FRAMES predictions was addressed in the Vanclay review*”. For the 5-year RFA review Spencer (2009) could not understand why Forests NSW insisted that there could be no comparison between actual and predicted yields at any scale, stating:

However it is a specific RFA requirement to monitor modelled and actual performance on a continuous basis. The reasons for such a requirement seem quite obvious and

to not do so suggests that models should be accepted without reference to whether they reflect reality.

The Auditor General (2009) recommended that *by June 2010* Forests NSW “*compare harvest results against its yield estimates over five year periods as a means of testing the accuracy of estimates*”. In response to questions on notice from the General Purpose Standing Committee No.1 Budget Estimates 2009-10, Steve Whan claimed that the annual and five year (till June 2010) “*results will be published on Forests NSW website by December 2010*”. They were not. On the 24 December 2010 Forests NSW finally responded to the Auditor General, presenting some unreferenced graphs of revised timber volumes which were published on Forests NSW website and effectively continuing their refusal to release results of comparisons between actual and predicted yields.

Similarly the Commonwealth has allowed Forests NSW to get away with not undertaking the RFA's required 2006 yield review. The RFA “Attachment 12, Long-term Timber Supply Strategy and Sustainable Yield Systems and Processes, Part B, FRAMES and Wood Supply Reviews”, states:

15 NSW, through SFNSW, agrees to complete the following by 1 December 2006:

- *Update the FRAMES information base and enhance the FRAMES Models consistent with Part E of this Attachment;*
- *Commission and publish an independent review of the enhanced systems and process, models, information base, and assumptions which contribute to the FRAMES system;*
- *Using the results of the above FRAMES enhancement and review, NSW will review the timber resource and the annual volume which may be harvested from 2007 – 2018 consistent with the overall Sustainable Wood Supply Strategy to achieve a long-term Sustainable Yield and to optimise sustainable use objectives consistent with this Agreement.*

There were also a variety of requirements to improve FRAMES such as establishment of additional inventory plots and to “*Monitor FRAMES performance through comparison of actual versus predicted volumes each 12 months for 20 years*”.

This reflects the UNE Forest Agreement (3.5) requirement for enhancement of FRAMES:

The second level of refinement must be an aggregation of these progressive enhancements into a review of supply levels across the RFA Region at Year 8 of the 20 Year Term Agreements. The review must determine a supply level for Years 9-20 of the Term Agreements.

The supply review at year 8 is specified in the Term Agreements. The review will be based on the 1999 forest agreement land base, the EPA conditions and Conservation Protocols applying to the 1999 IFOA (without amendment), and the enhanced FRAMES estimates of supply levels. The review must determine a supply level for Years 9-20 in accordance with the Term Agreements. In addition, value-adding criteria will have been applied at year 5.

Despite attempts to pass off Vanclay's 2002 review as satisfying the need for a 2006 yield review, Forests NSW's (2005) UNE ESFM Plan states:

Forests NSW will:

- *Undertake a Forest Resources and Management Evaluation System (FRAMES) inventory program to improve volume estimates at Forests NSW administrative region level by 2006;*
- *Improve the biometric models in FRAMES and refine harvesting area definition to improve the precision of standing timber volume estimates by 2006;*

As well as requiring a yield review by 2006, the Regional Forest Agreement (RFA) required a review of sustainable yield:

48 (g) Implement the review and monitoring processes and develop the strategic and operational requirements of sustainable yield systems and processes using enhanced Forest Resource and Management Evaluation System (FRAMES) as described in Attachment 12 (Part E) to enable the review of sustainable yield by 1 December 2006 as described in Attachment 12 (Part B);

Milestone 16.5 for the UNE RFA is:

Strategic and operational requirements of sustainable yield systems and processes, review sustainable yield every five years using enhanced FRAMES and publish methods

It is particularly concerning that the NSW & CoA (2009) 5 year RFA review relies upon the 20 year estimates from the 2004 Review of Wood Resources as a surrogate for the long-term sustainable yield as required to be identified in the RFA (48g). Sustainable yield has to be maintained in perpetuity, not just for 20 years.

The NSW Auditor General (2009) states that in 2006 and 2007 Forests NSW bought back wood supply allocations from two customers totalling 13,403m³. It is assumed that these must have been for large sawlogs from north east NSW because WSA are now claimed to be 13,577 m³ less. It is not revealed how much was paid to the millers.

As well as possibly getting into the plantations and small sawlogs too early, the Auditor General notes that Forests NSW have not been meeting their target of 30,000m³ per annum from private property for the north coast, instead averaging only 7,000m³ per annum over 5 years. This increases the strain on public forests and plantations and further jeopardises future yields.

The Regional Forest Agreement 2000, Attachment 12, Part C, Hardwood Sawlog Supply Supplementation Strategy, states:

19 The Parties agree that the following long-term hardwood sawlog supply supplementation strategy will be implemented to allow the supply of more timber and raise the long term Sustainable Yield of hardwood sawlogs from public forests in northern New South Wales;

- Subject to availability of suitable land, New South Wales will spend the allocated \$18 million between 1999 and 2004 to purchase Private Land and/or timber rights to provide approximately 180,000 m³ of High Quality Large Sawlogs and Large Veneer Logs for the Upper North East and Lower North East regions within the term of this Agreement.*
- Subject to the availability of suitable land, New South Wales will spend the allocated \$30 million by 2004 to establish at least 10,000 ha of hardwood Plantations across both the Upper and Lower North East Regions to supplement supplies of High Quality Large Sawlogs and Large Veneer Logs from public forests. This initiative is expected to produce approximately 125,000m³ per annum for 10 years commencing*

DECCW (2010) note:

Forests NSW has purchased 11 properties across the UNE and LNE regions (three in the UNE region and eight in the LNE region) under the Private Property Timber Supplementation Program. These cover an area of more than 13,000 ha of native forest with an estimated standing volume of 141,439 m³ of high quality large quota sawlogs.

As of June 2005, three timber sale agreements for purchase of private property timber rights have been implemented across the LNE region with a further 10,962 m³ of high quality large sawlogs estimated to be produced.

In sourcing 152,401 m3 of supplementary high quality large sawlog, Forests NSW has made substantial progress in achieving the targeted outcome of 180,000 m3.

....

Forests NSW successfully established 7,543 ha of hardwood plantation in the UNE and LNE regions between 1999 and 2004.

Subsequent strong real estate prices and competition for land have made it difficult for Forests NSW to secure appropriate land to establish additional hardwood plantations.

These are significant shortfalls in the volumes (15%), areas (25%) and 2004 timelines established by the RFAs, it is thus surprising that they are not remarked on in FA Implementation Reports. It would be interesting to know if the \$48 million provided by the Commonwealth has been spent.

One of the Auditor General's (2009) recommendations was for Forests NSW to investigate the reasons for not meeting its private property targets for hardwood timber. In their 24 December 2010 response Forests NSW make the extraordinary claim:

Important background note to this recommendation is that the 'private property targets' were set in the ESFM Plans framed in 2005, not in the Regional Forest Agreements signed around 2000.

There are significant shortfalls in the targeted volumes of timber required to be obtained from private property and the areas of new plantations required to be established to enhance yields from 2018 until 2100. These are RFA commitments and have been funded by the Commonwealth, though Forests NSW seem unaware of this. When combined with declining yields and early logging of sawlogs from native forests and plantations the prospects of reasonable long-term yields are declining.

The NSW Auditor General (2009, Exhibit 20) indicates that the new Wood Supply Agreements are for 209,500 m³ per annum of large high quality sawlogs. It is astounding that none of the NSW Forest Agreement implementation reports or reviews bother to identify the WSA commitments and the changes made to them. The draft NSW&CoA (2009) 5 year RFA review is the only document located that identifies the new Wood Supply Agreements, though it fails to identify their type.

While the Auditor General highlights one change there have obviously been significant changes to high quality small sawlogs (-25,087) and low-quality sawlogs (+125,657). Such changes to allocations of public resources should be made public and not kept secret.

WOOD SUPPLY AGREEMENTS FOR NORTH EAST PUBLIC FORESTS UNTIL 2023.

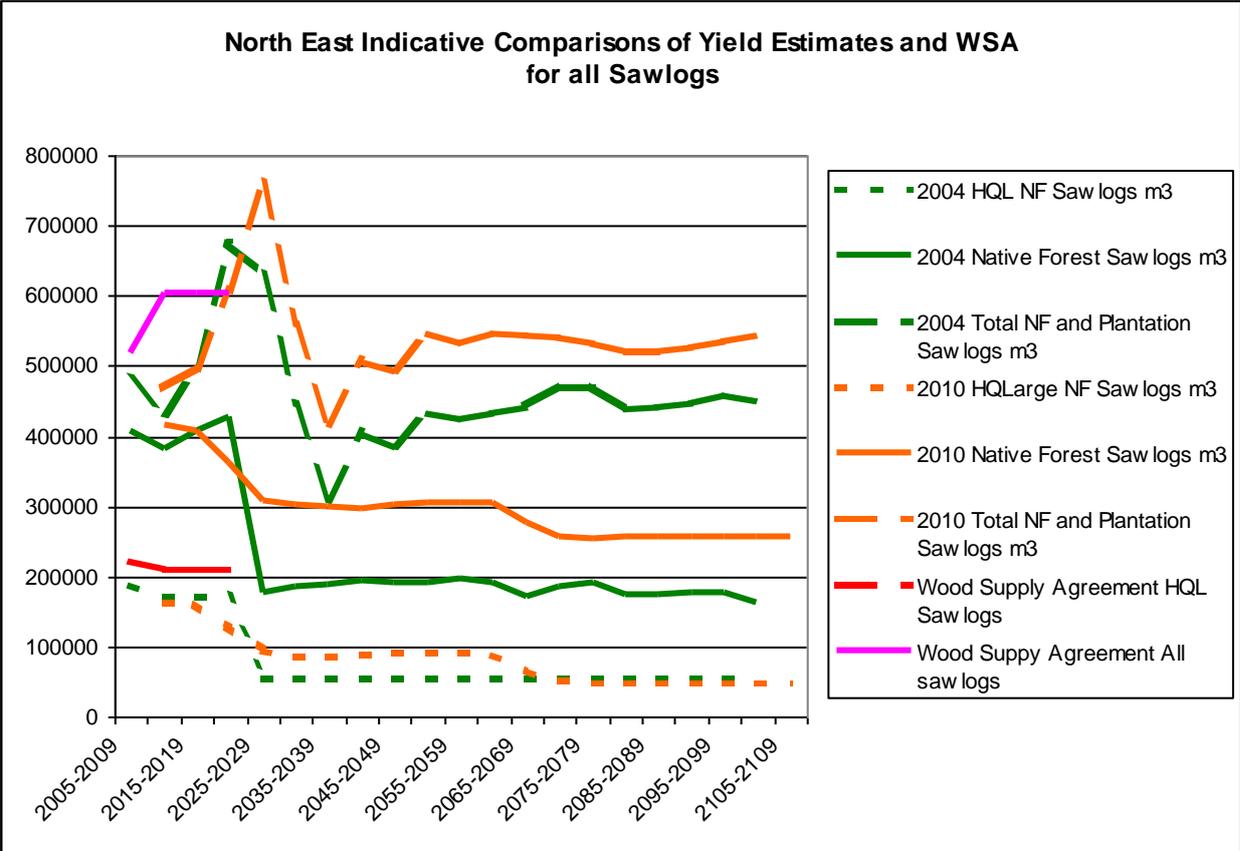
From NSW & CoA 2009 4.21 Volume Review, Table 4.7.

Log type	UNE (cubic metres)	LNE (cubic metres)	TOTALS
High-quality large sawlogs including veneer logs and girders	83,686	125,814	209,500
High-quality small sawlogs	27,184	36,588	63,772
Low-quality sawlogs	153,677	176,867	330,554
Pulp grade and chipwood (domestic and export grade)	45,000	120,000	165,000

This is well overdue and the revised FRAMES needs to be refined to reflect reality. Spencer (2009) concludes:

... the Auditor General, in his April 2009 Performance Review of Forests NSW effectively comes to the same conclusion of this Independent Assessment that there is a definite need to, at the very least, revisit estimates of wood availability as a matter of priority.

The Auditor General (2009) recommended that Forests NSW “by June 2010, publicly report the results of yield estimates for high quality large sawlogs, high quality small sawlogs, low quality logs and pulpwood for each region”. The graph below represents Forests NSW’s latest yield offering made on their website in response to the Auditor General’s recommendation, it is dated November 2010, though was not released until 24 December 2010. There is no explanatory report other than the statement that “The charts included in this report show estimated annual yields by broad product category in cubic metres (m3) over the next 100 years”. Forests NSW’s latest yield estimates are presented without any methodology, explanation or review (independent or otherwise) and thus are of unknown veracity. As yet no data on plantation resources has been provided. Comparison with other yield estimates are made harder by the fact that the Central Region has now been separated from the North East Region and the data underlying the graphs has not been presented.



Notes on table: This table is presented for illustrative purposes. The 2004 data have been reduced by 15% in accordance with the caveat in the 2004 yield review. There are no revised plantation yields yet for 2010 so the 2004 plantation figures have been used. It is not known when the WSA commitments were increased for low quality purposes, though for plotting purposes 2009 was taken as the date (also for the reduction in HQL sawlog commitments). For comparison purposes the 2004 figures are aligned with 2005.

The only conclusion that can be reached from the data provided is that Forests NSW’s new FRAMES is once again predicting significantly increased resources. The overall quota sawlog yields are on a par with the 2004 estimates before the identified 15% reduction is accounted for, and there has been a significant increase in estimates of total sawlogs from native forests.

NEFA remain incredulous that Forests NSW are allowed to get away with failing to document their yield estimates, accounting for the 2004 criticisms, comparing predictions with reality and ensuring their estimates are peer reviewed. There are many complicit agencies and Ministers who should also be held accountable for their lack of oversight of Forests NSW. Forests NSW need to urgently document their methodology and the NSW Government has

to ensure that brand new FRAMES is peer reviewed and the estimates reality-checked against actual yields.

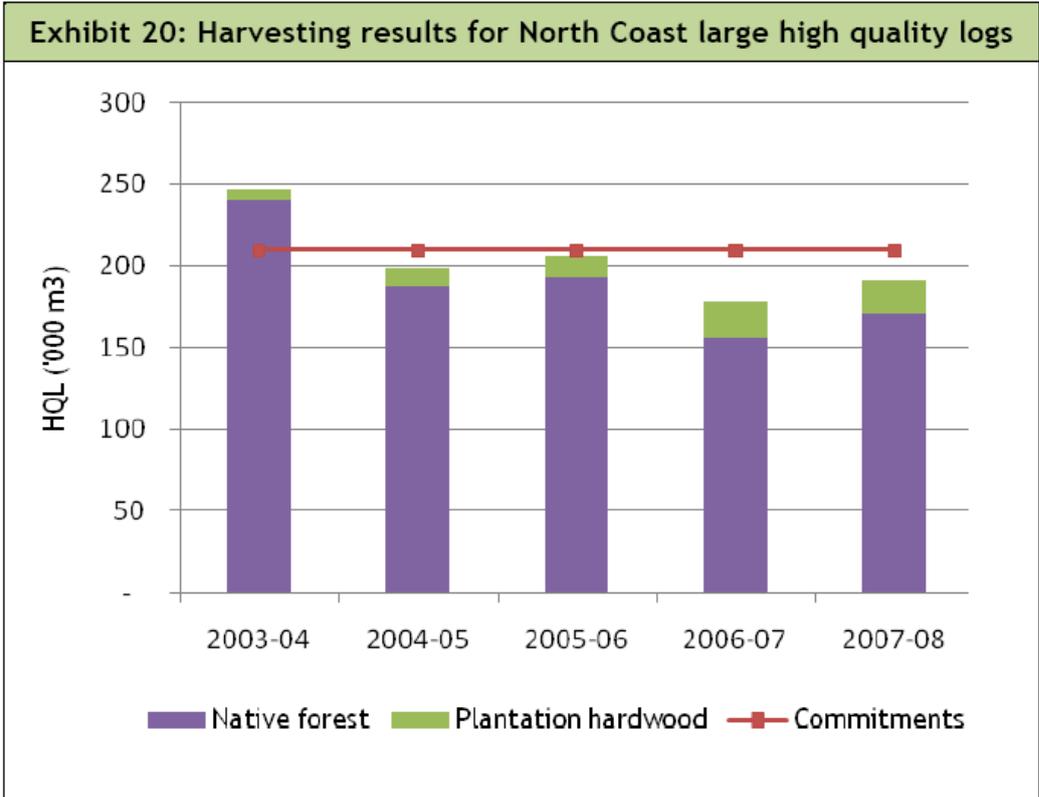
1.2.2. Yield Shortfalls

Ever since the new 2004 WSAs were signed Forests NSW have not been able to meet commitments, particularly in the Upper North East. Over the 5 years 2004-09 there was a shortfall between commitments given in WSA and actual yields of large high quality sawlogs of at least 144,000m³ (13%). This has forced Forests NSW to increase logging of small high quality sawlogs (the large sawlogs of the future) and get into the plantations too early, further compromising future yields. Forests NSW have already had to buy back timber committed in WSAs and compensate mills that they couldn't meet supply commitments to.

The Auditor General (2009) identifies that at 2008 there were wood supply agreements for some 209,500 m³ per annum of large high quality sawlogs from north coast forests and that commitments are not being met (see below), and neither are commitments for low quality sawlogs. Immediately after giving the new Wood Supply Agreements to the millers, the Auditor General identifies that Forests NSW had to compensate mills for not supplying commitments and start buying back wood supply allocations, for example paying one mill \$550,000 for 34,000m³ of high quality large sawlog they were unable to supply during 2004-2006.

The Auditor General accepted that 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”. NEFA considers that such information should be publicly available and included in the annual Implementation Reports.

North coast high quality large commitments not being met (NSW Auditor General 2009)



Note that the Auditor General fails to account for increased WSA commitments pre 2006.

In 2008/9 the yield of high quality large sawlogs (including from plantations) was 101,504m³ from LNE and 55,730m³ from UNE (DECCW 2010), which is a continuation of the downward trend.

Since the new Wood Supply Agreements (WSAs) were introduced it is evident that WSA commitments are being significantly undercut for large sawlogs in the UNE, small sawlogs in the LNE, low-quality sawlogs in both UNE and LNE, and pulpwood in the UNE and LNE. In the UNE the cut of small sawlogs is significantly higher than commitments, presumably to help compensate for the significant undercut in large sawlogs. This just helps entrench unsustainable logging further as the future large sawlogs are cut early.

NORTH EAST COMPARISON OF ACTUAL YIELDS TO COMMITMENTS From NSW&CoA (2009). (based on WSA commitments therein rather than Forests NSW (2005) ESFM Plan, note that WSA figures for UNE and LNE have been significantly changed over these three years though as the timing of the changes and their distribution across the regions is not publicly available, the current figures have had to be used)

		Wood Supply Agreement m ³ per annum	2004/5 yields m ³ (% WSA)	2005/6 yields m ³ (% WSA)	2006/7 yields m ³ (% WSA)	3 year deficit m ³ (% WSA)
High-quality large sawlogs (incl. veneer and girders)	UNE	83,686	70,389 (84%)	70,333 (84%)	68,814 (82%)	-41,522 (-17%)
	LNE	125,814	127,539 (101%)	135,744 (108%)	111,537 (89%)	-2,622 (-0.7%)
Small high quality sawlogs	UNE	27,184	29,500 (109%)	32,763 (121%)	29,959 (110%)	+10,670 (+113%)
	LNE	36,588	24,780 (68%)	29,316 (80%)	31,127 (85%)	-24,541 (-22%)
Low-quality sawlogs	UNE	153,677	86,258 (56%)	88,219 (57%)	69,148 (45%)	-217,406 (-47%)
	LNE	176,867	147,401 (83%)	138,769 (78%)	148,788 (84%)	-95,643 (-18%)
Pulp-grade and chipwood (domestic and export grades) (tonnes)	UNE	45,000	11,648 (26%)	19,220 (43%)	12,269 (27%)	-91,863 (-68%)
	LNE	120,000	108,647 (91%)	97,170 (81%)	121,162 (101%)	-33,021 (-9%)

Annual shortfalls of at least 17% in large quota sawlogs and 47% in low-quality sawlogs in the UNE are significant. The failure to meet large sawlog commitments indicates an inability to meet supply commitments given in the Wood Supply Agreements. Given that this is one of the performance indicators the causes should have been documented by now. Across north east NSW over the 5 years 2004-09 there was a shortfall between commitments given in WSA and actual yields of large high quality sawlogs of at least 143,978m³ (13%).

NORTH EAST COMPARISON OF ACTUAL YIELDS TO COMMITMENTS. Source DECCW 2010, Auditor General 2009.

	Wood Supply Agreements m ³	HQ Large Yields m ³	% Actual of WSA
2004-05	223077	197928	89
2005-06	223077	206077	92
2006-07	209500	178351	85
2007-08	209500	191086	91
2008-09	209500	157234	75
TOTAL	1074654	930676	87

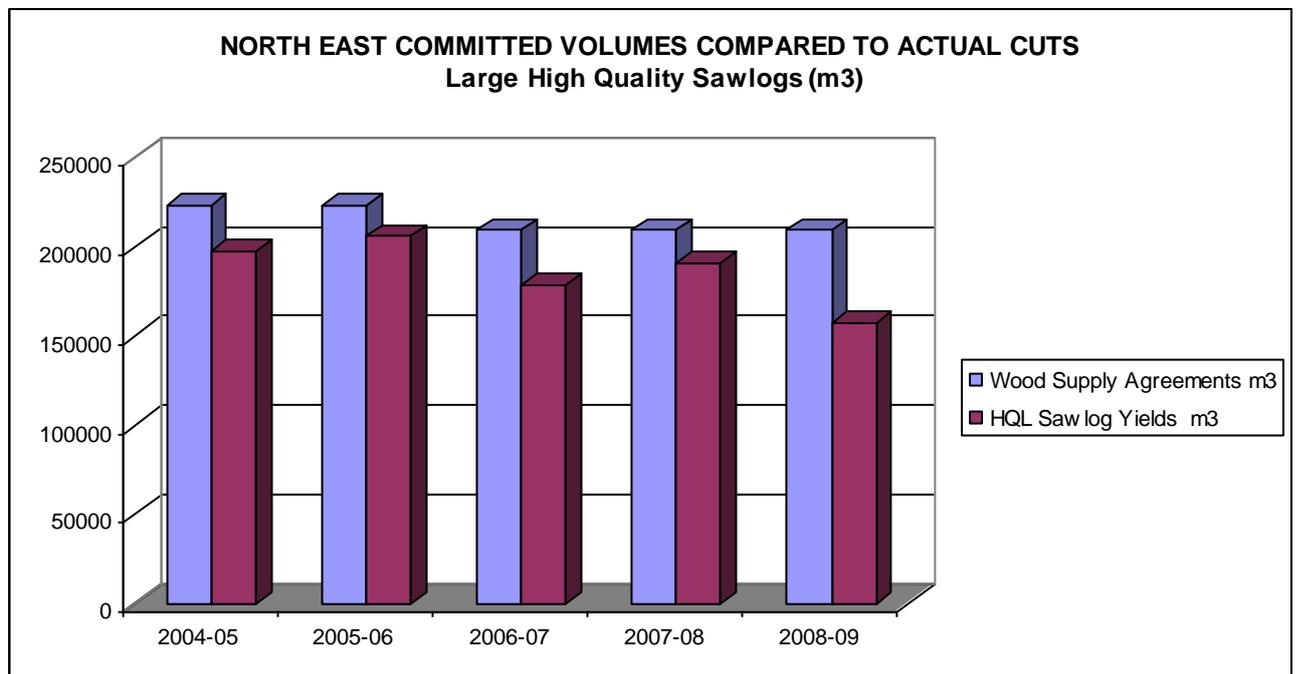
The Auditor General (2009) notes:

... Resource reviews were a key risk management tool for Forests NSW which is no longer available under wood supply agreements for large logs.

...the North Coast region has been unable to meet its species commitment since 2004 for blackbutt, although this is based on 'best endeavours'. This commitment accounts for about 36 per cent of all high quality sawlog allocations on the north coast.

Regional staff report that the Blackbutt commitment forces them to harvest coastal timber when they would prefer to balance commitments between the less accessible tableland timber and other species. This is in order to sustain the resource on the coast and buffer the impact of cost increases as it accesses more tablelands timber. This issue could have been addressed if the review clause remained in the north coast wood supply agreements.

NORTH EAST COMPARISON OF ACTUAL YIELDS TO COMMITMENTS.



The Auditor General identifies that Forests NSW is currently taking 56% more sawlogs from plantations than proposed, noting that if it is taking more than planned to meet commitments *"this could affect future production"* as plantations *"will form an increasing proportion of future supply"*, *"because current yield from native forests in the north coast is not sustainable in the long term; that is, beyond the term of the current contracts"*.

Based on a comparison between commitments given in Wood Supply Agreements and actual yields in north east NSW it is evident that Forests NSW are unable to supply committed volumes of large high quality sawlogs, with the situation being particularly bad in the UNE. Over a 5 year period Forests NSW accumulated a deficit of 144,000 m³, and the situation is deteriorating. Forests NSW have already had to buy back timber committed in WSAs and compensate mills that they couldn't meet supply commitments to. They appear to be overcutting small sawlogs in the UNE and sawlogs in plantations to help compensate for their shortfalls.

This problem is widely recognised, for example URS (2008) state:

... There is concern that Forests NSW will not be able to meet commitments in Wood Supply Agreements (WSAs) with the current forest areas allocated for commercial

forest production. This is evidenced through the fact that Forests NSW is purchasing private native forest resources to meet current commitments.

The Inquiry needs to reassert that the management of native forests on a sustainable yield basis, and within ecological constraints, is a fundamental requirement for Ecologically Sustainable Forest Management. The inquiry needs to recognise that public native forests in north east NSW are not being managed on a sustainable yield basis. In order to satisfy the RFA's requirement to review sustainable yields in 2006, reduce commitments in line with timber reviews and cease unsustainable logging of native forests as soon as possible, it is requested that the Inquiry:

- a. Investigate the failure of the Commonwealth to document, consider and account for identified criticisms of FRAMES wood assessments;**
- b. Investigate and remedy the failure by NSW to annually report on actual versus predicted yields as required by the RFA;**
- c. Investigate the expenditure of Commonwealth funds provided for the enhancement of FRAMES and long-term timber supplies;**
- d. Investigate the decision to entrench and extend unsustainable logging for a further 5 years in contravention of the RFA, and for 3 years beyond the expiry of the RFA;**
- e. Investigate the failure of Forests NSW to satisfy current Wood Supply Agreements;**
- f. Require an immediate independent review of the new FRAMES wood assessments that accounts for previous criticisms and specifically identifies the sustainable yield from native forests; and,**
- g. Identify means of reducing the logging of native forests to a sustainable level as soon as possible.**

2. Environmental impacts of forestry

Forestry operations have a large variety of impacts on our natural environment, including:

1. Interference with ecosystem processes and functioning;
2. Causing dysfunction and dieback;
3. Degrading habitat for a large variety of mammals, birds, reptiles and frogs;
4. Causing erosion and stream pollution;
5. Reducing stream flows;
6. Reducing carbon storage; and,
7. Reducing aesthetic values.

Aside from having a grossly inadequate reserve system, forestry operations on public lands are governed by the Integrated Forestry Operations Approval (IFOA) for Upper North East Region and the licence it contains. These are referred to as Environmental Protection Licence (EPL), Threatened Species Licence (TSL) and Fisheries Licence (FL). Together with various clauses of the IFOA these constitute the regulatory regime applied to forestry operations on public lands in north-east NSW

Notwithstanding this requirement, Forests NSW no longer obtain EPLs for most forestry operations. For example in 2006/7 there were 221 forestry operations in the UNE region, the EPL applied to 23 of these, leaving 198 operations where logging occurred without EPL coverage. This enables Forests NSW to avoid some requirements and the scrutiny of an outside agency for most operations.

As Fisheries NSW and Forests NSW are both in the Department of Industry and Investments there is a strong reluctance by Fisheries to regulate or penalise their colleagues, as evidenced by just one FL audit/complaint being dealt with in the UNE over the 10 years 1999/2009, and no enforcement action being taken. Our recent audits prove that the FL is being regularly breached, the problem is that there is no enforcement.

Another problem is that Forests NSW interprets the Fisheries Licence to mean that they do not have to take specified actions to protect threatened fish species unless the data is first provided by Fisheries NSW. When NEFA recently complained about the failure of Forests NSW at Doubleduke to consider information presented in the 2005 Recovery Plan for the nationally endangered Oxleyan Pygmy Perch, (Pugh 2010c) we were told (J. Murray pers. com., November 2010) that they didn't need to consider the species because Fisheries NSW had not provided them with the required information. It is revealing that Fisheries NSW were going to give them the data 5 years ago, but hadn't got around to it, as stated in the 2004/5 RFA report:

Preparation of distribution data for the Oxleyan pygmy perch (Nannoperca oxleyana), a species occurring in coastal areas of northern New South Wales, and Macquarie perch (Macquaria australasica) occurring in streams of the southern highlands and slopes, is complete. Both species could be affected by forestry operations and the distribution data is expected to be provided to Forests NSW shortly

It is also revealing that Fisheries NSW approved the Doubleduke assessment without themselves identifying the missing endangered species. What you don't know won't hurt you – just the fish.

DECCW are principally responsible for ensuring Forests NSWs compliance with the Environmental Protection Licence (EPL) and Threatened Species Licence (TSL). In the 5 years 2004/9 DECCW undertook an average of some 3 audits a year, and while they located a large number of breaches of the EPL in 2006/7 and 2007/8, they otherwise appear to find relatively few breaches.

Over the past year and a half NEFA have undertaken preliminary audits of three areas of public forests. We have written a number of audit reports and submitted them to the

appropriate authorities (Pugh 2009, 2010a, 2010b, 2010c and 2010d). To date only the breaches we identified in Yabbra have been reported on. We understand that DECCW are currently considering legal action over the breaches we identified in Doubleduke and we are waiting for responses for Girard.

Even when breaches are proved the agencies downplay them and only implement token fines. Pursuant to our complaints for Yabbra SF (Pugh 2009, Pugh 2010a) the following action against Forests NSW eventuated:

- 1 DECCW issued a Penalty Infringement Notice (PIN) and a \$300 fine for “harvesting timber within IFOA mapped rainforest”, this was for illegally logging dozens of trees within 3ha of rainforest and causing massive damage by pushing over and piling up over 100 rainforest trees.
- 2 DECCW issued a Penalty Infringement Notice (PIN) and a \$300 fine for “the failure to mark Yellow-bellied Glider sap feed trees and feed trees”, we detailed 11 extant sap feed trees and estimate there were more than 50 such trees, many of which would have been logged. In addition to retaining sap-feed trees Forests NSW were required to identify, mark and retain 15 “feed trees” within various distances of sap-feed trees and 34 mapped Yellow-bellied Glider records, which equates to hundreds of trees, none of which were marked, and many of which are likely to have been logged.
- 3 DECCW issued a Penalty Infringement Notice (PIN) and a \$300 fine for “timber felling within a wetland and wetland exclusion zone”, Fisheries NSW issued a warning letter for these same offences, this was for logging over a dozen trees within what were meant to be 10m exclusion zones around two small wetlands. They also failed to mark their boundaries, conduct searches for the frog *Philoria* within them, exclude post logging burning from them, and excluded cattle from them.
- 4 DECCW issued a Penalty Infringement Notice (PIN) and a \$300 fine for “machinery entry within a wetland and wetland exclusion zone”, this was for the two wetlands above, where machinery drove through the wetlands at a number of locations, causing extensive damage.
- 5 DECCW also issued a formal warning to Forests NSW for not identifying habitat and surveying for Richmond’s Frog, and inadequate mark-up of exclusion zones and retained habitat trees.
- 6 Fisheries NSW issued a Penalty Infringement Notice and \$500 fine, for failing to mark exclusion boundaries on unmapped drainage lines, we identified 5 unmapped grainage lines which had not been identified in the field or on harvest plans in contravention of the ESFM Plan, EPL and FL and expected there to be dozens more.
- 7 Fisheries NSW issued a Penalty Infringement Notice and \$500 fine for logging, bulldozing and burning within 10m of these unmapped streams. We documented 22 trees to have been illegally removed from these stream banks and suspect that there were over a hundred such trees logged, as well there were a variety of snig tracks constructed within these buffers and across the streams which were not rehabilitated.

As a result of our complaints Forests NSW also repaired drainage on four stream crossings and one track because they were not up to pollution control requirements.

So, for illegally logging 3ha of rainforest, 2 wetlands, numerous stream banks, and potentially hundreds of feed trees of the Yellow-bellied Glider, Forests NSW were fined a total of \$2,200. In addition to this Forests NSW were given token reprimands for a variety of other offences, excused many other breaches on the basis that they did not have an Environmental Protection Licence (DECCW could not take action against the contractors), and excused others on the basis that their controlled burn got out of control. This is an insult as Forests NSW and the contractors made far more money from the timber illegally logged than what they were fined. It cost us more than the fine to undertake our audit.

As well as being concerned about the paltry penalties, we are concerned that DECCW and Fisheries NSW failed to explicitly identify the breaches that occurred, treated multiple breaches as single breaches, failed to apply required auditing methods, and (despite the

evidence of systemic breaches) failed to assess additional areas in the vicinity of our complaints (we also believe that they did not assess all our complaints). Forests NSW also assessed our complaints but refused to provide us with a copy of their report.

We are also concerned that at Yabbra, despite the presence of Bell Miner Associated Dieback, rampant lantana, an endangered ecological community, the Endangered Black-striped Wallaby and a variety of other threatened species, there was no assessment of the habitat degradation associated with the breaches and no specific rehabilitation works required (aside from the erosion mitigation works) in the rehabilitation plan prepared by Forests NSW and approved by DECCW.

Forests NSW also have their own internal audit process, for example 253 incidents of non-compliance were recorded in 2003/4 in the UNE region (NSW Government 2007), across NSW *"In 2003/2004 the main area of noncompliance soil erosion and water quality (59%), followed by flora and fauna issues (33%). The remaining 8% of incidents were related to other issues such as safety"*. Details of these are not provided in RFA reports.

We only checked Forests NSW's own breach reports for Girard SF (Pugh 2010d). Before NEFA informed Forests NSW that we were going to undertake an audit, they had identified 9 breaches; 6 related to trees being dropped and pushed into streams, one related to a tree being dropped into a rainforest exclusion, one related to four breaches of a frog exclusion area, and one related to bulldozing a road across two drainage lines. The records indicate that no action has yet been taken for a single breach, other than the contractors being talked to occasionally, and it is apparent that no rehabilitation works have been undertaken for the road across the drainage line.

Of the 4 breaches identified after we informed Forests NSW of our audit, 3 related to hollow-bearing and recruitment trees and, significantly, one related to a major intrusion into a wildlife corridor and FMZ 2 area. It is revealing that before we specifically told Forests NSW's CEO that we expected to find breaches of hollow-bearing and recruitment tree requirements because they are common, Forests NSW had not reported any such breaches.

In our brief audit (Pugh 2010d) of the same area they had been auditing for months, and intensively for the two weeks after we informed them of our proposed audit, we independently found 3 of their reported breaches and documented numerous additional breaches of 2 conditions of Forests NSW's Integrated Forestry Operations Approval, 24 conditions of their Threatened Species Licence, 9 conditions of their Fisheries Licence and 10 conditions of their Environment Protection Licence. On a site inspection we showed some of these breaches to Forests NSW and they did not assuage our concerns.

Most resources available for auditing are used internally by Forests NSW for their own auditing program. It would be far preferable and more effective to strengthen external regulation by allocating the resources to DECCW and Fisheries NSW.

URS (2008) consider:

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. ...

Governments manage native forests for multiple objectives. They manage them to protect a range of environmental and biodiversity values as well as for commercial wood production. Separation of the environmental from the commercial objectives is fundamental to sustainable multiple-use management. So too is separation of regulatory and audit functions from the bodies being regulated and audited.

URS (2008) state:

A lack of separation between environmental, governance and commercial management can result in a lack of transparency and accountability. For example, 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. To offset this incentive, checks and balances should be in place to ensure that harvest volumes are indeed sustainable and do not compromise environmental objectives (outside the domain of the forest entity).

In Victoria, for example, DSE determines the sustainable yield while VicForests is responsible for the harvest and commercial sale of timber. The environmental aspects of commercial operations of these agencies are externally regulated though the EPA, which undertakes annual audits of compliance with relevant legislation. The situation is similar in Queensland where operational and governance/auditing activities are undertaken by separate government agencies. However in other states, there is less separation of commercial operations from the regulation and governance function. This is most notable in NSW, where Forests NSW sets sustainable harvest levels and also carries out commercial operations on public land, and is not subject to external audit against relevant legislation and regulation.

It is suggest that the Inquiry consider the issue of public forest management arrangements and consider recommending separating policy and regulation from operations. Any such system would be enhanced by allowing members of the public third party appeal rights.

2.1. Ecosystems

We have found that the subsequent reservation of lands in UNE has not redressed the extremely poor reserve outcome achieved for north east NSW in 1998 and the Government's refusal to report on forest ecosystem target achievement has masked this situation. Even when off-reserve management is accounted for there is a shortfall of some 250,000-300,000 ha (33-39%) in areal targets for forest ecosystems, with more than 50% of ecosystems below national reserve targets. The vast majority of nationally rare, endangered and vulnerable ecosystems have not met reserve targets. "Annual" reporting has failed to update relevant information and Forests NSW ignores the reserve status of poorly reserved ecosystems when logging them.

For example (as identified in 5.2.3) the audit of Yabbra (Pugh 2009) encompassed a large expanse of forests suffering from Bell Miner Associated Dieback (BMAD), with a dense lantana understorey in places. The forest ecosystems most affected are Grey Box-Red Gum-Grey Ironbark, and Wet Bloodwood-Tallowwood, which have achieved 41% and 82% respectively of their national reservation targets (including in Informal Reserves and Protection by Prescription). In the affected areas there were numerous sick and dead trees with extensive lantana understoreys. Forests NSW failed to identify or consider the reserve status of the ecosystems or their poor health, instead logging them on a maximum utilisation basis and, despite the proliferation of weeds following logging and the poor prognosis for the survival of the ecosystems, failed to identify any rehabilitation works.

In our recent audits we identified 4 areas of one Endangered Ecological Community (EEC) that had been logged and roaded. After we identified the first area Forests NSW failed to admit to the other three breaches in an effort to cover them up. At another site fire had escaped into an EEC and despite breaches of legal requirements and significant degradation no rehabilitation was undertaken by Forests NSW or required by DECCW. At approximately the same time logging of another EEC was separately reported

Endangered Ecological Communities are excluded from Forests NSW's licence, making picking or harming an endangered ecological community a direct offence under sections 118A and 118D of the National Parks and Wildlife Act 1974. At Doubleduke SF (Pugh 2010b, Pugh 2010c) we have identified 4 incursions into an Endangered Ecological Community, in part because the planning process failed to accurately identify the community and in part because the forester undertaking the marking up apparently did not have the expertise to identify and delineate what is, at its core (i.e. away from edges), an easily identifiable community. We have counted 1,453 trees and shrubs picked or harmed within this EEC, each offence being liable to a \$11,000 fine. DECCW are now going through the process of initiating legal action.

Around the same time as Forests NSW committed this offence they logged the EEC Lowland Sub-tropical Rainforest in Grange State Forests. This offence was revealed by the Clarence Environment Centre. DECCW are now going through the process of initiating legal action over this too.

The problem is that the DECCW auditors do not have the expertise or will to identify such breaches and thus it is left up to the community to identify intrusions into EECs. Given the small number of logging operations assessed by suitably qualified volunteers it is apparent that such breaches are far more widespread.

In Yabba SF (Pugh 2010a) Forests NSW illegally logged mapped rainforest without recognising it as such. The existence of this mapped rainforest went unnoticed in Forests NSW's implementation of plantation accreditation process (despite being pointed out to them), it was not noticed in the planning process for logging in this compartment, was not identified according to Forests NSW's "rainforest protocol" when marking up, and was logged. .

There was maximum damage deliberately done to the rainforest understorey in the logging operation, with hundreds of rainforest trees bulldozed over with the apparent aim of maximising disturbance to promote eucalypt growth. Some large rainforest trees were cut down (along with eucalypts previously planted along old snig tracks and in log dumps for rehabilitation) and there are already some significant weed problems. Much of the debris is piled up and hindering regeneration. Pursuant to our complaint, DECCW issued Forests NSW with a Penalty Infringement Notice and a fine of \$300 for logging in this rainforest.

Further work undertaken since our audit (Pugh 2010a) has established that 1.9ha of mapped rainforest was logged, and re-mapping by Forests NSW's botanist Doug Binns has identified an additional hectare that he considers qualifies as rainforest according to application of the standard protocol "Forest Practices Circular No. 2005/02, dated 24 June 2005". This brings the total area of rainforest unlawfully logged to some 3ha, and raises the question as to why Forests NSW's planning processes and forest foremen failed to identify it for protection.

In Forests NSW's (2010) subsequent "Rehabilitation and Monitoring Plan, Compartments 162 and 163 Yabba State Forest No 394" this area is considered, though the early intervention required to get regeneration on track was not admitted and monitoring is all that is proposed for illegally logged rainforest. DECCW have approved this plan.

Many oldgrowth forest ecosystem targets were not met in the CAR reserve system. To some unspecified extent target achievement has been facilitated by off-reserve protection, mostly as High Conservation Value Old Growth Forests (HCVOG). Forests NSW now refuse to recognise the existence of mapped oldgrowth forest that is not HCVOG. While its existence is denied, we found that oldgrowth forest is still being logged, including in a Special Prescription Zone (FMZ 3B) apparently created specifically to protect the oldgrowth forest present which was also a contribution towards the CAR reserve system. In addition, Forests NSW's reporting on growth stages fails to recognise oldgrowth forest exists outside HCVOG.

Forests NSW pretend that they can clearfell an oldgrowth stand and not affect its growth stage!

The inquiry needs to recognise that forestry operations can and do have significant impacts on inadequately reserved, rare and endangered ecosystems. In order to appropriately protect inadequately reserved, rare and endangered ecosystems, it is requested that the Inquiry:

- a. Require the identification of the reservation status of all forest ecosystems in accordance with the RFA;**
- b. Review the management arrangements for values protected in informal reserves and by prescription;**
- c. Review the poor management of forest ecosystems intended to be excluded from logging; and,**
- d. Identify appropriate management arrangements for each inadequately reserved, rare and/or endangered ecosystem.**

2.2. Threatened Species

During expert workshops conducted as part of the CRA process for North East NSW information describing the disturbances that affect the priority species was collected (Environment Australia 1999). This involved experts listing all the disturbances affecting a species and then ranking them in terms of their impact on the regional population. Those disturbances that had the most detrimental affect were ranked one and so on.

Of those species identified as being of particular conservation concern, a total of 7 mammals (excluding bats), 27 bats, 31 birds, 16 frogs, 5 turtles, 15 lizards and 8 snakes were identified as being specifically vulnerable to logging, with many of these species, and a number of others, also vulnerable to the associated fire regimes, stream pollution and weed invasions (Appendix 1). For 41 of these 109 species logging is identified as a primary (number 1) threat.

In the whole of north east NSW only 31% of the CRA reserve targets for viable populations of fauna species have been achieved to date. This outcome shows that our reserve system does not contain sufficient habitat for most vulnerable forest dependent species to survive in the long term and emphasises the need for expanded reserves. But most importantly, it highlights the need for adequate off-reserve management.

Forests NSW undertake logging operations under a Threatened Species Licence (TSL) and Fisheries Licence (FL) which attempt to regulate activities so as to protect State and national threatened species of terrestrial animals, plants and fish. We have found that the FL has rarely been applied or enforced. The TSL is only subject to occasional audits and, in our experience, significant breaches are missed even when pointed out to DECCW. Even when breaches are reported to the regulators they are not explicitly or comprehensively audited, the fines and penalties are grossly inadequate, and no rehabilitation or provision of compensatory habitat is required to compensate for illegally logged threatened species habitat.

2.2.1. Compartment Mark Up

Both the Threatened Species Licence and Fisheries Licence require a variety of habitat assessments and the identification of specific Threatened fauna habitat attributes and Threatened flora localities to be undertaken by appropriately trained people. We found that attributes required to be identified at the mark-up stage are rarely identified, that stream and Threatened species exclusion areas are often not marked, and that habitat trees required for

retention rarely marked. We do not consider that adequately trained people are undertaking thorough searches for the “*threatened and protected species features*” required by the TSL at the mark-up stage with the result that feed trees, habitat trees and areas required to be retained for threatened species are often logged. Neither do we consider that other features requiring identification and protection are being adequately located and marked in the field, resulting in further losses of key fauna habitats.

One of the basic requirements of the Threatened Species Licence is the Compartment Mark-up Surveys (TSL 5.2.). Under the TSL (5.2.1d) Harvesting Operations are prohibited in areas which have not been subject to compartment mark up surveys.

At this time “*an adequately trained person must conduct a thorough search for, record and appropriately mark ... threatened and protected species features*”. These features include nests, roosts and dens of a variety of hollow-dependent species, Koala high use areas, latrine and den sites of the Spotted-tailed Quoll, Glossy-black Cockatoo feed trees, Yellow-bellied Glider and Squirrel Glider sap feed trees, bat tree roosts, Swift Parrot and Regent Honeyeater feed or nest trees, wombat burrows, soaks and seepages in *Phyloria* spp. habitat, and threatened flora. This is a key step in providing the intended protection to a range of threatened species. It is only by undertaking the required on-ground assessment that the features can be found that that trigger a variety of prescriptions.

These features are not necessarily easy to locate and the diverse range of tasks requires a high level of expertise in a range of fields, which is a lot to ask of any person. The requirement to thoroughly search for the features requires that the necessary techniques and methods are applied. There is also a necessity to reasonably assess the entire compartment, and particularly the nett harvest area.

PHOTOS: What had been potential soaks for Richmond Frog that were meant to be protected with 10m buffers. Forests NSW were fined \$300 and not required to do any rehabilitation.



In our audits we found a poor outcome from the mark-up surveys with regards to identifying and protecting the targeted features:

- the targeted nests, roosts and dens of a variety of species have not been identified at any sites, despite some obviously being present;
- Koala's were present at all sites, though no intermediate or high use areas were identified (Pugh 2010b);
- Yellow-bellied Glider sap feed trees were present at all sites (we identified 11 such trees at Yabbra, Pugh 2009) and were not identified;
- Sparkes (2010) found that wombat burrows and exclusion areas were not being identified;

- Sparkes (2010) found that bat tree roosts have not been identified anywhere in the UNE;
- Sparkes (2010) found that Tiger Quoll latrine sites were identified in one area, though misplaced, none were found in our audit areas though the species would have been present;
- soaks and seepages in Philoria habitat at Yabbra (Pugh 2009) were not identified; and,
- threatened flora at Doubleduke were not identified (Pugh 2010b).

Forests NSW's Threatened Species Licence (5.2.1b) requires them to identify and appropriately protect locations around an array of threatened plant species. There have been no locations identified within the nett logging areas in the Harvesting Plans we have assessed. In a single inspection of Doubleduke SF a botanist employed by the North Coast Environment Council (see Benwell 2010, Pugh 2010b) found "*The endangered species *Lindsaea incisa* (a small ground fern) was identified at a site that appeared to be within the harvestable area of cpt 145*" and in compartment 144 he found the threatened grass *Paspalidium grandispiculatum* "*amongst earth on an upturned stump at the edge of the recently constructed or upgraded access track, so would appear to have been directly damaged during track construction*".

NEFA subsequently found large numbers of *Lindsaea incisa* (within a wetland and its buffer that had been illegally logged) in Doubleduke SF from within which trees had been logged and machinery driven through it, despite the requirement being for a 50m exclusion zone to be established.

In Doubleduke, Benwell (2010) considered "*No pre-logging flora surveys or flora assessments that could have detected this species appear to have been carried out by FNSW*". After roading and logging resumed in compartment 144 NEFA was informed that a foreman had been trained (by showing him a picture) to identify the cryptic *Paspalidium grandispiculatum*.

The Fisheries Licence (Section 9) requires that "Pre-Logging and Pre-Roading Aquatic Habitat Assessments" be prepared under certain circumstances by "*suitably experienced and trained persons*". In Doubleduke SF (Pugh 2010c), compartment 144, the assessment was undertaken by a Forester who apparently did not have the required expertise as he failed to undertake a proper assessment and omitted to consider the nationally endangered Oxleyan Pygmy Perch.

The Compartment mark-up is the time when many other features are marked for protection, notably a range of exclusion zones, a variety of feed trees, habitat trees, and recruitment trees. Importantly this is the time when stream and wetland exclusions are marked.

We have found numerous instances of failures to mark exclusion boundaries and required trees:

- At Yabbra (Pugh 2009) exclusion boundaries and habitat trees were rarely marked in the field away from roads, unmapped streams and wetlands had not been identified and marked, feed trees were not marked, and rainforest was not identified;
- At Doubleduke (Pugh 2010b) we found active logging in an area they had not fully marked-up. In some areas at Doubleduke marking-up seemed to be limited to defining the boundary of the nett logging area with little other tree marking away from roads. The boundary of an Endangered Ecological Community was not delineated. At one site the required number of habitat trees had not been marked for retention, though sufficient trees had been retained. At other sites tree retention appeared deficient.
- At Girard (Pugh 2010d) one area had been marked up, though the boundaries had been erroneously marked-up at two locations, a mapped stream was not

identified and cleared, some unmapped streams were not marked and cleared and drainage depressions were not marked and severely impacted. Habitat and recruitment trees had been marked, though there were insufficient trees marked. In another area at Girard there had been a failure to mark stream buffers, threatened frog exclusion area, feed trees and enough habitat trees - marking up was limited to token hollow-bearing trees near the main track.

Whatever the excuse we do not consider that adequately trained people are undertaking thorough searches for the *threatened and protected species features* required by the TSL at the mark-up stage. We also found that other required features are not being adequately located and marked in the field.

Part of the problem is that often the contractors in their machines are driving around choosing what to log. They have effectively replaced the forest foreman in many operations. They have limited chance of finding many of the required fauna features, such as Koala scats, and little chance of finding cryptic threatened plants. They place reliance upon their Geographic Position Systems (GPS) and often measure exclusion areas from mapped features rather than the required natural features (i.e. top of stream banks). GPSs are also of limited accuracy in the forest.

Forests NSW appear to be moving in the direction of increasing mechanization and away from mark-up surveys. The principal problem with this is that it precludes the implementation of a raft of requirements of the TSL aimed at minimizing impacts on threatened flora and fauna.

2.2.2. Protecting Hollow-bearing trees

A plethora of forest animals depend upon the trunk and branch hollows provided by big old trees for their survival. Approximately 20% of the Australian bird fauna, 75% of arboreal marsupial fauna and an undetermined proportion of the bat, reptile and invertebrate fauna are dependent on the hollows provided by old trees for roosts, nests and shelter.

Generally speaking, small hollows begin to develop once a eucalypt is over 100 years old, and the large hollows required by many species after a tree is over 200 years old. Depending on the species and site conditions trees may live for 300 to over a thousand years old, providing their lives are not cut short. In order to provide for hollows through time it is necessary to protect those trees with existing large hollows, as well as sufficient trees in the next age class to replace them when they die, and trees in the next age class to replace the replacements.

The NSW Scientific Committee has identified *Loss of Hollow-bearing Trees* as a Key Threatening Process. The highest priority action for this KTP is "*Adopt appropriate policies for recruitment tree ratios with a stipulated minimum retention density in areas of forestry operations*".

Under the Threatened Species Licence (TSL 5.6 a) a minimum of 10 hollow-bearing trees per 2 hectares, selected from the largest trees in the stand, are required to be retained within the nett harvest area. Where there are insufficient hollow-bearing trees then the largest trees need to be retained. In the coastal "regrowth" zone only extant hollow-bearing trees need to be retained (TSL 5.6 c), that is that if only one hollow-bearing tree is left then that is all that needs to be retained.

Under the TSL (5.6 b, d) a "mature to late mature" recruitment tree is required to be retained for each hollow-bearing tree required to be retained, so that when the old tree dies the recruitment tree will be old enough and healthy enough to provide the required homes for hollow-dependent species.

Retained hollow-bearing trees must be selected from the trees with the largest dbhob and must be live trees and should have good crown development and minimal butt damage (TSL 5.6 a, c). Recruitment trees are required to be mature to late mature growth stages, to have good crown development and minimal butt damage, and also to not be “suppressed” (TSL 5.6 b, d). Suppression occurs when trees are out competed by adjoining trees and become consequently stunted and deformed, which can persist after the competing trees are removed.

Retained trees must be scattered throughout the logging area. The TSL (5.6 g) requires damage to retained trees to be minimised and that *“logging debris must not, to the greatest extent practicable, be allowed to accumulate within five metres of a retained hollow bearing tree”* or recruitment tree.

The (TSL 5.6 (f) (iii)) requires that retained trees *“must be marked for retention”*. This is required to be undertaken at least 100m in advance of logging.

In Yabbra (Pugh 2009) it appeared that, with few exceptions, hollow-bearing and recruitment trees were not marked in the field, except near the principal roads and one side track. At that time we did not attempt to quantify the retention deficit as we thought DECCW would (we were wrong). At a number of sites large stumps made it apparent that hollow-bearing trees had been felled despite there apparently being insufficient hollow-bearing trees retained in the vicinity. Many of the marked recruitment trees were small and/or suppressed trees which have limited prospects of developing into the habitat trees of the future – they were not mature to late mature trees.

PHOTO: Yabbra: note the butt damage to the marked hollow-bearing tree and the small size of the marked suppressed recruitment tree. The large old tree is vulnerable to burning and is unlikely to survive long, while even if the recruit was healthy it has no chance of providing replacement hollows in time – though as it is suppressed it will be lucky to outlive the hollow-bearing tree. This is pure and deliberate tokenism.



In our first audit of Doubleduke (Pugh 2010b) we found logging underway in Compartment 146 without hollow-bearing and recruitment trees being marked. We complained at the time.

When we returned after logging had finished we found that the hollow-bearing trees that had survived had subsequently been marked. Though it appeared to us that retention requirements had not been met.

At another area in Doubleduke (Pugh 2010b) where tree retention appeared deficient, a large senescent hollow-bearing tree had been felled while nearby damaged late-mature trees without significant hollows had been marked as hollow-bearing trees for retention.

In a third area in Doubleduke (Pugh 2010c) it was found that an average of 1.9 hollow-bearing trees, and 1.3 recruitment trees, per hectare had been marked for retention. A measurement of all trees and stumps in a subset of this area found that sufficient trees had been retained to meet retention requirements, though 3 of the 7 largest trees had been logged. In this area it appeared that someone had walked along a track and the boundary of the nett harvesting area marking habitat trees in an ad-hoc manner as they went, without venturing far into the logging area.

In one area at Girard (Pugh 2010d) trees and stumps were measured to quantify tree retention standards. In that area the density of Greater Gliders exceeded 1 per hectare so the TSL owl prescription (6.9d) required the retention of 8 hollow-bearing trees per hectare and the general recruitment tree prescription required the retention of 10 mature/late mature recruitment trees per 2 hectares. It was found that while there were originally 7.8 large old (late mature/senescent) trees per hectare they only retained 4.8 per hectare, and of the next size class (mature/late mature) there were originally 19 per hectare but only 3.9 per hectare were retained. Insufficient trees were retained to satisfy TSL licence requirements. It is important to recognise that the area measured was oldgrowth forest within a special prescription zone, with tree retention generally appearing significantly lower elsewhere in the compartment.

PHOTOS: Girard: note the debris stacked around the habitat tree ready for burning, and the extensive damage to the retained hollow-bearing tree on the right.



In another area at Girard (Pugh 2010d) only three hollow-bearing trees and two recruitment trees were marked for retention in a 3.7 ha area, giving a retention rate of one hollow-bearing tree per 1.2ha and one recruitment tree per 1.4ha. In this case there were additional trees available for marking though these were not quantified. It appeared that, even with the inclusion of the unmarked trees, that retention was still deficient. It appeared that someone had walked along the track only marking easily accessible hollow-bearing and recruitment trees in the vicinity of the track. Near the end of the track a “clump” of trees had been marked in an attempt to improve counts.

Contrary to licence requirements retained hollow-bearing trees often have butt damage. Trees retained as recruitment trees are commonly too young and too suppressed to satisfy licence requirements. At both Yabbra and Doubleduke (Pugh 2009, Pugh 2010b) it was found that marked recruitment trees were often suppressed regrowth trees with poor crown development. At one site at Girard (Pugh 2010d) 2 hollow-bearing trees and 7 recruitment trees were classed as suppressed, and one recruitment tree had 60% of its butt severely damaged. At the other site 1 hollow-bearing tree and 1 recruitment tree had significant butt damage.

At both Yabbra and Doubleduke (Pugh 2009, Pugh 2010b) it was found that retained trees often had large amounts of debris felled and pushed around their bases. At one site at Girard (Pugh 2010d) 8 of 13 hollow-bearing trees and 7 of 10 recruitment trees had significant amounts of debris dropped or pushed around their bases. At the other site all five marked trees had significant amounts of debris left around their bases.

There is a war of attrition against hollow-bearing trees being waged. Their numbers are being depleted by continued logging, the required replacements are not being retained and funeral pyres are regularly being constructed around them in apparent attempts to burn them to the ground. The Australian Forestry Standards (4.4.5) require that the forest manager shall ensure damage to forest growing stock during forest operations stays within tolerable levels, in order to maintain wood quality and promote forest health. We consider that the damage being caused to hollow-bearing and recruitment trees is beyond tolerable levels and is causing forest degradation.

2.2.3. Implementing Prescriptions for Threatened Fauna

In NSW the protection of Threatened Species in logging operations on public lands is governed by the Threatened Species Licence. As well as general prescriptions there are species-specific prescriptions. The results from our audits, and those of Sparkes (2010), provide an indication of the scale of the problem. It is emphasised that only a small sample of the logging areas have been audited and that problems are evidently far more widespread.

From his review of 384 harvest plans for north east NSW, Sparkes (2010) considered that conditions of the Threatened Species Licence (TSL) that are under represented in these plans were:

- *Microchiropteran bat roost tree exclusions (TSL 5.14.1b);*
- *Koala high use area exclusion (TSL 6.14c);*
- *Yellow-bellied Glider Den exclusion (TSL 6.17a);*
- *Bird Nest and Roost site protection (TSL 5.13); and*
- *Threatened Flora conditions of the TSL (TSL 6.22, 6.23, 6.24.,6.25,6.26,6.27,6.28)*

In relation to our recent audits of the prescriptions specified in the licences we identified numerous failures (i.e. Pugh 2011), including failures to:

- recognise the existence of, and appropriately plan for, the Endangered fish Oxleayan Pygmy Perch;
- recognise the habitat of the Endangered Richmond Frog, undertake required surveys, exclude logging, roading and burning, assess and rehabilitate habitat;
- mark exclusion zones around the habitat of the Endangered Stuttering Frog and fully exclude it from logging;
- recognise the habitat of the Endangered Hastings River Mouse, and undertake required surveys;
- assess and rehabilitate the habitat of the Endangered Black-striped Wallaby after it was intensively logged and then accidentally burnt. Despite grazing being an identified threat Forests NSW continued to allow illegal grazing of its habitat after they said they would stop. They also failed to prepare the required grazing management plan by 2000;

- adequately assess habitat of the Vulnerable Koala, and conduct pre-logging scat searches;
- identify den and sap-feed trees of the Vulnerable Yellow-bellied Glider and systemic failures to apply the prescription for the retention of feed trees;
- appropriately locate and protect exclusion areas required to be implemented for the Vulnerable Spotted-tailed Quoll;
- apply prescriptions to exclude logging from the vicinity of burrows of the regionally significant Wombat; and,
- identify roost and nest trees for the Vulnerable Powerful Owl, exclude logging from retained habitat and retain the required habitat trees in good habitat.

Forests NSW often measuring exclusion zones along creeks (often with GPS) from the mapped centreline rather from the top banks (which can make them considerably wider). For this reason alone they frequently and repeatedly under-protect riparian areas.

In relation to biodiversity Forests NSW (2005) ESFM Plan notes:

Forests NSW will use adaptive management principles and actions within State forests to complement the management of the CAR reserve system.

...

During operations, site specific conditions are continually assessed, results recorded, the appropriateness of operational conditions reviewed and plans amended where necessary.

Operational auditing monitors compliance with plan conditions and, where non-compliance occurs, assesses environmental harm, details repair works where necessary, the cause of non-compliance, whether sanctions are necessary and how the non-compliance can be avoided in future operations.

We have come across no evidence of this, quite to the contrary we are concerned that Forests NSW does not learn from their mistakes. We are most concerned that neither DECCW nor Forests NSW bother to assess the effectiveness of prescriptions and improve them accordingly. Rather than applying adaptive management as a routine practice we find that Forests NSW use it as an occasional excuse to log somewhere they shouldn't.

One has only to look at the supposed rehabilitation plan for Compartments 162 and 163 of Yabba SF (Forests NSW 2010) where, despite the intense scrutiny, Forests NSW failed to consider why numerous prescriptions were inadequately applied, failed to assess the impacts that eventuated and failed to identify any rehabilitation measures (aside from repairing drainage). Despite being found guilty, they apparently learnt nothing.

Example 1: Hastings River Mouse.

Pseudomys oralis is listed at both state and national levels as an Endangered species. For the Hastings River Mouse only 8% of the mean of the habitat targeted for reservation is included in the reserve system in north-east NSW, all 8 populations have achieved less than 29% of reservation targets, with 6 below 10%. For Hastings River Mouse, the CRA expert panel (Environment Australia 1997) identified predation by foxes and cats as the biggest threat to this species, followed by burning.

On their threatened species site DECC identify as threats:

- *Loss of habitat through clearing.*
- *Reduced groundwater and stream flow as a result of clearing or canopy reduction.*
- *Cattle grazing and trampling of preferred habitat, especially close to water.*
- *Too frequent fires, which may destroy or severely reduce species diversity ground cover.*
- *Predation by foxes and feral cats.*

The Threatened Species Licence (TSL 6.13) requires that exclusion zones of 200-800 metres must be established around records of Hastings River Mouse. TSL 8.8.9 establishes that habitat surveys and trapping surveys need to be undertaken in modelled habitat before it can be logged.

In three separate forests Sparkes (2010) identified a total of 83 hectares of modelled habitat of the Hastings River Mouse where the required surveys had not been undertaken. Because the required surveys were not done it is not known whether the mouse was present and the exclusion zones should have been applied. DECCW issued warning letters for two of these breaches.

Example 2: Richmond Frog.

NSW has identified *Philoria richmondensis* as an Endangered Species, it is also listed as endangered on ICUN's Red List. For the Richmond Frog only 56% of the habitat targeted for reservation is included in the reserve system in north-east NSW, and this target is only a fraction of the habitat needed for a viable population. For *Philoria* species, the CRA expert panel (Environment Australia 1997) identified changes in soil moisture resultant from logging and roading as the most significant threats to these species.

DECCW's website identifies a variety of threats including:

- *Degradation of habitat due to changes in hydrological regimes and water quality, and also from trampling by domestic stock*
- *Reduction of moisture levels caused by intensive forest management, including timber harvesting, road construction and burning.*

On their threatened species site DECC state:

What needs to be done to recover this species?

- *Prevent conversion of large areas of old-growth forest to young, even-aged stands.*
- *Protect known and potential habitat from forest management practices that reduce dry season stream flows and ground moisture levels.*
- *Protect areas of known habitat from roading, logging and other disturbance.*
- *Reconnect isolated rainforest patches with corridors of wet forest, particularly along drainage lines in stream headwaters.*
- *Adopt the DEC frog hygiene protocol to prevent the spread of chytrid fungus in amphibian habitat.*

Section 5.2.1 of the Threatened Species Licence requires that an adequately trained person must conduct a thorough search for, record and appropriately mark permanent soaks and seepages in *Philoria* spp. potential habitat during or before the marking-up of a compartment. In Compartment 163 of Yabbra State Forest (Pugh 2009) we found 2 soaks/wetlands that had not been identified in the planning process and had not been surveyed for *Philoria* spp. as required. Forests NSW had mistakenly identified that surveys for *Philoria loveridgei* rather than *P. richmondensis* were required, though neither was apparently searched for. One of these soaks was identified in our audit as likely to have been potential habitat for *P. richmondensis*, though the intensity of the disturbance has now rendered it unsuitable habitat.

As wetlands, both these soaks were required by the Fisheries Licence and Threatened Species Licence to be marked on the harvesting plan, have 10m buffers established and have forestry operations excluded. Both the soaks were intensively disturbed by roading, logging and burning (Pugh 2009). As a consequence of our audit DECCW issued Forests NSW a Penalty Infringement Notice for "timber felling within a wetland and wetland exclusion zone", Fisheries NSW issued a warning letter for these same offences, and DECCW issued a formal warning to Forests NSW for not identifying habitat and surveying for Richmond's Frog.

In Forests NSW's (2010) subsequent "Rehabilitation and Monitoring Plan, Compartments 162 and 163 Yabbra State Forest No 394" there is no mention, or assessment of the condition, of these wetlands and no proposal to undertake any remedial actions to restore the wetlands. And this has been agreed to by DECCW.

Example 3: Oxleyan Pygmy Perch.

Nannoperca oxleyana is identified as 'endangered' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Fisheries Management Act 1994*.

The "Terms of Licence under section 220ZW of the *Fisheries Management Act, 1994* to harm threatened fish species during undertaking of forestry related activities. Upper North East Region" (the Fisheries Licence) requires in Section 9 for Forests NSW to prepare "Pre-Logging and Pre-Roading Aquatic Habitat Assessments": While the licence implies these should be prepared for all operations, in practice they are only prepared when in-stream works are proposed. In response to our request for the assessment for compartment 144 of Doubleduke SF (Pugh 2010c) NEFA was provided with the document "Assessment of Proposal for In-stream Works in Aquatic Habitats" (1/7/2009).

The assessment undertaken failed to recognise the existence of Oxleyan Pygmy Perch despite the 2005 Recovery Plan identifying that this compartment occurs within the identified "likely natural distribution" of the Oxleyan Pygmy Perch, with a pre 1980 record of this species apparently near Compartment 145. The assessment guidelines included in the licence also identify this as one of the 3 primary target species in UNE.

The Fisheries Licence requires that those undertaking assessments have some expertise and to consider existing records. Forests NSW apparently get untrained foresters to do their aquatic habitat assessments despite their not having the appropriate expertise (Pugh 2010c). Though according to a Forests NSW planner under the licence they only need to consider a species if records and data are first provided by Fisheries, which was meant to happen five years ago, as stated in the 2004/5 RFA report:

Preparation of distribution data for the Oxleyan pygmy perch (Nannoperca oxleyana), a species occurring in coastal areas of northern New South Wales, and Macquarie perch (Macquaria australasica) occurring in streams of the southern highlands and slopes, is complete. Both species could be affected by forestry operations and the distribution data is expected to be provided to Forests NSW shortly

Intentional ignorance, supposedly by a fish expert, should not be an excuse for inaction to protect an endangered species.

As of November 2010 Fisheries NSW had still not provided the documentation to Forests NSW. This oversight means that since Oxleyan Pygmy Perch was listed as endangered Forests NSW has used their intentional ignorance to justify not taking any specific action to protect it. Given that the "Assessment of Proposal for In-stream Works in Aquatic Habitats" for compartment 144 was approved by Fisheries NSW, and it did not even recognize the existence of Oxleyan Pygmy Perch, it is apparent that there is something very wrong with Fisheries approval process. You would think that over the years someone would have noticed that Oxleyan Pygmy Perch wasn't being duly considered.

The inquiry needs to recognise that forestry operations can and do have significant impacts on a range of native plants and animals and that many current prescriptions are inadequate and inadequately applied. In order to appropriately protect rare and endangered plant and animal species, it is requested that the Inquiry:

- a. Identify the reservation status of all nationally threatened species;**
- b. Engage appropriate experts to review the adequacy of prescriptions applied to safeguard threatened species in logging operations; and,**
- c. Review the application of prescriptions in logging operations and identify means to improve their implementation.**

2.3. Water Quality

As noted by Cornish (1980) *“the quality of water emanating from virgin forested catchments is generally of the highest order. A reduction of quality may occur as a consequence of operations associated with logging, and this is frequently due to an increase in stream sediment concentrations and associated turbidity levels.”*

Raindrop impact and overland flow are the principal means of detaching and transporting sediments and nutrients in forests.

In a logging operation the removal of vegetation allows an increase in rainfall volumes and the force of raindrops reaching the ground, and thus a greater mobilisation of soil particles can occur. Movement of machinery and dragging of logs causes an increase in compacted areas of soil surface and removal of topsoil, thereby reducing the permeability of the soil and increasing runoff, as well as causing channelling and creating loose soil for easy movement. In the short term the removal of the canopy also decreases transpiration, allowing water tables to rise and the soil to become saturated sooner and begin generating overland flow, particularly nearer streams.

The increased runoff also acts to increase the erosive force as doubling the depth of overland flow increases the velocity four times, resulting in the movement of particles 4096 times larger than before and an increase of 1024 times in the total mass able to be carried.

Loss of understorey vegetation and leaf litter, which slows overland flows and traps sediment, will also facilitate transport of soil for longer distances. The impacts of logging are greatly amplified by burning which removes the understorey and ground litter and/or weakens soil structure or increases soil hydrophobic properties.

As the soil becomes more disturbed or wetter it becomes more resistant to infiltration and thus overland flow is increased and mobilised soil can pass directly into streams and thus increase stream turbidity. The potential effects of logging on streams are therefore more pronounced in wetter weather and as operations get closer to streams.

As the velocity of the water begins to slow the larger soil particles begin to be deposited, causing sedimentation of stream beds and ultimately dams.

Logging has been found to result in a variety of impacts on stream quality:

(i) significant increases in peak sediment loads (Campbell and Doeg 1989, Lake and Marchant 1991, Bonell, Gilmour and Cassells 1991, Sadek *et. al.* 1998) leading to increased sediment deposition in streams with consequent short-term and long-term impacts on invertebrates and fish (Campbell and Doeg 1989, Lake and Marchant 1991, Davies and Nelson 1994);

(ii) increased nutrient levels which can stimulate algal production in summer (Campbell and Doeg 1989, Lake and Marchant 1991, Davies and Nelson 1994), affecting both the instream community in the vicinity of logging and downstream water users and reservoirs; and,

(iii) reductions in levels of dissolved oxygen in streams as a result of oxygen demands of decomposing logging debris in streams, which becomes most apparent in periods of low flows (Campbell and Doeg 1989).

The impacts of logging on stream quality is largely related to the impacts of machinery on soils and the consequences this has for runoff and thus changes in stream turbidity, nutrients and chemistry.

2.3.1. Increased runoff

Logging operations have been found to have a very significant impact on soil structure and stability. The most significant of these in relation to runoff is the compaction of soil reducing its permeability and thus increasing runoff. As noted by Croke *et. al.* (1997), *“once surface runoff commences, flows transmit relatively quickly downslope in the absence of areas of higher infiltration which can absorb large volumes of surface flow.”*

During logging operations from 16% (Van Loon 1966) to 23% (Wronski 1984) of the logging area can be subject to significant disturbance by machinery, increasing to over 70% in wetter forest types where machinery disturbance is maximised to encourage regrowth (Forestry Commission 1982, Rab 1994, 1996). Rab (1996) found that *“snig tracks, log landings and disturbed general logging area occupied about 19%, 3% and 66% of the coupe area, respectively.”*

Compaction of forest soils during logging operations is caused by the weight of machinery, loads and falling trees. The single passage of machinery has been shown to cause major compaction (e.g. Incerti, Clinnick and Willatt 1987) while repeated loadings and logging cycles have been shown to increase compaction effects (e.g. Seymour 1981). Wronski (1984) found that after two or more passes of logging vehicles the full depth of the soil's A horizon was compacted immediately beneath the wheel tracks and to a lesser extent up to 0.75 m from the edges of the tracks.

Compaction effects have been shown to dramatically increase with soil moisture (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Wronski 1984, Lamb 1986), Greacen and Sands report that one passage of a tractor over wet soil made it almost impermeable to water and the effect was equivalent to four passages over dry soils. Shear stress and wheel slip can increase the compaction effect of static loads by up to 2 and 5 times respectively (Greacen and Sands 1980). To some extent, gravel and organic matter in the soil reduce compaction effects (e.g. Wronski 1984, Lamb 1986).

For krasnozem soils compaction is generally greatest in the top 25-30 cm of the soil profile though there is some effect down to 50 cm (Jakobsen and Moore 1981, Jakobsen 1983). In sandy soils movement down to 120 cm depth has been recorded (Greacen and Sands 1980).

As noted by Jakobsen (1983) *“Compacted forest soils, in the absence of ameliorative treatment, recover slowly under the influences of climatic processes and the activity of roots and soil fauna. However, it may take 10-20 or more years for soil to recover after shallow compaction ... while compaction of deeper layers may persist for 50 to 100 years ... When biological activity in the soil is severely reduced by compaction, recovery may be further retarded.”*

In relation to water movement, soil compaction resultant from logging machinery and vehicles, has been shown to significantly:

- increase soil density (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al* 1987, Rab 1994, Croke *et. al.* 1997), with various estimates of 20-65% increases on major snig tracks and log landings;
- reduce infiltration capacity (Langford and O'Shaughnessy 1977, Greacen and Sands 1980, Jakobsen and Moore 1981, Wronski 1984, Lamb 1986, Campbell and Doeg 1989, Rab 1994, Croke *et. al.* 1997), thereby increasing surface runoff, loss of water from the site and erosion; and,
- reduce hydraulic conductivity (Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al* 1987, Rab 1994);

Croke *et. al.* (1997) found that *“the bulk density of snig track soils was approximately 1.25 times higher than those on the general harvesting area. This is due partly to compaction but*

also to the loss of more porous surface soil during cross bank construction.” Croke *et. al.* found that as a consequence of this “For the 1:2 and 1:10 year storms, snig tracks generate approximately seven times more surface runoff per unit contributing area than the general harvesting areas on recently logged sites”.

Rab (1994) concluded that “The results indicated that logging significantly increased bulk density and decreased organic carbon and organic matter content, total porosity and macroporosity on over 72% of the coupe area. However, on 35% of the coupe area, the snig tracks, log landings and subsoil disturbed areas of the general logging area, bulk densities and macroporosities reached critical levels where tree growth could be affected. On these areas, organic carbon decreased between 27 and 66%, bulk density increased between 39 and 65% and macroporosity decreased between 58 and 88%.”

Rab (1994) found that “Saturated hydraulic conductivities decreased to critical levels for runoff to occur on over 72% of the coupe area (topsoil and subsoil disturbed areas of the general logging area, snig tracks and log landings). On this area, the reduction in saturated hydraulic conductivity varied between 60 and 95%.”

Other water related problems with the impact of logging machinery on soils include dramatic increases in erosion resulting from: removal of the more stable surface organic layer and channelling of overland flow and increasing its erosive force (Bonell, Gilmour and Cassells 1991).

On its own, fire has been found to cause very significant increases in surface runoff following rainfall (Floyd 1964, Langford and O'Shaughnessy, 1977, Good 1973, Leitch, Flinn and van de Graaff 1983, Atkinson 1984), this is attributed to a reduction of the soils infiltration rate caused by high temperatures, and loss of litter and vegetation cover. In one instance streamflows for a 14,600 ha area in Western Australia increased by 72% following wildfire (Langford and O'Shaughnessy 1977). Various recovery periods of one to six years have been reported (eg. Langford and O,Shaughnessy 1977).

Fire can also degrade soil structure and functioning (Floyd 1964, Langford and O'Shaughnessy 1977, Leitch, Flinn and van de Graaff 1983, Sims 1991), including the formation of hydrophobic (water-repellent) surface layers. Repeated (control) burning has been found to compound the impacts of a single fire on soil structure (Floyd 1964).

2.3.2. Increased erosion

Roads and tracks are the most significant sources of erosion in logging operations (Langford and O'Shaughnessy 1977, Lamb 1986, Grayson *et. al.* 1993, Davies and Nelson 1993, State Forests 1996b, Croke *et. al.* 1997, Lacey 1998), contributing up to 95% of sediments in streams at one NSW site (Lamb 1986). Roads and tracks also alter hydrological patterns by creating new drainage lines and affecting the pattern of surface and subsurface waterflows (Bren and Leitch 1985, Lamb 1986, Bonell, Gilmour and Cassells 1991).

Sediment production rates from unsealed roads have been found to vary from 0.2 to 2,000 tonnes per hectare per annum ($t\ ha^{-1}\ year^{-1}$) (Grayson *et. al.* 1993). Grayson *et. al.* (1993) found that sediment production from unsealed roads in the Melbourne Water catchment (annual rainfall around 1600mm) was in the order of 50-90 $t\ ha^{-1}$ of road surface per year, with 15-25 $t\ ha^{-1}$ of this being coarse sediment and 35-65 $t\ ha^{-1}$ being suspended sediment. They note that the sediment loading being composed of two-thirds suspended sediment “is important for management, as it is more difficult to prevent suspended sediment entering streams.”

Grayson *et. al.* found that “with low usage [2 return passes per week] the level of road maintenance is not a factor in sediment production; however, with high usage [15 return passes per week], the level of road maintenance becomes important”. They considered it noteworthy that “on several occasions after grading, very large sediment loads were

deposited in fumes. On one occasion, approximately 6 t of coarse sediment was removed from the fumes in one week.

The concentrated nature of runoff from roads, particularly when situated on side slopes, makes it difficult to control sediments and ensure their deposition prior to reaching streams.

Bren and Leitch (1985) found that spreading outflow from a road evenly over a 5m wide and 5m long area of undisturbed ground *“did not have any effect. Scrutiny of the individual storm records indicated that a possible effect was discernible only for very small storms”*, an outcome which they in part attributed to the area quickly becoming *“covered with a layer of fine sediment which blocked points of infiltration entry into the soil”* and the tendency of the water *“to flow along preferential paths, thereby reducing the opportunity for infiltration”*.

The next most significant source of sediment production in a logging operation are the snig-tracks used to transport logs from where they are felled to log dumps for loading onto trucks. Cross-banks are the principal means used to control runoff and thus erosion from snig-tracks. They are used to slow runoff and thereby precipitate and trap coarser sediments on the track surface and to redirect runoff into less disturbed areas in order to trap additional sediment.

Croke *et. al.* (1997) assessed erosion from logged areas using simulated rainfall events and experimental plots and found that *“Snig tracks on these recently logged sites generate, on average, 20 times more sediment than the general harvesting areas for the 1:100 year [110 mm/h] storm intensities”*, with *“for the most recently logged sites, sediment yield is in the order of 2 to 11 t/ha for the 1:2 year and 1:100 year storms”* over a 30 minute period.

Croke *et. al.* (1997) found that with various 30 minute rainfall simulations 65-100% of the mobilised sediment was deposited at cross banks at relatively low rainfall intensities of 45mm/h, while 33-88% was deposited at higher rainfall intensities of 110 mm/h, noting that *“The particle size distribution of the eroded sediment from the snig track and the cross bank outlet indicates the propensity for the coarser sediment to be deposited in this area, leaving a predominance of fine materials to be transported into the general harvesting area.”*

While there was no real attempt by Croke *et. al.* (1997) to analyse the reduction in sediment after leaving the cross bank, it would appear that with a rainfall intensity of 110mm/hr lasting for half an hour, some 3-51% of the remaining sediment was transported across 5-7m of the forest floor, with volumes depending upon soil types and particle sizes. Croke *et. al.* note *“Relative differences in sediment yield from the cross bank outlet to the trench ... suggest that approximately 50% of the sediment eroded on the metasediment sites reached the hillslope trench.”*

Lacey (1998) assessed sediment production on snig-tracks in Orara West and Doyles River State Forests under natural conditions and presumably best practices, finding that *“the total average amount produced on snig tracks in the first year was 29 t ha⁻¹ at Doyles River and 31 t ha⁻¹ at Orara West. Second year results displayed a greater difference with 9 t ha⁻¹ at Doyles River and 4.5 t ha⁻¹ at Orara West.”* It needs to be noted that his sediment traps did overflow and thus unquantified volumes of silt were transported further on.

Lacey also assessed sediment accumulation at traps located 5 m below cross bank outlets on other tracks and found it *“to be of a similar magnitude to that of the on-track traps”* at all of the Orara West sites and one of the four Doyles River sites. In other words, in the majority of cases re-direction of silt laden water over infiltration slopes had no effect. Lacey attributed this to a fire 2 months before logging at Orara West removing ground litter and vegetation and *“some ground disturbance by logging machinery”* at the Doyles River site.

Croke *et. al.* (1997) found that *“The relationship between surface runoff and total cover varies with rainfall intensity as reflected in coefficients of variance of 36%, 34% and 5% for*

the 1:2, 1:10 and 1:100 year storms. This suggests that the effect of total cover in reducing runoff volumes is greater for low to medium events, but once rainfall intensity exceeds some threshold value, the influence of cover on surface runoff weakens as a greater percentage of the general harvesting area produces runoff and vegetated areas become saturated."

Fire alone has been found to result in significant and sometimes extreme erosion (Floyd 1964, Good 1973, Leitch, Flinn and van de Graaff 1983, Atkinson 1984). Atkinson (1984) estimated soil losses of 30 to 48 t/ha, over a 10 week period, following a wildfire in Royal National Park, he suggested that for that terrain and climate 20 t/ha may be a more realistic estimate of soil loss following wildfire in an average year. Losses of similar magnitude have been recorded in other instances (e.g. Leitch, Flinn and van de Graaff 1983). Thus a fuel reduction or accidental burn occurring around the same time as a logging operation greatly reduces the effectiveness of erosion mitigation measures while also compounding the impacts of logging on erosion.

2.3.3. Impacts on streams

As noted by Croke *et. al.* (1997) *"Erosion undoubtedly occurs in forestry environments and, in particular, on disturbed areas such as snig tracks. The transportation and delivery of this material to the drainage lines depends upon a number of factors. These include the prevailing slope, topography, soil texture, and trapping efficiency of drainage structures and protection features, such as buffer strips, within the catchment."*

Cornish's (1980) brief assessment of the relative turbidities of Rocky Creek and Little Rocky Creek (Gibbergunyah Creek) concluded that *"Turbidity levels in both Rocky Creek and Little Rocky Creek were at or below recommended levels for treated water on 78% of the sampled weeks"* (implying that it was above recommended levels 22% of the time).

For a low erosive catchment such as Girard State Forest, State Forests' (1996b) identified that *"turbidity was projected to increase by 50% at the compartment scale following integrated harvesting, and to return to pre-logging levels within four years"* and there was estimated to be a *"long-term increase due to existing roads"* of 10% at a catchment scale. The combined impacts from these for the Girard catchment was simplistically modelled as an average 12-16% increase in annual turbidity.

In adjacent catchments in Tasmania, Wilson and Lynch (1998) found that following logging around a small intermittent stream the mean turbidity of the stream was 4.7, with a maximum of 40, compared to a nearby unlogged catchment around 10 times the size generating a mean turbidity of 1.12 with a maximum of 20. They concluded that in their study area *"logging does appear to increase turbidity in small tributary streams draining logging coups, even when these streams are protected by buffer strips."*

Even with a highly constrained and regulated logging operation Grayson *et. al.* (1993) still found that the important changes detected were a 30% increase in the median value for turbidity, 20% increase in the median value of iron and a 100% increase in the median value of suspended solids. Though they did not consider these to be a major impact.

The impact of logging on turbidity is highest in storm events. Sadek *et. al.* (1998) found that *"the disturbed forest basin produced approximately 10 to 100 times the load per unit area during storm events compared to the undisturbed basin"*. Cornish (1980) found that even where comparing two logged catchments *"Turbidity levels in Rocky Creek relative to those in Little Rocky Creek rose when logging activities in Rocky Creek coincided with periods of high rainfall"*.

The increased turbidity following logging and burning have been found to result in massive depositions of sediment in stream channels (Good 1973, Leitch, Flinn and van de Graaff 1983, Lamb 1986, Davies and Nelson 1993). While some of the impacts may only persist for a few years after logging, others may persist for long periods, for example Davies and

Nelson (1993) found that *“road crossings were associated with large increases in infiltration in adjacent riffle pairs, 30-50 years after construction.”*

Effects on macroinvertebrates have been recorded in catchments where logging has been carried out with extremely restrictive prescriptions for the protection of aquatic habitats (Robinson [1977] in Forestry Commission of Tasmania 1991) and some changes have been found to be longterm (up to 40 years after logging) (Silsbee and Larson [1983] in Forestry Commission of Tasmania 1991).

Davies and Nelson (1994) found that *“Logging significantly increased riffle sediment, length of open stream, periphytic algal cover, water temperature and snag volume. Logging also significantly decreased riffle macroinvertebrate abundance, particularly of stoneflies and leptophlebiid mayflies, and brown trout abundance. All effects of logging were dependent on buffer strip width and were not significantly affected by coupe slope, soil erodibility or time (over one to five years) since logging. All impacts of logging were significant only at buffer widths of <30 m.”*

At buffer widths of 10-30 m Davies and Nelson (1994) found that the most significant impacts were increases in superficial silt and decreases in populations of macroinvertebrates and Brown Trout, with declines in abundance of 80% and 54% respectively at buffer widths <30 m.

Davies and Nelson caution that their assessment was undertaken during low flow conditions and that *“it is possible that larger buffer widths may be needed in some or many situations to protect streams from enhanced sediment and/or nutrient loads associated with substantial storm events.”* They cite research by Gowns and Davis which found that even with 100m buffers the macroinvertebrate composition in buffered streams was intermediate between unlogged and clearfelled streams, suggesting *“that even logging with 100-m buffers may still cause community responses at the species level.”*

Increased water flows have been found to scour gullies and undermine streambanks (Good 1973, Leitch, Flinn and van de Graaff 1983).

2.3.4. Mitigating impacts

Direction of runoff onto undisturbed vegetation and the maintenance of undisturbed filter strips along streams are the principal means of reducing the impacts of logging on water quality. The theory being that the undisturbed soil allows increased infiltration of water and thus sediment deposition and the roughness of the ground litter and vegetation act as sediment traps. Though if the forest is disturbed by machinery which causes compaction or channelling, or subject to burning removing ground litter and vegetation then the effectiveness of such zones is greatly reduced. Filter strips along streams encompass the most saturated soils of a catchment, so their effectiveness as sediment traps is also greatly diminished when higher groundwater levels reduce infiltration of runoff.

There are two licences aimed at mitigating impacts of Forests NSW's operations on streams and water quality; the Environmental Protection Licence (EPL) and Fisheries Licence (FL). In addition to this the Forest Management Zone 8 (FMZ 8) incorporates modelled streams that are supposed to be subject to ground-truthing when preparing Harvest Plans and allocated to the appropriate FMZ.

Unfortunately we found that the EPLs are rarely applied, the FL is usually ignored and the requirement to resolve the FMZ8 zones is not undertaken.

The EPL states:

The objects of this licence are to require practical measures to be taken to protect the aquatic environment from water pollution caused by forestry activities and to ensure

monitoring of the effectiveness of the licence conditions in achieving the relevant environmental goals.

It is a shame that Forests NSW get away with refusing to apply this licence. This is apparently part of an agenda to open up “unmapped” drainage lines for logging and to not protect drainage depressions, which they frequently log and road anyway.

Even with the implementation of ‘best practice’ measures logging has been found to still result in increased erosion and thus stream turbidities (Davies and Nelson 1993, Davies and Nelson 1994, Grayson *et. al.* 1993, Lacey 1998).

Lamb (1986) considers *"Much damage can be minimised, if not prevented, by providing ample water-dispersing drainage, locating roads on ridges rather than on steep slopes, minimising river crossings and hastening revegetation of earthworks."*

Cornish (1975) recommended that *"Roads, tracks and [log] dumps should be drained immediately they are no longer required to prevent large increases in the depth and velocity of runoff water, and to direct this runoff on to adjacent undisturbed vegetation. ... Log dumps often become compacted during use, making revegetation difficult. Ripping to a depth of 10-30 cm when the area is drained would increase the rate of revegetation, and hence reduce total sediment production"*.

Bren and Leitch (1985) found that *"The passage of runoff across a short length of natural forest slope appeared to make little difference to the flow, and it is concluded that if infiltration of the outflow of road culverts is to be obtained then special measures to distribute water adequately over the slope and to maintain infiltration pathways may be necessary."*

Cornish (1975) also considers that *"air transport systems, where the log is lifted from the ground at point of cutting and transported to the landing without further contact, will cause least damage; whereas large, heavy, poorly manoeuvrable crawler tractors, dragging logs dully on the ground are likely to create maximum damage, particularly in steep areas."*

In their paired catchment experiment Grayson *et. al.* (1993) applied a strict logging regime in which *"buffer strips with a minimum width of 20 m were maintained around the saturated source areas, all roads, snig tracks and log landings were drained into areas with a high infiltration capacity, no logging was allowed during wet periods, the logged surface was expeditiously replanted, and compacted areas such as log landings were deep ripped. The supervising officer was present at all times and exercised total authority over the operation. ... The maximum extent of the saturated area (defined by a break in slope) was surveyed by Melbourne Water staff, and it was ensured that this area was well within the limit of the buffer zone."* In addition to this there were no stream crossings within the area.

While Grayson *et. al.* (1993) considered that strict adherence to their methodology resulted in acceptable outcomes in terms of drinking water quality it went far beyond measures applied in practice. Application of prescriptions in the real world is also a very different matter.

In terms of erosion, Cornish (1975) notes that strips of vegetation (filter strips) should be retained along watercourses to reduce the velocity of overland flow, slow water to allow deposition of sediment, and stabilise banks. Cornish states that *"the effective width of a filter strip is of direct relevance to the absorption of sediment from upslope"*, and that rather than *"permanence of flow"* *"the high peak flow situation (with the coincident likelihood of higher surface runoff) is more in need of strip protection"*, and recommends that *"A filter strip of natural vegetation should be retained to extend 20 m on either side of a stream and be provided downstream from the point on that stream where its catchment area exceeds (at most) 100 ha."*

Davies and Nelson (1994) found that stream buffer widths need to be greater than 30 metres to avoid significant increases in superficial silt and significant decreases in populations of

macroinvertebrates and Brown Trout, while also acknowledging that buffer widths less than 100 m “*may still cause community responses at the species level.*”

Davies and Nelson (1993) note that “*the role of first-order streams in sediment transport from hillslopes experiencing accelerated erosion has long been recognised*”. In their assessment of logging impacts on streams in steep country in northern Tasmania, Davies and Nelson (1993) found that “*fine sediment infiltration in ephemeral, first-order streams ... is significantly enhanced by logging on steep slopes, by factors of two to three times the median values for unlogged streams. Infiltration by very fine organic sediment ... is greatest during the 2 years immediately after logging, decreasing with time to a level similar to that for unlogged streams after 6 years.*”, concluding that “*enhanced fine sediment movement in streams as a result of logging is most likely to occur owing to disturbance of headwater stream channels.*”

In current practice buffer strips along streams increase in size with stream size rather than catchment area. Bren (1999) notes that the problem with this is that “*compared to more rigorous methods this under-protects the stream head, but overprotects divergent areas downstream. A method based on a constant ratio of upslope contributing area to buffer area gave the widest buffers at the stream head and buffers of diminishing width as one moved downstream.*” Bren notes that having relatively wider buffers for the smaller headwater streams “*makes sense hydrologically but is probably politically unacceptable.*”

It is apparent that enhanced measures could be adopted to reduce increases in sediment mobilisation, stream turbidity and sedimentation due to logging in the catchment, though this would require significant enhancements of current practices, such as:

- Adequate buffers should be applied to all streams, stream channels and areas most likely to become saturated in wet periods;
- Logging should be discontinued when soil moisture is higher than an acceptable level;
- Heavily compacted sites (ie log dumps, snig tracks) should be deep ripped after use and revegetated to an acceptable cover within 6 months;
- Roads and tracks need to be well drained, with temporary tracks (i.e. snig tracks) having adequate cross drains constructed at the end of operations and when rain is threatening;
- Logging operations must be constantly and rigorously supervised;
- All runoff needs to be directed into areas with a good vegetation and leaf litter cover, in an area unlikely to become saturated in prolonged wet weather, and not subject to machinery disturbance or burning;
- Roads crossing streams should be avoided where possible, where a stream crossing is unavoidable the road should be properly drained well away from the stream and the road surface adequately armoured (rocks, concrete, bitumen) in the vicinity of streams to resist erosion; and,
- Roads left open for regular traffic need to be regularly maintained, with special precautions taken after grading.

If impacts on streams are to be minimised it is essential that the buffers applied be of an adequate width. Munks (1996) reviewed the available literature to identify buffer widths for various functions:

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

Munks (1996) recommended the following minimum buffer widths for streams:

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

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

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

It also needs to be recognised that areas subject to increased rainfall intensities and/or an increased number of high intensity rainfalls as a result of global warming will be subject to an increase in the rate of soil erosion, particularly when possible ecosystem instability and changes reduce soil protection (Tegart, Sheldon and Griffiths 1990). It is thus important to consider the likely impacts of climate change when deciding appropriate mitigation measures.

2.3.5. Poor Practice

Forests NSW undertake logging operations under an Environmental Protection Licence (EPL) and Fisheries Licence (FL) which attempt to regulate activities so as to protect water quality. These represent minimal best practice. Forests NSW have opted not to obtain EPLs for over 90% of their operations and, until our recent audits, the FL has rarely been applied or enforced. Even when breaches are reported to the regulators they are not explicitly or comprehensively audited, the fines and penalties are grossly inadequate, and no rehabilitation is required for illegally logged wetlands and stream banks.

In our recent audits we found that Forests NSW routinely breach prescriptions intended to protect water quality and fish habitat, most notably failing to adequately protect unmapped drainage lines, wetlands and drainage depressions, dropping trees into stream buffers, poorly constructing and failing to rehabilitate stream crossings, failing to establish adequate drainage on tracks and roads, and otherwise being careless. We found that Forests NSW are ignoring the requirement to remap and appropriately rezone streams delineated as FMZ 8 areas when preparing harvesting plans and are often logging them. It is of particular concern that Forests NSW refuse to “turn on” Environmental Protection Licences (EPLs) in over 90% of logged compartments in order to avoid external regulation. Their agenda is to be allowed to log unmapped drainage lines.

Our audits did not focus on compliance with Environmental Protection Licence (EPL) and Fisheries Licence (FL) conditions, though incidental observations were made.

At Yabbra (Pugh 2009) we documented a variety of contraventions of the EPL (Schedule 4; 17, 20C D6, D15, D19B, D20, D20J, D20R, D20S, D20T, D21, D22, D23, H70, Schedule 5; I 37) and FL (7, 7.2, 7.4, 7.5), such as;

- 3 sites where snig tracks had caused extensive soil disturbance to areas adjacent to and across unmapped drainage lines;
- failure to identify, delineate or protect unmapped streams from logging roading and burning;
- failure to delineate or protect drainage depressions from significant machinery disturbance;
- failure to identify, delineate and protect wetlands from logging roading and burning;

- inadequate drainage of a snig track; and,
- drainage off roads and tracks being diverted directly into streams.

At Yabbra Forests NSW subsequently repaired drainage on four stream crossings and one track because they were not up to pollution control requirements

PHOTOS: Left; one of the 22 trees documented as being felled next to one of the 5 drainage lines that were logged at Yabbra – these only represent the tip of the ice-berg though the regulators could not be bothered revealing their full extent. Right: Doubleduke crossing; Note the sediment in stream bed which extended a long-way downstream - the Minister failed to report this to Fisheries.



At Doubleduke (Pugh 2010b) we found two poorly constructed creek crossings without implementation of soil stabilisation measures that resulted in significant mobilisation of sediments into both streams (Breaches EPL J45, J46, J52, FL 8.4.1.(a), 8.4.2.(b), 8.4.3.(b)). Forests NSW subsequently implemented erosion mitigation works at both crossings, though Fisheries NSW were not informed of our complaint.

At Girard (Pugh 2010d) we documented a variety of contraventions of the EPL (6, 15, 22, 30, 46, 50, 51, 53, 54, 56) and FL (7, 7.1, 7.4, 7.5, 7.8, 7.9, 8.4), such as;

- one mapped drainage line had been logged and intensively disturbed;
- some unmapped drainage lines were not identified and protected;
- drainage depressions were not delineated and protected;
- debris from a log dump were pushed into a drainage line;
- stable structures were not used to cross streams;
- stream crossings were not rehabilitated; and
- large amounts of spoil were deposited in some streams.

Forests NSW identified one of these Girard breaches in April 2010, stating “*Bulldozer driver opening old road for snig track, pushed through 2 unmapped drainage lines*”. Despite large amounts of fill being pushed into the drainage lines and both crossings being situated upstream (50-80m) from a Stuttering Frog exclusion zone, Forests NSW concluded that there was no environmental harm and simply explained the licence to the operator without undertaking any remedial action. When we audited the operations in August we independently identified these breaches and observed that erosion had commenced. While logging had finished no attempt had been made to remove the spoil from the streams and undertake rehabilitation.

PHOTOS: Girard; note the extensive disturbance to stream crossing on left and the lack of rehabilitation. The large tree on right of second photo is marked as an exclusion boundary, with another marked tree bulldozed into the debris on the left.



At Girard, Forests NSW also identified 6 breaches where trees had been dropped into stream exclusions.

Sparkes (2010) identified 27 breaches of NSW environmental regulations by FNSW in the UNE, noting:

Ten of these involved failures to implement adequate erosion controls after logging, in the worse case 27 cross-banks had been so poorly constructed that they failed and caused significant pollution of Washpool Creek. In one case a bridge had collapsed into a 4th order stream and in another Forests NSW had failed to properly assess, and thus under-estimated, soil erodibility. DECCW directed that remediation should be undertaken for 8 of these breaches and sent warning letters in respect to 3 others. No action was taken in respect to the failure to properly assess soil erodibility.

Five of the breaches involved logging of stream exclusions imposed to protect habitat for an array of threatened species (TSL 5.7a) and water quality, with up to 2,150m² being logged in the worst case. DECCW issued a Penalty Infringement Notice for one of these incursions and issued warning letters for three others.

Despite most compartments not being subject to the EPL, at its peak there were 146 “non-compliance Incidents” with the EPL identified by regulators in the UNE in 2006/07 and 122 in 2007/08. We consider that the decline since then is due to a lack of auditing, rather than an improvement in practices.

It is apparent that Forests NSW are regularly and frequently breaching requirements of the Environmental Protection Licence.

2.3.6. Forest Management Zone 8

Significant areas within the compartments audited are identified as Forest Management Zone 8. FMZ 8 is meant to be an interim zoning of areas where field investigation is required to determine final Forest Management Zone classification as part of pre harvest planning processes. In the assessed cases the FMZ 8 areas represent modelled streams that are intended to be further assessed at the Harvesting Plan stage.

In the 1999 Forests NSW document “Managing our forests Sustainably: Forest Management Zoning in NSW State Forests” FMZ 8 is described as:

An interim zoning of areas where field investigation is required to determine final Forest Management Zone classification. Field investigation will be undertaken as part of pre harvest planning.

These areas require field validation before allocation to a specific Forest Management Zone and are:

...

ii Areas of modelled GIS data where field verification is required to accurately map the features.

The correct information will be mapped onto the harvesting plan ...

Management will be for protection under the same requirements as FMZ 3A until field investigation allows determination of final FMZ classification.

Forest NSW's 2005 ESFM Plan for UNE reiterates: *FMZ 8 areas require field assessment to identify into which of the seven FMZ they should be placed. This is normally done at the time of assessment for harvest planning.*

Forests NSW Sustainability Reporting Supplement 2009-10 states:

FMZ 8: *Land for further assessment - An interim zoning of areas where field investigation is required to determine final Forest Management Zone classification. Field investigation will be undertaken as part of pre-harvest planning. Management will be for protection under the same requirements as zone 3a until field investigation has taken place.*

FMZ 8 is meant to be an interim zoning of areas where field investigation is required to determine final Forest Management Zone classification as part of pre harvest planning processes. These are a surrogate for unmapped (i.e. not shown on 1:25,000 topographic maps) drainage lines that are meant to be refined, appropriately zoned and then protected in accordance with Environmental Protection Licence (condition D6) and Fisheries Licence (condition 7).

In these compartments, the obvious intent was for Forests NSW to assess the FMZ8 areas and unmapped streams, include the results in refined stream maps in the harvesting plans, and appropriately rezone the refined streams (presumably to FMZ3A). These are also required to be marked in the field as riparian exclusion areas.

At Yabbra (Pugh 2009) we documented 22 trees that had been unlawfully logged within riparian areas along five unmapped streams that were meant to be rezoned prior to logging and that were also required to be protected as unmapped drainage lines, and estimate that there were likely to be over 100 such trees unlawfully logged based on our small sample. No heed was taken of FMZ 8.

There was an attempt to identify unmapped streams at Girard (Pugh 2010d), though significant streams (drainage lines) were missing from the remapping in the working plan and were logged, and no attempt had been made to rezone any FMZ8. The head of a mapped stream was also logged and cleared at Girard.

In compartment 144 of Doubleduke we recently scouted a logging area and found numerous unmapped drainage lines and wetlands that had not been mapped and identified for the required management. A large stream was also incorrectly located. The harvesting Plan failed to identify and appropriately zone any unmapped streams.

In none of our audit areas has Forests NSW attempted to map and identify unmapped drainage lines or wetlands and assign them to the appropriate FMZ. At Yabbra all unmapped drainage lines and FMZ 8 areas had simply been ignored and logged. While at Girard all

FMZ 8 areas had been ignored, some of the unmapped drainage lines had been mapped and protected on the ground, though Forests NSW was unsure what to do with the mapping.

This planning failure to remap FMZ 8 areas is systemic and deliberate and has the effect of counting trees in what should be exclusion areas towards satisfying retention requirements in the nett logging area. It also increases the likelihood that they will not be identified and appropriately protected during logging.

The Inquiry needs to recognise that forestry operations do cause soil erosion and do have a significant impact on streams, and that Forests NSW go out of their way to avoid external regulation and the application of Best Management Practices to protect stream quality. To ensure the application of best management practices to minimise the impacts of forestry operations on soil erosion and streams it is requested that the Inquiry;

- a. Engage appropriate experts to identify performance standards and review the adequacy of prescriptions applied to safeguard streams and water quality in logging operations;**
- b. Ensure independent regulation by requiring application of Environmental Protection Licences to all logging operations;**
- c. Ensure that Forests NSW comply with the requirement to assign FMZ8 areas to the appropriate protection zone; and,**
- d. Identify measures needed to improve compliance with requirements.**

2.4. Water Availability

Forests are responsible for capturing water from the atmosphere by increasing rainfall and condensing fog. This effect is enhanced by the taller trees and rougher canopy of an oldgrowth forest. Forests are also responsible for returning significant amounts of water to the atmosphere through transpiration, thereby contributing to rainfalls elsewhere.

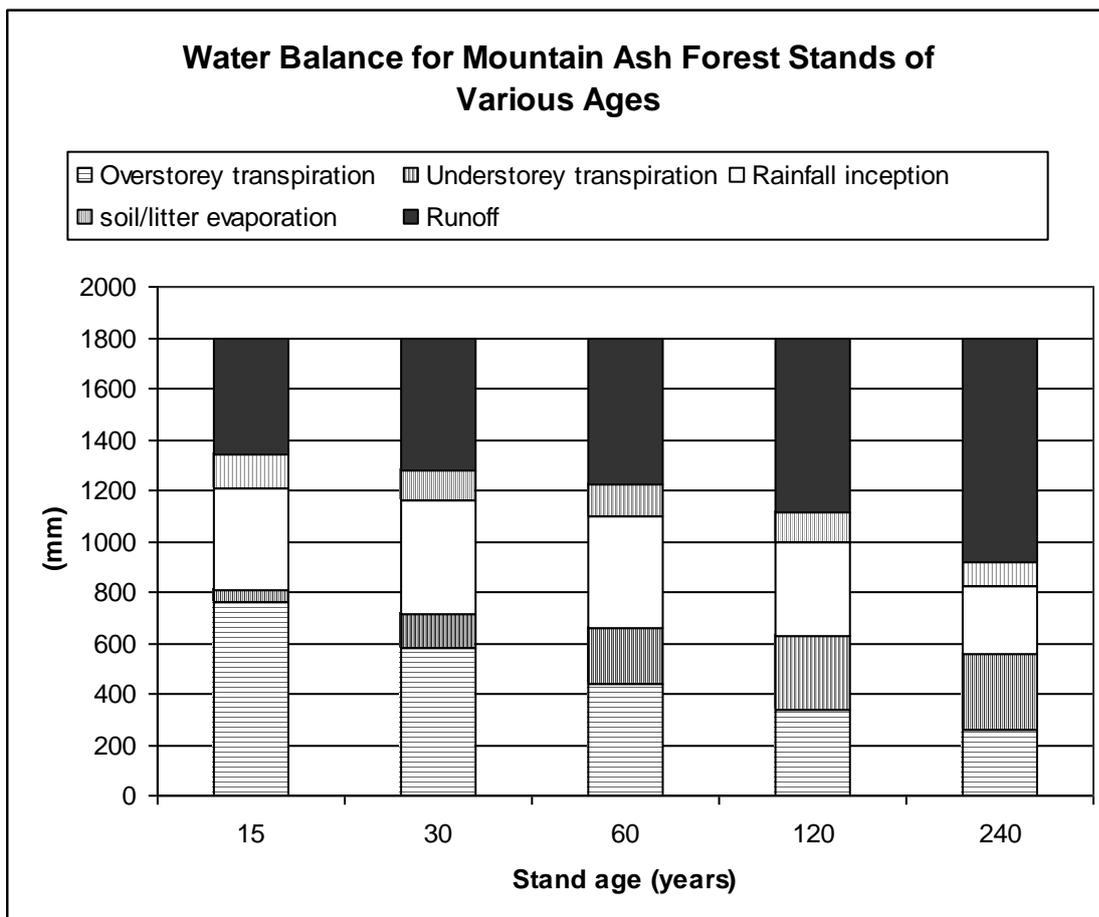
Of the rain which falls upon a forested catchment some is evaporated directly from leaf and ground surfaces and part may be redirected by surface flows directly into streams. Except in intense rainfall events, the majority can be expected to infiltrate the soil where it is used for transpiration by plants, with the excess contributing to groundwater seepage into streams or possibly seeping deep down to aquifers. In a natural forest situation most of the streamflow response to rainfall is provided by the groundwater system.

In their review of 'Logging and Water' Dargavel et. al. (1995) concluded "*The hydrological evidence reviewed in this report indicates that current logging regimes in the native forests of eastern Australia result in a decline in water yields. ... In catchments used to supply urban centres, this means that there is less water flowing into dams that provide water to cities and towns for drinking, washing, cleaning, watering gardens and industrial uses.*"

The basic relationship between water yields and eucalypt forest age was established by studies of regrowth Mountain Ash forests following wildfires in Victoria. Kuczera (1985, cited in Vertessy et. al. 1998) developed an idealised curve describing the relationship between mean annual streamflow and forest age for mountain ash forest. This shows that after

burning and regeneration the mean annual runoff reduces rapidly by more than 50% after which runoff slowly increases along with forest age, taking some 150 years to fully recover.

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



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

While not apparent at the large catchment scale used to generate the Kuczera curve, smaller catchments have been found to often generate increased flows of water following clearfelling where a significant area of the catchment is cleared. This “initial yield increase” is largely due to removal of vegetation and soil disturbance causing increased overland flows during rainfall events.

The generalised pattern following heavy and extensive logging of an oldgrowth forest is for there to be an initial increase in runoff peaking after 1 or 2 years and persisting for a few years. Water yields then begin to decline below that of the oldgrowth as the regrowth uses more water. Water yields are likely to reach a minimum after 2 or 3 decades before slowly increasing towards pre-logging levels in line with forest maturity.

Following clearfelling of a forest there may or may not be an initial increase in water yields for a relatively limited period. Thereafter water yields usually decline relatively rapidly in relation

to growth indices of the regrowth, after some decades maximum transpiration of the regrowth is reached and water yields begin to recover with increasing forest maturity.

For Mountain Ash forest in Victoria, a mean annual rainfall of 1,800 mm/yr has been found to generate a mean annual runoff from oldgrowth Mountain Ash forest of about 1,200 mm/yr (Kuzcera 1987, Vertessy et. al. 1998). After burning and regeneration the mean annual runoff reduces rapidly by more than 50% to 580 mm/yr by age 27 years, after which runoff slowly increases along with forest age, taking some 150 years to fully recover (Kuzcera 1987).

In the Barrington Tops area Cornish (1993) found that *“water yield decline exceeded 250 mm in the sixth year after logging in the catchment with the highest stocking of regeneration and the highest regrowth basal area”*. This represents a major reduction given that the mean runoff pre-logging was only 362 mm (38-678 mm). With only 61% of its catchment logged and over 20 years left before yields could be expected to bottom out, it is apparent that yield declines in north-east NSW could be expected to be of a similar magnitude to those found in Victoria.

Vertessy (1999) cites an unpublished assessment by himself and Cornish of the Karuah catchments up to 14 years after logging, stating *“streamflows declined below pre-treatment levels seven years after logging in three of the six treated catchments, and declined in a regular manner over the next seven years”*, with yields from the other 3 catchments apparently affected by insect attack causing defoliation and associated reductions in transpiration and thus enhanced streamflows at times. Vertessy notes that *“the maximum decrease in annual streamflow is over 60 mm per 10% of forest area treated, which is similar to the maximum reductions noted for Victorian mountain ash forests”*.

To make it more confusing, this relatively simple pattern is complicated by varying vegetation types and conditions within a catchment, a multitude of environmental variables, and the compounding effects of events over time. Even then we are still dealing with averages and it is in the drought events when water stored in dams and soils is of highest value, that impacts are greatly accentuated and have the most effect.

The effects of yield reductions are most pronounced in dry periods as the vegetation utilises proportionately more of the rainfall. Vertessy (1999) notes that South African studies demonstrated *“that absolute reductions in streamflow were greatest during the wet months, but that the reductions were proportionally greatest during the low flow periods”*.

Forest areas that have been recently logged or where regrowth is the dominant vegetation have a very rapid response time in relation to delivery of water into the storage system. Conversely, older less disturbed forests allow more water to permeate into the soil. Soil moisture then percolates more slowly through the catchment increasing the persistence of higher flows.

Water yield has been found not to return to pre-logging levels for some 150-200 years (Kuzcera 1987, O'Shanghnessy and Jayasuriya 1987).

The Inquiry needs to recognise that logging has significant impacts on water yields from native forests, such that:

- a. Reduction of mature and oldgrowth forest to younger growth stages will cause a significant reduction in water yields;**
- b. Water yields will increase with increasing forest maturity; and,**
- c. Logging should be excluded from significant water catchments.**

2.5. Dieback

Bell Miner Associated Dieback (BMAD) is recognised as a significant problem and growing threat to thousands of hectares of forests in UNE, it has been listed as a “Key Threatening Process” (KTP) and identified as affecting timber and water yields, as well as many plants and animals. It is associated with the invasion of forest understoreys by the weed Lantana (another KTP) following logging. It occurs in one of our audited areas. Despite the presence of an Endangered Ecological Community and an endangered wallaby in the same area we found that Forests NSW made no attempt to delineate the area affected by dieback, logged most of the healthiest trees remaining, and has no intention to rehabilitate the severely degraded “forest” left behind. Both Forests NSW and DECCW appear disinterested in the problems caused by BMAD and Lantana invasion, and the need for active rehabilitation of affected stands.

There are many forms of dieback affecting native forests and remnant trees in partially cleared land in NSW. The most obvious example of forest ecosystem collapse in NSW is the dieback associated with logged forests, psyllid infestations and colonies of the Bell Miner. “Bell Miner Associated Dieback” (BMAD) has affected tens of thousands of hectares of forests in north-east NSW, in severe cases leading to death of trees and replacement by lantana.

The Bell Miner Associated Dieback Working Group (BMADWG 2004) summarise the problem:

Bell miners are a natural part of eucalypt ecosystems and normally have minor and positive impacts on forests. However, increases in Bell miner populations and their distribution, in addition to other factors such as tree stress, psyllid infestation, dense forest understoreys as well as weed invasion, drought, logging, road construction, pasture improvement, bio-diversity loss both floral and faunal, soil nutrient changes, and changing fire and grazing regimes have all been implicated in the spread of dieback. The outward expression of BMAD is generally characterised by:

- *trees stressed and dying;*
- *high populations of psyllids and other sap-sucking insects contributing to tree stress;*
- *high Bell miner numbers, with their aggressive territorial behaviour, driving away insectivorous birds that would otherwise help to control insect numbers;*
- *alteration of the forest structure: canopy and midstories depleted with grassy and wet and dry sclerophyll understoreys replaced by dense shrubby vegetation, often associated with lantana invasion*

The Bell Miner Associated Dieback Working Group (BMADWG 2004) summarise the consequences:

The potential impacts of BMAD on forest productivity and biodiversity cannot be overstated.

Potential impacts for conservation include:

- *Extreme degradation of forest ecosystems in World Heritage listed National Parks such as Border Ranges NP, Murray Scrub and Dome Mountain in Toonumbar NP, Bungdoozle and Cambridge Plateau in Richmond Range NP, Mt Nothofagus NP, Kooreelah NP, and Mt Clunie NP.*
- *Major disruption in ecosystem function, and reduction in diversity and abundance of threatened flora and fauna species including Dunn's White Gum (*Eucalyptus dunni*) and Rufous Bettong (*Aepyprymnus rufescens*) across all land tenures,*
- *Increased weed invasion and associated displacement of native forest species.*

Impacts on forest productivity can be severe. Dieback defoliates the crown, ultimately leading to the death of standing trees. Not only do the standing trees die, but the lack of foliage and flowering and subsequent fruiting, reduce and eventually eliminate the seed production necessary for forest regeneration. Dense understorey development (primarily Lantana weed invasion in northern NSW and Cissus in the south) continues with little overstorey and reduced alternative species competition. Reduced eucalypt flowering directly impacts on honey production and on bird species and populations that compete with Bell miners.

Impacts of BMAD on private lands are significant, as these areas are critical to the livelihoods and well being of local communities. Forest woodlots and timber supplies, honey production, shelter belts and forest-related lifestyles are under threat from BMAD.

Local economies may also be impacted through declining forest tourism as dieback reduces the value, significance and aesthetic appeal of the forests.

In 2004 Forests NSW identified almost 20,000 hectares of the approximately 100,000 hectares of apparently susceptible forest types in an area of north-eastern NSW bounded by the Border Ranges, Richmond Ranges and Captains Creek as being affected by dieback attributed to BMAD (Wardell-Johnson et. al. 2006). The NSW Scientific Committee's (2008) final determination for listing 'Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners' as a Key Threatening Process notes that:

Of the affected area, approximately one third (6511 ha) has been assessed as 'severe', with 'many dead trees, severe thinning of crowns, low stocking rate of susceptible species and greatly increased mesophyllic ground story vegetation including weeds such as lantana' (State Forests of NSW, 2004).

Wardell-Johnson et. al. (2006) state

Bell Miner Associated Dieback (BMAD) is a significant threat to the sustainability of the moist eucalypt forests of north-eastern NSW and south-eastern Qld, and to biodiversity conservation at a national scale.

...

BMAD is a nationally significant conservation problem that has the potential to reduce the chances of achieving sustainable forest management in north-eastern NSW. There is a strong likelihood for significant biodiversity loss in the medium future in the general region, including south-eastern Qld, as well as reduced available timber volumes. Blaming Bell miners for the problem will not lead to its resolution.

...

The severity of the BMAD problem is such that tens of thousands of hectares in north-eastern NSW is currently affected with over 2.5 million hectares considered potentially vulnerable (Ron Billyard pers comm., Nov. 2004). A substantial (although uncertain) area of south-eastern Queensland is similarly affected, although less attention has been directed there. BMAD occurs on both public and private land and the area affected is expanding rapidly. The severe impact of this form of forest canopy dieback has profound implications for the conservation of the internationally significant biodiversity of the region.

There are numerous requirements for Forests NSW to redress dieback and restore degraded areas to a healthy and productive condition.

The IFOA (2.7.1) requires that in carrying out forestry operations "SFNSW must give effect to the principles of ecologically sustainable forest management as set out in Chapter 3 of the document entitled, "ESFM Group Technical Framework".

Principle 1 is: *Maintain or increase the full suite of forest values for present and future generations across the NSW native forest estate.* Relevant specific criteria are:

3.2.1.2 *The productive capacity and sustainability of forest ecosystems maintain ecological processes within forests (such as the formation of soil, energy flows and the carbon, nutrient and water cycles, fauna and flora communities and their interactions); maintain or increase the ability of forest ecosystems to produce biomass whether utilised by society or as part of nutrient and energy cycles; ensure the rate of removal of any forest products is consistent with ecologically sustainable levels; ensure the effects of activities/disturbances which threaten forests, forest health or forest values are without impact, or limited.*

3.2.1.3 *Forest ecosystem health and vitality*

...
ensure the effects of activities/disturbances within forests, their scale and intensity, including their cumulative effects are controlled and are benign; restore and maintain the suite of attributes (ecological condition, species composition and structure of native forests) where forest health and vitality have been degraded.

The IFO (4.26) also requires:

SFNSW must ensure that the scale and intensity at which it carries out, or authorises the carrying out of, forest products operations in any part of the Upper North East Region, does not hinder the sustained ecological viability of the relevant species of tree, shrub or other vegetation within the part.

Forests NSW's (2005) ESFM Plan identifies as policy:

Forests NSW will maintain or enhance the health and productivity of forests to support nature conservation, timber production and other ecologically sustainable uses in Upper North East (UNE) Region.

In relation to BMAD Forests NSW (2005) go on to state:

Chronic decline occurs when long term environmental changes, as a result of human management, impair tree health. It is increasing throughout dry and moist eucalypt forests, particularly in coastal areas. Approximately 20,000 ha of forest within UNE Region, including about 6,000 ha on State forest is showing signs of decline while a larger area of forest throughout the region is thought to be susceptible.

In UNE Region; Forests NSW is collaborating with other agencies, universities, landholders and conservation groups through the Bell Miner Associated Dieback Working Group in the coordination of efforts to better manage chronic decline. The group has identified key actions that need to be undertaken to develop effective management measures including surveying and assessing the extent of decline, supporting independent literature review, lantana removal trials, guidelines for restoration of affected areas and promotion of the issue.

...
Declining forests are susceptible to invasion by exotic weeds such as lantana because unhealthy trees are weak competitors, and the weeds are better adapted to changed soil conditions that make the trees unhealthy.

One of the requirements of the UNE Forest Agreement (2.11.2, Appendix 9) is annual reporting on factors affecting forest health:

Indicator 3.1.a Area and percent of forest affected by processes or agents that may change ecosystem health and vitality (narrative as interim).

Rationale

A number of agents can affect ecological processes in forests and may produce significant changes to the condition of the forest. This indicator measures the areas affected by those processes, and the level of impact within those areas.

Indicative target

Minimisation of the area and percent of forest affected by processes or agents that reduce ecosystem health and vitality. Note that on the level of individual agents, specific targets may be generated with further research.

Data requirements and Monitoring methodology

Processes and agents that may change ecosystem functioning need to be identified on a regional basis. These include interactions between natural events and management actions in the following areas; fire, climatic events, river regulation, salinisation, grazing, introduction of exotic biota, logging, clearing, roading, bell-miner dieback, insects and diseases.

RFAFTI data should be considered as baseline data, e.g., disturbance codes.

Data from agency fire monitoring, pest control programs and pest survey and research. Data may be generated out of local observation.

Reporting

Narrative, and where possible quantitative, reporting of the area and percent of forest affected by given processes or agents considered important at a regional level.

Narrative, and where possible quantitative, reporting of the area and percent of forest where given processes or agents are controlled or their effects are countered by rehabilitation.

Reporting processes should distinguish between natural and human induced effects.

The RFA reviews recognize the significance of BMAD, The seriousness of BMAD is stated in the NSW & CoA (2009) 5 year review of the RFA:

*The resultant cycle of tree stress commonly causes the eventual death of forest stands, and serious ecosystem decline. In NSW the potential impact of BMAD-induced native vegetation dieback represents a serious threat to sclerophyll forest communities, particularly wet sclerophyll forests, from Queensland to the Victorian border. The forests most susceptible to dieback are those dominated by Dunn's white gum (*Eucalyptus dunnii*), Sydney blue gum (*E. saligna*), flooded gum (*E. grandis*) and grey ironbark (*E. siderophloia*). There is also evidence that some normally nonsusceptible dry sclerophyll types may be affected when dieback is extreme. Current estimates place the potential at-risk areas at a minimum of approximately two and a half million hectares across both public and private land tenures in NSW.*

BMAD is emerging as a pressing forest management issue in both the UNE and LNE regions. The potential impacts include:

*degradation of sclerophyll forest ecosystems across the UNE and LNE
reduction in diversity and abundance of threatened flora and fauna species including Dunn's white gum and rufous bettong
increased weed invasion and associated displacement of native forest species.*

Dieback-affected areas are located in the catchments of the major rivers of the North Coast of NSW including the Tweed, Richmond, Clarence, Macleay and Hastings. Maintenance of water quality in these river systems is critically dependent on maintenance of healthy forest cover over the catchment uplands. Bell miner associated dieback has the potential to degrade these forests, and consequently impact negatively on rivers and catchment communities through increased sediment and nutrient loads, and increased frequency and intensity of flooding.

The 2003/4 FA implementation report (NSW Government 2007) and DECCW (2010) echo these concerns and identify BMAD as “a serious threat to sclerophyll forest communities, particularly wet sclerophyll forests”. The NSW&CoA (2009) 5 year RFA review identifies that BMAD “is of prime concern in the northern forest regions of the state”.

Continued logging of BMAD areas can-not be considered to be maintaining ecological processes, conducive to biomass production, to be ecologically sustainable, without (limited) impact, benign, restorative of forest health, or not to hinder the ecological viability of the natural vegetation. This is degrading the forest ecosystems and forest productivity. Logging of affected areas is clearly not in accord with any of the principles of ecologically sustainable forest management.

2.5.1. The causes of Bell Miner Associated Dieback

NEFA considers that in the UNE Bell Miner Associated Dieback is typically associated with heavily logged forests where much of the overstorey has been removed and the understorey invaded by lantana. While we recognise that there are a variety of confounding factors we consider heavy logging to be the primary factor responsible for its current extent. Our concern is that the range of secondary factors are being used to confuse the issue and frustrate required responses.

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

Broad-scale canopy dieback associated with psyllids and Bell Miners usually occurs in disturbed landscapes, and involves interactions between habitat fragmentation, logging, nutrient enrichment, altered fire regimes and weed-invasion (Wardell-Johnson et al. 2006). At present, no single cause explains this form of dieback, and it appears that ‘Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners’ cannot be arrested by controlling a single factor. Over-abundant psyllid populations and Bell Miner colonies tend to be initiated in sites with high soil moisture and suitable tree species where tree canopy cover has been reduced by 35 – 65 % and which contain a dense understorey, often of Lantana camara (C Stone in litt.).

...Increased light intensity associated with canopy reduction promotes the growth of the expanding foliage preferred by psyllids as well as understorey growth which is also influenced by altered fire regimes. Increased understorey growth, particularly of the invasive weed Lantana camara, suppresses eucalypt regeneration and provides enhanced shelter and safer nest sites for Bell Miners.

Stone et. al. (1995) found that the affected areas range in size from 1 ha to nearly 100 hectares, with the Sydney Blue Gum league of forest types (FT no’s 46, 49, 53 and 54) most affected and the grey ironbark/grey gum league (FT 60) second most affected. They note that “The vast majority of plots (97%) had been exposed to some degree of logging and were on their second or third rotations”, postulating “that bell miners prefer a dense understorey and a discontinuous sclerophyll overstorey.” Stone et. al. (1995) concluded that:

“A possible long-term explanation of why the dieback problem may be increasing, is that the proportion of moist sclerophyll forest being exposed to selective logging is increasing throughout the State. In support of this argument is the observation that the non-logged old growth Sydney blue gum stands in Pt. Giro State Forest (Walcha District) are in good health(based on aerial observations) and bell miner colonies appear to be absent in this forest (R. Kirwood, Forester, Walcha District, pers. Comm.).”

Wardell-Johnson et. al. (2006) state

A range of multi-tropic attributes (e.g. local climate/host tree condition and structure/natural enemies) have been identified as contributing to elevated psyllid

populations. Fragmentation, changed disturbance regimes (particularly fire and logging), and pathogens are implicated. Changes in nutrients and other soil constituents, climatic regimes and hydrological factors have also been implicated.

...

Logging and associated disturbances can have direct and indirect effects on overstorey, midstorey and understorey structure and floristics. However, studies directly associating logging, forest structure, floristics and BMAD have not been carried out. While the proliferation of dominant understorey weeds, such as *Lantana* (*Lantana camara*), in the north-eastern region of NSW has largely been attributed to the disturbance caused by logging and associated activities, no direct link between BMAD and *Lantana* has been established.

...

Bower (1998) argued that it is probable that broad-scale habitat modification through intensive logging operations and subsequent *Lantana* domination has promoted conditions that favour the establishment of psyllids and Bell miner colonies.

...

Kavanagh and Stanton (2003) argued that their findings supported the hypothesis that the disturbance associated with logging can be a contributing factor in creating the habitat conditions required by Bell miners.

...

...Stone (1999) suggested that selective logging without effective overstorey regeneration encouraged dense understorey development. She suggested that this provided conditions favouring the colonisation of Bell miners. Stone (1999) argued that Bell miners then trigger forest decline because they interfere with predators that would otherwise regulate folivorous insects.

...

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

...we have not been able to locate information concerning the impacts of logging on BMAD. We find it surprising that more information is not available concerning the direct and indirect impacts of logging, in the preferred Bell miner habitat of north-eastern NSW. The increase in the area of BMAD has potential not only for significant biodiversity loss, but also for significant reduction in timber yields from these eucalypt stands.

In the UNE BMAD is most commonly associated with the invasive weed *lantana*. Even where not associated with dieback, *lantana* is the most significant understorey weed in UNE. In deciding to list the Invasion, establishment and spread of *Lantana* (*Lantana camara* L. sens. lat) as a key threatening process, the NSW Scientific Committee note:

9. *L. camara* readily invades disturbed sites and communities. Various types of sclerophyll woodlands, sclerophyll forests, rainforests and dry rainforests are all susceptible to *Lantana* establishment ... There is a strong correlation between *Lantana* establishment and disturbance (Stock and Wild 2002; Stock 2004), with critical factors being disturbance-mediated increases in light and available soil nutrients (Gentle and Duggin 1998) and, in rainforest, the competitive advantage of seedlings relative to many native species (Stock 2004). ...

...

16. The generally suppressive effect of *Lantana* on a wide range of native species is attested by several studies (Gentle and Duggin 1998, Day et al. 2003) and a multitude of field observations. Swarbrick et al. (1995), citing observations by Driscoll and Quinlan (1985) that "eucalypt seedlings generally fail to establish under *lantana*", infer inhibition of germination through lack of light.

...

22. *L. camara* is "regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts" (CRC Weed Management 2003). It is one of the initial 20 Weeds of National Significance declared under the National Weeds Strategy, and a national Lantana Strategic Plan has been adopted (ARMCANZ ANZECC&FM 2001). ...

In relation to lantana, the Bell Miner Associated Dieback Working Group (BMADWG 2004) state:

Lantana is a highly invasive weed affecting a range of land-use types within a wide range of climates and topographies of Australia. The complexity of this weed is amplified by its 29 different varieties, difficulty in integrating control measures and finding suitable biocontrol agents. The extensive infestation across more than 4 million hectares poses a threat to economically effective control. Lantana is a social problem for landholders and community. The National Lantana Strategy highlights the need for increased responsible action and incentive to landholders, local government, regions and State government to take action. The Strategy establishes the National Lantana Management Group; provides for extension and education; encourages best practice in lantana control and management; and includes a community biocontrol element encouraging adoption of biological control measures.

Wardell-Johnson et. al. (2006) state

While Lantana may not be a primary causal factor initiating BMAD, the literature suggests that its presence reflects increased canopy opening, which in itself may be a primary cause for increases in psyllids. These outbreaks in turn may attract the presence of Bell miners, which have the benefit of increased food resources and suitable structure for nesting. There has been some advocacy for management strategies which reduce weed encroachment and plant community degradation to identify and maintain ecological barriers to Lantana invasion. Because large areas in the region affected by BMAD are dominated by Lantana, there has also been advocacy towards the use of fire as a means of Lantana control.

...

For the environments in which BMAD occurs, arguments have been presented suggesting a need both for more frequent fire, and for less frequent fire in particular ecosystems. ...

...

... Lantana in particular has become a dominant understorey plant in open areas of eucalypt forest in the region (Bower 1998; Wardell-Johnson et al., 2005). There have been many recent changes in agriculture and forest management in north-eastern NSW that have been associated with the spread and intensification of Lantana in particular, but also a wide range of other weedy species (see Kanowski et al., 2003; Wardell-Johnson et al., 2005).

...

Bower (1998) argued that the proliferation of Lantana in his study areas was largely associated with the disturbance associated with logging activities which improves the conditions for Lantana germination and recruitment. Bower (1998) further argued that while high intensity burns can be effective at controlling Lantana, many post-logging burns are of low to medium intensity and have often been found to be ineffective at controlling Lantana, which resprouts from basal stems. Bower (1998) argued that the inability of Lantana dominated areas to regenerate significantly impacts on the succession of a structurally complex forest ecosystem.

...

Gentle and Duggin (1997)...found that shading played a greater role as a limiting factor than any other and concluded that successful invasions of Lantana are likely to occur whenever canopy disturbances create patches of increased light availability. ...

...

... While it is no surprise that Lantana proliferates as the eucalypt canopy opens or dies or that Lantana is associated with events which disturb the soil and open the ground to sunlight, this does not mean that Lantana is a cause of BMAD.

While there have been a number of logging trials established, the principal problem is that Forests NSW continue to log in and adjacent to BMAD areas without considering the impacts of their operations on the proliferation of the Key Threatening Processes of BMAD and Lantana invasion. In affected areas logging is focussing on the removal of most of the healthiest trees surviving, is promoting lantana due to extensive understorey removal, and this degradation then favours BMAD. And they can not be bothered monitoring the effects or undertaking post-logging rehabilitation. These impacts will be compounded by increasing severity of droughts due to climate change (which is likely to already be a factor in the spread of this problem).

2.5.2. What is being done about Bell Miner Associated Dieback

The North East Forest Alliance has been pursuing the issue of Bell Miner Associated Dieback for over twenty years. We tried to get it addressed in the Environmental Impact Statements prepared in the early 1990s. This was a major issue we pursued when we were on the North East Harvesting Advisory Board in 1996/8. We unsuccessfully attempted to have this issue dealt with in the CRA process. We have been involved with the BMAD Working Group since early 2002.

While we recognise that we have made some progress over that time the condition of the forests has continued to decline, and Forests NSW are continuing to ignore and compound the problem in their logging operations.

State Forests recognised dieback associated with psyllids as a significant problem in the Gosford-Wyong area of north-east NSW in 1950 (Moore 1959). Stands of Sydney Blue Gum were reported as dying during the period 1949 to 1958, *“the increasing numbers of deaths reaching economic significance toward the end of that period”* (Moore 1959). The two areas assessed by Moore showed 55% and 59% of trees as dead or expected to die. Moore (1959) hypothesised that *“the abnormal rainfall adversely affected the physiology of Eucalyptus and other species generally, making them susceptible to heavy attack by psyllids.”* Bird et. al. (1975) report Moore (1962) as finding that *“there were more than 150 separate occurrences of variable extent up to 1,500 ha.”*

Wyong District Forester, Charlie Mackowski (pers. comm.), noted that field work in the early 1990's had delineated 5,000 hectares of “Bellbird Dieback” on State Forests in the then Wyong District.

Forests NSW (Stone et. al. 1995) have identified significant areas of dieback in the Morisset, Bulahdelah, Gloucester, Taree, Wauchope, Kempsey, Walcha and Urbenville districts. Stone et. al. (1995) notes *“More recently, District staff have reported that affected areas are increasing in size and that previously unaffected areas are developing symptoms.”*

In 2003 the NSW Nature Conservation Council Annual Conference unanimously passed the resolution:

“that there should be no further logging in BMAD affected forests or those at high risk of developing BMAD until the causes of the problem are better understood and an acceptable, sustainable management plan is developed to restore the health of these forests”.

The Bell Miner Associated Dieback Working Group (BMADWG 2004) has identified key actions that they consider need to be undertaken in order to develop effective management measures for BMAD. They do not address logging directly, though include “Developing

guidelines for restoration of dieback affected sites which may be implemented by landholders and government agencies”.

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

8. Due to the complex interaction between factors that have been altered as a consequence of landscape-level disturbance, there is at present no obvious means of arresting the threat presented by 'Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners'. Moreover, expert opinion varies considerably as to which factors are causes of dieback and which factors are effects. Broad-scale research and adaptive management are required to understand how to best manage this threatening process, to prevent its expansion throughout forests of eastern New South Wales.

NEFA understand (J. Morrison pers. com.) that DECCW are presently preparing a 'Statement of Intent' to address the BMAD Key Threatening Process determination. NEFA note that this is a considerably weaker response than the preparation of a 'Threat Abatement Plan' and is only required on the NPWS estate. NEFA consider that attempts to address the BMAD issue warrants strong legislative requirements across all tenures in relation to disturbance to at risk forests and mandatory requirements to undertake post disturbance rehabilitation where disturbance cannot be avoided.

The Bell Miner Associated Dieback Working Group (BMADWG 2004) identifies Forests NSW's claimed approach:

Consistent with the EFSM requirements FNSW are preparing Regional Forest Health Management Plans as part of the Native Forest Health Management Strategy. The current management intent is to integrate native forest harvesting with trials to reduce the spread of dieback into open forests by use of frequent low intensity fire and to trial rehabilitation methods for dieback affected areas.

While some trials have been instigated, the heavy logging of BMAD affected areas continues unabated.

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

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

Forests with existing colonies of bell miners and susceptible tree species are at very high risk of developing BMAD following disturbance and subsequent weed invasion. NEFA considers that considerable resources need to be directed towards rehabilitation of extensive weed infested tracts of susceptible forest types, and the minimizing of disturbance to less than thirty percent canopy removal relative to a fully stocked healthy forest stand.

When NEFA were on the North East Harvesting Advisory Board in the late 90s we attempted to get Forests NSW to map dieback areas in compartments on harvest plans. According to Jim Morrison (pers. comm. 2010) the BMAD Working Group's attempts to get Forests NSW to take appropriate action has been similarly frustrated:

The BMADWG has for a number of years requested that FNSW record simple data about the presence of Bell Miners and or associated dieback on its harvest plans as they are prepared. Systematic, simple BMAD identification procedures urgently need to be made a mandatory part of the harvest planning process. This could be done when ecological surveys are undertaken, and also by the harvesting forester and be required to be reported just like any other threat identified in logging compartments. In fact the continued refusal of Forest NSW to undertake this simple task requested by

the BMADWG only heighten suspicion that Forest NSW don't want to reveal the full extent of the problem across its estate.

There is an urgent need for a moratorium on logging in and adjacent to Bell Miner Associated Dieback areas until such time as a responsible response to this growing problem is identified.

2.5.3. A Case Study in Management

The audit of Yabbra (Pugh 2009) encompassed a large expanse of forests in Compartment 163 suffering from Bell Miner Associated Dieback (BMAD), with a dense lantana understorey in places. The forest ecosystems most affected are Grey Box-Red Gum-Grey Ironbark, and Wet Bloodwood-Tallowwood, which have achieved 41% and 82% respectively of their national reservation targets (including in Informal Reserves and Protection by Prescription). Also affected is the Endangered Ecological Community *White Gum Moist Forest*. In the affected areas there were numerous sick and dead trees with extensive lantana understoreys.

The degraded nature of these stands can be largely attributed to past logging opening up the overstorey and burning regimes promoting lantana. The creation of a low dense understorey and opening up of the canopy are factors which favour dominance by Bell Miners. The Bell Miners in turn facilitate lerp predation on retained trees and regrowth, causing widespread dieback.

These forests had been suffering from Bell Miner Associated Dieback for over thirty years (pers. obs.) and thus those trees still hanging on were survivors. It is likely that the presence of Yellow-bellied Gliders assisted their survival by preying on lerps. Though the ability of the few trees now remaining to persist has been jeopardised by Forests NSW's felling of the sap and feed trees required to be retained to maintain Yellow-bellied Gliders in the area.

The Harvesting Plan for compartments 162 and 163 of Yabbra SF (4.2) states:

Lantana & shrubby understorey is providing conditions suitable for occurrence of Bell Minor (sic) Associated Dieback (BMAD). A significant section of the harvest area has been adversely affected. There are many dead stems and the crowns of some of the remaining trees are thin and appear unhealthy. BMAD affected areas will have unhealthy merchantable trees removed during this operation.

This is it. There was no mapping of dieback areas, no assessment of severity, no consideration of amelioration measures to apply in dieback areas, nothing.

The applied logging prescription "*BMAD affected areas will have unhealthy merchantable trees removed during this operation*" resulted in a logging intensity well in excess of the 35% Basal Area removal claimed in the harvesting plan and the maximum 40% allowed to be removed by the IFOA (1.5.10) silvicultural practices. What is effectively a "maximum economic utilisation" silvicultural regime is not allowed for by the UNE IFOA.

Given that most eucalypt trees in the worst affected areas were either dead or unhealthy, this prescription resulted in the removal of most of the biggest and healthiest trees from the dieback areas. Some retained trees were killed in the post logging burn and others by the added stress.

PHOTOS: Bell Miner Associated Dieback areas in Yabba subject to maximum economic utilisation logging. No rehabilitation is proposed and regeneration is currently being smothered by weeds.



From our audit (Pugh 2009), we reported that:

Most remaining healthy trees were removed from forests affected by Bell Miner Associated Dieback (resultant from previous logging operations), having significant degrading impacts on forest health, ecosystem functioning and viability and forest productivity. Many retained affected trees had then succumbed to the hot post-harvest burn. This logging and “management” is clearly not in accord with any of the principles of ecologically sustainable forest management as defined in the IFOA (breaches IFOA conditions 2.7.1 and 4.26).

Bell Miner colony establishment was noted to be widespread throughout Compartments 162 and 163 and appeared to have been favoured by the logging and burning operations. It can be expected that the threatening process associated with colonies of this species (BMAD) will cause further deaths of trees, severely retard forest recovery and result in the loss of substantial areas of threatened species’ habitat in the mid to long-term.

It was obvious to those visiting the site that there had been excessive canopy removal, though neither Forests NSW nor DECCW would accede to our request to measure tree retention by establishing transects as required in their own auditing manual. Initially both Forests NSW and DECCW told NEFA that it was impossible to audit tree retention, though in accordance with an IFOA requirement in 2003 Forests NSW developed a “Forests Practices Circular” (2003/01) “Monitoring and Measuring Compliance of Operations” which includes a “Compliance check sheet – Tree retention”. It basically requires the recording of trees on 250m transects. That neither DECCW nor the forester in charge of auditing Yabba realised that such a methodology existed specifically to audit retention of habitat trees, recruit trees, Yellow-bellied Glider feed trees, winter flowering trees, and Koala feed trees is a worry.

The outcomes from this logging and burning of the dieback areas were significant reductions in canopy cover, further degradation of the understorey, and prolific weed growth, particularly of lantana. While there has been eucalypt regeneration amongst the weeds, the problem for Forests NSW is that this means that the weeds can not be burnt until the eucalypts are large enough to survive the burn. Many will not be able to out-compete the weeds. The forestry operations have greatly compounded the existing BMAD problems and left the dieback areas in a parlous state (see photos Pugh 2009).

In DECCW’s response (Simon Smith, 19/5/2010) they dismiss our concerns regarding BMAD on the spurious grounds that the logging, burning and subsequent weed proliferation that occurred in and adjacent to an existing BMAD area could not be proved to have affected it:

DECCW notes your concerns regarding Bell Miner Associated Dieback (BMAD) and the principles of ecologically sustainable forest management. It is noted however that the NSW Scientific Committee's determination in relation to broad-scale canopy dieback associated with psyllids and Bell Miners "involves interactions between habitat fragmentation, logging, nutrient enrichment, altered fire regimes and weed-invasion". The Scientific Committee's determination also notes that "at present, no single cause explains this form of dieback. And it appears that 'Forest eucalypt associated with over-abundant psyllids and Bell Miners' cannot be arrested by controlling a single factor". An Inter-agency BMAD working group is working to improve knowledge on the interrelation of land management activities and the prevalence of BMAD.,

*...
As noted above, the NSW Scientific Committee's determination notes that there is inadequate information available to determine if Bell Miner populations and Bell Miner associated Dieback has been favoured by these logging and burning operations.*

This is an abomination of the "Precautionary Principle" in that lack of certainty about the interaction of known causative agents of BMAD is used to justify undertaking activities known to contribute to dieback. What is most reprehensible is that DECCW did not consider that the undertaking of activities that were likely to aggravate the BMAD, a Key Threatening Process, even warranted documenting and monitoring.

It is evident that logging is a contributing factor to Bell Miner Associated Dieback, and that the reduction in canopy and the growth in weeds (enhanced by the hot fire) are contributing factors to this key threatening process and will thus exasperate existing problems. As can be seen from the photographs (Pugh 2009) the forest is a mess.

The fact that the BMAD in compartment 163 is affecting inadequately reserved forest ecosystems, the endangered ecological community *White Gum Moist Forest*, and known locations of the Endangered Black-striped Wallaby, vulnerable Yellow-bellied Glider and vulnerable Brush-tailed Phascogale, appears to be irrelevant to DECCW.

By no stretch of anyone's imagination can logging of these dieback areas be considered "ecologically sustainable". As is particularly obvious in compartment 163, logging is being undertaken in dieback areas in contravention of silvicultural requirements to apply single tree selection, retain 60% of basal area of trees above 20cm dbh, and concentrate growth on the more vigorous trees while promoting low level site disturbance for regeneration. Rather logging is based on a maximum economic utilization basis.

Despite BMAD and lantana being emphasized in our audit, and on a site inspection with Forests NSW's CEO Nick Roberts, in Forests NSW's (2010) subsequent "Rehabilitation and Monitoring Plan, Compartments 162 and 163 Yabba State Forest No 394" there is no mention what-so-ever of the dieback issue, no delineation of problem areas, and no identification of rehabilitation measures relevant to the problem. There is no identification of problem and noxious weeds, not even a mention of Lantana. This plan has been endorsed by DECCW.

There are generic prescriptions for enrichment plantings with eucalypts and Hoop Pine should sites requiring rehabilitation be identified, though no such sites have been identified. There is also an intention to "*Introduce and maintain low intensity fire regime into the grassy forest areas on 3-5 year cycle*", though this is inappropriate in eucalypt regrowth and in areas that naturally have a rainforest understorey. Given that most of the understorey in the dieback areas is now thick weeds with a scattering of eucalypt seedling which have little chance of out-competing the lantana, the forest is in a parlous state. If they burn it again they will just kill the eucalypt seedlings. The only commitment is to some unspecified monitoring – they can watch the seedlings die.

There is no commitment for any immediate action to control rampant weeds and assist recovery of dieback areas despite the need for immediate action being obvious. It is a do nothing, wait and see, response to an urgent problem. Unless NEFA can force action we suspect we will be waiting a long time.

It is apparent that the logging of the Bell Miner Associated Dieback area in Compartment 163 is in contravention of the silvicultural prescriptions of the Harvesting Plan (2.1 and 4.3), the limits to silvicultural prescriptions specified in the IFOA (1.5.3), the ESFM principles (i.e. 3.2.1.2, 3.2.1.3) required by the IFOA (2.7.1, also 4.26), and the Australian Forestry Standards aimed at maintaining forest productivity and health (4.1.4., 4.4.1., 4.4.2, 4.4.3, 4.4.4., 4.4.5., 4.5.1., 4.5.2., and 4.5.4). What is most significant is that neither Forests NSW nor DECCW apparently care.

BMAD needs to be dealt with as a serious issue. It is contrary to the most basic principles of ESFM that Forests NSW can go on logging areas affected by BMAD, particularly as there is sufficient evidence that this is likely to aggravate the problem. For Forests NSW to be allowed to practice maximum economic usage in the worst affected stands, without specific management prescriptions, a specific rehabilitation plan, and at least a pretence of scientific monitoring, is grossly irresponsible.

The reality is that in the most heavily logged areas the survival of the stands of inadequately reserved ecosystems is doubtful and that the productive capacity of these ecosystems has been dramatically diminished to the point of being unlikely to provide any timber resources for a considerable time. BMAD is now likely to worsen and expand into the healthier stands (including Dunn's White Gum), native species have been diminished and weeds promoted. Anyone buying timber sourced from such dieback areas are aiding and abetting this environmental vandalism.

The Inquiry needs to recognise that Bell Miner Associated Dieback is a significant threat to native forests and that appropriate management involves:

- a. Identifying and mapping all affected and susceptible areas;**
- b. Placing all affected and susceptible areas under a logging moratorium until such time as appropriate management responses that maintain ecosystem functioning are identified; and,**
- c. Undertaking rehabilitation works (i.e. weed control) in affected stands.**

2.6. Atmospheric Carbon

Solving the climate change problem facing Australia and the world requires that emissions of greenhouse gases be reduced and that the storage of carbon in vegetation be increased, so as to enable atmospheric concentrations of greenhouse gasses to be stabilized at a level that avoids the most dangerous climate changes.

The need for reducing emissions from deforestation and forest degradation is now recognized by the international community as an essential part of solution to addressing carbon emissions. Since the 2007 United Nations Climate Change Conference in Bali international negotiations have focused on the role of natural forests in storing carbon.

Native forests play a significant role in the storage of carbon and the sequestration of carbon dioxide from the atmosphere. Old growth forests are the most significant carbon storehouses, with most carbon stored in the oldest and biggest trees (Roxburgh *et.al.* 2006, Mackey *et. al.* 2008). Old-growth forests also remove carbon dioxide from the atmosphere and sequester it in live woody tissues and slowly decomposing organic matter in litter and soil. (Zhou *et. al.* 2006, Luysaert *et. al.* 2008)

Mackey *et. al.* (2008) found;

Our analyses showed that the stock of carbon for intact natural forests in south-eastern Australia was about 640 t C ha⁻¹ of total carbon (biomass plus soil, with a standard deviation of 383), with 360 t C ha⁻¹ of biomass carbon (living plus dead biomass, with a standard deviation of 277). The average net primary productivity (NPP) of these natural forests was 12 t C ha⁻¹ yr⁻¹ (with a standard deviation of 1.8).

Average Carbon Carrying Capacity of the Eucalypt Forests of South-eastern Australia. (from Mackey *et. al.* 2008)

Carbon component	Soil	Living biomass	Total biomass	Total carbon
Carbon stock ha⁻¹ (t C ha⁻¹)	280 (161)	289 (226)	360 (277)	640 (383)

Carbon stock per hectare is represented as a mean and standard deviation (in parentheses), which represents the variation in modelled estimates across the region

Logging significantly reduces the volume of carbon stored in forests. In regards to logging Mackey *et. al.* (2008) note:

The carbon stock of forests subject to commercial logging, and of monoculture plantations in particular, will always be significantly less on average (~40 to 60 per cent depending on the intensity of land use and forest type) than the carbon stock of natural, undisturbed forests.

...

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

It is important to recognise the outstanding contribution of big old trees to storage of carbon in forests. For example Roxburgh *et.al.* (2006) found:

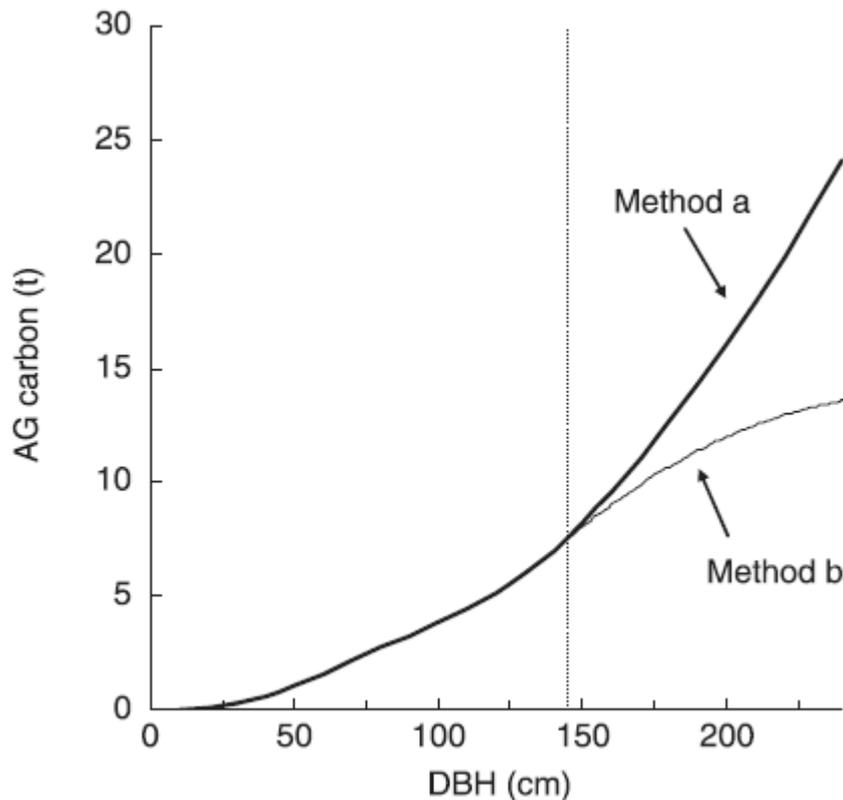
In mature forests, large diameter trees greater than 100 cm d.b.h. comprised 18% of all trees greater than 20 cm d.b.h. and contained 54% of the total above-ground carbon in living vegetation. ... The influence of large trees on carbon stock therefore increases with their increasing size and abundance.

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

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

This is compatible with the findings of Harmon *et. al.* (1990) in America, who found that during simulated harvesting carbon storage is reduced by 49-62% and does not approach old growth storage capacity for at least 200 years (even when storage in wooden buildings is accounted for).

Above-ground biomass/carbon relationship to tree diameter at breast height. From Roxburgh *et al.* (2006). Method A assumes minimal internal tree decomposition. Method B allows for internal decay.



Mackey *et al.* (2008) state:

Conventional approaches to estimating biomass carbon stocks are based on stand-level commercial forestry inventory techniques. These data are not, however, suitable for calculating the carbon carrying capacity of natural forests.

Roxburgh *et al.* (2006) and Mackey *et al.* (2008) advocate an approach to assessing the carbon stocks of native forests based on the Carbon Carrying Capacity of oldgrowth forest. Mackey *et al.* (2008) consider that for reliable carbon accounts two kinds of baseline are needed;

1) the current stock of carbon stored in forests; and 2) the natural carbon carrying capacity of a forest (the amount of carbon that can be stored in a forest in the absence of human land-use activity). The difference between the two is called the carbon sequestration potential—the maximum amount of carbon that can be stored if a forest is allowed to grow given prevailing climatic conditions and natural disturbance regimes

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

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

It is outrageous that the reporting on *MIG Indicator 5.1.a* only considers the sequestration of carbon in plantations and ignores the carbon budget of native forests. Even though this is the requirement, the need is simply ignored. It has been shown that it can be done, the State and Commonwealth Governments just refuse to account for native forests because they do not want to.

Reporting on carbon storage in forests by forest type, age class, and successional stages is a key requirement of the Regional Forest Agreements and essential for Australia to satisfy its international obligations. Despite this the State and Commonwealth Governments refuse to consider carbon storage and sequestration in native forests and instead only consider carbon sequestration in plantations.

This is a deliberate failing as the Governments do not want to admit that logging reduces the carbon stored in native forests and account for this loss. Forests recovering from logging will sequester carbon though it is likely that logging rates would need to be significantly reduced to achieve a nett balance between release and uptake of CO₂. There is no excuse for failing to identify the break even point.

The Inquiry needs to recognise that logging has significant impacts on carbon storage in native forests, such that:

- a. Reduction of mature and oldgrowth forest to younger growth stages will cause a significant reduction in carbon storage in forest;**
- b. Carbon storage will increase with increasing forest maturity;**
- c. Large trees are particularly important for carbon storage; and,**
- d. Forests should be managed so that they are carbon sinks.**

3. Creating a better business environment for forest industries

The timber market in NSW is totally distorted by massive Government subsidies, inefficient resource allocations, cross-subsidisation of public native forests by plantations, lack of competitive pricing, public subsidies distorting and depressing timber values from private forests and plantations, and excessive long-term timber allocations.

As noted by URS (2008):

Native forests are managed for multiple objectives – commercial and environmental. As a result public ownership is appropriate. However, achieving economic efficiency and good public administration requires clear objectives, separated institutional and governance arrangements, adequate reporting, and competitive pricing and allocation mechanisms. However in several jurisdictions there is a lack of transparency in public management of forest resources and a lack of commercial drivers within publicly owned forest managers. A key example is where the financial performance of plantations and native forest operations are not reported separately. Non-commercial public forest management also acts to encourage downstream industry dependence on government support.

The administrative pricing system, as compared to competitive pricing, introduces distortions into prices and generally leads to lower returns to the forest owner than what would be realised in a free and competitive market. For example URS (2008) recognise that :

Administered pricing is the predominant pricing mechanism used in Australian states, excluding Victorian native forest sawlogs. This leads to poor price discovery in the marketplace. Based on the experience of the introduction of logs auctions in Victoria, and limited competitive sales in other states, administered prices appear to be lower than competitive prices. Low prices depress return on investment and can distort the allocation of resources from highest to lower value uses. Low or non-transparent prices could also fuel public scepticism of the ongoing requirement to pursue commercial utilisation of an asset which also provides environmental services. Competitive pricing can be used by public forest managers to realise true market value and capture resource rent on behalf of the community – the owners of the resource. However its use is limited outside Victoria.

...
The LVPS residual pricing methodology seeks to obtain a measure of willingness to pay, however this methodology is only used to adjust price relativities not to determine base prices and there is a high risk that the system does not result in efficient pricing outcomes that accurately reflect capacity or willingness to pay.

The most accurate and efficient way of determining true market prices is to use the market itself. Market based approaches to log pricing and allocation promote the most efficient allocation of forest resources (allocative efficiency). This is on the basis that buyers who can put the logs to most productive use will be able to outbid those with less productive possible uses. ...

While NSW has constrained its ability to implement a competitive pricing system due to its Wood Supply Agreement, every opportunity should be made to do so.

NSW has compounded its problems by issuing Wood Supply Agreements for excessively long periods beyond the time required to obtain a return on investments. This leads to further market distortions and favours inefficient processors. URS (2008) recognise:

The length of supply contracts offered by public forest agencies are generally excessive, often being much longer than pay-back period for user industries investments (e.g. saw mills). These contract lengths inhibit innovation and investment

in user industries by creating barriers to entry and inflexibility in the face of changing market conditions. ...

*...
Long term contracts create inflexibility for both forest managers and the industry. This is particularly important when supplies are being reduced as a result of continual revision of sustainable yields. The public forest managers may remain committed to their contractual obligations. In practice, such long term contracts also tend to commit the agencies to supply even in the face of changes in supply, e.g. as a result of bushfires. Such sharing of risks can lead to further deterioration in the already low profitability of native forest operations if the agency has to purchase logs from elsewhere to meet long term obligations.*

Long term supply contracts also impair the ability of the industry to effectively respond to market changes and derive the greatest value from the resource. Such changes could include changes in local and global demand for wood-based products, new technologies for processing, entrance of new processors and new investment in processing facilities and changes to transport costs.

Long term supply contracts act as a barrier to entry into the wood products industry when the supply is being reduced overall. While new entrants to the processing sector can purchase existing processors or their long-term contracts, such buyouts generally require compensation for the vendor which has to downsize or cease operations. In contrast, under short-term agreements processors are required to compete more frequently with other existing processors and new entrants.

Long term contracts have been justified as providing certainty of access for the processing sector. While such an argument may have some merit regarding the establishment of new timber processing facilities it is weak in a mature industry that has continuity of supply and adequate processing facilities in place. Indeed in practice there is likely to be a trade-off between 'certainty' of supply and industry competitiveness. The argument certainly does not justify contract lengths well in excess of the pay-back period for processing investment which is typically around 6 to 10 years.

Every opportunity should be taken to reduce the terms of Wood Supply Agreements. As state by URS (2008):

Whilst there is likely to always be a place in the Australian industry for long term contracts, there is scope to reduce the length of long term contracts to a duration more aligned with the payback period for new investment and to increase the proportion of volume sold under short term contracts. These actions would act to increase competition and improve the environment for investment by new entrants.

The Inquiry needs to recognise that NSW's Wood Supply Agreements distort the hardwood sawlog market and are for excessively long periods. The Inquiry needs to recommend that every opportunity should be taken to reduce the volumes committed and reduce the length of the agreements.

3.1. Separating plantations from native forestry

There is a deliberate confusing of plantations with native forests in NSW. Yield estimates from hardwood plantations are included with yields from native forests to disguise the true magnitude of the grossly unsustainable logging being undertaken. Similarly the financial returns from plantations are used to disguise the major losses from native forest logging. This also results in the use of plantations to subsidise native forest logging.

URS (2008) note:

If a State Government chooses to be involved in commercial plantations, profit maximisation is an appropriate objective to deliver a dividend for taxpayers in contrast to the multiple objectives of native forest management. However an agency's performance in achieving its multiple objectives for native forest plantation management should be reported separately. The New South Wales, Western Australian and Tasmanian models do not perform well on these criteria as they do not produce separate financial reports for native forest and plantation operations. ...

... In the absence of separate reporting, it is possible that softwood plantations could be used to support less profitable native forest activities. However there is no stated government policy by any Australian state supporting the provision of such subsidies.

Lack of financial reports for native forest management can exacerbate community anxiety about achievement of environmental objectives and the extent of state support for logging in native forests. Such lack of disclosure could enable agencies to deviate from profit goals through cross subsidisation and also to pursue other unstated objectives such as regional or industry development.

Cross-subsidisation of native forest operations by plantations is in effect a direct subsidy using taxpayer funds as the profits from plantation forestry would otherwise become direct government revenue. The risk of implicit support to native forestry operations is that it effectively builds up adjustment pressure, adding to the social and economic costs of adjustment when such operations are required to meet commercial pressures. This has implications for the certainty and risk to private businesses in the native forest supply chain, similar to the risk of a future lack of access to resources, discussed below.

URS (2008) identify as the pre-eminent key sectoral reform:

Recommendation 1 - Transparency in reporting: *National reporting of public forest agency performance should be improved with separation of native forest and plantation finances. Such improvements to reporting could be driven by COAG federation reform processes and be modelled on the annual Report on Government Services undertaken for COAG*

It is requested that the Inquiry recognise the market distortions and lack of transparency caused by NSW's amalgamation of plantations and native forests for resource allocation and reporting and recommend separate reporting of native forests.

3.2. Accreditation

Within Australia and overseas consumers are increasingly demanding that the timber they buy comes from ecologically sustainably managed forests. Many regions, such as Europe, North America, Canada and Asia will not import timber unless it can be traced back to a forest certified as being managed in a sustainable manner.

To satisfy this demand the Australian Forestry Standard was drafted in 2000 under the direction of Australian Forestry Standard Steering Committee comprised of the Commonwealth and State and Territory Governments, National Association of Forest Industries, Plantation Timber Association of Australia, Australian Forest Growers and the Australian Council of Trade Unions. It needs to be recognised that the AFS is effectively the industry's own standard and that the standards were not developed in consultation with environmental NGOs and are not condoned by them.

In June 2006 Forests NSW gained certification for its environmental management system under ISO 14001:2004 for native and planted forests. In December 2006, Forests NSW gained forest certification under the Australian Standard for Sustainable Forest Management (Australian Forestry Standard - AFS) AS 4708 (Int) – 2003. Forests NSW were accredited (certificate 13761) for 2,555,681 hectares of native forests and plantations under AS4708:2007 by the certification body NCS International. NCS International were in turn accredited by JAS-ANZ.

NEFA has established that timber is being obtained from illegitimate sources in the UNE, that many legal requirements are not being complied with and that the industry's own Australian Forestry Standards are not being complied with. This has been documented and submitted to JAZ-ANZ as a complaint. NEFA considers that under the criteria the UNE should be recognised as a "high" risk region and treated accordingly.

It is self evident that timber volumes being removed from public native forests in north-east NSW are not sustainable. The Sustainable Wood Supply Strategy (CoA&NSW 2000), as modified in 2004, is to log at an acknowledged unsustainable rate until 2023 and then to dramatically reduce the volumes being removed. Yield downgrades and increased commitments have increased and entrenched unsustainable logging. Claims that timber from plantations will make up the shortfall are dubious and do not negate the fact that public native forests are being intentionally logged unsustainably.

Our recent audits have also found that timber is regularly being obtained from illegal sources on public lands in the UNE (such as Endangered Ecological Communities, rainforest, stream exclusion areas, owl exclusion areas, Hastings River Mouse habitat etc.), and that trees required to be retained for threatened species (hollow-bearing trees, recruitment trees, Yellow-bellied Glider feed trees etc) are being illegally removed for timber. We have also found that oldgrowth forest continues to be logged.

We have even found that timber claimed to be sourced from a plantation was actually obtained from illegal rainforest logging.

Our recent audits have established that many legal requirements and many of the AFS criteria are not being complied with. We are perplexed as to how Forests NSW's operations in north-east NSW ever gained accreditation given that they are based on intentional and openly acknowledged unsustainable logging. We are also concerned that those charged with independently auditing Forests NSW's operations, DECCW, Fisheries NSW and NCS International, fail to identify the extremely poor performance found in our audits.

The Inquiry should recognise that the accreditation of timber being obtained from north-east NSW's forests as coming from ecologically sustainably managed forests and legal sources risks Australia's international reputation and the credibility of its accreditation programs.

4. Social and economic benefits of forestry production

All too often assessment of the economics of the timber industry are based solely on their economic benefits, with the costs ignored. The Department of Planning (1994) in its report on the Kempsey/Wauchope EIS notes:

"The NSW Guidelines for Economic Appraisal (NSW Treasury 1990) proposes two techniques for economic appraisal, cost benefit analysis (CBA) and cost effectiveness analysis (CEA). Both techniques have the underlying objective of identifying alternatives which maximise community welfare and thus improve economic efficiency and require as many as possible of the benefits and costs to be quantified. The Guidelines also clearly identify that while regional impact analysis may prove a useful adjunct to CBA (consideration of costs and benefits) it is not an alternative to CBA (NSW Treasury 1990)."

"An integral part of the evaluation of alternatives and justification of the proposal is based on aspects of regional impact analysis. While such an approach is of use in identifying the structure of a regional economy, the employment, income and output impacts in a region and the distribution of these impacts among industries, it is not an evaluation methodology. Having regard to the legislative framework, Treasury Guidelines on economic appraisal, the literature on regional impact analysis and the purpose of economics it is considered that such an analysis should be considered as an adjunct to the consideration of the economic costs and benefits of the proposal and alternatives and not as an alternative to it."

A proper cost-benefit analysis should account for the standing value of the trees, management, extraction and transport costs, and quantifiable reductions in water yields, carbon storage, and soil nutrients. Then there are the numerous "non-use" values that need to be accounted for, for example URS (2008) note:

Native forests and plantations provide many unpriced goods and services to the economy and values to society, none of which are reflected in the marketplace. Trees assist with water and land management by reducing run-off and controlling erosion. They sequester carbon and reduce greenhouse gas emissions. Forest ecosystems are a major protector of biodiversity and provide habitats for native species. In such circumstances, market forces alone will not provide economically efficient outcomes, as individual decisions will not reflect social benefits and costs. ...

*...
Some of the environmental benefits of forests and plantations are public goods. The aesthetic values of forested landscapes are available for all to enjoy, for example. Similarly, the benefits to water quality accrue to all water users. On the other hand, bushfires are a public 'bad' that impose significant economic costs on the community at large and on individuals.*

It is therefore important to determine the impacts of economic settings of forest policies on such public goods.

4.1. Balancing all costs and benefits

The issue is one of managing public land in the best interest of the community; regionally, nationally and internationally. An assessment of socio-economic values to identify the costs and benefits to society as a whole arising from allocation of forests is required to inform decision making processes. Assessments of economic impacts are usually simplistic and biased towards the identification of worse-case scenarios for affected extractive industries. A

holistic socio-economic assessment requires consideration of all values, including forest protection values and community values.

Bennett (1998) identifies that forest protection benefits can be classified broadly into use and non-use values:

“Use values involve beneficiaries experiencing first hand the forest ecosystem. Non-use values are enjoyed even without that direct contact. Use values are mostly associated with tourism and recreation activities such as sight seeing, camping or bush walking.”

For the UNE and LNE CRAs the approach taken to integrate both “use” and “non-use” values within a socio-economic framework was a “Benefit Transfer Threshold Values Analysis” (Bennett 1998). This is based upon identifying the “threshold values” of the “opportunity costs” resulting from the protection of an area which need to be exceeded by the “forest protection values” *“for it to be in the best interests of the community overall for the forests to be reserved from timber production”* (Bennett 1998).

Some of the primary values of forests to communities are:

- Protection of biodiversity,
- Provision of water,
- Use for recreation,
- Provision of timber, and
- Storage of carbon.

It is generally acknowledged that logging causes decreases in water yields, water quality, aesthetic values and the populations of some plant and animal species. While not universally accepted, logging also reduces the carbon storage capacity of forests. Thus conflicts in use exist between logging and all of the other primary values.

It terms of overall community preferences revealed in community attitude surveys, it is apparent that cessation of logging within an area identified as having extremely high conservation and social value would be in the best interests of the majority of the community. Associated with this is the next question of whether it would also be in the community’s best economic interests?

Pugh (2000) undertook an assessment of the values of the then Whian Whian State Forest and found that timber was worth only a fraction of the other values identified:

VALUE	ANNUAL VALUATION (\$1,000)
Timber	2.5 - 11
Water	4,500
Recreation	2,500 - 5,000
Conservation	2,250 - 15,000

Pugh (2000) notes:

The most recent valuation suggests that based upon optimistic yields, timber production from Whian Whian State Forest has a current value of somewhere between \$2,484 to \$10,953. This is the threshold that the forest protection benefits need to exceed in the current year for cessation of logging to be in the best economic interests of the community.

Given that the forest represented the catchment for the Rocky Creek Dam (a regional water supply for 4 local government areas) and had a visitation of 125,000 visitors per annum, and that both water yields and visitation would increase in the absence of logging, there could be no doubt that both these values far outweighed timber production values.

Given that the forest also supported eleven species of plants and animals listed as in danger of extinction, 61 species listed as vulnerable to extinction, and a further 22 species of plants considered nationally rare, along with significant rainforest stands, and extremely high national estate values, there could be no doubt that its protection as National Park was in the community's economic interests.

Please note that in this section no attempt has been made to update values given, many of which maybe a decade or more old. Values are thus significantly understated in relation to present values.

4.1.1. Non-use values

There has historically been minimal attempts to assess the forest's preservation values (i.e. by assessing and accounting for public opinion and identifying priceless attributes), the replacement cost of public resources removed (e.g. soils, nutrients, water, habitat) or the real and potential economic worth of non-timber values (e.g. recreation, tourism, water supply). A valid economic assessment must identify socially optimal outcomes of proposals, thus in relation to forests it should include assessments of direct use value, ecological function value, option value, existence value and bequest value. The need to incorporate these into economic assessments is well established in the literature.

The presence of existence value is a powerful social reason for conservation and is a value felt by all Australians. All Australians own an equal share in the public forests and they are all entitled to an equal say in their future. Theoretically each Australian who feels a personal consumption loss if the proposal goes ahead should be compensated. Any survey of the value of the forest must survey nationally, as well as locally, if it is to capture this effect. There are a range of techniques available to evaluate public opinion (e.g. contingent valuation, switching value), at least two of which should be utilised for greater credibility.

A major requirement of any social assessment and a key component of determining the social values of public lands is the determination of public preferences. Statistically valid methodologies need to be utilised to assess the values the community places upon otherwise economically unquantifiable natural attributes (such as oldgrowth forests and endangered species), determining existence values and for assisting in determining recreational use. The broad category of conservation values includes the non-use values such as option value, existence value and bequest value. While harder to quantify, conservation values are real values that should be taken into account along with other values.

Non-use values include are expressed in a variety of forms; *"passive use values"* include such things as *"reading books or watching films that are based on the environment ...benefit from scientific advances that have been made through research undertaken in a protected forest ... high quality water supplies that have originated in protected forest catchments"*, *"existence values"* *"are held by people who simply enjoy the knowledge that some forest areas have been set aside in reserves even though they have no wishes to visit them"* and *"bequest values"* represent the desire to protect areas for *"members of future generations"* (Bennett 1998).

The Community Attitude surveys undertaken for the Comprehensive Regional Assessments (CRAs) (McGregor *et. al.* 1997 a,b) show that the regional communities place far more emphasis upon "forest protection values" than "opportunity costs" and establish that "non-use" values are extremely important to the broad regional community.

Community attitude surveys undertaken in the region show that for public forests the vast majority of the community attach the highest priority upon protecting threatened species, maintaining sites of natural beauty and maintaining water quality (McGregor *et. al.* 1997, Duthy 1998). This compares to a small minority supporting logging.

The Community Attitude survey for the Upper North East (UNE) CRA (McGregor *et. al.* 1997a) established that the priorities respondents gave to “*various activities with relation to public forests*” were;

- protecting native plants and animals (100%),
- maintaining sites of natural beauty (99%),
- educational/scientific (97%),
- maintaining water quality (96%),
- aboriginal sites (89%),
- bushwalking/picnics (87%),
- protecting wilderness (87%),
- camping (79%), and
- eco-tourism (75%).

Exploitative uses of public lands received a lot less support (timber production 24%, woodchipping 7% and mining 13%), with the highest opposition being to mining (72%), hunting (70%) and woodchipping (65%).

In response to the question “*what is it about forests that you value?*”, those values ranked highest were aesthetic (80%), conservation reasons (46%), spiritual (25%), intergenerational equity (14%) and recreation (10%) as compared to relatively low values for economic/employment (6%) and economic goods and use (5%).

The UNE Community Attitude survey (McGregor *et. al.* 1997a) showed that at both the macro and micro scales more respondents put environmental principles before economic principles when faced with conflict between the two, finding that :

- 56.3% of the people surveyed agreed that they “*would like to see more forested land conserved, even if it means a loss of state income from timber harvesting*” as compared to 23.2% disagreeing.
- When asked if it is the case that “*Timber harvesting in native forests may have an adverse impact on the abundance of native plants and animals*”, 66.1% of people surveyed considered “*The environmental costs are too high, it might be better to compromise on forestry activities*” as compared to 15.6% considering “*This is unfortunate but we need forestry products and employment.*”
- When asked if it is the case that “*Forestry jobs may be lost to create new environmental reserves. This may affect some small communities adversely, by reducing their access to basic services*”, 45% considered this “*Unfortunate for these communities but we need environmental reserves for the benefit of future generations*” as compared to 31.5% considering “*The social costs are too high, it may be better to compromise on creating environmental reserves than reduce people’s access to basic services.*”

Duthy (1998) undertook a ‘contingent valuation study’ to determine the level of community support for the dedication of Whian Whian State Forest as a new national park. Consistent with regional attitudes, local respondents to his survey identified catchment protection, endangered species habitat and preservation for future generations as the most important uses of the Whian Whian area.

As an example of the weighting provided by local communities, out of a scale of 1 to 10, use of Whian Whian as a commercial timber resource achieved a mean ranking of 3.79, compared to camping and recreation achieving 6.38, endangered flora and fauna habitat achieving 8.77 and catchment protection achieving 9.03 (Duthy 1998). Catchment protection was considered extremely important by 63% of respondents, endangered flora and fauna habitat by 60% of respondents, and enjoyment of future generations by 56%, as compared to 8% considering commercial timber resource as extremely important (Duthy 1998).

In response to the request for local people to indicate their relative priorities between sometimes opposing environmental issues, Duthy (1998) found a similar preference for

environmental concerns over economic concerns as McGregor *et. al.* (1997). For example when respondents were asked to rank utilisation versus conservation of natural resources; 43% indicated that they considered they had a balanced view, a further 43% indicated that conservation was the priority and only 14% indicated utilisation as the priority. When the issue related to employment versus the environment less people considered they had a balanced view, with those favouring employment increasing to 25% and 41% still placing environment protection above employment. Conversely, when the issue related to private development issues versus environmental protection those favouring development declined to 7% while those favouring environmental protection increased to 71%. (Duthy 1998).

Duthy (1998) concluded *“The dedication of Whian Whian SF as a new national park is supported by the level of valuation, the amount of voluntary labour available, and the consistency with national park management objectives of the majority of the more important uses.”*

The value to the community of such ‘non-use’ conservation values is hard to quantify. The general community may well regard some conservation values, such as habitat critical for the survival of a threatened species, as ‘priceless’. Though to enable comparisons with ‘use values’ it can be useful to estimate the monetary value of quantifiable aspects.

Bennett’s (1998) rule of thumb for forest protection benefits is that non-use values are worth three times the value of recreational use.

Duthy (1998) found from his sample of the local community that the mean willingness to pay for the non-consumptive use and non-use values of Whian Whian State Forest was \$18.89 per respondent per annum, which was extrapolated to \$2.25 million per annum across the local area. As Duthy did not account for the value of Whian Whian to the broader community, his estimation can be considered extremely conservative given Whian Whian’s state, national and international significance.

Aside from direct economic valuations, there is a need to consider the ‘irreplaceability’ of conservation values along with the ‘replaceability’ of resource values. Many conservation values have a high irreplaceability in that they occur in a limited number of localities, while logging for most products can be undertaken at a large number of localities and thus have high replaceability. As noted by Bennett (1998):

“In general, forest protection benefits are likely to increase through time whereas the opportunity costs will most probably remain static. These differential growth rates are largely the result of the degree to which substitute goods are available for both the timber and non-timber forest products. Timber products are easily substituted. ... The non-timber, or protection values, of forests are, however, much more difficult to substitute. For instance, habitat for endangered species cannot be readily “manufactured”. Recreation in constructed or artificial sites may not be considered as providing the same experience as time spent in a protected forest reserve.”

4.1.2. Use values

There is a need to consider all the economic values provided by the region's public lands, these include water supply, timber, carbon storage, honey production, recreation and tourism. It is equally important to identify the impacts of one use upon others. For example logging of mature trees significantly decreases the availability of nectar and water, thus it has a negative impact on these other economic attributes.

Timber values

For the Comprehensive Regional Assessment (CRA), Bennett (1998) used two approaches to quantify timber values:

static analysis - where the *“opportunity costs can be viewed as the value that the benefits of protecting the forests must exceed for it to be in the best interests of the community overall for the forests to be reserved from timber production”*;
dynamic analysis – which accounts for *“the differential growth rates for the alternative streams of benefits”* to *“provide a more complete picture of the forest protection choice”*.

Bennett (1998) assessed that the foregone timber harvesting benefits resulting from a reduction of 15,880 cubic metres per annum in the volumes of large high quality logs (along with associated products) being processed in the Upper North East. He identified that this volume of timber would have a static value of \$9.47 million to \$17.01 million (or \$596 to \$1,071 per cubic metre of large high quality sawlogs) depending on the discount rate applied and associated profit. Using the dynamic analysis Bennett identified the value as \$43,750 to \$193,243 (or \$2.76 to \$12.17 per cubic metre of large high quality sawlogs).

Based on values used by Bennett (1998) and with a static analysis, the combined value of the producer’s and consumer’s surplus for 900 cubic metres of large high quality logs (and associated products) per annum would range from something like \$536,400 (at a discount rate of 8% under a producer's profit scenario of 20%) to \$963,900 (at 5% discount and 10% profit).

Bennett (1998) notes *“in general, forest protection benefits are likely to increase through time whereas the opportunity costs will most probably remain static. These differential growth rates are largely the result of the degree to which substitute goods are available for both the timber and non-timber forest products. Timber products are easily substituted. ... The non-timber, or protection values, of forests are, however, much more difficult to substitute. For instance, habitat for endangered species cannot be readily “manufactured”. Recreation in constructed or artificial sites may not be considered as providing the same experience as time spent in a protected forest reserve.”*

Bennett (1998) considers that *“The static approach therefore overestimates the extent of the opportunity costs associated with protecting the forest”*.

Similarly, James (1998) identified that for a 15,880 cubic metre drop in volumes of large high quality products (and proportional declines in associated products) the direct impacts would be a reduction in the value of output by \$3.8 million and loss of employment for 24 people.

Water values

All forests are important for water supply, though this importance increases in relation to the numbers of people and the value of industries a catchment supplies. For the more significant catchments water supply should be a *“primary consideration in decision-making affecting the catchment”* and not an incidental consideration as it often is now.

The Sydney Water Inquiry was established following the 1998 Sydney water contamination crisis, in part it concluded (McClellan 1998):

“The health of the catchment is a fundamental responsibility of our community, both for this, and subsequent generations. I have concluded that immediate action must be taken to establish appropriate management and regulatory structures to ensure the catchment is not further compromised and, if possible, existing problems minimised or removed. ... We must not allow vested interests to inhibit the creation of effective planning, regulatory and management structures for the catchment.

“The problems of the catchment demand a strong and effective response. A modern treatment plant is not a substitute for proper catchment management. Protecting the catchment provides the best long-term protection for Sydney’s drinking water. ...

“Under the current arrangements, the catchment is managed to allow a range of activities. Water quality considerations may be diminished in favour of agricultural, urban and rural residential, forestry, mining and other developments. ...

“In my view, this situation cannot be allowed to continue. ... From now, water quality should be the primary consideration in decision-making affecting the catchment. This has significant implications for proposed future developments in the catchment. ...

“There is a need to develop directions, catchment wide strategies and water quality objectives to guide management activities and development decisions in the catchment. ...

“I also believe it is appropriate to give one agency specific responsibility for managing Government-owned land in the Inner Catchment. In my view, the National Parks and Wildlife Service is best placed to manage these areas for both water quality and broader ecological considerations, provided it is resourced adequately.”

Dargavel *et al.* (1995) note *“There are very large costs associated with providing water storage for urban water supply, so that decrease in stream flow may mean that greater or earlier investments in dams become necessary. Similarly, increased siltation of streams due to upstream economic activities may require dredging of dams or construction of new ones before they are due. These both impose costs on urban water consumers. Sediment from logging activities can increase the cost of municipal water treatment.”*

Read, Sturges and Associates (1992) identified the current marginal willingness to pay for water at the tap as 30c, 60c and 80c per KL, which *“correspond to prices ‘in the stream’ of 26c, 53c and 70c”*. Read, Sturges and Associates adopted a *“preferred estimate of water price of \$530 per ML at the tap”*.

Read, Sturges and Associates (1992) determined that the economic worth of water and timber from the forests of the Thomson Dam catchment, in Victoria, was maximised by either no logging at all or by strip thinning combined with a rotation length of 200 years. These two options had a 'Net Present Value' of \$147 and \$169 million, respectively, above continued logging under the current system.

Recreational Values

Public land is a highly valued resource, providing the only natural areas for recreation for many residents. The Centre for Coastal Management (1993) note *“as indicated by the recreationalist survey ... the most significant source of recreational forest visitation comes from the residents of the local government area”*.

People primarily visit forests for passive experiences, *“enjoying the scenic beauty, tranquillity, solitude, smells and sounds of nature in undisturbed natural areas with family groups”* (Buultjens *et al* 1998).

For 1984 the annual visitation to the Border Ranges National Park was 18 466, Nightcap National Park 17 556 and Washpool National Park was 2 250, this gives a total of 38 272 (NPWS 1985). By 1990 the visitation rates had almost quadrupled to 148 800; Border Ranges NP - 43 800, Nightcap NP - 70 000, Washpool NP 35 000 (NPWS 1991).

Tourism is promoted as the worlds' largest industry, and is rapidly expanding worldwide, with expectations it would double in value from \$3.4 trillion in 1994/5 to \$7.2 trillion in 2005 (Buultjens *et al* 1998). Tourism can have significant regional impacts, for example in 1996/97 there were estimated to be over 1.2 million visitors to the local government areas of Ballina, Byron and Ballina, resulting in visitors staying almost 4.4 million nights and spending some \$295 million in the region (Buultjens *et al* 1998). Tourism is thus a major contributor to the regional economy.

Tourism is the most rapidly expanding sector of the regional economy. It is thus essential that its socio-economic values be accounted for and appropriate opportunities explored. The act of converting a State Forest to a National Park can increase its recreational value, as noted by Buultjens et. al. (1998) *“National Parks are an international concept and this recognition has the potential to attract both domestic and international tourists”*.

Buultjens et al (1998) note:

“The natural environment is perceived to be one of the most important tourist attractions for Australia, and in particular of the north east NSW region. Forested areas represent a significant proportion of tourism and recreational attractions in natural environments ... Furthermore, this demand is increasing significantly, with a 48 percent increase in National Park visitation in NSW and a 66 percent increase in bushwalking between 1989 and 1994 ...”

“Overall, nature based tourism in forested areas is increasing, with the NPWS forecasting a 2.25 percent per annum growth in visitation levels ...”

Buultjens et. al. (1998) consider:

“Visitation in the UNE over the next twenty years will increase from 2,828,201 in 1997 to 4,202,558 in 2017 and consumers’ surplus will increase from between \$57.4 million to \$85.3 million. Expenditure, in the same period, will increase from between \$59.7 million and \$74.7 million to between \$88.7 million and \$111 million, and employment will increase from between 1,131 and 1,980 to between 1,680 and 2,942. In the LNE visitation will increase from 2,828,201 in 1987 to 3,268,839 in 2017 and consumers’ surplus will increase from \$44.7 million to \$66.4 million. Expenditure, in this same period, will increase from between \$46.5 million and \$58.2 million to between \$69.1 million and \$86.5 million, and employment will increase from between 880 and 1,540 to between 1,308 and 2,288.”

The Kuring-gai Colledge of Advanced Education (1988) found that of visitors to the rainforest parks of New England and Dorrigo 37% were local visitors, 12% were 'day-trippers' from outside the region, and 51% 'overnight visitors' from outside the region. The average daily expenditure per visitor were estimated as \$34, \$59 and \$89 respectively. Of this expenditure 39% has been estimated to flow directly into local wages (Kuring-gai Colledge of Advanced Education 1988), which has an employment flow on effect of 2.06 (employment multiplier).

In 1995 for the Dorrigo National Park the average expenditure per person associated with visits was found to be \$175.03 and for the Gibraltar Range National Park it was \$73.45, respectively with 35% and 23% spent on accomodation, 20% and 15% spent on meals, 14% and 27% spent on shopping, 20% and 25% spent on cars, 9% and 8% on fares, with the remaining 2% classed as 'other'(Powell and Chambers 1995). For the Dorrigo National Park, 11% of this, an average of \$20.10 per person, was assessed as being expended in the township of Dorrigo and the surrounding area. With 160,000 visitors per annum Powell and Chambers undertook an input/output analysis to assess that;

“the total impact associated with visits to the Dorrigo National Park generated \$3.6m in regional output; \$2.0m in regional value added activity; \$1.3m in regional household income; and 59 jobs. This represented 7 per cent of output, 6.5 per cent of value added activity and household income and 7 per cent of employment in the Dorrigo region.”

Using the same data, Bennett (1995) undertook an assessment using the Travel Cost Method (TCM) to identify the net economic benefit, or the consumer surplus, for the parks. Bennett identified *“the amount the surveyed visitors would be willing to pay for their experience at the park, in excess of what they have to pay”* as \$17.33 per visit to Dorrigo National Park and \$15.83 per visit to Gibraltar Range National Park. Bennett identified the economic value of recreation use of Dorrigo as \$2,772,800 per annum and Gibraltar Range

as \$633,200 per annum, which equated as present values (at a 7% discount rate) of almost \$40m and about \$9m respectively.

Based upon the Dorrigo and Gibraltar data, updated to 1996/97, Buultjens *et al's* (1998) assessment for the Comprehensive Regional Assessment used the figure of \$20.30 per visit as the assumed consumers surplus per visit, \$21.14 to \$26.44 as the assumed regional expenditure per visitor, and employment of 4-7 jobs per 10,000 visitors.

The Inquiry needs to recognise that forests have both use and non-use values that need to be taken into account when identifying the costs and benefits to the community from use of public forests. Use values include timber, water supply, carbon storage, recreation and tourism, all of which are usually compatible except logging. Non-use values include aesthetics, wildlife, ecological function value, option value, existence value and bequest value.

4.2. Removing Public Subsidies

Forests NSW native forests operations are operating at a substantial financial loss. A situation that is expected to worsen dramatically into the future. NSW taxpayers are going to have to pay many millions more every year to prop up this unsustainable industry that is running down the value of the public's assets.

The subsidisation of the timber industry has been going on for decades despite repeated suggestions to remedy the situation. As noted by the Public Accounts Committee (1990):

"... native forest asset valuations really only consider replacement costs, a satisfactory inventory of native forests is lacking, there is no accounting for the non-timber values inherent in the native forest, ... and numerous subsidies enjoyed by the Commission ... are not quantified in the accounts." (p21)

"The State's timber processing industry is heavily subsidised by the public sector. Chief among the subsidies are under priced raw materials (in the case of Eucalypt logs), and failure to bear the full costs of road construction and maintenance which are attributable to the industry's operations. As a result of these subsidies, sawmilling businesses which would be marginal or non-viable in their present form are able to continue operating and to continue resisting the pressures to change their inefficient methods of operation." (p31)

Pugh (1992) found that the then Forest Management Areas of Urbenville, Murwillumbah, Casino West and Grafton operated at a financial loss of \$1,090,000 (in 1991 dollars) over the ten years 1981/82 to 1990/91. In 1987/88 the Forestry Amendment Act gave an additional subsidy to the Forestry Commission by relieving them of the interest payable on their accumulated debt of some \$110 million! They were supposed to pay a dividend to Treasury in return, though failed to do so in 1987/88 or 1988/89 (PAC 1990 p27).

While Forests NSW now attempt to hide the subsidisation of logging public native forests by including their accounting with plantations, it is evident that they are still operating at a substantial loss. In response to questions on notice from the General Purpose Standing Committee No.1 Budget Estimates 2009-10, the Forestry Minister Steve Whan identified that Forests NSW's native forest operations ran at a loss of \$8.1 million in 2009/10, stating:

Given, as reported by the Auditor General in 2009, that the current cash flow of Forests NSW Native Forests Operations Branch is negative, any NPV calculation now will result in a valuation of zero.

The Auditor General (2009) wonders how Forests NSW will perform in the future, given that:

... Native forest operations operated at a loss of \$14.4m for 2007-08. We are unable to conclude if this is the result of inefficient operations, or because prices do not reflect the true cost of meeting wood supply commitments or a mixture of both.

Not only are Forests NSW losing money, the public are losing a natural resource and environmental values. There is no resource rent being paid to the community, so we are being duded twice, as noted by URS (2008):

Extracting resource rent from the use of the state's forest resources – resource rent is the additional profit above “normal” business profits that can be gained by providing access to a natural resource. Because resource rent is in excess of normal business profits, there is a rationale for governments to collect some of this rent on behalf of the owners of the resource – the community.

URS (2008) note:

Low returns to public forestry and plantation agencies distribute income from taxpayers to the forest industry, as do subsidies to plantations and wood processing plants. The distortion in returns to forestry created by the range of poor economic policy settings reduce returns and lead to underinvestment for the longer term by both the private and public sectors.

...

To the extent that the market failure relating to social rates of time preference is not addressed through these policies, then future generations will be worse off. This will also be the case if there is poor transparency and reporting of native forest operations with clear achievement of environmental objectives.

It is often claimed that Forests NSW can operate at a loss because of the public good they provide. Though URS note that “Forests NSW received a contribution from the state government for community service obligations of approximately \$9.5M pa. In 2006/07 expenditure on community service obligations was \$11.1M”. Their claims as to what constitute community services are dubious.

4.2.1. Costs Increasing

Despite repeated claims by Forests NSW that they can turn the situation around and operate at a profit on their native forest operations, this is increasing unlikely due to the entrenched pricing distortions and subsidies built into the current system, the declining yields, and the increasing costs of accessing whatever timber is available.

Partington and Stevenson (Forests NSW 2004b) warn that “Only 50% of the native forest volume is easily accessible - on slopes less than 20° and more than 50m from an exclusion boundary. Harvesting practices and costs will need to address the issue of difficulty of access in order to meet current native forest commitments”. This means that the costs and difficulty of obtaining available timber will increase into the future.

Partington and Stevenson (Forests NSW 2004b) also consider “we understand that there may be an increasing need to harvest crops previously considered unmerchantable” ... “areas previously considered unmerchantable are now being reclassified as merchantable as the constraints on available timber become more severe”.

The Auditor General (2009) supports the contention that obtaining whatever timber is available will become increasingly expensive:

Over the last five years, harvest and haulage prices for all north coast products increased 45 and 36 per cent respectively. Central Region advised that harvesting is becoming more difficult as they are moving into more remote areas with lower yield per hectare and steeper terrain.

Regional staff believe that the last five years of wood supply agreements for the north coast (i.e. 2018-2023) will be the most difficult, with Forests NSW increasingly accessing timber further away from sawmills.

With increasing costs involved in obtaining the timber available and an apparent need to buy out more quota and compensate millers for shortfalls, Forests NSW's losses can be expected to rapidly escalate into the future.

4.2.2. Roads and Bridges

There has been an ongoing failure to account for indirect subsidies resulting from the impacts of logging trucks on roads and bridges and the associated costs.

The State Pollution Control Commission (1975) noted that:

"Several submissions, in particular from local councils, commented on the damage to secondary roads by heavy woodchip vehicles. Experience in Tasmania is said to show that the damage is not trivial"

The Department of Planning (1994) note that while they recognise *"road pavement damage from logging trucks may be considerable (as identified in a number of submissions) it has not been possible to quantify this ..."*

Dobinson (1985) notes that road pavement damage increases in relation to the fourth power of axle load and that therefore a truck loaded to the permissible limit do 14,000 times the damage of an average car to road pavements. He further notes that bridge life depends on the extent of concentrated load by an axle group and the gross weight of the vehicle on the bridge.

Quantifiable, but usually unaccounted, costs include damage to council roads and bridges by logging trucks. At a 1990 rate of 4 cents per net tonne/kilometre this is quite significant (PAC 1990 p34).

The Inquiry needs to acknowledge that logging of public native forests in NSW does not pay a resource rent to the community and is operating at a considerable financial loss. It also needs to be recognised that costs are rapidly escalating and timber volumes declining. The Inquiry needs to identify means of removing public subsidies to the timber industry and returning a resource rent to the community from the commercial use of public resources

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Appendix 1

Extract from Environment Australia (1999) Response to Disturbance of Forest Species in CRA Regions in NSW- Upper North East and Lower North East Regions.

FORESTRY Disturbances identified and their impacts ranked relative to ALL IDENTIFIED DISTURBANCES.

Species	Disturbance	Rank	Comments
MAMMALS (excl. bats)			
Red-legged Pademelon	logging - reduction of midstorey	3	in rf and wet sclerophyll - reduced leaf litter etc
Common Wombat	climate change	?	
Hastings River Mouse	logging - loss of hollows	3	need hollows in butt cavities of old growth
Broad-toothed Rat	climate change	3	
Dusky Antechinus	logging - altered hydrology oldgr-regr	2	affects litter moisture - reduces food (see Alberts Lyrebird)
Koala	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive)	3	Logging that fails to retain stems in the 30-80 DBH size class
Squirrel Glider	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive)	3	Removal of large trees and hollows, includes firewood collection
	High frequency burning	2	
Yellow-bellied Glider	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive)	1	Logging that fails to retain a high proportion of large trees and hollows
	High frequency burning	3	
Greater Glider	High frequency burning	2	
	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive)	1	Logging that fails to retain a high proportion of large trees and hollows
Eastern Pygmy-possum	High frequency burning	1	
BATS			
Nyctimene robinsoni	Logging of wet sclerophyll	2	of wet sclerophyll
	Regeneration burn	5	regeneration
	Weed invasion	3	lantana and others
	Roading	5	
	Climate change	5	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Pteropus alecto	Logging of sclerophyll	3	of sclerophyll - loss of older trees
	Climate change	6	
	Weed invasion	4	
	management burns	3	
Syconycteris australis	Logging of sclerophyll	3	coastal sclerophyll with banksia understorey
	management burns, including illegal	1	
	Weed invasion	2	
Pteropus poliocephalus	Logging of sclerophyll	3	
	Climate change	6	
	Weed invasion	5	less restricted to rainforest remnants than P. alecto
	management burns	3	
Kerivoula papuensis	Logging - loss of hollows	2	

Species	Disturbance	Rank	Comments
	Logging - loss of understorey	2	
	Weed invasion	3	
	Frequent burning	1	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Chalinolobus nigrogriseus	Logging - loss of hollows & oldgrowth	2	
	Logging - loss of understorey complexity	4	
	Frequent burning	4	
Myotis adversus	Altered hydrol old-regrowth - altered flow	3	
	Altered hydrol old-regrowth – sedimentation	3	
	Logging - loss of hollows	4	
	Frequent burning	4	
Mormopterus beccarii	Logging - loss of hollows	1	
	Logging - loss of understorey complexity	5	
	Frequent burning	3	impact on invertebrates
Vespadelus troughtoni	Frequent burning	3	
	Clearing - fragmentation	4	
	logging - loss of foraging habitat	3	
Miniopterus australis	logging - loss of foraging habitat	3	
	logging - loss of hollows	5	
	Frequent burning	3	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Chalinolobus dwyeri	Frequent burning	2	
	logging - loss of foraging habitat	3	
Vespadelus pumilus	Logging - loss of hollows & oldgrowth	2	
	Logging - loss of understorey	3	
	Frequent burning	3	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Rhinolophus megaphyllus	logging - loss of foraging habitat	3	
	logging - loss of hollows	5	
	Frequent burning	4	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Saccolaimus flaviventris	Logging - loss of hollows & oldgrowth	1	
	Frequent burning	3	
Nyctophilus timoriensis	Logging - loss of hollows	1	
	Logging - loss of understorey complexity	2	
	Frequent burning	3	
Nyctophilus bifax	Logging - loss of hollows	4	
	Logging - loss of understorey	3	
	Frequent burning	3	
	Weed invasion	4	
Scotorepens orion	Logging - loss of hollows & oldgrowth	2	
	Logging - loss of understorey	4	
	Frequent burning	4	
	Altered hydrology/microclimate - oldgrowth-regrowth	5	
Falsistrellus tasmaniensis	Logging - loss of hollows & oldgrowth	1	
	Logging - loss of understorey	3	
	Frequent burning	3	
	Weed invasion	4	

Species	Disturbance	Rank	Comments
	Altered hydrology/microclimate - oldgrowth-regrowth	4	
	Climate change	2	
Scotoecanax rueppellii	Logging - loss of hollows & oldgrowth	1	
	Logging - loss of understorey	3	
	Frequent burning	3	
	Altered hydrology/microclimate - oldgrowth-regrowth	4	
Miniopterus schreibersii	logging - loss of foraging habitat	4	
	logging - loss of hollows	5	
	Frequent burning	4	
	Altered hydrology/microclimate - oldgrowth-regrowth	3	
Scotorepens balstoni	Logging - loss of hollows	2	
	Logging - loss of understorey	4	
Scotorepens greyii	Logging - loss of hollows	2	
	Logging - loss of understorey	4	
	Frequent burning	5	
	Altered hydrology/microclimate - oldgrowth-regrowth	5	
Mormopterus norfolkensis	Logging - loss of hollows	1	
	Logging - loss of understorey	4	
Mormopterus planiceps	Logging - loss of hollows	2	
	Logging - loss of understorey	4	
Nyctinomus australis	Logging - loss of hollows	1	
	Frequent burning	3	
Mormopterus sp 1	Logging - loss of hollows	2	
	Logging - loss of understorey	4	
Scotorepens sp 1	Logging - loss of hollows	2	
	Logging - loss of understorey	4	
	Frequent burning	5	
	Altered hydrology/microclimate - oldgrowth-regrowth	5	
BIRDS			
Double-eyed Fig-parrot	weed invasion	4	in lowland remnants (exotic vines)
	logging	5	eucalypt adjacent to lowlands - subtropical and dry rainforest
Red Goshawk	logging	4	
	weed invasion	7	
	changed fire regimes	5	
Regent Honeyeater	logging that reduces age classes	3	reduced age class, decreased nectar
	changed fire regimes	4	
Black-breasted Button-quail	any logging	3	alters microclimate and removes shelter
	high frequency burning	2	
Swift Parrot	logging that reduces size class of trees	2	
Wompoo Fruit-dove	logging that reduces size class of trees	1 (2 JS)	Of fleshy fruit trees in wet sclerophyll forest
	weed invasion	2	In lowland remnants
Rufous Scrub-bird	logging	2	that alters microclimate and litter dynamics - of wet sclerophyll
	climate change	1	
	management burns	2	
Albert's Lyrebird	logging	3	that alters microclimate and litter dynamics
	climate change	2	
	weed invasion	2	by lantana following logging of wet sclerophyll on higher nutrient sites
Eastern Bristlebird	Altered fire regimes	1	
	Climate change	2	

Species	Disturbance	Rank	Comments
Square-tailed Kite	logging	2 (3 JS)	increases structural density through reducing age classes, decreased nectar prod.
Red-tailed Black-Cockatoo	Logging	2	loss of large, old, dead trees
Barred Cuckoo-shrike	weed invasion	1	
Painted Honeyeater	logging	2	Yellowbox forest only
Rose-crowned Fruit-dove	logging that reduces age classes	2	of mesomorphic midstorey
Glossy Black-Cockatoo	logging that reduces age classes	1 (DM,S G) 2 (HR,JS)	of eucalypts and allocasuarina
Paradise Riflebird	logging that reduces age classes	1	
	management burns	3 (1 JS)	
Superb Fruit-dove	logging that reduces age classes	2	of mesomorphic midstorey
Regent Bowerbird	Logging	1	Logging that affects fruit lower strata
	Logging	2	Logging that affects fruit lower strata
	Weeds	1	In remnants and gallery strips
Olive Whistler	climate change	1	
	logging	3	immediate response only
White-eared Monarch	weed invasion	2	of remnants
Pale-yellow Robin	Logging	1	Logging that encourages dense low stratum
Pacific Baza	logging that reduces age classes	2	
	weed invasion	2	of remnant gallery forest
Grey Goshawk	Logging that reduces age classes	2	
Gang-gang Cockatoo	Logging that reduces age classes	2	Loss of old trees
Noisy Pitta	Logging	3	Removes the large rainforest trees changing microclimate and reducing food supply
	Weeds	1	
Brush Bronzewing	Altered fire regimes	2	
Little Shrike-thrush	Logging	1	Loss of older age classes
	Weeds	1	
Little Bronze-Cuckoo	Weeds	2	
Russet-tailed Thrush	Logging	2	Increases understorey density and changes moisture regimes
Musk Lorikeet	logging that reduces size class of trees	2	
Chestnut-rumped Heathwren	Altered fire regimes	1	
Prince Edward Lyrebird	management burns	2	
Yellow-tufted Honeyeater	high intensity logging	3	
	weed invasion	3	lantana - suppressing understorey recovery
	management burns	1	
Red-backed Kingfisher	Logging	2	Change in forest structure with young regeneration
Marbled Frogmouth	selective logging wet scler	1	
	Aust group selection	1	
	reducing forest age	1	
	weed invasion	1	
	thinning	1	

Species	Disturbance	Rank	Comments
Powerful Owl	logging which reduces prey mammals	1	Where arboreal mammals are reduced - dependent on regime and location
	fire which reduces prey	2	Where it reduces prey
	nest and roost site dist	3	by logging and recreational birdwatching
Sooty Owl	logging which reduces prey mammals	1	Where arboreal and terrestrial prey are affected
	nest and roost site dist	2	
	fire which reduces prey	4	frequent burning where reduces ground mammal abundance
Masked Owl	logging which increases structural density of forest	2	Where affects mid to ground layer - affects manoeuvrability
	fire - high frequency	3	
	nest and roost site dist	6	
Barking Owl	fire - high frequency	2	
FROGS			
Litoria castanea	introduced weeds	5	
	altered hydrology - earthworks	2	
Litoria brevipalmata	altered hydrol - oldgr - regrowth	?	
	oldgrowth logging	?	
	changes in soil moist - roading	?	
	changes in soil moist -logging	?	
	logging - removal large dead fallen trees	?	
	logging - reduced leaf litter input	?	
Litoria piperata	siltation from logging	?	
	siltation from roading	?	
	introduced weeds	?	
Mixophyes fleayi	change in soil moist - logging	2	
	change in soil moist - roadding	2	
	logging - reduced litter input	2	
	introduced weeds - lantana	3	lantana
Litoria aurea	introduced weeds	5	
Assa darlingtoni	changes in soil/litter moisture	1	
	climate change	4	
Philoria sphagnicolus	changes in soil/litter moisture	1	
	climate change	5	
	altered hydrology and stream flow	2	
	siltation from logging	6	
	siltation from roading	6	
Mixophyes iteratus	change in soil moist - logging	1	
	change in soil moist - roadding	1	
	logging - reduced litter input	1	
	introduced weeds - lantana	3	
	siltation from logging	3	
	siltation from roading	3	
	altered hydrology - oldgr-regr	3	
Philoria loveridgei	altered hydrol - oldgr-regr	2	
	change in soil/ litter moist-log	1	
	change in soil/ litter moist - road	1	
	siltation from logging	5	
	siltation from roading	5	
Litoria subglandulosa & daviesi	siltation from logging	1	
	siltation from roading	1	
	altered hydrology- old-regrowth	3	
	change in soil moist - logging	4	
	change in soil moist - roading	4	
	burning - frequent	2	
	oldgrowth logging - removal hollows	3	
	logging - removal fallen trees	2	

Species	Disturbance	Rank	Comments
Mixophyes balbus	change in soil moist - logging	2	
	change in soil moist - roadding	2	
	logging - reduced litter input	2	
	introduced weeds - lantana	3	
	siltation from logging	3	
	siltation from roading	3	
	altered hydrology - oldgr-regr	3	
Phyloria kundagungan	altered hydrol - oldgr-regr	2	
	change in soil/ litter moist-log	1	
	change in soil/ litter moist - road	1	
	siltation from logging	5	
	siltation from roading	5	
	logging - removes fallen trees	3	
	logging - reduced litter	3	
Litoria olongburensis	altered hydrology etc earthworks	1	
Phyloria sp 2 (undescribed)	altered hydrol - oldgr-regrowth	2	
	change in soil/ litter moist - road	1	
	change in soil/ litter moist -logging	1	
	siltation from roading	5	
	siltation from logging	5	
	logging - removes fallen trees	3	
	logging - reduced litter	3	
Phyloria sp 3 (undescribed)	altered hydrol - earthworks	2	
	change in soil/ litter moist - road	1	
	siltation from roading	4	
Litoria revelata	altered hydrol - oldgr - regrowth	?	
	oldgrowth logging	?	removal of hollows/n cavities
	changes in soil moist - roading	?	
Pseudophryne bibronii	altered hydrology - earthworks	?	
	change in soil moist - logging	?	
	change in soil moist - roading	?	
Litoria pearsoniana	siltation from logging	4	
	siltation from roading	4	
	altered hydr - oldgrowth-regrowth	2	
	change in soil moist - logging	4	
	change in soil moist - roading	4	
	old growth logging - removal cavities	4	
	logging - removes large fallen trees	4	
logging - reduced litter input	4		
Heleioporus australiacus	siltation from logging	3	
	siltation from roading	3	
	altered hydrology - earthworks	3	
	burning - frequent	2	
	change in soil moisture - roading	3	
	change in soil moisture - logging	3	
	weeds	3	
Pseudophryne australis	siltation from logging	3	
	siltation from roading	3	
	altered hydrology - earthworks	3	
	burning - frequent	2	
	logging - reduced litter	5	
	weeds	3	
Litoria barringtonensis	siltation from logging	4	
	siltation from roading	4	
	altered hydr - oldgrowth-regrowth	2	
	change in soil moist - logging	4	
	change in soil moist - roading	4	

Species	Disturbance	Rank	Comments
	old growth logging - removal cavities	4	
	logging - removes large fallen trees	4	
	logging - reduced litter input	4	
TURTLESs			
Elseya georgesi	Roading - construction and maintenance assoc with logging	1	
	Logging - siltation - local	2	
	Logging - siltation - upstream	2	
Elseya purvisi	Roading - construction and maintenance assoc with logging	1	
	Logging - siltation - local	2	
	Logging - siltation - upstream	2	
Elseya sp2 (Gwydir & Namoi Rivers)	Roading - construction and maintenance assoc with logging	3	
	Logging - siltation - local	3	
	Logging - siltation - upstream	3	
	Illegal netting	2?	
Emydura sp (Bellingen River)	Roading - construction and maintenance assoc with logging	3	
	Logging - siltation - local	3	
	Logging - siltation - upstream	3	
Emydura sp1	Roading - construction and maintenance assoc with logging	3	
	Logging - siltation - local	3	
	Logging - siltation - upstream	3	
LIZARDS			
Ophioscincus truncatus	Weed invasion - lantana	3?	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
Cautula zia	Logging - changing canopy structure	1	
	Logging - loss of large ground logs	1	
	Logging - dessication - altered microhab	1	
	Logging that reduces age/size structure	1	
	Climate change	1	for potential to be affected
Coeranoscincus reticulatus	Any fire	2	
	Logging - changing canopy structure	1	
	Logging - loss of large ground logs	1	
	Logging - dessication - altered microhab	1	
	Weed invasion	3	
	Logging that reduces age/size structure	1	
Ctenotus eurydice	Fire - any except wildfire	2	
Saproscincus challengeri	Any fire	2	
	Logging - changing canopy structure	1	
	Logging - loss of large ground logs	1	
	Logging - dessication - altered microhab	1	
Saproscincus galli	Logging that reduces age/size structure	1	
	Any fire	1	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
Saproscincus rosei	Logging that reduces age/size structure	1	
	Any fire	1	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
Eulamprus kosciuskoi	Logging that reduces age/size structure	1	
	Any fire	3	
	Weed invasion	3	
	logging - altered microhab - altered flow	1	

Species	Disturbance	Rank	Comments
	Climate change	2	potential to influence reserve selection
Hypsilurus spinipes	Any fire	1	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
	Weed invasion	2	
	Road maintenance	1	
Lampropholis caligula	Any fire	1	
	Weed invasion	1	scotch broome
	Climate change	1	
	Logging - altered microhab - old-regrowth	1	
Lampropholis elongata	Any fire	2	
	Climate change	1	
Saltuarius swaini	Any fire	3	
	Weed invasion	3	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
	Logging - loss of large trees and hollows	1	
Saltuarius wyberba	Any fire	2	
	Logging - altered microhab - old-regrowth	2	
	Logging that reduces size and age class	2	
	Logging - loss of hollows	2	
Calyptotis ruficauda	Any fire	2	
	Logging - changing canopy structure	2	
	Logging - dessication - altered microhab	2	
Eulamprus murrayi	Any fire	1	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
	Weed invasion	2	
	Logging that reduces age/size structure	1	
Eulamprus tenuis (N pop only)	Any fire	1	
	Logging - changing canopy structure	1	
	Logging - dessication - altered microhab	1	
	Weed invasion	3	
	Logging that reduces age/size structure	1	
	Logging - loss of hollows	1	
Eulamprus tryoni	Climate change	1	
Tympanocryptis diemensis (northern)	Any fire	1	
	Logging - altered microhabitat - reduced ground cover and litter	1?	
Tympanocryptis lineata pingucollis	Any fire	1	
	Weed invasion	1	
Saproscincus oriarus "North Coast sp"	Any fire	1	
SNAKES			
Cacophis harriettae	Any fire	1	
	Logging - loss of fallen logs	1	
Hoplocephalus bitorquatus	Any fire	1	
	Logging - loss of large treesl, stags and hollows	1	
	Logging - loss of fallen logs	1	
Hoplocephalus stephensii	Any fire	1	
	Weed invasion	3	
	Logging - changing canopy structure	2	
	Logging - loss of large treesl, stags and hollows	1	
	Logging - loss of fallen logs	1	

Species	Disturbance	Rank	Comments
Tropidechis carinatus	Any fire	2	
	Logging - loss of large trees, stags and hollows	2	
	Logging - loss of fallen logs	2	
Austrelaps ramsayi	Any fire	3	
	logging - altered microhab - altered flow	3	
	Climate change	2	
Drysdalia coronoides	Any fire	1	
	Climate change	2	
Cacophis krefftii	Any fire	1	
	Logging - loss of large logs	2	
Acanthophis antarcticus	Any fire	1	
	Logging - altered microhabitat - reduced ground cover and litter	2	
Hoplocephalus bungaroides	Any fire	1	
	logging - loss of large trees, hollows and stags	1	