First Respondent
Affidavits

IN THE LAND AND ENVIRONMENT COURT

OF NEW SOUTH WALES

No. 40052 of 1990

JOHN ROBERT CORKHILL
Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES
Respondent

AFFIDAVIT

Deponent: J.H. Drielsma

Sworn: day of 1990

H. K. ROBERTS,
Crown Solicitor,
8-12 Chifley Square,
Sydney. N.S.W. 2000

D.X. 19, Sydney.

Tel: 228 7357
(Mr. Peter Bowe)

On the 3rd day of JULY 1990

I, JOHANNES HENDRIK DRIELSMA of 8 Linden Street, Wyoming in the State of New South Wales, Forester, say on oath:

1. I am Commissioner for Forests in New South Wales. I have held that position since 23rd May, 1990. I hold the degrees of Bachelor of Science in Forestry, conferred by the Australian National University and Master of Forest Science and Doctor of Philosophy conferred by Yale Univesity, U.S.A.

   Annexed hereto marked "A" is my Curriculum Vitae.

2. The Commission has determined that it will endeavour to ensure that Environmental Impact Statements (hereafter referred to as "EISs") are prepared in all cases where environmental reviews of forestry activities concludes that EISs are

desirable or necessary. In my opinion a substantial proportion of the Commission's proposed harvesting and related forestry operations may require EISs to be prepared.

3. At the same time the Commission has long-term contractual commitments to the timber industry and a statutory duty to provide adequate supplies of timber for building, commercial, industrial, agricultural, mining and domestic products within New South Wales.

4. The Commission has determined that it will initiate a programme of EIS preparation to include all relevant forests in New South Wales.

5. As a first step towards preparing EISs for all operations in New South Wales which are likely to significantly affect the environment, the Commission has identified 14 areas of forest comprising a total area of some 180 000 hectares with little or no disturbance (referred to as "old growth" forest) which will be incorporated within EISs to be prepared for each of the relevant Management Areas over approximately the next 5 years. Within those 14 <u>determined</u> areas, there will be no harvesting whatsoever until EISs have been completed.

6. Annexed hereto marked "B" is a document including explanatory map, entitled "Meeting the Environment Challenge - A Forestry Strategy" together with a press release issued by the Premier of New South Wales in launching that strategy on behalf of the Government on the 24th June, 1990.

7. Annexed hereto marked "C" is a map for the whole of the Dorrigo Management Area (of Chaelundi State Forest) identifying the area which will not be logged pending completion of an EIS for that Management Area and the area comprising compartments 180, 198 and 200 in which logging is now proposed.

8. With reference to the schedule of 14 areas referred to on the fourth page of the firstmentioned document in Annexure "B", it is intended that the EIS for the Dorrigo Management Area will be completed by mid-1991.

SWORN by the Deponent at)
on the day and year first mentioned)
Before me:)

JOHN CANDAR
SOLICITOR OF THE SUPREME COURT OF
....
~~A Justice of the Peace~~ NSW

....
Johannes Hendrik Drielsma

"A"

95-99 YORK STREET
SYDNEY. 2000

A
JOHANNES HENDRIK DRIELSMA
SYDNEY
3rd
JULY 1990
BEFORE ME
Solicitor

CURRICULUM VITAE

Johannes Hendrick Drielsma

B. Sc. Forestry (First Class Honours) Australian National University, 1973.

Awarded Schlich Medal by Department of Forestry.
Awarded University Medal of the A.N.U.

1974 - 76	Forester with Forestry Commission of N.S.W., Wyong District.
1976 - 79	Postgraduate studies, School of Forestry and Environmental Studies, Yale University U.S.A. in Silviculture, Ecology, Land Use and Environmental Planning, Policy Analysis and Natural Resource Sociology. Awarded Master of Forest Science 1978. Awarded Ph.D 1984. Dissertation entitled "The Influence of Forest Based Industries on Rural Communities".
1980 - 82	Project Forester, Management Planning Division, N.S.W. Forestry Commission.
1982 - 87	Deputy Chief, Management Planning Division.
1987 - 88	Chief, Management Planning Division.
1985 - 89	Chairman of N.S.W. Division and Councillor of Institute of Foresters of Australia.
1986 - 88	Member, Advisory Committee of "Australian Forest Research".
1987 - 88	Chairman, Forest Planning Working Group of the Standing Committee of the Australian Forestry Council.
1988 -	Member, Technical Advisory Committee under Section 18 of State Pollution Control Commission Act.
1988 -	Member, Catchment Areas Protection Board.
1988 -	Assistant Commissioner, Forestry Commission of N.S.W.
1990 -	Appointed Commissioner for Forests, Forestry Commission of N.S.W.

"B"

Forestry Commission of New South Wales

Meeting the Environmental Challenge

A Forestry Strategy

June 1990

Introduction

Forestry in New South Wales is facing an increasingly difficult legal and political environment.

Forests, especially native forests, are a valuable resource to be carefully managed to provide a range of benefits, now and for the future, on a sustainable basis.

We need to demonstrate to the community that our forests are in good hands and that they are being managed in a way that will maintain both their ecological integrity and the survival of the industries and jobs which depend on them.

The challenge is to review forest management strategies in the light of new Government policy directions and community attitudes, and to adopt policies and strategies that will ensure sustainable and balanced use of resources.

Forests considered to be substantially undisturbed – often referred to as "old growth forests" – merit special attention.

Forestry and Timber in an Environmental Future

There are sound reasons why forestry should proudly take its place as a central plank in any responsible environmental policy. Forests are renewable provided that their ecosystems and processes are not irreversibly altered. Timber, the major material product of forests, is a very environmentally friendly product.

Timber:-

- is renewable
- is environmentally benign and non-polluting
- is recyclable, biodegradable
- requires low energy input for processing
- has high energy conservation attributes when in service in buildings
- stores CO_2 from the atmosphere and therefore works against global warming
- involves processes in its production which have much lower environmental impacts than agriculture or mining
- has outstanding aesthetic qualities.

Printed on 100% recycled paper

The forest products industry also plays a vital role in Australia's economy. It is the second largest manufacturing industry and the most significant in rural areas. Yet Australia currently imports $2.3 billion worth of forest products each year, leaving a net trade deficit of $1.7 billion.

Sustainable forest management including timber production must play an important role in any environmentally and economically responsible future for this State. The Government is committed to achieving and maintaining a proper balance in the use of the forest resource for the production of both timber and other values, including water quality, wildlife and flora conservation.

The New Environmentalism

In his recent major statement on the environment, the Premier defined the Government's broad policy direction and philosophical approach to the environment and provided the basis for developing more detailed policies for natural resource management. Philosophically the approach can be restated as follows:

- Nature is neither sacrosanct nor something to be pillaged. Rather, nature contains resources which we must use sensibly and rationally, but use nevertheless, if we are to maintain the quality of our lifestyles. This is a view shared by the great majority of Australians.
- While we may embrace many of the concerns of the hard-core environmental movement, we are not bound to embrace the ideological and sometimes silly nostrums they offer as solutions to our problems. Wider community concerns are not centred around a simplistic "green" agenda, but recognise the need to balance legitimate and sometimes competing interests. We must be willing to respond to the concerns of the majority.
- It is not ideology that matters, but solutions; solutions which work in the real world. These solutions lie in an economically rationalist approach and in better management. There must be a deliberate choice of achievable reform over "deep green" ideology.
- There is a need for stability and predictability in long term government policy.

Principles for Public Forest Management

The NSW Government accepts the following principles as a necessary and practical foundation for management of our State Forests:

- Decision-making must be based on a comprehensive information base covering relevant ecological, social and economic attributes of particular forest areas.
- Forests must be managed on an ecologically sustainable basis which maintains the ecosystem and provides for the interests of future generations in respect of both wood supply and environmental benefits.
- Forest management must be economically viable and efficient and must provide for a viable and efficient forest products industry.
- Decision-making must be balanced and open, and provide for public participation in the planning process.
- Forest management must be publicly accountable in ecological, social and economic terms, and responsive to evolving community concerns.

While a great deal has been achieved already in putting these principles into practice in NSW forests, the community now reasonably expects a higher level of visible commitment to their implementation.

The challenge is to develop strategies for fully applying these principles within the constraints of available funds, commercial viability, and rapidly evolving legal and political imperatives. In particular "old growth" forest has emerged as an issue requiring immediate attention.

A Strategic Direction

It is entirely appropriate that one of the practical expressions of the "New Environmentalism" should be directed to the conflict surrounding the management of native forests.

The central dispute in this conflict is a question of land use rather than forest management. There is no right or wrong answer in this land use dispute. The "Deep Green" lobby is calling for an end to all native forest logging. The timber industry and its employees are understandably anxious and want assurances that they can look forward to a sustainable and stable future in this important industry. An acceptable balance must be achieved.

Both the Governmentand and, some of the major conservation groups, acknowledge that there must be some logging of old growth forests to maintain the viability of industry over the next 20-30 years. After that time current yields can be sustained entirely from previously logged areas. However, it is important to examine these forests and their values in considerable detail, evaluate the options for land use, and determine those areas where logging can be undertaken using sensitive management practices in order to lessen and ameliorate the environmental impact.

It is recognised that there is wide community concern about our environment. Government decisions will reflect that concern by increasing significantly the openness and accountability of the natural resource management of public authorities, such as The Forestry Commission.

The new forest strategy represents a real step forward in a number of respects:

- It recognises community concern about forestry issues and the need for more public involvement in forest management decisions.
- It provides for that involvement through the provisions of The Environment Planning and Assessment Act. In fact it will go beyond those legal requirements.
- The Forestry Commission will not conduct these EISs behind closed doors. It will hire Independent Consultants to carry out some of the more sensitive EISs. In addition, the Commission will go to the community and seek its assistance in determining the scope of the EISs, and the issues that will be addressed in them.
- There will be a moratorium on harvesting in 14 major old growth areas until the EISs have been completed. This will occur progressively over a five-year period.
- An order of priority will be established for the sequential preparation of EISs. Priority will be given to management areas having substantial areas of "old growth" forming part of the sustained yield resource base, and for which EISs have not yet been completed.

- In establishing priorities, an assessment of the whole State has identified the following key areas of unlogged old growth forest within State Forests, for which EISs have not already been completed.

Management Area	State Forests	Key Areas
Urbenville	Richmond Range, Yabbra	Duck Creek
Murwillumbah	Nullum	Blackbutt Plateau
Tenterfield	Boorook, Spirabo, Forestland	–
Glen Innes	London Bridge, Glen Nevis, Oakwood,	London Bridge
Casino West	Mount Marsh	Mount Marsh
Grafton	Dalmorton	Cunglebung
Dorrigo	Chaelundi	Chaelundi
Walcha-Nundle	Ben Halls Gap, Tuggolo, Giro	Ben Halls Gap,
Kempsey	Nulla Five Day, Styx River,	–
Wauchope	Doyles River, Mount Boss, Yessabah, Kippara	–
Wingham	Dingo, Bulga, Doyles River, Enfield	–
Gloucester	Stewarts Brook, Barrington Tops	Barrington Tops
Chichester	Chichester, Boonabilla	Whispering Gully, Boonabilla
Mount Royal	Mount Royal	Davis Creek

These identified areas comprise some 180 000 ha within 14 separate forest management areas.

Old Growth Forest

Old-growth forests have attracted considerable attention. There are practical problems in defining just what is meant by "old growth" forest. At one extreme, it may include any forest with old trees, and this definition covers practically all State Forest where selective logging has been practised for decades. A more meaningful definition would include only natural forest with few or no signs of human disturbance.

Using a definition of "old growth" based broadly on "forest with little or no disturbance", there are about 5 million ha of such forest in the State, distributed throughout different land tenures as follows (areas in millions of ha):

National Park	2.0
State Forest	1.6
Various Crown Lands	1.1
Privately-owned Lands	0.3
	5.0

Major areas of old growth are already reserved within the State's National Park system. Many of these Parks resulted from the revocation of extensive areas of State forest, particularly in recent years.

Of the 1.6 million ha within State Forests, 1.3 million ha are deliberately excluded from logging (eg in Flora Reserves or for catchment protection) or are unsuitable (eg excessively steep terrain and economically inaccessible areas). Together with the 2.0 million hectares protected with National Parks, this represents 92% of the total "old growth" conserved within either National Parks or State Forests.

The debate about the harvesting of old growth forest therefore revolves around approximately 0.3 million ha of State Forest or about 8% of the total old growth permanently conserved within National Parks and State Forests. This 0.3 million ha, together with the 1.5 million ha of previously logged (and regenerated) State Forest currently provides our resource base for long term sustained yield of the State's hardwood timber needs.

The EIS process will determine the most appropriate use of these forests in line with sound, economic, social and environmental principles.

The "Rainforest Decision of 1982"

The current dispute in the North coast forests should also be seen in the context of decisions made in 1982.

The "Rainforest" decision of the former State Government in 1982 removed from production some 100 000 ha of old growth, formerly part of the north coast's sustained yield resource. Impacts on industry viability and jobs were significant, but industry concern was tempered by a firm Government guarantee that the remaining resource base would not be eroded.

Industry was given a written undertaking by the Government that alternative (i.e. remaining) timber resources would be identified, "the availability of which will be assured by Government." It also guaranteed the "maintenance of employment levels consistent with those existing and predicted from the current management proposals of the Forestry Commission of NSW," (NSW Government Rainforest Policy 1982). Thus both industry and the Forestry Commission were able to make adjustments to the reduced resource base, secure in the knowledge that it was guaranteed by Government.

Environmental lobby groups now have made further demands for the exclusion of harvesting from what remains of the north coast hardwood resource, specifically in those State Forests identified in 1982 by the former government as the "alternative" resource for industry.

Industry, having adjusted to the trauma of 1982 and having received firm undertakings from the Wran and Unsworth Governments, has good reason to expect the maintenance of its resource base.

The Legal Challenge

The Environmental Planning and Assessment Act, enacted in 1979, requires an Environmental Impact Statement (EIS) for any activity likely to significantly affect the environment. It does not require an EIS for logging <u>per se</u>. It was not envisaged at the time, nor did the then Minister or the Department of Planning suggest, that an EIS would be required for all logging activities. In fact consultations with the Department led to the development of a system of internal environmental review designed to meet the requirements of the Act and identify those cases where EIS preparation might be required.

Since the Act came into force in 1980, the Forestry Commission has completed five EISs for operations within areas seen to have particular sensitivity. However, interpretation of a Land and Environment Court ruling in 1989 suggests that EISs could be required for a considerably broader range of logging operations than previously thought, and particularly in respect of "old growth" forest. In fact there is considerable doubt as to when an EIS might be held <u>not</u> to be required. This ruling, which has been successfully exploited by anti-logging groups, is the cause of the current crisis facing the Forestry Commission and the timber industry, particularly on the North Coast.

This situation, coupled with perceived community concerns, gives additional impetus to the need to implement a strategy for the management of old growth forest.

Other Related Initiatives

The above strategy is complemented by a number of additional initiatives.

The Forestry Commission is reviewing its policy on hardwood plantations and identifying options for pursuing a more positive program consistent with broader timber supply objectives and economic efficiency.

The Government is exploring the feasibility of plantation share-farming schemes within NSW through a working party composed of representatives of the Forestry Commission, Nature Conservation Council, Land Conservation Council and Soil Conservation Service.

The Government will continue to pursue Commonwealth financial assistance for hardwood plantation schemes.

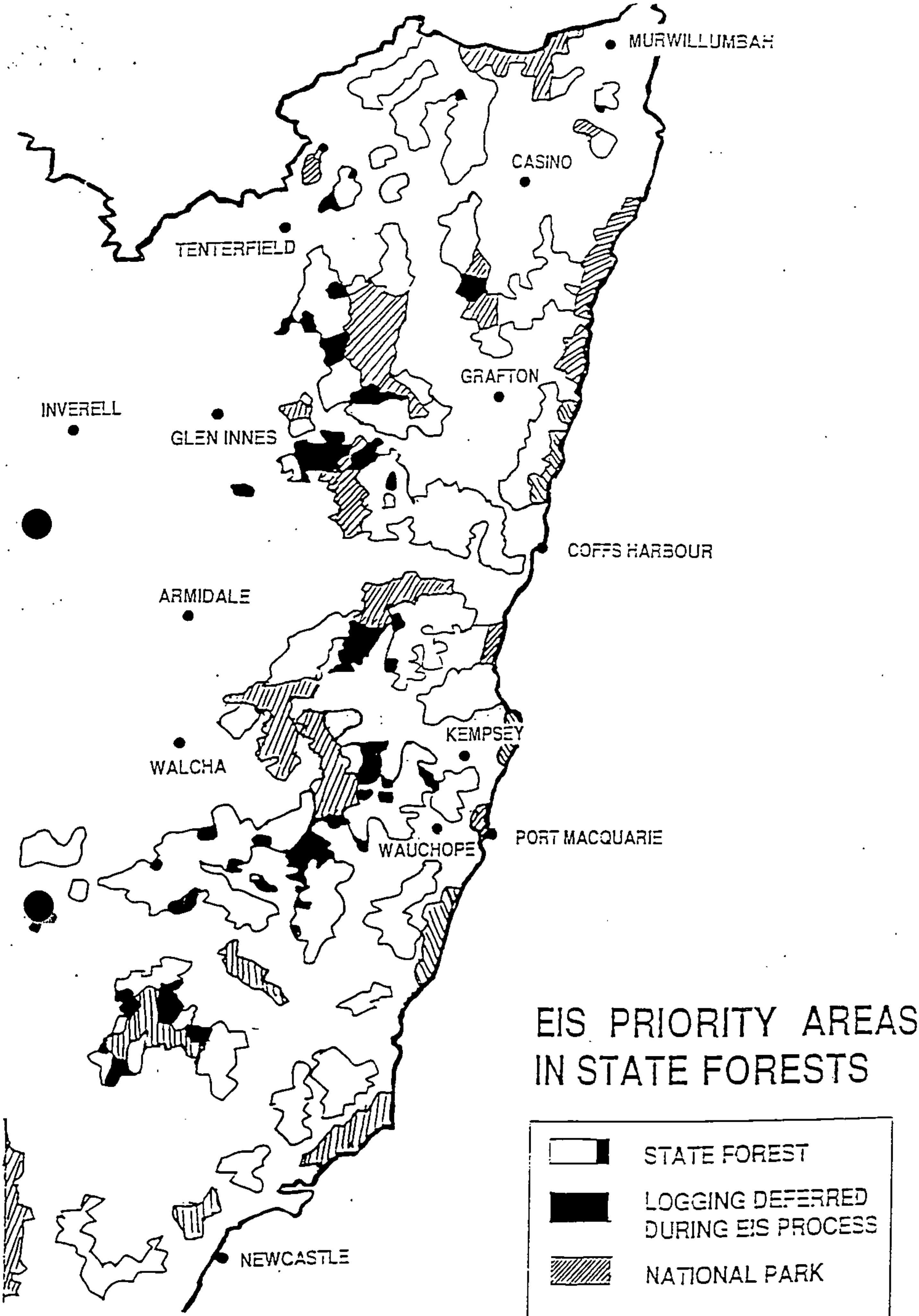
The Forestry Commission is currently establishing hardwood plantations at a rate of about about 200 hectares per annum.

The Forestry Commission will develop a more pro-active and adequately resourced communications program so as to increase the community's access to information about its policies and activities, particularly their environmental significance. The program will also provide avenues for feedback from the community.

The Forestry Commission is developing a computer based Geographic Information System as a basis for improving its resource data bases and analytic capabilities. This system will greatly enhance community access to forest resource information and the ability to formulate management plans and evaluate environmental impacts.

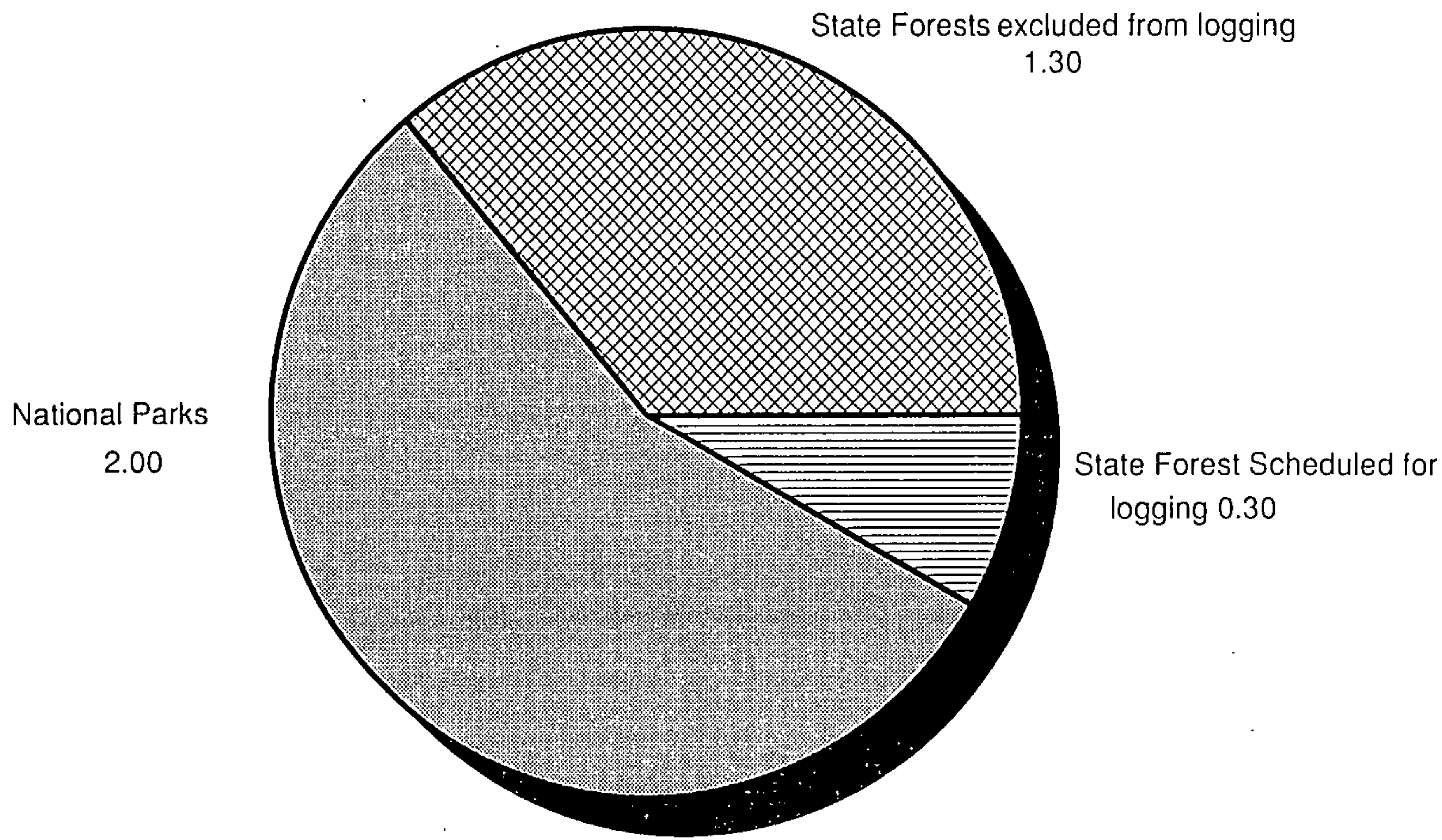
Summary

The strategy outlined above, provides a responsible and workable basis for a new approach to the legal, ecological and economic requirements for the management of "old growth" within State Forest. It will allow greater public participation in decision making processes and a higher degree of accountability to the community for the management of what it rightly regards as a precious natural resource.

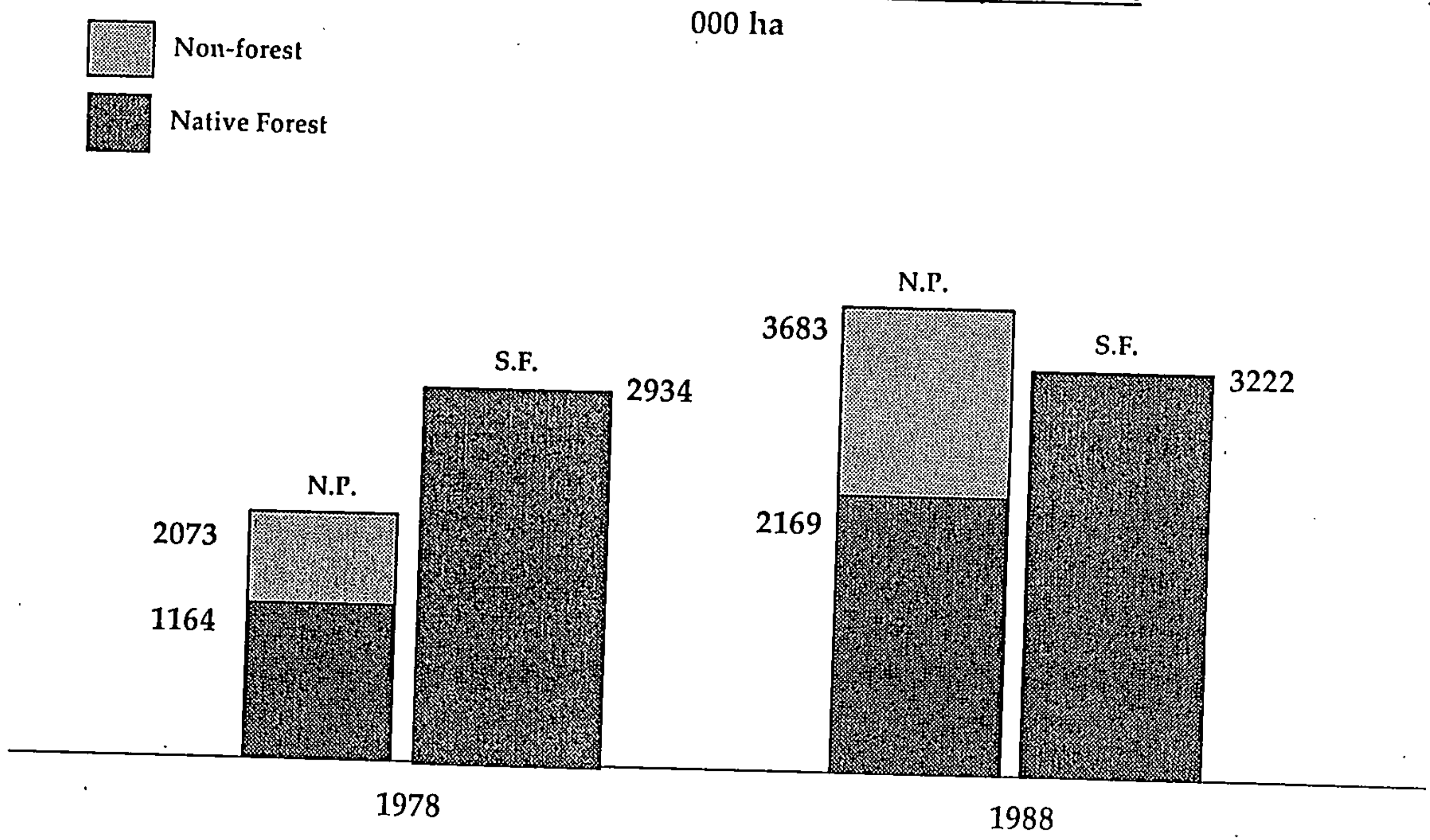


EIS PRIORITY AREAS IN STATE FORESTS

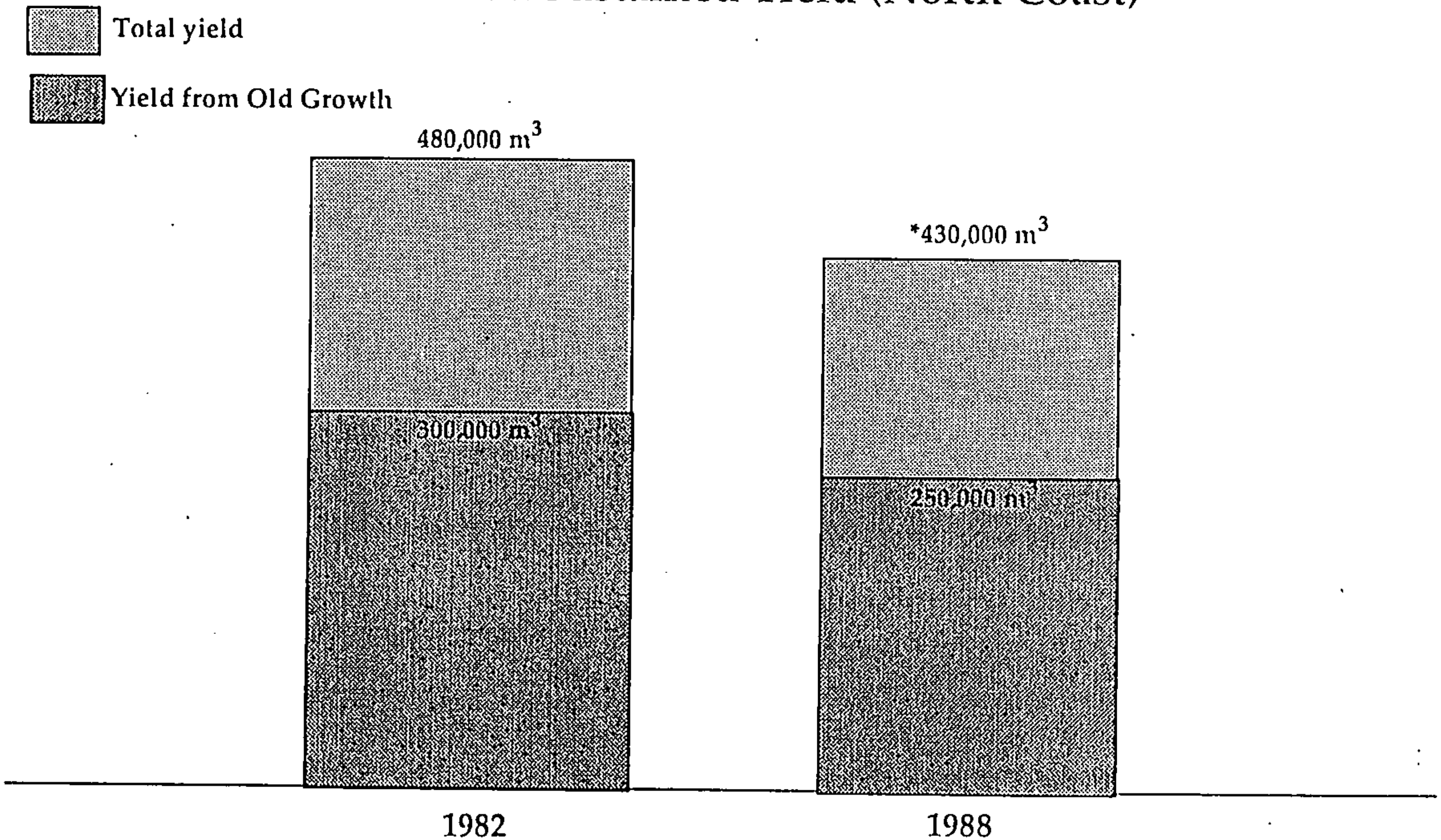
OLD GROWTH FOREST IN NATIONAL PARKS & STATE FORESTS - 3.6 Million Hectares



National Parks and State Forests, N.S.W.



Hardwood Sustained Yield (North Coast)



* Reduction of 50,000 m^3/p.a. due to "Rainforest" Decision of 1982–83

NEWS RELEASE

Premier of New South Wales
Australia

24 June, 1990

PREMIER LAUNCHES FORESTRY STRATEGY

Premier Nick Greiner today announced a freeze on harvesting timber from large tracts of "old-growth" forests on the North Coast of New South Wales pending the results of comprehensive environmental impact studies to be carried out progressively over the next five years.

Mr Greiner said 180,000 hectares of timber in 14 old-growth State forests would be the subject of the environmental studies --- nearly ten times the area sought for consideration by leading conservationists.

"This is a real step forward for the conservation movement in New South Wales," Mr Greiner said.

"It will reassure the community that the Government has an overall plan to care for our forest areas and indicates the Forestry Commission is making a real effort to acknowledge the legitimate views of the conservation movement."

"I don't pretend for a moment that the Government's forests strategy will satisfy everyone but reasonable people who care about the environment will see it as an effective balance between the interests of the timber industry and the need for an overall conservation plan."

Mr Greiner,along with the Minister for Natural Resources, Mr Ian Causley launched the Forestry Commission's new forests strategy at the Bellangry State Forest, a restored "re-growth" forest area near Wauchope.

The strategy identifies the areas of greatest environmental sensitivity and makes a commitment that there will be no timber harvesting until a full environmental impact process has been completed.

The main features of the policy include:

* The great majority of old-growth within State forests will never be logged however some will be needed to maintain vital timber supplies over the next 20-30 years.

* Beyond that time community demand for timber is to be sustained entirely from re-growth forests and plantations.

* The Forestry Commission will be required to canvass all likely impacts of any timber harvesting and examine possible alternatives.

* Community participation in the planning process is to be actively encouraged.

Mr Greiner said that while the studies are carried out the timber industry will be supplied from adjacent forest areas.

He pointed out that 3.6 million hectares of old-growth timber is located within the boundaries of National Parks or State Forests -- the 2 million hectares in the parks are protected and 1.3 million hectares in State Forests are excluded from logging, leaving only 0.3 million hectares regarded as essential to sustain timber production.

The forests strategy is the first practical expression of the Government's "New Environmentalism" launched by the Premier in his Earth Day statement on April 22.

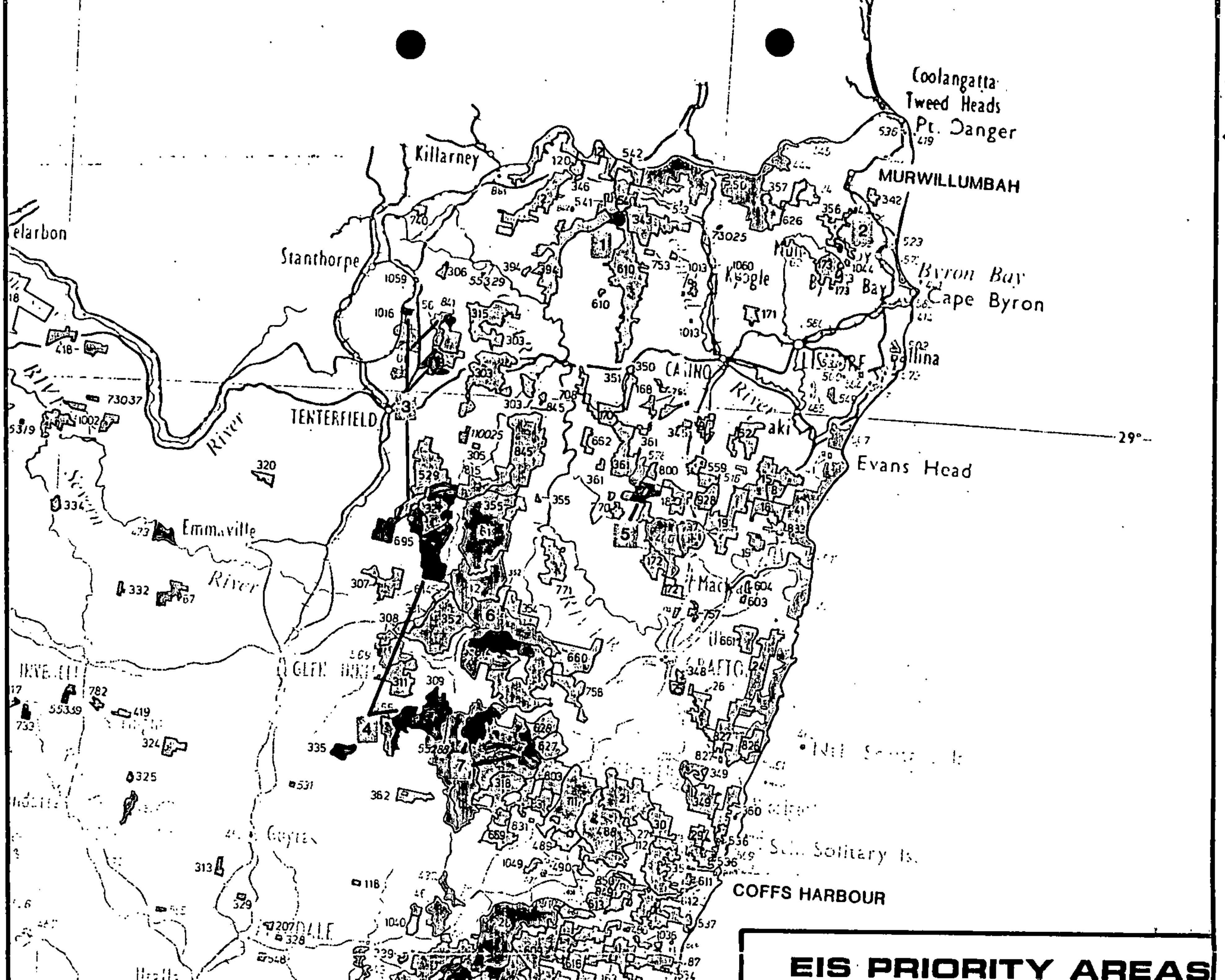
"In putting forward this strategy the Government and the Forestry Commission are recognising community concern about the management of our forests and the need for more public involvement in the forest management process," Mr Greiner said.

"The Government has sought to reconcile legitimate and competing demands on our forests.

"We believe we have found the right balance, which will safeguard the environment while ensuring the sustainable production of a renewable resource that the community needs."

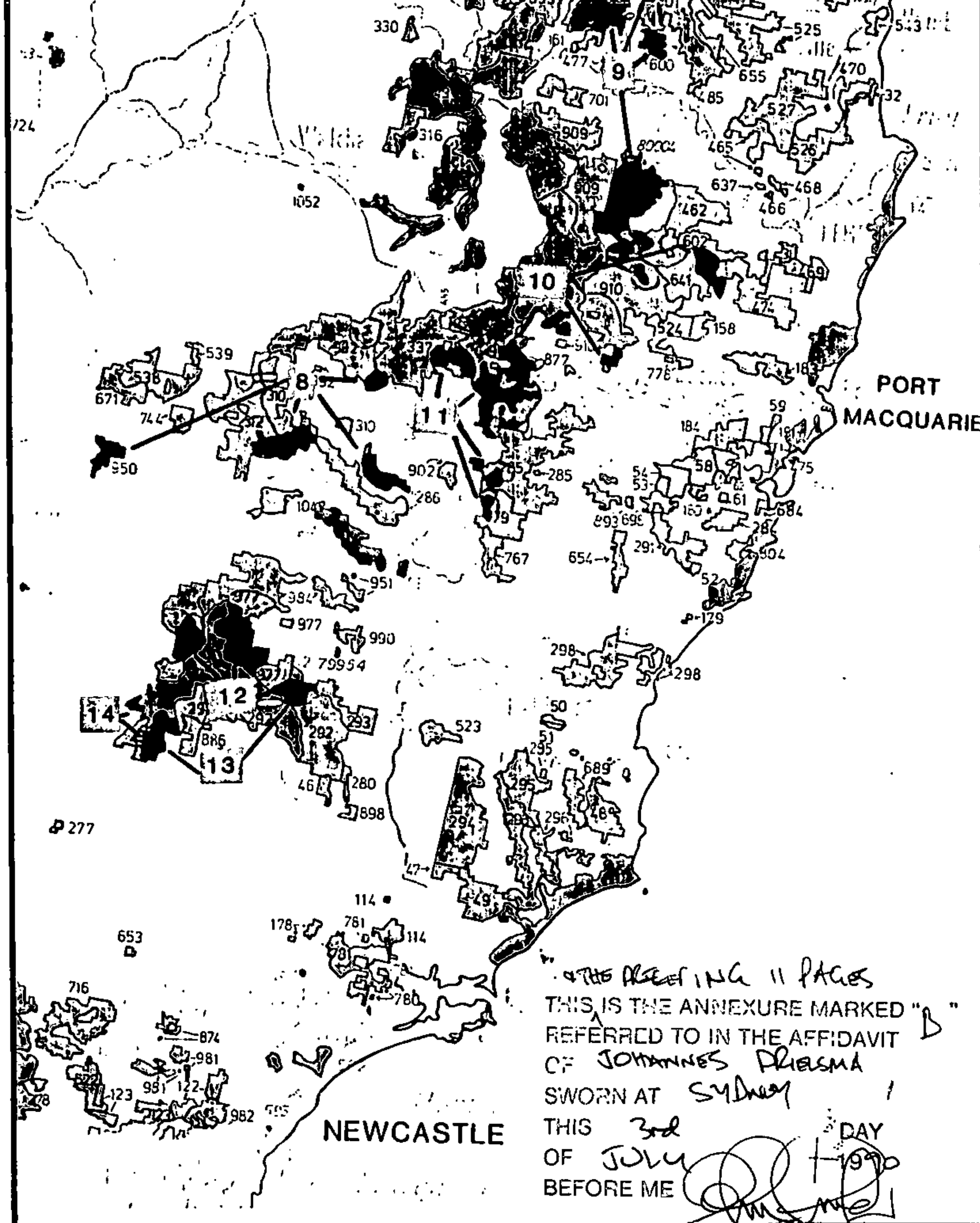
Contact: David Jones
Premier's Press Secretary
228 3666 (0) 869 1565 (h)

David Newman
Forestry Commission Public Relations Officer
234 1618 (0) 560 1510 (h)



EIS PRIORITY AREAS

IN STATE FORESTS



*THE PRECEDING 11 PAGES
THIS IS THE ANNEXURE MARKED "B"
REFERRED TO IN THE AFFIDAVIT
OF JOHANNES RIEMSMA
SWORN AT SYDNEY
THIS 3rd DAY
OF JULY 1990
BEFORE ME

Solicitor

SCALE

0 50km

LEGEND

State Forest
Logging deferred during EIS process

Interim supply zone

National Park

1 DUCK CREEK (URBENVILLE M.A.)
2 BLACKBUTT PLATEAU (MURWILLUMBAH M.A.)
3 TENTERFIELD M.A.
4 LONDON BRIDGE (GLEN INNES M.A.)
5 MOUNT MARSH (CASINO WEST M.A.)
6 CUNGLEBUNG (GRAFTON M.A.)
7 CHAELUNDI (DORRIGO M.A.)
8 WALCHA-NUNDLE M.A. (INCLUDES BEN HALLS GAP)
9 KEMPSEY M.A.
10 WAUCHOPE M.A.
11 WINGHAM M.A.
12 BARRINGTON TOPS (GLOUCESTER M.A.)
13 CHICHESTER M.A. (INCLUDING WHISPERING GULLY)
14 DAVIS CREEK (MOUNT ROYAL M.A.)

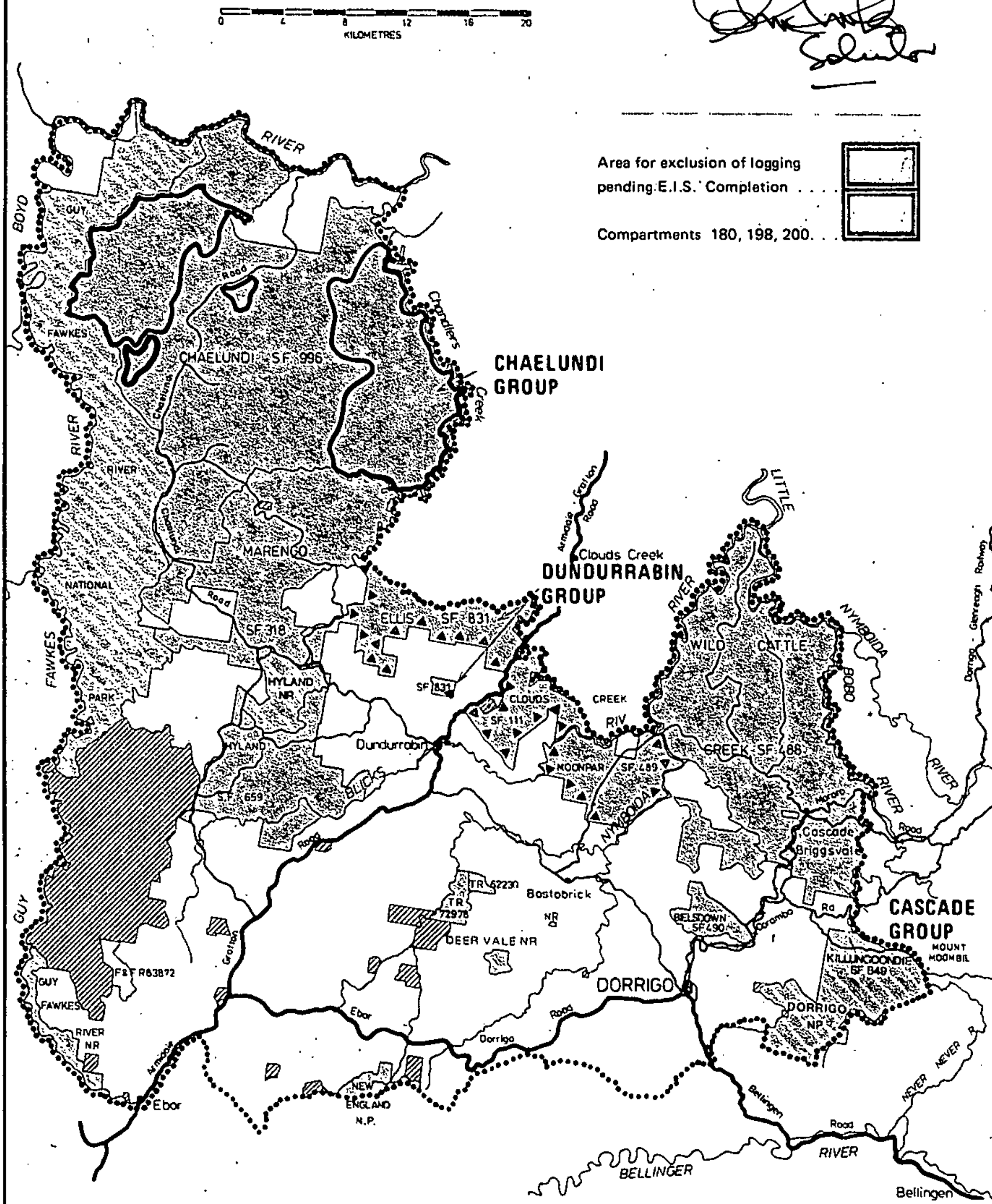
ANNEXURE C

This is the Annexure marked "C" referred to in the Affidavit of Johannes Hendrik Drielsma sworn the 3rd day of JULY 1990 before me:

Solicitor

DORRIGO MANAGEMENT AREA

Locality Map



Forest Group ▲ ▲ ▲ ▲

Management Area Limits • • • • • • • •

Major Public Access Road

Minor Public Road

Major Forestry Access Road

State Forest - Timber Reserve

National Park-Nature Reserve

Other Crown-timber Land

JOHN CORKILL DIPLOMA IN TEACHING

ENVIRONMENTAL EDUCATOR, PLANNER, POLICY ADVISOR

Executive Officer - GREEN APPEAL Inc; Member, Coastal Committee of NSW; Vice President, North Coast Environment Council Inc; Sydney Co-ordinator, North East Forest Alliance.

SYDNEY: NSW Environment Centre, 39 George St, The Rocks. 2000. Ph. 02 2474 206, Fx 02 2475 945
LISMORE: The Big Scrub Environment Centre Inc, 88A Keen St, Lismore. 2480. Ph 066 213 278, Fx 066 219 420

FAX COVER SHEET

TO: LOUISE - Resource Planning P/L

FAX No. 049 331 107 PH No

No. of Pages following 2 DATE SENT 8/10/91

MESSAGE:

Letter as promised - Sorry about delay!

IF TRANSMISSION FAILS OR IMPERFECT, PLEASE PHONE: 02 2474206

JOHN CORKILL DIPLOMA IN TEACHING

ENVIRONMENTAL EDUCATOR, PLANNER, POLICY ADVISOR

Executive Officer GREEN APPEAL Inc; Member, Coastal Committee of NSW; Vice President, North Coast Environment Council Inc; Sydney Co-ordinator, North East Forest Alliance.

SYDNEY: NSW Environment Centre, 39 George St, The Rocks. 2000. Ph. 02 2474 206, Fx 02 2475 945
LISMORE: The Big Scrub Environment Centre Inc, 88A Keen St, Lismore. 2480. Ph 066 213 278, Fx 066 219 420

FAX COVER SHEET

URGENT!

TO: CHAELUNDI NEWS ~~STAFF~~

FAX No. 02 236-8839 PH No

No. of Pages following 5 DATE SENT ..../..../....

MESSAGE: Extracts from NPWAct 74 as @ 23 AUG '88

IF TRANSMISSION FAILS OR IMPERFECT, PLEASE PHONE: 02 2474206

NATIONAL PARKS AND WILDLIFE ACT 1974 No. 80

[Reprinted as at 23 August 1988]

NEW SOUTH WALES

TABLE OF PROVISIONS

PART 1—PRELIMINARY

PART 2—ADMINISTRATION

Division 1—National Parks and Wildlife Service

Division 2

Division 3—Ex-officio and honorary rangers

3336-1 (210)

2,576

Taking or killing protected fauna, other than endangered fauna.

98. (1) In this section, "protected fauna" does not include endangered fauna or locally unprotected fauna under section 96.

(2) A person shall not—

(a) take or kill any protected fauna; or

(b) use any animal, firearm, explosive, net, trap, hunting device or instrument or means whatever for the purpose of taking or killing any protected fauna.

Penalty: $2,000 or imprisonment for 6 months or both.

(3) A person shall not be convicted of an offence arising under subsection (2) if he proves that the act constituting the offence was done—

(a) under and in accordance with or by virtue of the authority conferred by a general licence under section 120, an occupier's licence under section 121, a game licence under section 122 or a trapper's licence under section 123; or

(b) in pursuance of a duty imposed on him by or under any Act.

(4) Subsection (2) does not apply to the taking of any reptile of a species named in an order made by the Governor and published in the Gazette for the purposes of this subsection.

Taking or killing endangered fauna

99. (1) A person shall not—

(a) take or kill any endangered fauna; or

(b) use any animal, firearm, explosive, net, trap, hunting device or instrument or means whatever for the purpose of taking or killing any such fauna.

Penalty:

(a) in respect of any endangered fauna of a species named in Part 3 (threatened fauna), Part 4 (fauna in imminent danger of extinction) or Part 5 (marine mammals) of Schedule 12—$10,000 or imprisonment for 2 years or both; or

(b) in respect of any other endangered fauna—$4,000 or imprisonment for 1 year or both.

(1A) Where—

(a) a person is convicted by the Land and Environment Court of an offence arising under subsection (1) in relation to a marine mammal; and

(b) the Court is satisfied that the person committed the offence in the course of commercial operations relating to the killing of marine mammals,

the maximum pecuniary penalty that the Court may impose in respect of the offence is $100,000.

(2) A person shall not be convicted of an offence arising under subsection (1) if he proves that the act constituting the offence was done under and in accordance with or by virtue of the authority conferred by a general licence under section 120.

(3) Where the provisions of any other Act or instrument under any other Act authorise or require anything to be done that would constitute an offence arising under subsection (1)—

(a) the provisions of this section prevail; and

(b) a person shall not be convicted of an offence against that other Act or instrument by reason of his failure to comply therewith in so far as compliance therewith would constitute an offence arising under subsection (1).

Further provisions respecting taking or killing protected fauna (including endangered fauna)

Not

100. (1) A person shall not be convicted of an offence arising under section 98 (2) or 99 (1) if he proves—

(a) that the animal concerned was in some person's lawful possession and that the act constituting the offence was, having regard to the circumstances of the case, reasonably necessary for promoting the welfare of the animal; or

(b) that the animal concerned had strayed or escaped from some person's lawful possession and that the act constituting the offence was, having regard to the circumstances of the case, reasonably necessary for securing the return of the animal.

s.100 contd

(2) The regulations may make provision for or with respect to exempting, subject to the prescribed conditions and restrictions (if any), any person or class or description of persons from the provisions of section 98 (2) or 99 (1) or both.

Not in Academy cd

Buying, selling or possessing protected fauna

101. (1) A person shall not buy, sell or have in his possession or control any protected fauna.

Penalty:

(a) in respect of any protected fauna other than endangered fauna—$2,000 or imprisonment for 6 months or both;

(b) in respect of any endangered fauna of a species named in Part 1 (fauna of special concern) or Part 2 (vulnerable and rare fauna) of Schedule 12—$4,000 or imprisonment for 1 year or both; or

(c) in respect of any endangered fauna of a species named in Part 3 (threatened fauna), Part 4 (fauna in imminent danger of extinction) or Part 5 (marine mammals) of Schedule 12—$10,000 or imprisonment for 2 years or both.

(2) * * * * *

(3) The Governor may, by order published in the Gazette*, exempt from subsection (1) protected fauna of a species named in the order, subject to such conditions and restrictions relating to the buying, selling or having in possession of any such protected fauna as may be prescribed in the order.

(4) A person shall not be convicted of an offence arising under subsection (1) in respect of the buying or selling of any protected fauna if the person satisfies the court that the person believed, on reasonable grounds, that the act constituting the offence was done, or that the state of affairs constituting the offence existed, under and in accordance with or by virtue of the authority conferred by a licence under Division 2 of Part 9 or an aviary registration certificate under section 128.

(5) A person shall not be convicted of an offence arising under subsection (1) in respect of the possession of any protected fauna, if the person satisfies the court—

(a) that the person believed, on reasonable grounds, that the state of affairs constituting the offence existed under and in accordance with or by virtue of the authority conferred by a licence under Division 2 of Part 9 or that the person otherwise obtained the fauna lawfully;

* See Gazettes No. 54 of 11.4.1975, p. 1393; No. 147 of 19.10.1984, p. 5146; and No. 138 of 4.10.1985, p. 5240.

Plants

(2) A person shall not be convicted of an offence arising under subsection (1) in respect of—

(a) Christmas Bush that has been grown on private land and picked by or with the consent of the owner or lessee of that land;

(b) any protected native plant that has been picked for commercial purposes in pursuance of a licence issued under section 131; or

(c) any protected native plant that has been grown in pursuance of a licence issued under section 132 and picked by or with the consent of the holder of the licence.

PART 9—LICENSING, ETC., IN RESPECT OF FAUNA AND NATIVE PLANTS

Division 1—Preliminary

Definitions

119. In this Part—

"authorised officer" means—

(a) the Director; or

(b) in relation to a provision of this Part—

(i) an officer of the Service, or any other person, duly authorised by the Director; or

(ii) any person holding an office, position or rank prescribed,

for the purposes of that provision;

"private land" includes land leased from the Crown, or which is in the course of alienation by the Crown under any Act.

*

Division 2—Fauna

General licence

see Certain vs Fenson

120. **(1)** An authorised officer may issue a licence (in this Act referred to as a "general licence"), authorising a person to do any or all of the following:

(a) to take or kill or obtain any protected fauna—

(i) for the purpose of providing specimens of natural history for any scientific institution or museum;

(ii) for the purpose of carrying on any scientific investigation;

(iii) for the purpose of exhibiting the fauna; or

(iv) for any other specified purpose;

(b) to exhibit protected fauna;

(c) to dispose of, whether by sale or otherwise, any fauna taken or killed, obtained or exhibited under the authority of the licence;

(d) to sell any fauna in his lawful possession, otherwise than as a fauna dealer or skin dealer.

(2) A general licence does not, except in so far as the terms of the licence otherwise expressly provide, authorise the taking or killing of fauna in a national park, historic site, nature reserve, state game reserve, wildlife district, wildlife refuge, wildlife management area, conservation area, wilderness area or area subject to a wilderness protection agreement.

Occupier's licence

121. **(1)** An authorised officer may issue a licence (in this Act referred to as an "occupier's licence"), authorising an owner or occupier of specified lands—

(a) to take or kill; or

(b) to permit a person, holding a general licence issued to him under section 120 or a trapper's licence issued to him under section 123, to take or kill,

a specified number of fauna of a specified class found on those lands and the licence may authorise the disposal, whether by sale or otherwise, of fauna taken or killed under the authority of the licence.

(2) An occupier's licence shall not be issued unless the licensee has been supplied by the Service with labels, tags, slips or other objects sufficient in number to affix or attach, in compliance with any condition of the licence, to the skin or carcase of fauna taken or killed under the authority of the licence.

(3) An occupier's licence shall not be issued with respect to endangered fauna.

(3) Without affecting the generality of subsection (2) (a), a person shall not, upon a request for information or other reasonable assistance being made by the Director, any other officer of the Service, an ex-officio ranger or an honorary ranger in the exercise of any powers, authorities, duties or functions under this Act or the regulations, the Wilderness Act 1987 or regulations under that Act, refuse to give the information or other assistance requested or knowingly give any information that is false or misleading in a material particular.

(4) A person shall not incite or encourage another person to contravene subsection (3).

Corruption

170. A person shall not, without lawful authority, offer, make or give to an officer of the Service, an ex-officio ranger or an honorary ranger any payment, gratuity or present in consideration that the officer or ranger will do or omit to do any act or thing pertaining to his powers, authorities, duties or functions as such an officer or ranger.

Penalty: $1,000 or imprisonment for 1 year or both.

Authority of officers of Service to take or kill etc.

see Corkill v/s FCNSW

171. (1) The Director may authorise an officer of the Service, an ex-officio ranger or an honorary ranger—

(a) to take or kill—

(i) any animals of a class or description specified by the Director, being animals within a national park, historic site, nature reserve, state game reserve, Aboriginal area, protected archaeological area, wildlife district, wildlife refuge, wildlife management area or conservation area; or

(ii) any animals of a class or description specified by the Director, being protected fauna outside a park, site, reserve, area, district or refuge referred to in subparagraph (i), other than fauna that are not the property of the Crown;

(b) to fell, cut, destroy, injure, remove or set fire to any tree, timber or vegetation of a class or description specified by the Director, within a nature reserve or state game reserve; or

(c) to pick or have in his possession any native plant of a class or description specified by the Director, within a nature reserve or state game reserve.

(2) An officer of the Service, an ex-officio ranger or an honorary ranger shall not be convicted of an offence against this Act if he proves that the act constituting the offence was done, or the state of affairs constituting the offence existed, under the authority of the Director under subsection (1).

(3) For the purposes of this Act, the Director shall be deemed to be authorised under subsection (1) with respect to all animals, and all trees, timber, vegetation and native plants, to which that subsection relates or may relate.

(4) Except in so far as the Director otherwise directs, his authorisation of a person under subsection (1) with respect to any animals also authorises that person to do, in connection with the taking and killing of any such animal, any act referred to in section 45 (1) or 56 (1).

(5) Subsection (1) (a) (i) does not apply with respect to an animal that is not the property of the Crown unless the animal apparently has no owner and is not under control or unless an officer of the Service believes on reasonable grounds that the animal is endangering, or likely to endanger, any other animals or any persons or property within the park, site, reserve, area, district or refuge referred to in subsection (1) (a) (i).

(6) Nothing in this section affects the provisions of section 155 (2) (bb).

Member of police force

172. A member of the police force shall not be convicted of an offence against this Act in respect of an act done in pursuance of or as part of his duties as such a member.

Removal of trespassers

173. (1) Where, but for this section, section 255 of the Crown Lands Consolidation Act 1913 would not apply to or in respect of any lands within a national park, historic site, state recreation area, nature reserve, state game reserve or Aboriginal area, that section, subject to subsection (2), applies to and in respect of those lands in the same way as it applies to and in respect of Crown lands within the meaning of that Act.

(2) In the application of section 255 of the Crown Lands Consolidation Act 1913, whether by virtue of subsection (1) or otherwise, to or in respect of any lands within a national park, historic site, state recreation area, nature reserve, state game reserve or Aboriginal area, a reference in that section to any person duly authorised by the Minister includes a reference to the Director or any person duly authorised by the Director.

Department of Environment and Planning

HC 86-0993

Minute

Subject: REMNANT RAINFOREST AREA, MIDDLE POCKET, BILLINUDGEL

INTRODUCTION

At its meeting on 1st May, 1986 the Heritage Council considered the need for the making of an interim order for the abovementioned natural area in accordance with the provisions of the Heritage Act, 1977.

BACKGROUND

Details of the item are given in the Heritage Council Report at folio 50 (tagged), and in correspondence from The Big Scrub Environment Centre at folios 40 and 41.

ELECTORATE AND LOCAL MEMBER

Byron: Mr D Beck, M.P.

CRITICAL DATES

Early attention required.

RECOMMENDATION

The Heritage Council RESOLVED TO:

(a) advise the Minister that the Heritage Council considers that it may be found on further inquiry and investigation that the item of the environmental heritage being an area of remnant rainforest and sclerophyll forest at Middle Pocket, Byron Shire, is so necessary as to warrant the making of a permanent conservation order;

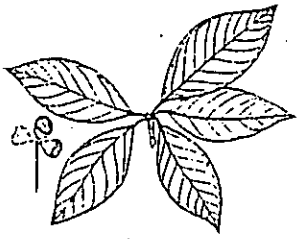
(b) recommend to the Minister, pursuant to Section 24 of the Heritage Act, 1977, the making of an interim conservation order in respect of the place being known as Portion 263 and Part Portion 264, parish of Billinudgel, comprising 221.5 hectares, at Middle Pocket, Byron Shire, as shown edged heavy black on the plan catalogued HC 1233 in the office of the Heritage Council of New South Wales; and

(c) request the Heritage and Conservation Branch and the National Parks and Wildlife Service to expedite the further inquiries and investigations into the significance of the area, those to be co-ordinated by Mr Whitehouse.

"Mr Garry West Minister for CALM has also utterly failed to fullfill his Ministerial responsibilities to exercise his control over Dr Drielsma and the Commission. He has consistently failed to bring this 'out of control' agency to heel. There have been numerous breaches of law by the Forestry Commission proven before the Courts yet Mr West has refused to inquire into the circumstances of these unlawful acts. He has condoned 'more of the same' by the Commission. Mr West should resign or be sacked.

A MEDIA CONFERENCE WITH ANALYSIS OF THE EXACT TERMS OF THE COURTS JUDGMENT AND ITS IMPLICATIONS WILL BE HELD AT N.S.W. PARLIAMMENT HOUSE PRESS GALLERY, LEVEL 6 AT 12 NOON OR SOON AFTER.

For more information, contact John Corkill 02 2474 206 w.
Please note previous home no. 02 660 3496 is no longer applicable.



BRUSH BOX
Lophostemon confertus

N.E.F.A.
NORTH EAST FOREST ALLIANCE

SYDNEY: NSW Environment Centre, 39 George St, The Rocks. 2000. Ph. 02 2474 206, Fx 02 2475 945
LISMORE:The Big Scrub Environment Centre Inc, 88A Keen St, Lismore. 2480. Ph 066 213 278, Fx 066 219 420

NEWS RELEASE - 1/11/1991

COURT OF APPEAL REJECTS GOVERNMENT'S APPEAL. NEFA'S CHAELUNDI CAMPAIGN A SUCCESS!

The Court of Appeal's dismissal of the Greiner Government's appeal against findings, by Mr Justice Paul Stein in the Land and Environment Court, that the Forestry Commission of NSW was in breach of the National Parks and Wildlife Act, 1974 has vindicated the campaign to protect the three disputed compartments in the Chaelundi State Forest, according to NEFA's Sydney Co-ordinator and successful applicant, Mr John Corkill.

"This decision is a mortal blow to Mr Greiner's credibility. He commenced the appeal as a smoke screen to the making of the draconian Regulation 138 which permits just about anyone to harm protected and endangerd species," Mr Corkill said.

"The Government must accept that there is no legal basis for exempting the Forestry Commission or other NSW agencies from the law which has been affirmed by the Court of Appeal. Economic activity in the state has not, and will not, grind to a halt as Mr Greiner falsely claimed. The Regulation must be withdrawn or be disallowed in the Parliament.

"There has always been provisions for licences or authorities to be granted under the National Parks and Wildlife Act, 1974 to permit reasonable economic activity where good reasons for harm to fauna can be demonstrated. Mr Greiner and Forestry Commission have chosen to ignore them. Instead they've run a disgraceful campaign of fear and falsehood.

Mr Corkill said that the decision of the Court of Appeal is the death knell for the bona fides of the Forestry Commission and its Commissioner, Dr Hans Drielsma.

"Dr Drielsma has got it wrong repeatedly. In his intransigent demand to log an exceptional area of natural heritage significance, the three compartments of Chaelundi SF, he has plunged the Government, the public and local communities into a bitter dispute. He has cost the community, and the Government a great deal of pain, and hundreds of thousands of dollars.

"A private sector employee responsible for such a monumental blunder would be dismissed for gross incompetence. Dr Drielsma cannot be relied upon and should now be sacked.

59

Heritage Council of New South Wales

Remington Centre
175 Liverpool Street, Sydney 2000
P.O. Box A284, Sydney South 2000

Telephone: (02) 266 7111 Ext. 7649

Contact: Mrs. C. Williams

Our reference: KHC 86-0993

Your reference:

Mr. D. Beck, M.P.,
24 Bay Street,
TWEED HEADS 2485 97

Dear Mr. Beck,

Property: Rainforest Area, Middle Pocket, Billinudgel

I would like to advise that the Minister for Planning and Environment, after having considered a report by the Heritage Council, has made an interim conservation order in respect of the abovementioned item.

2. Notice of the Order is given to you as prescribed under Section 29 of the Heritage Act, 1977. A copy of the formal notice together with other relevant advices attached for your information.

3. The purpose of an interim conservation order is to provide protection over a building, work, place or relic which may be found on further investigation by the Heritage Council to be an item of the State's environmental heritage and worthy of permanent conservation.

4. Interim conservation orders take effect when they are published in the Government Gazette and remain in force for a maximum period of two years. Within this time, the Heritage Council carries out its investigation into the significance of the item with a view to recommending the making of a permanent conservation order, or it may recommend that the interim conservation order be revoked or allowed to lapse.

5. Where the Heritage Council recommends that a permanent conservation order should be made in respect of a heritage item and this recommendation is supported by the Minister, notification is then given by the Minister of his proposal to make a permanent conservation order. Submissions may be made to the Minister at that time and should an owner, a mortgagee or lessee of a heritage item object to the proposal, the Minister will then appoint a person to hold an inquiry into the matter.

6. In addition to the statutory advice contained in the attached document, there are a number of other matters which may need clarification. In this regard, to assist persons to understand the purpose and effect of an interim conservation order, the following information is provided.

SALE OF A PROPERTY

7. The making of a conservation order does not place any restriction on the sale of a property.

.../2

over Dr Drielsma and the Commission. He has consistently failed to bring this 'out of control' agency to heel. There have been numerous breaches of law by the Forestry Commission proven before the Courts yet Mr West has refused to inquire into the circumstances of these unlawful acts. He has condoned 'more of the same' by the Commission. Mr West should resign or be sacked.

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Please note previous home no. 02 660 3496 is no longer applicable.

Robyn Kruk
Marian Bennet
Pauline Gregg

Cabinet Office.

the delegation as being subject to compliance with the policies so laid down. This approach involved him in considering the detailed provisions of the manual and putting a construction on such phrases as "clearly defensible and approved local group restructuring program" (see s 4) and answering the question whether in a particular case of a post office alternative facilities are "reasonably accessible" (see s 4 in conjunction with s 1) and the application of such provisions in the manual to the circumstances disclosed in the evidence in relation to Watsons Bay Post Office.

In our opinion, it is necessary first to come to a conclusion as to the construction and operation of the delegation which has been set out above. The phrase "associated policies" is an awkward one because it is not clear in the context with what the policies have to be associated. An easier phrase might have been "policies relevant to the delegation". Assuming, however, that the manual is a statement of policies within the wording and that the exercise of powers by the first appellant is "subject to" those policies, the question remains how far this required strict compliance by him with policies so stated.

The manual requires decisions upon many discretionary matters and matters of judgment. It is not cast with the precision of a statute. Clearly this is an area in which guidelines may be useful and necessary. Much has to be left to the person selected as the delegate to give effect to them. It is an administrative area where one would expect that the delegate would have to direct his mind to the matters laid down in the policy but where he would not be bound, in the strict legal sense, by every word in the policy manual. Rather one would expect he would be open to correction or discipline by the Commission should he depart in material respects from it: cf *Minister for Industry and Commerce v East West Trading Co Pty Ltd* (1986) 10 FCR 264 at 269-270, 278-279; *Minister for Immigration and Ethnic Affairs v Conyngham* (1986) 11 FCR 528 at 540-542; *Gunaleela v Minister for Immigration and Ethnic Affairs* 14 (1987) FCR 591; S Lee, "Circular Arguments" (1985) 101 LQR 311; R Baldwin and J Houghton, "Circular Arguments: The Status and Legitimacy of Administrative Rules" (1986) Public Law 239.

In other words, to our minds, failure to observe strict compliance with the manual would be a matter not so much of absence of power in the delegate as a failure by the delegate to carry out his duties under the delegation in the manner required by the Commission. It appears to us that, in stating that the exercise of his delegated powers is "subject to" the matters stated in the delegation, the Commission is indicating those matters to which he must have regard and with which, in general, he must comply. We do not think that the Commission is laying down a set of pre-conditions which, if not strictly observed, will result in an absence of power in the delegate. Put differently, the paragraphs following the words "subject to", deal with matters of an essentially administrative character; as such they should be seen as directory rather than mandatory.

In our opinion, the decision made by the first appellant was not beyond power.

Having regard to the general area of administration into which it is necessary to enter if one adopts the interpretation of the delegation which treats the requirements regarding policy as pre-conditions, it is useful to bear

in mind the words of Lord Brightman in *Puhlhofer v Hillingdon London Borough Council* [1986] AC 484 at 518:

> "Where the existence or non-existence of a fact is left to the judgment and discretion of a public body and that fact involves a broad spectrum ranging from the obvious to the debatable to the just conceivable, it is the duty of the court to leave the decision of that fact to the public body to whom Parliament has entrusted the decision-making power save in a case where it is obvious that the public body, consciously or unconsciously, are acting perversely."

One curious fact here is that the Commission has been a party to the proceedings both before the learned trial judge and before our Court. It has strenuously supported the decision which the first appellant had made. The Commission itself, of course, has never had any restriction on its powers such as has been found by the trial judge to be inherent in the delegation. It follows that the Commission could immediately have made the same decision at any stage and could still do so. In a sense it might be said that the presence and the active part taken by the Commission constitute a ratification of the decision which has been made since the proceedings commenced. However that may be, it seems that, in the light of the Commission's role and attitude, it would have served no useful purpose to set aside the decision in question even if we had otherwise been minded to do so.

It follows that we would allow the appeal in part and set aside orders 2, 3 and 4 made on 1 April 1987. Since the respondent succeeded on the question of standing but failed on the substantive question, it is appropriate that there be no order for costs both at first instance and on the appeal.

So ordered

Solicitors for the appellants: Australian Government Solicitor.

Solicitors for the respondent: *R F Giles Payne & Co.*

L-B

NEWS RELEASE - 1/11/1991

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"Mr Garry West Minister for CALM has also utterly failed to fullfill his Ministerial responsibilities to exercise his control

5.10 ABC State Wide

03 640 3193

ABC Aust Tonight

Gary Litchman

Bev. O'Connor

IN THE SUPREME COURT OF NEW SOUTH WALES
COURT OF APPEAL

CA of 1991
L & E Court No. 40169
of 1991

FORESTRY COMMISSION OF NEW SOUTH WALES
Appellant

JOHN CORKILL
First Respondent

G.L. BRIGGS & SONS LIMITED
Second Respondent

DUNCANS HOLDINGS LIMITED
Third Respondent

ALLEN TAYLOR & COMPANY LIMITED
Fourth Respondent

IN THE COURT BELOW

JOHN CORKILL
Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES;
G.L. BRIGGS & SONS LIMITED;
DUNCANS HOLDINGS LIMITED;
ALLEN TAYLOR & COMPANY LIMITED
Respondents

NOTICE OF APPEAL

H.K. ROBERTS,
Crown Solicitor,
8-12 Chifley Square,
SYDNEY 2000
DX 19 SYDNEY
Tel: 228-7357
Mr. Bowe

The proceedings appealed from were heard on 20-23, 26-30 August, 1991 and 2-4 September, 1991; and decided on 25 September, 1991.

The Appellant appeals from the whole decision of Mr. Justice Stein

GROUNDS

1. His Honour erred in holding that sections 98 and 99 of the National Parks and Wildlife Act 1974 bind the Crown.

2. His Honour erred in holding that the said sections proscribe indirect actions of persons.

3. His Honour erred in holding that "disturb" in the definition of "take" in section 5 of the Act includes indirect action, including present and/or future modification of the habitat of protected and endangered fauna within the meaning of the Act.

4. His Honour erred in holding that section 176A of the Act applied to threatened and apprehended breaches of the Act, rather than actual breaches which had occurred or were continuing to occur.

5. His Honour erred in holding that mens rea was not a necessary ingredient of offences under both section 98 and 99 of the Act.

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6. His Honour erred in holding that the Land and Environment Court had jurisdiction to make a declaration of right in lieu of an injunction under section 176A of the Act or otherwise.

7. His Honour erred in not holding that PART V Environmental Planning and Assessment Act 1979 impliedly repealed and was inconsistent with sections 98 and 99 of the firstmentioned Act.

8. Alternatively, his Honour erred in not holding that in the circumstances of the case the relevant consent issued by the Appellant under the authority of PART V Environmental Planning and Assessment Act 1979 was inconsistent with section s 98 and 99 of the firstmentioned Act.

ORDERS SOUGHT

1. That the appeal be upheld.

2. That the declaration made by Stein J. be set aside.

3. That the proceedings be dismissed.

4. That the First Respondent pay the Appellant's costs in the Court below.

5. That the First Respondent pay the Appellant's costs of the appeal.

Appeal papers will be settled on 1991, at 11.00 a.m. in the Registry by the Court of Appeal.

TO: The First Respondent,
C/- Messrs. Woolf Associates,
Solicitors,
82 Elizabeth Street,
SYDNEY

TO: The Second to Fourth Respondents,
C/- Messrs. Toomey Pegg & Drevikovsky,
Solicitors,
Level 12,
180 Castlereagh Street,
SYDNEY

Before you take any step in these proceedings you must enter an appearance in the Registry.

APPELLANT:	Forestry Commission of New South Wales,
SOLICITOR:	Hugh King Roberts, State Crown Solicitor, 8-12 Chifley Square, SYDNEY 2000 DX 19 SYDNEY
APPELLANT: ADDRESS : FOR : SERVICE :	C/- Hugh King Roberts, State Crown Solicitor, 8-12 Chifley Square, SYDNEY DX 19 SYDNEY
ADDRESS OF: REGISTRY :	Supreme Court, Queens Square, SYDNEY 2000

H.K. Roberts
....
Solicitor for the Appellant

Signed in my capacity as a solicitor employed in the office of the said H.K. Roberts.

Peter Bowe
....

L4.912616.90

IN THE SUPREME COURT OF NEW SOUTH WALES
COURT OF APPEAL

CA of 1991
L & E Court No. 40169
of 1991

FORESTRY COMMISSION OF NEW SOUTH WALES
Claimant

JOHN CORKILL
First Opponent

G.L. BRIGGS & SONS LIMITED
Second Opponent

DUNCANS HOLDINGS LIMITED
Third Opponent

ALLEN TAYLOR & COMPANY LIMITED
Fourth Opponent

IN THE COURT BELOW

JOHN CORKILL
Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES;
G.L. BRIGGS & SONS LIMITED;
DUNCANS HOLDINGS LIMITED;
ALLEN TAYLOR & COMPANY LIMITED
Respondents

NOTICE OF MOTION

H.K. ROBERTS,
Crown Solicitor,
8-12 Chifley Square,
SYDNEY 2000
DX 19 SYDNEY
Tel: 228-7357
Mr. Bowe

The Claimant will, at 10.15 a.m. on October, 1991 at the Supreme Court, Queens Square, Sydney, move the Court for an order:-

1. That the proceedings be expedited.

DATED: 1991

......H.K. Roberts......
Solicitor for the Claimant

Signed in my capacity as a solicitor employed in the office of the said H.K. Roberts.

......Peter Bowe......

The time before which this Notice of Motion is to be served has been abridged by the Court to

TO: The First Opponent,
C/- Messrs. Woolf Associates,
Solicitors,
82 Elizabeth Street,
Sydney

L4.912616.91

TO: The Second to Fourth Opponents,
C/- Messrs. Toomey Pegg & Drevikovsky,
Solicitors,
Level 12,
160 Castlereagh Street,
Sydney.

IN THE SUPREME COURT OF NEW SOUTH WALES
COURT OF APPEAL

C.A. of 1991
L & E COURT
No. 40169 of 1991

FORESTRY COMMISSION OF NEW SOUTH WALES
Appellant

JOHN CORKILL
First Respondent
G.L. BRIGGS & SONS LIMITED
Second Respondent
DUNCANS HOLDINGS LIMITED
Third Respondent
ALLEN TAYLOR & COMPANY LIMITED
Fourth Respondent

In the Court below

JOHN CORKILL
Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES
G.L. BRIGGS & SONS LIMITED
DUNCANS HOLDINGS LIMITED
ALLEN TAYLOR & COMPANY LIMITED
Respondents

AFFIDAVIT

Deponent: Peter Alfred Fisher
Sworn:
H.K. ROBERTS,
Crown Solicitor,
8-12 Chifley Square,
SYDNEY DX 19
Tel: 228-7357
Mr Bowe

On the 1st day of October, 1991, I, PETER ALFRED FISHER of Building 2, 423 Pennant Hills Road, Pennant Hills in the State of New South Wales, Assistant Commissioner of Forests, say on oath:

1. I am the Assistant Commissioner (Operations and Marketing) within the Forestry Commission of N.S.W.

2. On 25th September 1991 following a hearing over 12 sitting days, the Land and Environment Court of NSW delivered judgment in the decision under appeal in these proceedings.

3. Exhibited hereto and marked with the letters "PAF 1" is a true copy of the said judgment.

4. There are 15 million hectares of forests in New South Wales.

5. 3,877,960 hectares are State Forests or Timber Reserves under the management and control of the Appellant.

6. 185,000 hectares of State Forests are State Forest Plantations, that is to say Plantations of softwood species planted and grown mainly on formerly open or cleared lands.

7. Exhibited hereto and marked with the letters "PAF 2" is a true copy of the Annual Report of the Appellant for 1989-1990.

L4.912616.3

Peter Bowe

8. The Appellant employs directly over 1,000 persons involved in Forest operations and management including forest workers, Rangers, Professional Foresters, and nursery works and the like.

9. Pursuant to the Forestry Act 1916 licences are granted to timber contractors, operators, and saw-millers, to harvest and process timber products.

10. Approximately 780 timber licences, 165 contractors licences, 1,855 operators licences, 110 Crown sawmill licences, 497 non-Crown sawmill licences and 150 Forest products and Forest materials licences are current.

11. There are approximately 1,900 persons currently employed directly within NSW in the Logging and Log Transport Industries, and 5,230 persons are currently employed directly within NSW in the Sawmilling Industry.

12. The total revenue of the Appellant for the year ended 30 June 1991 was approximately $80 million, and the total expenditure for wages was approximately $30 million.

13. The Appellant is a major rural firefighting authority within the State. The Appellant has responsibilities pursuant to the Forestry Act 1916 and the Bush Fires Act 1949 to prevent the spread of bush fires. It is essential for the purpose to construct and maintain access roads and fire trails and to undertake fuel reduction by hazard reduction burning of forest lands. Cessation of the Appellant's activities in this regard, in my opinion, would expose large tracts of forests as well as surrounding urban and rural lands and public and private property to risk of damage or destruction by wild-fires and bushfires.

14. The Appellant also has responsibility and actively pursues a policy of eradication of noxious plants and animals. Rabbits, feral cats and wild dogs are examples of the latter. Some such animals are predators of protected fauna within the meaning of <u>The National Parks and Wildlife Act 1974</u>.

15. State Forests are used, consistently with the object of <u>The Forestry Act 1916</u> for public recreational purposes.

16. The presence of persons and employees in State Forests, be they members of the public or officers of the Commission, has the potential of adversely affecting essential behavioural patterns relating to feeding, breeding or nesting of protected fauna in the sense referred to on page 17 of the judgment of the Land and Environment Court.

17. I estimate that the current total value of annual timber output is $800 million.

Peter Gowe

18. I estimate that the total annual wages expended by employers in the Timber Industry is $300 million.

19. In 1990 over 600,000 cubic metres of sawn wood was imported into New South Wales.

20. The Commissioner for Forests issued a memorandum on 26 September 1991 to all Regional Foresters and Chiefs of Division. Annexed hereto and marked with the letter "A" is a true copy of the said memorandum.

21. I respectfully request that this Honourable Court grant the utmost expedition of the proceedings.

SWORN at Pennant Hills)
)
before me:)

Peter Bowe
PETER BOWE
Solicitor
8-12 CHIFLEY SQUARE
SYDNEY.

FORESTRY COMMISSION OF N.S.W.

H.O. No. ______

S.O. 308

This and the following 6 pages is the annexure marked with the letter "A" referred to in the affidavit of PETER ALFRED FISHER Sworn 1st OCTOBER 19 91, at SYDNEY before me

Peter Bowe
~~A Justice of the Peace~~/Solicitor
8-12 CHIFLEY SQUARE
SYDNEY.

URGENT AND CONFIDENTIAL

26 September 1991

TO : ALL REGIONAL FORESTERS AND CHIEFS OF DIVISION
FROM: COMMISSIONER FOR FORESTS

Re: Chaelundi Court Decision

I have studied the decision handed down by Justice Stein in the Land and Environment Court yesterday and have received some advice about its implications. I believe the Commission has been placed in an impossible legal position.

The judgement is framed clearly and unambiguously in terms of its interpretation of sections 98 and 99 of the National Parks and Wildlife Act. It found that logging does disturb the habitat of **protected and endangered** animals.

There has never been any doubt that logging (or a range of other activities) disturbs, to varying degrees, individual animals. It is obviously quite impossible to log without doing so. Our management and our environmental assessments have always been based on protecting the long-term viability of **species** not **individuals.**

Section 99 covers endangered animals which, as the attached advice from our wildlife ecologist Dr Jim Shields shows, occur in most native forests and hardwood plantations in the State. Section 98, however, covers protected animals which occur virtually everywhere, including pine plantations. Included are birds such as magpies and seagulls. Indeed, so numerous are protected animals that the schedule (11) lists the *exceptions*, being animals such as elephants, bears and lions.

Please note that, in spite of what the media presents, this judgement does not in any way impinge upon the adequacy of our Environmental Impact Statement, which remains a model of its kind. The environmental movement has not challenged it under the Environmental Planning and Assessment Act - an obvious course open to them if there are any genuine doubts about its adequacy.

The bottom line is that we have been beaten on a technicality, but that technicality could have drastic ramifications across the State. My advice to date strongly suggests that all of our activities, including hazard reduction burning and roading are almost certainly illegal and that the activities of all our licensees are almost certainly illegal unless covered by general licences under section 120 of the NP&W Act. This includes logging of eucalypt forests and plantations and, quite possibly, pine plantations, beekeeping and grazing.

While the Government is considering a resolution to this issue, I cannot and will not allow the Forestry Commission to act contrary to the law. I have requested more formal legal advice from senior counsel, which should be available within the next few days. If it confirms my earlier advice, and unless the law is changed, I will have no alternative but to instruct all the Commission's officers to ensure that all licenses and all activities comply with Sections 98 and 99 of the National Parks and Wildlife Act in the terms outlined above.

I will advise immediately of appropriate action to be taken on the basis of counsel's formal advice. A copy of the judgement is being sent to each region under separate cover.

H. Driel...

Hans Drielsma
Commissioner for Forests

Protected and Schedule 12 Fauna on State Forests

Because of the wide ranging implications of the current litigation in the Land and Environment Court concerning Chaelundi State Forest, the wildlife biologists of the Wood Technology and Forest Research Division were requested to advise on the general situation with NSW State Forests.

That advice, prepared By Dr. Shields, is attached. I have considered his statement and agree that it is a realistic assessment of the situation. You will note that some of the fauna listed on Schedule 12 of the National Parks and Wildlife Act occur within pine plantations, so that even operations within the exotic conifer estate would present a risk to Schedule 12 species. Some species of protected fauna, are, of course, quite common in pine plantations.

One further aspect to be considered is the transport of timber products from the forest to the sawmill or other centre. Log trucks from both exotic and native forest harvesting operations travel extensively through both State Forest and National Park in the course of normal activities, and would therefore present some degree of probability of causing harm to both groups of fauna.

R.A. Curtin, PhD.
Manager
Silviculture & Ecology Branch
Management Planning Division
6 September, 1991

Protected and Schedule 12 Animals on State Forests

The State Forests of New South Wales comprise a wide variety of vegetation communities. These, in turn, are suitable habitat for rich and diverse animal communities. The Forestry Commission has adopted a Wildlife Policy which aims to ensure the evolutionary viability of species through maintaining adequate populations of all native animals in a regional context.

The State Forest system contains rainforest, many different kinds of eucalyptus forests, Cypress Pine forests, riparian forests of River Red Gum in the inland, and a wide variety of exotic pine forests. These forest communities have a variety of age structures, ranging from very old, undisturbed native forest to recently planted plantations of exotic pines. All of these forests support populations of protected native fauna, and at least some populations of fauna listed on Schedule 12 of the National Parks and Wildlife Act.

Forestry operations disturb individuals within the populations of these animals. This is an accepted fact in wildlife management, and has never been doubted by any serious land manager or scientist. The concept of managing populations of animals, rather than individual organisms, is accepted throughout Australia and around the world. It is impossible to harvest forest products in any State Forest in New South Wales without disturbing, harming, or occasionally, directly killing animals through mis-fortune.

For example, in River Red Gum forests in central, southern and western New South Wales, the Northern Hairy-nosed Wombat (_Lasiorhinus krefftii_) and the Black-eared Miner (_Manorina melanotis_) are reported to occur. These are listed as in danger of imminent extinction in Schedule 12 of the National Parks and Wildlife Act. Further listed as endangered or of special concern are the Superb Parrot (_Polytelis swainsonii_), the Regent Parrots (_Polytelis anthopeplus_), the Platypus (_Ornithorhynchus anatinus_) and the Carpet Python (_Morelia spilota_), all of which are found in Red-gum forests.

In the more xeric woodlands and cypress pine forests of the western slopes and northwestern New South Wales, a wide variety of Schedule 12 Wildlife occurs. The Pilliga Mouse (_Pseudomys pilligaensis_) is endemic to Cypress Pine forests. The Pink Cockatoo (_Cacatua leadbeateri_), the Glossy Black Cockatoo (_Calyptorhynchus lathami_) and the Turquoise Parrot (_Neophema pulchella_) have also been recorded from these habitats. The Rainbow Bee-eater (_Merops ornatus_) is sometimes very common along road cuttings in open forests.
In regrowth hardwood forests, Koalas (_Phascolarctos cinereus_) are common, and they are listed on Schedule 12 of the National Parks and Wildlife Act. The Feather-tailed Glider (_Acrobates pygmaeus_), the Spotted-tail Quoll (_Dasyurus maculatus_), the Eastern Pygmy Possum (_Cercateus nanus_), the Hastings River Mouse, (_Pseudomys oralis_) the Brush-tailed Phascogale (_Phascogale tapotafa_), the Long-footed Potoroo (_Potorous longipes_), the Powerful Owl (_Ninox strenua_), the Sooty Owl (_Tyto tenebricosa_), the Masked Owl (_T. novaehollandiae_), the

Spotted Quail-thrush (Cinclosoma punctatum), the Cicadabird (Coracina tenuirostris), and the Gang-gang Cockatoo (Callocephalon fimbriatum), among others, are all found on regrowth hardwood State Forests.

In pine plantations, the Rufous Fantail (Rhipidura rufifrons) and White's Thrush (Zoothera dauma), listed on Schedule 12, are commonly encountered. The Peregrine Falcon (Falco peregrinus), listed as vulnerable and rare in Schedule 12, frequently forages over newly planted pine plantations, pursuing, amongst others, the White-throated Needle-tail (Hirundapus caudacutus) and the Fork-tailed Swift (Apus pacificus), species also listed on Schedule 12. The Spotted Quail-thrush occurs in pine plantations 5-10 years old, while the Spotted-tail Quoll is known from several pine plantations in the Tumut region.

A listing of animals that occur in old growth hardwood forests hardly seems necessary. These forests support the full component of fauna found in forested habitats. No animal species are restricted to old growth forest in Australia.

All forest types contain a plethora of species which are protected by the National Parks and Wildlife Act, as opposed to those given special status in Schedule 12. The Emu (Dromaius novaeholladiae), the Common Wombat (Vombatus ursinus), the Red Kangaroo (Macropus rufus) and the Eastern Grey Kangaroo (M. giganteus) are examples of protected wildlife species that are often abundant in State Forests.

In the context that forestry operations fall under the jurisdiction of Sections 98 and 99 of the National Parks and Wildlife Act, and that any forestry operation which disturbs or harms an animal is in breach of these sections of the Act, it will be necessary to cease all harvesting, burning, roading and major works construction in State Forests forthwith.

James M. Shields

James M. Shields, PhD.
Research Co-ordinator
Forest Ecology and Silviculture
Section
W.T.F.R.D., Forestry
Commission of N.S.W.

IN THE SUPREME COURT OF NEW SOUTH WALES
COURT OF APPEAL

C.A. 40575 of 1991
L & E COURT
No. 40169 of 1991

FORESTRY COMMISSION OF NEW SOUTH WALES
Appellant

JOHN CORKILL
First Respondent
G.L. BRIGGS & SONS LIMITED
Second Respondent
DUNCANS HOLDINGS LIMITED
Third Respondent
ALLEN TAYLOR & COMPANY LIMITED
Fourth Respondent

In the Court below

JOHN CORKILL
Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES
G.L. BRIGGS & SONS LIMITED
DUNCANS HOLDINGS LIMITED
ALLEN TAYLOR & COMPANY LIMITED
Respondents

DRAFT INDEX

H.K. ROBERTS,
Crown Solicitor,
8-12 Chifley Square,
SYDNEY DX 19
Tel: 228-7354
Mrs. Elliston

provisionally settled.

4 pm. 11/10.

appt request b4 4pm 18

NO	DOCUMENT	TEXT INCLUDED	DATE	PAGE
8.	Affidavit of Hugh Philip Possingham except part paragraphs 12, 13	Y	16.8.91	
9.	Affidavit of Harry Frederick Recher except part paragraphs 11, 13	Y	27.8.91	
10.	Affidavit of Harry Frederick Recher except paragraphs 3 & 7	Y	19.8.91	
11.	Affidavit of Andrew Peter Smith except part paragraph 8 and paragraph 9	Y	9.8.91	
12.	Affidavit of Bruce Stephen Woolf except paragraphs 10, 12 and 13 and part paragraph 11	Y	9.8.91	
13.	Affidavit of Dennes John Murray	Y	21.8.91	
14.	Transcript of Evidence taken before Mr. Justice Stein	~~N~~	~~20.8.91~~	
		~~N~~	~~21.8.91~~	
		~~N~~	~~22.8.91~~	
		N	~~23.8.91~~	
		~~N~~	~~26.8.91~~	
		Y	27.8.91	
		Y	28.8.91	
		~~N~~	~~29.8.91~~	
		N	30.8.91	
		N	2.9.91	
		N	3.9.91	
		~~N~~	~~4.9.91~~	

20-26 incl affidavits

MURRAY, Dennes John		
Examined		27.8.91
		28.8.91
Cross Examined		28.8.91
Re-examined		28.8.91
RECHER, Harry Frederick		
Examined		28.8.91
Cross Examined		28.8.91
Re-examined		28.8.91

NO.	DOCUMENT	TEXT INCLUDED	DATE	PAGE
15.	EXHIBITS			
	Page	Not Reproduced Separately Available.		
	EIS relating to Compartments 180, 198 & 200 Chaelundi State Forest "1"	NRSA ~~Y~~	19.9.90	
	EIS clause 64 report "2"	NRSA ~~Y~~	2.91	
	Coffs Harbour Forest Map "A"	" ~~N~~		
	Guy Fawkes and Chaelundi Forest type maps B"	" ~~N~~		
	Koala Sitings Map "C"	" ~~N~~		
	Two (2) volumes of documents "D"	" ~~N~~		
	~~Dorrigo Management Area Plan "E"~~	~~" N~~	x3	
	Standard Erosion Mitigat. Condit. (July, 1990) "F"	" ~~N~~ —		
	Code of logging practices 1988 Edition "G"	" ~~N~~ —		
	Submissions on E.I.S. "H"	" ~~N~~ —	Hines NEFA NPWS	
	R.A.C. Forest and Timber Inquiry Draft Report Vol. 2. "J"	" ~~N~~ —	PP.	
	~~Premier's memorandum to Ministers re interdepartmental litigation "K"~~	" ~~N~~ —		
	Forestry Commission Annual Reports 1988 - 1990 "L"	" ~~N~~	x3.	
	Logging history map "M"	" ~~N~~ —		
	Pole History map "N"	" ~~N~~ —		
	Three (3) maps of Hastings River Mouse Sites "O"	" ~~N~~ —		
	Preferred Management Priority Map "3"	" ~~N~~		
	Technical Paper #32 1985 "P"	" ~~N~~		

XII

4pm Fri.

NO.	DOCUMENT	TEXT INCLUDED	DATE	PAGE
	L+E Court Cartwright vs Fenton Proc. ~~Forestry Commission~~ File 40052/90 & additional documents "4"	NRSA ~~N~~		
	P.22 of 1989-90 Forestry Commission Report "5"	~~N~~ "		
	Documents produced by Director of National Parks and Wildlife Service and Subpoena to Produce "Q"	~~N~~ "		
16.	Reasons for Judgment of Mr. Justice Stein including declarations.	Y		
~~17.~~	~~Minute of Judgment~~	~~Y~~		
18.	Notice of Appeal	Y		
19.	Notice of Contention	Y		
20.	Solicitors Certificate of Examination of Transcript			

Solicitor for the Respondent

Solicitor for the Appellant

State Crown Solicitor,
DX 19 SYDNEY,
228-7121,
8-12 Chifley Square,
SYDNEY

To the Registrar of the Court of Appeal:

No part of any Affidavit listed above was struck out or rejected or not read or expressly admitted for a limited purpose only, except as shown above.

DATED: October, 1991

Appellant's Solicitor

briefing notes – independents
– ALP
– selected Libs.

CORKILL MEETING

AGENDA
11 September 1991, 07.30

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1. **CHAELUNDI CASE**

   a. Expected judgment date

   If we lose didn't contest FPA FCNSW
   * fauna habitat
   * cons. sig.
   * FCNSW couldn't manage wildlife
   * FCNSW misled re 50% impacts public

   b. Pre-judgment political work - pamphlet/letter to politicians, briefing notes to media, confidential "personal" briefings of politicians by TFR, follow-up 4-Corners.

   c. Pincus J's judgment re: use of exhibits 2 x copies - F BBW

   d. Do we revive Corkill v FC (1990-Chaelundi) to challenge EIS? Letter of demand first to FC to redo EIS? Or has it already been sent? Delay factors - excuse being the discovery of fresh evidence re: impacts of 50% canopy retention logging.

   absurb to state to that post judgement would stop logging → NPWS

   e. Legal Aid - current position - do we need to make representations to Commission - my concern is that if a grant of aid is made after judgment, we may not be protected from an adverse order for costs! Have we made it clear to the Commission that we needed two Counsel in this case? Yes. Thursday pm

   f. Billing - we must ensure that we have accurately and completely recorded all time, documents inspected, drafted, settled and conferences. I have asked my chambers for a read out of photocopying and telephone charges attributable to this case. MWA to

2. **SECTION 25 CASE** Application to BBW F

   J to apply Legal Aid

   a. Do we need directions? If so, should we send a letter to the Crown Solicitor seeking consent to directions?

   b. Legal aid - we must apply for it <u>now</u> so that it can be dealt with together with the other Corkill matter.

   c. Note that section 25 cause of action may also affect the estoppel argument.

3. **HOPE v. CORKILL**

   a. What do we need to do?

      - interrogatories
      - further subpoenas
      - legal aid - need for two Counsel
      - interview environmental groups re: refusal of Council to recommend ICOS.

- what is the Council's record on the natural environment?

b. Simos QC is against me each day this week - should I explore scope for settlement if we win Chaelundi? No!

4. WAY WAY

a. What do we need to do on this case?

- affidavits (we need more faunal information)
- interrogatories
- do we need further and better particulars of their defence
- what have the Land Councils done
- do we have an arrangement for regular reporting to each other re: preparation

b. Does the Commission genuinely want to settle this case? It probably will, if we win Chaelundi, provided that we can get better fauna evidence of **density** as well as distribution, no. of habitat trees per hectare and fauna distribution relating to habitats likely to be disturbed. Do we know precisely what habitat will be disturbed? Have we analysed the **history** of logging for these **specific** areas?

c. Our legal aid position?

d. Where is the anthropologist up to?

e. Do we need McGarity to return to the forest?

f. Can we rely on anything that Michael Jones has given in evidence?

g. Do we need a Koala expert?

h. Do we need a biologist to check timber currently being felled to prove that it includes habitat trees?

5. WASHPOOL AGREEMENT

a. The agreement had time limits - have they been exceeded?

b. Webb - how is he going?

c. McGarity - how is he going?

d. What have we done to write it up?

6. RAC REPORT

a. Forestry Commissioners met Justice Stewart privately after draft report and complained that it was grossly inaccurate. Stewart undertook to examine their complaints and apparently advised them that he was distracted from the Timber Inquiry by the need to complete the Kakadu inquiry and promised to rectify the errors. At about the same time as this meeting, the only RAC Commissioner with any scientific qualifications (Dr Graeme Caughley) resigned from the Commission. Should we FOI RAC (it has announced policy of openness), DOPIE FCNSW, Victorian Dept of CALM etc for the minutes of the meeting? Stewart should **not** be receiving submissions privately or else he should open his door to others.

b. Further submissions to RAC **essential** based on evidence in Chaelundi case. RAC staff will be most interested.

c. Should I contact Federal politicians re: replacement of Caughley by **competent** and **fair** scientist (someone like Peter Hitchcock)?

Contact Secretariat did meeting happen? When?
FOI minutes correspondence → TFR to draft

~~Submiss~~
Submit Cha.s.99. documents
Who will replace Caughley?
Why did he leave? → Norton to check

Ron Castan QC Melb Bar
did Advice re available powers → End Sp.

Commission got it wrong. In fact, when it comes to the Forestry Commission, even our own Public Accounts Committee got it wrong. It seems that the Forestry Commission is the whipping boy for everyone who has a concern about the environment. Perhaps in the past it has been the baddie, but today I can say that it is squeaky clean, a highly professional organisation and is totally committed to the industry and to the environment. The honourable member is correct in his understanding that the report of the Resource Assessment Commission said it could not find large areas of forest in Australia managed on a sustained yield basis. That is what it said in its draft report but I am confident that by the time the final report is issued it will acknowledge the proper practices adopted by the New South Wales Forestry Commission. A sustained yield policy for our native forests has operated for many years.

Basically sustained yield means that each year one can grow the same amount of trees that one cuts. It means that we can harvest our forests for ever. Timber is a renewable source and we are renewing it. To achieve sustained yield in our forests the volume of high quality or so-called quota sawlogs in each of the 56 forest management areas must first be established. It is then possible to calculate annual growth. Logging is then matched to growth. A good example of that occurring is in the Kendall forest, south of Port Macquarie. That forest has been harvested for timber production for more than a century. Recent studies have shown that careful regulation of the rate of harvest has maintained these forests in a healthy and diverse condition. In the past 30 years, for instance, one million cubic metres of sawlog timber has been harvested from these forests, yet the volume standing in the forest today is approximately the same as it was at the beginning of that period. The Resource Assessment Commission got it wrong when discussing the sustained yield issue in New South Wales because it relied on total sawlog production figures from published annual reports rather than data for the quota sawlogs which underpins the sustained yield policy. Consequently it arrived at a continually increasing post-war demand trend. This approach gives a misleading impression. The rise in total production has occurred because of better utilisation through technological development, market shifts and harvesting of regrowth areas.

<8>

A different picture emerges when these high quality logs are separated out and treated in the same way that underlines the sustained yield policy. Production peaked
in about the early 1960s and has been reduced towards sustainable levels throughout subsequent years. The harvesting rate for higher quality logs has reduced 47 per cent since the 1964 peak and in 1990 was about the same as it was in 1946, even though the net productive forest area has increased significantly. Consistent with the commission's policy, quota sawlog cut on ecologically sustainable principles is in force in 44 forest management areas. That is 83 per cent of the State's total yield of quota sawlogs. Within four years 95 per cent of the quota cut will be at a sustainable level. Full sustained yield will follow soon after. The strategy adopted by the Forestry Commission for achieving full sustained yield from native forest areas has been to adjust historical allocations in a planned, strategic manner. We will maintain that

approach.

Honourable members should understand that these measures relate to allocation ceilings. In fact, with the economic downturn and related factors, the actual quota harvest over the last four years averages no more than 8 per cent above sustainable levels statewide. In practice we are getting closer to sustained yield than the allocation ceilings would suggest. I take this opportunity to indicate that yesterday I was able to announce a major expansion of environmental impact statements on a number of North Coast forests and that impacts on the entire policy. The program being undertaken by the commission is the most comprehensive environmental assessment of forestry activities ever carried out in Australia. Apart from the five forest areas already subject to environmental impact statements the commission will soon engage consultants to prepare studies on the Grafton, Casino and Kempsey forest management areas. Next year we will go into the Tenterfield region, then the Gloucester-Chichester area and later into the Walcha-Nundle forest management areas. Environmental impact statements are under way at Duck Creek, Mount Royal, Dorrigo, Wingham and Glen Innes. We are using the best scientific knowledge available. Flora, fauna and archeological experts have been contracted for the extensive surveys which will underpin the assessments. The Forestry Commission is not only working to the letter of the law, it is now working very much to the spirit of the law.

ANSAIR BUS CONTRACT

Mr LANGTON: My question without notice is directed to the Minister for Transport. Who instigated the Minister's meeting with Sir Peter Abeles on 20th August? What other aspects of the bus tender were discussed, apart from the possible relocation of Ansair to Tamworth? Had the State Transit Authority not made a decision on the tender at the time of the meeting? Will the Minister table the minutes of the meeting?

Mr BAIRD: The answer to the first part of the question is that he instigated the meeting. The answer to the second part is that no other matters were discussed, apart from his intention to close down Eastwest operations in Tamworth. As to the tabling of the minutes of the meeting, there were no minutes taken. Mr Moore-Wilton, the Director-General of the Department of Transport, was at the meeting.

LOCUST PLAGUE

Mr RIXON: Is the Minister for Agriculture and Rural Affairs aware of reports in the past few days of locusts hatching in plague proportions across northern areas of the State? What effect would a major locust plague have on the State's rural economy and what action can be taken to assist primary producers?

[*Interruption*]

Victorian Government is using the project as its model to relocate the head office of its department to Bendigo in Victoria. That Government has employed the Orange city council as a consultant in order to emulate the successful formula used by the New South Wales department. The move has been so successful that a number of private enterprise organisations such as Pullman and Associates, one of the major divisions of ICI Australia Limited, and Dalgety Ethics, the computer technology division of Dalgetys, have already relocated to Orange and others are in the process of moving their businesses to Orange. Orange is rapidly being acknowledged, to use the words of the former Labor mayor, as the agri-business centre of Australia. There is no doubt that the Opposition is on extremely thin ice if it attempts to make any sort of tin-pot political capital out of that relocation.

It is significant that the Labor Party would obviously try to mount some form of weak attack on this project. It forgets that during the 12 years it was in government one of its contributions to agriculture—so it said—was probably the construction of the export terminal at Port Kembla, which was a job creation activity for the south coast. The wheatgrowers of New South Wales were left to pick up the bill in respect of that $200 million legacy, but this Government wrote it off. The former Labor Government incurred the debt and left it to the wheatgrowers of New South Wales.

[*Interruption*]

Mr SPEAKER: Order! I call the honourable member for Kiama to order.

Mr ARMSTRONG: The Opposition's contribution to agriculture, so far as relocation and decentralisation were concerned was to incur a massive debt that the wheat producers of this State had to bear. I suggest that the Opposition would do well to follow the lead set by its leader when this relocation announcement was made about two years ago: he welcomed the decision. I look forward to his continuing support.

RESOURCE ASSESSMENT COMMISSION INQUIRY INTO FOREST AND TIMBER RESOURCES

Mr COCHRAN: I address my question without notice to the Minister for Conservation and Land Management. Did the draft report of the Resource Assessment Commission following its inquiry into forest and timber resources state that it could not find any large areas of forest managed on a sustainable yield basis? If so, what action is being taken to implement a sustainable yield plan for forests controlled by the New South Wales Forestry Commission?

Mr WEST: The honourable member for Monaro has an obvious interest in this matter. I thank him for the assistance he has given to me, particularly in relation to the management of forests in the southeast to ensure that the right balance is achieved between conservation and timber interests. The Resource Assessment

Webb, L.J. 1980.

Dailan.

PROBLEMS OF RAINFOREST CLASSIFICATION IN A SPECIFIC LOCALITY

e.g. Terania Creek (Whian Whian State Forest N.S.W.)

Unpub. "Report to Inquiry into Proposed Logging of Terania Creek".

Definition of rainforest

The canopy is closed and the trees densely spaced, usually forming several layers. The opacity, soft texture, and dark green colour of the closed canopy readily set rainforest apart from the open, hard-leaved, grey-green crowns of adjacent sclerophyll forest. Rainforests are also distinguished from other forests by combinations of characteristic life forms e.g. epiphytes, lianes, certain root and stem structures (e.g. plank buttresses, cauliflory, strangling figs), tree ferns, palms etc., and the absence of annual herbs on the forest floor.

Interrelationships of rainforest and sclerophyll vegetation

The segregation of rainforest and sclerophyll vegetation is, however, rarely absolute. Away from optimal conditions for rainforest, and in increasingly unstable situations as the result of disturbance (natural or human), characteristic sclerophyllous tree species tend to infiltrate the rainforest margins for varying distances. Unless disturbance is repeated, affecting both the forest canopy and forest floor, sclerophylls do not regenerate under a developing rainforest canopy. Intermittent sclerophyll regeneration in practically all cases is the result of the intrusion of fires. This intrusion depends on various factors which may be catastrophic (e.g. cyclones, lightning strikes), gradual (e.g. consecutive drought years), or favourable for frequent and intense fires (e.g. steep slopes with shallow soils exposed to fire-bearing winds). Measurements in Tasmanian rainforests where tree growth-rings are annual indicate that wildfires occurring not more frequently than 300-400 years are adequate to regenerate sclerophylls within the boundaries of what was a well-developed rainforest canopy. Observations throughout the range of rainforest distribution in Australia also indicate that only certain species of sclerophylls are adapted to intermittent regeneration and co-existence within rainforest boundaries. Such species form characteristic associations with marginal rainforest species, to form so-called "wet sclerophyll forest", "scrubby forest", "bastard scrub" etc. Depending on ecological conditions and the length of time that fire is excluded, the sclerophylls are gradually replaced by rainforest species in the canopy i.e. the mature phase of succession, or mature rainforest. Earlier stages represent immature stages of rainforest.

Certain sclerophylls that occur in the succession may also occur as integral members of non-rainforest vegetation e.g. Banksia integrifolia in heath, Eucalyptus intermedia in woodland, Melaleuca quinquenervia in sedge swamp. However, some sclerophylls occur only in the mixed rainforest boundary communities e.g. Tristania conferta, Callitris macleayanus, Casuarina torulosa, Acacia melanoxylon.

Succession

Given this ecological background, the question to be asked is whether the sclerophyll-rainforest successions, or a particular stage of them, can be regarded as rainforest.

In early stages of succession following fire, and characterized in the Terania area and Whian Whian State Forest by Blackbutt (Eucalyptus pilularis) reaching over 60 m in height, sclerophylls occur in the understory of pioneer rainforest species which reaches a maximum of 10-15 m. In mature Blackbutt stands that have escaped fire, Blackbutt cannot however regenerate.

At a later stage of succession, on more fertile soils and less subject to fires, Brush Box (Tristania conferta) typically replaces Blackbutt, and reaches 35-50 m in height. Sclerophylls are absent from the understorey, which is composed of rainforest species reaching 20-30 m. It is estimated that veteran Brush Box over 6 m in girth is probably over 300 years old. Where such stands remain free from wildfires under natural conditions, the Brush Box trees eventually collapse, leaving a well-developed rainforest canopy over 30 m in height, and typically dominated by Coachwood (Ceratopetalum apetalum). Thus as succession proceeds from early to mature stages of rainforest, the emergent sclerophylls, typically Brush Box and Sydney Blue Gum (Eucalyptus saligna) in the advanced stages, become more scattered, and the rainforest broad-leaved species form a more uniform canopy between them. Under such circumstances, given variations in terrain, soil depth, soil fertility, and time elapsed since the last conflagration, there will be a mosaic of communities at different stages of succession varying from early to late, from BlackButt through Brush Box to Coachwood. Depending on the areas of different soils and slopes available, it may be easy to differentiate broad zones of different ("coarse-grained") communities, as on the Gibberagunyah Range. However, in the Terania Basin, the soils form an intricate mosaic on the slopes, with "fine-grained" communities. (see below)

Depending on the scale used in surveying the forest, the rainforest canopy between emergent Brush Box may be separated as a rainforest type: Coachwood, Crab Apple (Schizomeria ovata), Corkwood (Ackama paniculata), Mango Bark (Canarium australasicum), etc. Or the rainforest canopy, if the Brush Box is regularly and fairly densely scattered, may be included in the Brush Box type. Thus at a mapping scale of 1:100,000, McDonald (Moreton Region Vegetation Map

Series, Explanatory Booklet for Murwillumbah Sheet, 1979, p. 19) found that most of the coachwood-type rainforests were on rhyolite and typically contained conspicuous emergent Tristania conferta and/or Eucalyptus andrewsii ssp. campanulata. For convenience at such a small scale, these types were mapped as units of tall open forest.

Purpose of forest typing

Whatever decision is made will be arbitrary, and depend on the purpose of making a classification and definition in the first place. Thus different decisions will be made for forestry, botanical, or ecological purposes.

From a forestry point of view, *different forest types* "are named from the predominant species present. . . The degree of predominance required to determine indicator species is arbitrarily based, with particular weight being given to commercial values. With species of outstanding economic importance, as little as 20 per cent of the stand basal area is regarded as conferring predominance e.g. with Blackbutt and Spotted Gum". (Baur, 1968, "Developing a classification of forest types in New South Wales").

The forester clearly emphasizes "features of forestry, as opposed to botanical, significance", and does not claim to produce an ecological classification (Baur 1968). His aim is to estimate the volume of commercial timber.

The classification of forestry types "is based on the occurrence of types actually occurring in the field, regardless of whether these are permanent (i.e. climax, in the ecological sense), or temporary (i.e. tending to change, with the passage of time, into some different type)." (Baur, 1965, "Forest types in New South Wales"). Thus "the type classification is developed from communities actually present, and includes a number of obviously seral communities. In view of this, it is considered that types should normally be determined from the composition now evident, even though it is known that, in a few cases, the types recognized are likely to alter with the effluxion of time" (Baur 1968).

It should, however, be noted that this admittedly pragmatic classification, while evidently satisfactory for purposes of inventory of what timber is actually there, is certainly not adequate for purposes of forest management. A knowledge of succession, and the seral status of the type being logged, is essential if the reaction and trends of the forest to different kinds of logging are to be predicted. For example, drastic disturbance including fires will favour regeneration of Blackbutt rather than of Brush Box, provided that seed sources are available.

The plant ecologist is influenced not so much by the pragmatic considerations of basal area which determine the volume of timber to be harvested as by the history, pattern, and potential of a forest stand. For example, on a plot of 0.2 ha at Whian Whian State Forest, in a well-developed Brush Box stand with a rainforest understorey averaging 25-30 m in height, 148 rainforest trees (> 10 cm dbh) representing 29 species occupied only 0.3 per cent of the basal area of the plot. In addition there were about 40 species of shrubs, vines, and epiphytes observed. However on the same plot there were 15 trees of Brush Box (79.8 per cent of total basal area of plot), 6 trees of Crab Apple with 7.6 per cent, 13 trees of Corkwood with 6.4 per cent, and 6 trees of Endiandra introrsa with 5.9 per cent basal area. From the ecological point of view, besides being a good stand of Brush Box, it is also a relatively rich rainforest community at an advanced stage of succession just before the final Coachwood community becomes established.

In a series of "nearest neighbour" plots examined recently in the proposed logging area at Terania, the number of trees in the canopy were identified and girth measured as the nearest neighbours of a selected Brush Box tree. The counts of canopy trees were expanded in increasing circles until another Brush Box tree was encountered, and the plot then completed. Sites were chosen at different positions on slopes with rhyolitic soils in the Brush Box types between the Blackbutt type upslope and the complex subtropical rainforest on basalt in the gully.

Plot No.	Approx. Plot area (m^2)	No. of rainforest/ canopy trees	No. of rainforest spp.	Basal area Brush Box (%)
1	163	8	5	92.3
2	1256	55	9	30
3	314	29	10	74.8
4	530	42	13	70 (clump of 4 trees)
5	3216	52	16	29.1
6	1963	66	20	14.6

Without accurately mapping the area, the proportion of the Coachwood-type rainforest represented by Plot 6 throughout the area cannot be estimated. The distance from the reference tree of Brush Box in this plot to the next Brush Box was 25 m, but after that the nearest Brush Box was 64 m (for which a plot was not completed). This brief survey indicates the small-scale variability of forest types correlated with soil differences. Brush Box (and occasional Sydney Blue Gum) favour stony and bouldery small spurs and ridges on rhyolitic (porphyritic pitchstone) soils, where they sometimes occur in clumps of 2 or 3. The largest clump encountered had 7 trees ranging from approximately 2.3 m to 5.3 m gbh, in an area about 8-10 m across. Brush Box trees were rare or absent on deeper soils and concave slopes, which on the middle-lower slopes give way to gully heads with some basaltic influence and the characteristic Helmholtzia lily and coachwood-type rainforest patches. Farther down slope, the coachwood type is replaced by the complex Booyong (Argyrodendron) type on basaltic alluvium-colluvium above and along the creek.

5/2/80

FC NSW Research Report 1983 + 1984.

Table 11. Characteristics of the sub-catchments

Characteristic	Wicks End Creek	Ceb Creek	Will Bob Creek
Area (ha)	79.6	22.5	89.2
Elevation (m)	800 to 950	800 to 892	825 to 950
Dominant overstorey	Brown barrel	Brown barrel	Brown barrel

Water quality will also be monitored by automatic sampler at the Water Resources gauging station which is located 20 kilometres downstream. This will allow for the monitoring of the overall impact of small scale logging on the water quality, at a point on the stream which is close to the domestic supply uptake. Parameters used for determining water quality are suspended sediment, turbidity and conductivity. Table 12 gives examples of results obtained to date.

Table 12. Samples of water quality results

Parameter	Sampling date 6/3/84	21/3/84	26/4/84*
Antecedent† rainfall (mm)	0‡	59	234
Suspended sediment (mg L^{-1})	3	21	272
Conductivity ($\mu S\ cm^{-1}$)	50	46	36

* Sampling date for Ceb Creek was 27/4/84
† Rainfall during week preceding sampling
‡ Figures are averages for the three sub-catchments

Initial results show that suspended sediment concentrations were low during periods of low rainfall. Suspended sediment concentrations rose in conjunction with moderate (<50 mm) rainfall events. A major rainfall event was experienced in April 1984. High levels of suspended sediment concentration and a lowering of conductivity were associated with that event. These results concur with other Australian studies which illustrated the storm domination of suspended sediment transport.

TAREE REGIONAL RESEARCH CENTRE

Natural Regeneration of Wet Sclerophyll Forest with an Overstorey of Tallowwood, Sydney Blue Gum and Brush Box

This study was carried out on Bulga, Dingo, Douglas River, Mt Boss and Lower Creek State Forests, all of which are situated on the mid-north coast of New South Wales. The study included the assessment of regeneration on a number of sites of known silvicultural history.

On eleven of the assessed study sites, involving 894 plots which had been burnt after logging, the median regeneration stocking was 977 trees ha^{-1} with a stocking range of 291–2384 trees ha^{-1}. None of the burns covered 100% of this area as the most moist sections are almost impossible to burn. Twelve of the assessed study sites, involving 1196 plots, received no follow up post-logging burn. The regeneration stocking on these sites was 63–574 trees ha^{-1} which is much lower than that recorded at sites in areas receiving a post-logging burn.

All sites, both burnt and unburnt, had a similar overstorey stocking prior to logging as determined from aerial photographs. The percentage of tallowwood regeneration was similar at burnt and unburnt sites, whereas the percentage of blue gum regeneration was significantly higher on burnt sites than on unburnt sites: the percentage of brush box regeneration was significantly higher on unburnt sites (Table 13). There was also a similarity between sites in terms of the rainforest understorey tree species composition after logging. All sites had had a well developed rainforest understorey prior to logging and the continued presence of these species following logging indicated that it was regenerating along with the sclerophyllous overstorey species.

Table 13. Species composition (%) of the pre-logging overstorey and the subsequent regeneration on sites burnt and unburnt after logging in wet sclerophyll forest, northern New South Wales

Species	Silvicultural condition	Species composition (%) Burnt sites	Unburnt sites
Tallowwood	Pre logging overstorey	40	41
	Regeneration	36	34
Sydney blue gum	Pre logging overstorey	24	21
	Regeneration	31	13
Brush box	Pre logging overstorey	21	22
	Regeneration	25	46
Other *Eucalyptus* spp.	Pre logging overstorey	15	15
	Regeneration	8	7

A significant relationship was found between the development of competitive regeneration and retained canopy cover. Competitive regeneration is that regeneration equal to or greater in height than surrounding vegetation and considered highly likely to be successful in competition with the surrounding vegetation and with good potential for reaching the overstorey. The stocking of competitive regeneration was inversely related to the amount of retained canopy cover (Figure 7).

The likely mortality and growth rates in regrowth stands of this forest type were investigated by examining two long term growth plots, one on Douglas River State Forest and the other on Brooklana State Forest. The results indicated that there was very little mortality in

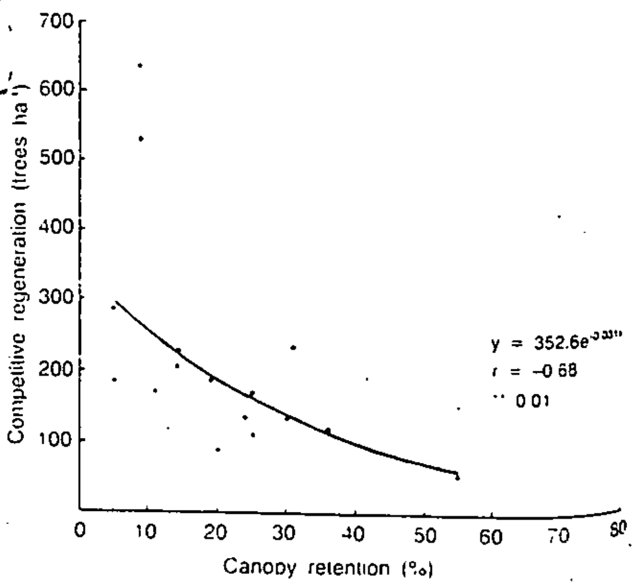

Figure 7. Stocking of competitive regeneration (*Eucalyptus* spp. and brush box) and retained canopy cover (14 sites)

regenerating trees of dominant or codominant status >15 cm diameter breast height at the time of first measurement. The best 100 trees ha^{-1} on the regenerating stand showed a mean annual diameter increment of 1.07 cm at Douglas River and 0.97 cm at Brooklana. This indicated that a tree of 50 cm diameter could be attained in 50–70 years and a tree of 100 cm diameter could be attained in 100–120 years.

The overstorey of a mature wet sclerophyll forest of the type under study generally has a stocking of 40–65 trees ha^{-1}. On all sites where an assessment was made of trees with good potential for continuing development (competitive regeneration), sufficient stems were present to provide a full overstorey canopy. With an increase in the intensity of logging, there will be a reduction in the residual canopy, an increase in the area of soil disturbance, an improved regeneration establishment and growth rate. Post logging burning will increase the area of available seedbed and the density of regeneration. The development of all the regenerating species will be faster in openings with access to light.

The Effect of Fire on Small Mammal Populations in Wet and Dry Sclerophyll Forests

Hazard reduction burning as a wildfire protection measure is considered to be an essential part of most forest fire prevention programmes. There is currently a lack of knowledge on the long term effect of regular, frequent prescribed burning on small mammal fauna in Australia. It is clear from previous research that most small mammals are good fire survivors. It is also clear that fire does affect the food and cover components of the habitat and that these effects can lead to animal population changes.

This study examined small mammal productivity in two forest types over time and the effect fire had on that productivity. Apart from prescribed burning effects, one site that had recently been subject to a severe wildfire was included for comparison purposes. The study areas were situated near Taree on the mid-north coast of New South Wales. The dry sclerophyll sites have an overstorey of white mahogany, grey gum and grey ironbark, a major understorey of forest oak and a minor understorey of xeric shrubs and grasses. The wet sclerophyll forest has an overstorey dominated by blackbutt and a well developed mesic understorey which increases in height approaching the gullies.

There was a clear difference in small mammal productivity between the two forests with the wet sclerophyll forest type supporting much higher animal numbers (Figure 8). There was also greater species richness of small mammals in the wet sclerophyll forest with 10 species being recorded compared with 6 species on the dry sclerophyll forest. Fawn-footed melomys was only recorded on the wet sclerophyll forest, whereas New Holland mice were only recorded on the dry sclerophyll forest. Southern bush rats and brown antechinus were recorded in much higher numbers on the wet sclerophyll forest. Apart from house mice, the remaining species were only captured occasionally, irrespective of forest type.

There appeared to be no effect of topography on animal distribution on the dry sclerophyll sites which was not surprising as they were fairly homogenous in appearance. Conversely, the wet sclerophyll sites had an increasingly mesic character moving down the slope and exhibited a corresponding increase in animal numbers down the slope (Table 14).

The site which had been subject to severe wildfire (fire intensity of 10,000–30,000 kW m^{-1}) was on wet sclerophyll forest. Recolonisation has been relatively rapid from the wildfire which took place in December 1979 (site 6, Figure 8). Three species of small mammals had returned to the site within four months. It is presumed fawn-footed melomys would have been present prior to the wildfire due to the similarity of the site with the other two wet sclerophyll sites. However, it has not been recorded since the wildfire. Population explosions of house mice took

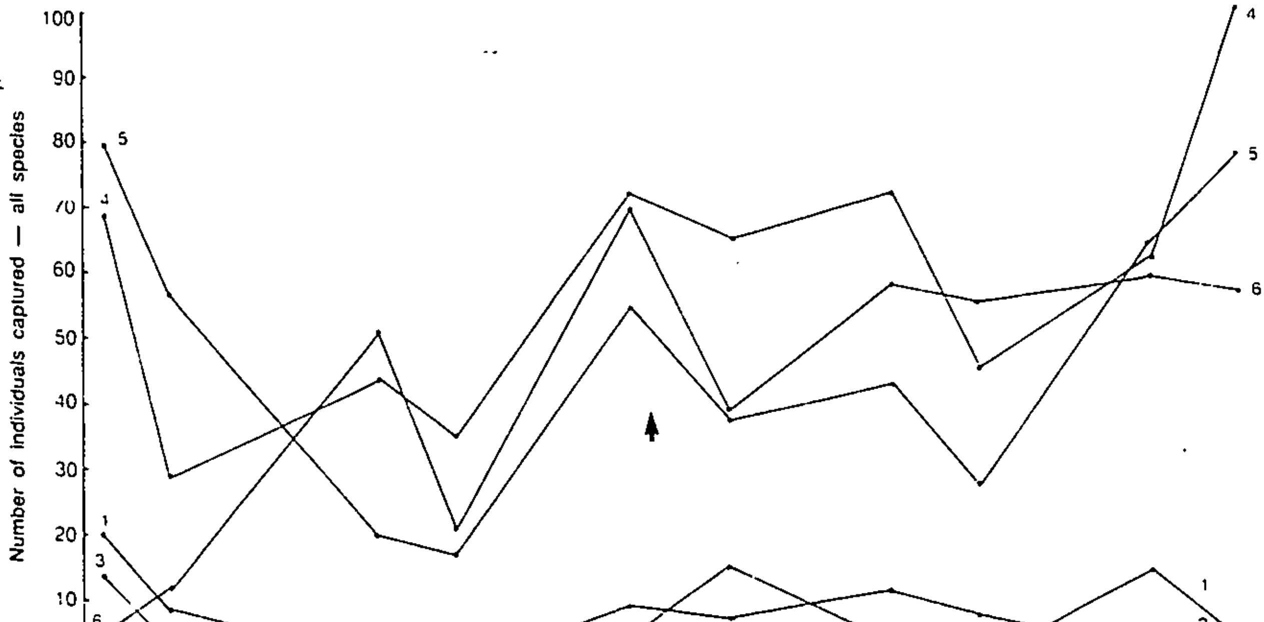

Figure 8. Number of individual small mammals captured on dry sclerophyll forest (sites 1–3) and wet sclerophyll forest (sites 4–6). Arrow indicates prescribed fire

Table 14. Small mammal distribution by species and topography on the wet sclerophyll sites for the period July 1980 to April 1985

Animal species	Number of individuals captured		
	Upper slope	Mid slope	Lower slope
Southern bush rat	120	165	220
Fawn-footed melomys	7	18	28
Brown antechinus	101	115	136

place in 1981 and 1982 but not since that time. Recolonisation with Southern bush rats was rapid compared with a more gradual recolonisation by brown antechinus.

The experimental prescribed fire on the wet sclerophyll in May, 1982, was a mild fire burning with an intensity of 102 kW m^{-1}. Sixty-three percent of the site area was burnt with most of the burnt areas being on the upper and mid slope. Following the prescribed fire, predicted Southern bush rat and brown antechinus numbers were not significantly different from actual numbers captured for the entire site. However, when the burnt and unburnt sections of the site were compared, there were significant increases in both species on the unburnt area of the site and a significant decrease in brown antechinus on the burnt area. As there was not a significant change in numbers on the site overall, it appears that animals have moved from the burnt to unburnt sections of the site (Table 15).

The effect of fire on animal numbers on the dry sclerophyll forest was not examinable due to the low number of mammals present.

Table 15. Animal numbers per trap-point on burnt and unburnt sections of wet sclerophyll site subject to a prescribed burn

Animal species	Site section	Pre-fire year	Post-fire year
Brown antechinus	Unburnt	0.89	1.17
	Burnt	0.65	0.48
Southern bush rat	Unburnt	2.67	5.72
	Burnt	1.52	1.52

TUMUT REGIONAL RESEARCH CENTRE

Post-thinning Fertilization

Trials aimed at developing practical methods for spreading fertilizers in recently thinned stands of radiata pine were undertaken by Tumut District in the spring of 1981. Fertilizer was mechanically spread on two first thinned sites and the second, third and fourth thinned sites in Buccleuch State Forest. At each site, approximately half a compartment was treated with nitrogenous fertilizer at the rate of 400 kg N ha^{-1}; the other half of the compartment was left untreated. Plots were established in each half compartment. The results of the remeasurements of these plots showed that there was a positive response to nitrogen fertilizer on three out of the five sites. The lack of response at the other two sites is felt to be due to other limiting factors, principally phosphorus or water.

Plantation Establishment — The Effect of Clearing Method on Pine Growth

In 1969, trials comparing broadcast and windrow clearing techniques were established at Green Hills and Buccleuch. At each site, three treatments were compared: broadcast clearing, between-windrows and within-windrows. Results for ages 11–12 have been analysed in detail.

At both sites, stocking in the broadcast plots was not significantly different to stocking on the between-windrow plots (1400 – 1500 trees ha^{-1}). At Buccleuch, mean diameters on the broadcast cleared plots were not significantly different (at the 5% level) from those of the between-windrow plots. Diameter increments were not significantly different. At Green Hills, all mean diameters were significantly different (at the 5% level) in the following order: within-windrow > between-windrow > broadcast. Diameter increments were also significantly different but in the reverse order to diameters: broadcast > between-windrow > within-windrow.

These results are extremely interesting although unexplained at this stage. At Buccleuch a difference was established early in the life of the stand; this difference is being maintained. At Green Hills differences were also established early in the life of the stand but, in contrast to Buccleuch, the slower-starting stands (broadcast and between-windrow plots) are now catching up.

None of the basal areas at Buccleuch were significantly different; at Green Hills the broadcast plots and the within-windrow plots were not significantly different but the basal area of the between-windrow plots was significantly greater.

The effect of clearing method on mean dominant height was not clear. While there was evidence of a modest height response (approximately 1.2 m) in the between- and within-windrow plots, the effect on mean dominant height was not significant.

Form quotients were calculated for a sample of trees at each site. Form quotient was defined as:

$$\frac{\text{Diameter over bark at half the height above breast height}}{\text{Diameter at breast height over bark}}$$

Form quotients for the three treatments at Buccleuch were not significantly different at the 5% level. The overall mean (and its standard deviation) was 0.70 (0.5). At Green Hills, the mean form quotient for the between-windrow trees was significantly lower than the mean form quotient for trees on the broadcast area. Values are shown in Table 16.

Table 16. Mean form quotient for trees growing at Green Hills

Treatment	Mean form quotient
Broadcast	0.74
Between-windrow	0.66
Within-windrow	0.69

Trees growing between the windrows are more sharply tapered than trees growing on broadcast areas. This difference is ascribed to differential height and diameter responses. A modest height response on the windrowed and ploughed areas was accompanied by a substantial diameter response.

Dallan.

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INVESTIGATIONS IN REGENERATING THE TALLOWWOOD - BLUE GUM FOREST TYPE

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CONTENTS

SUMMARY

Investigations described in this report concern mainly the regeneration of the Tallowwood-Blue Gum forest type.

The report includes laboratory studies of various effects on the germination of seed and data of four years' observations on the flowering and seeding habits of Tallowwood and Blue Gum.

Seed bed preparation is shown to be necessary and the method of tractor clearing to be better than that of burning. Mechanical clearing by means of extending existing snigtracks incorporates many advantages of full clearing with reduced costs.

The dusting of seed with Dieldrin powder resulted in a highly significant improvement in percentage stocking, while the presence of cover (50 per cent canopy) did not assist germinates.

The number of seedtrees per acre proved not to be a reliable guide to the quantity of seed to be expected and effective seed throw is shown not to exceed fifty feet from the base of the tree.

Attempts at the introduction of faster growing desirable species showed good promise.

INTRODUCTION

Tallowwood (*Eucalyptus microcorys*)*, is widely distributed in north eastern New South Wales and south eastern Queensland between the Pacific Ocean and the higher altitudes of the coastal escarpment of the Dividing Range, while Sydney Blue Gum (*E. saligna*), although it extends some three degrees of latitude further south than Tallowwood, generally occupies similar sites. Both species reach optimum development as an association on and below the coastal plateaux with an altitudinal range of 1,000 feet-3,000 feet above sea level, where the rainfall is not less than 35 inches per annum and frequently exceeds 60 inches, with a peak distribution in the summer months. The association only occurs on fertile to very fertile soils.

The Tallowwood-Blue Gum association often borders rainforest areas, and in the absence of fire rainforest frequently invades the type. Principal associated commercial species include Brush Box (*Tristania conferta*), Turpentine (*Syncarpia glomulifera*), Silvertop Stringybark (*E. laevopinea*), New England Blackbutt (*E. campanulata*), White Stringybark (*E. globoidea*), Diehard Stringybark (*E. cameronii*), Narrowleaved White Mahogany (*E. acmenioides*), and Whitetopped Box (*E. quadrangulata*).

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* Authorities for botanical names are given in Appendix I.

Tallowwood is the most valuable species in the type; it commands high royalties and is generally free from serious defect. Its timber combines great strength and durability with comparative ease of working and it is considered to be one of the best hardwoods in New South Wales (Anon., 1957).

However, it has a slow growth rate and its rotation is generally estimated at 125 years; it is considered to be one of the most shade tolerant species in the genus.

Blue Gum, although fast growing, is less desirable and generally very defective, especially in regrowth stands. In all trials described in later sections the main emphasis has been placed on Tallowwood.

The understorey of the Tallowwood-Blue Gum type is extremely dense and mainly composed of rainforest elements such as *Callicoma serratifolia, Cryptocarya rigida, Ackama paniculata, Elaeocarpus reticulatus, Schizomeria ovata, Orites excelsa, Synoum glandulosum, Endiandra sieberi, Duboisia myoporoides, Drimys* spp., *Casuarina torulosa* and the Acacias, *A. elata, A. binervata* and *A. irrorata.* Many vines and epiphytes also occur.

When the canopy is removed or opened and the soil exposed, the combination of high summer rainfall and good soil leads to a rapid and vigorous colonisation by agricultural weeds, in addition to the species originally occupying the site. This prolific weed growth is one of the most important factors hindering successful regeneration of the type.

As an accelerated programme of road construction, caused by increasing demands for high quality hardwoods, has opened up considerable areas of the Tallowwood-Blue Gum type in recent years, the need for a satisfactory technique to regenerate the type is of high priority.

The two prime requisites for regeneration are:—

(a) A satisfactory seed source,

(b) An exposed mineral soil;

and the trials to be reported involved studies in flowering, seeding and seed germination as well as combinations of various methods and degrees of site preparation, cutting systems, canopy cover, seed source and sowing rates.

Experiments described were mainly conducted in the period January, 1960 to February, 1961, in the Bulga-Dingo Management Area (elevation 1,800 ft-2,200 ft; Lat. 31° 39′ S, Long. 152° 10′ E, 25 miles north west of Taree, N.S.W.) and the Bellangry Management Area (elevation 2,800 ft-3,000 ft; Lat. 31° 12′ S., Long. 152° 24′ E., 46 miles N.N.W. of Taree) (see Appendix 2).

Appendix 3 lists all regeneration trials in numerical order; due to the lengthy treatment description of these trials they will frequently be referred to by number in the following sections which review the results of these experiments.

SECTION I. SEED STUDIES

(a) Germination Tests

Germination tests have been carried out on many seed batches of most species in the Tallowwood-Blue Gum type. An experiment to determine the longevity of seed under room temperature storage conditions is in progress, while tests have been conducted on optimum temperatures for germination, the effect of stratification at 30 °F, and the effects of soaking in different strengths of hydrogen peroxide.

Method

All general tests have been conducted in a constant temperature oven set on 80 °F to 90 °F. The method used has been that recommended by Grose and Zimmer (1958), with modifications, suggested by Floyd (1964) in relation to the marking of segments and the length of the hypocotyl when counting.

Due to variations in seed weight and size, 0·1g per subsample was used for Tallowwood and New England Blackbutt and 0·05g subsamples for Blue Gum and Brush Box.

It proved difficult to sample Tallowwood seed satisfactorily, primarily because of the large size differences between seed and chaff, and standard errors at the 95 per cent level approached 15 per cent of the mean. The number of Tallowwood seeds per pound varied from 53,500 (± 8,800) to 172,700 (± 13,500) at the 95 per cent level.

Germination tests of eight seedlots from 1959 and 1960 collections show a mean number of viable seeds per pound of 80,000.

Fertile Tallowwood seed differs greatly from the chaff and can be distinguished readily with the naked eye. This can lead to considerable bias when attempts are made to weigh out a sample of seed to an exact weight (e.g. 0·100 g) by the addition or subtraction of small quantities of seed to or from the sample being weighed. It is consequently recommended that, in future tests, samples should only approximate to a weight of 0·1 g, and that subsequent calculations should be adjusted accordingly.

Due to variations in total numbers of seeds per pound a figure was calculated, for use in storage tests, to show the percentage of viable seeds to total seeds.

(b) Storage Tests

Nine seedlots of Tallowwood of various ages are stored in airtight containers at room temperature. These are tested annually in order to determine viability and thus longevity of Tallowwood seed under these conditions.

Figure 1 illustrates that there is no definite falling off in Tallowwood viability at least in the first six years of room temperature storage.

Only seedlot T23 falls within the 6-10 years age group and it tends to show a marked decrease in viability. It will be interesting to note if this trend is confirmed by Tallowwood seedlots now approaching this age.

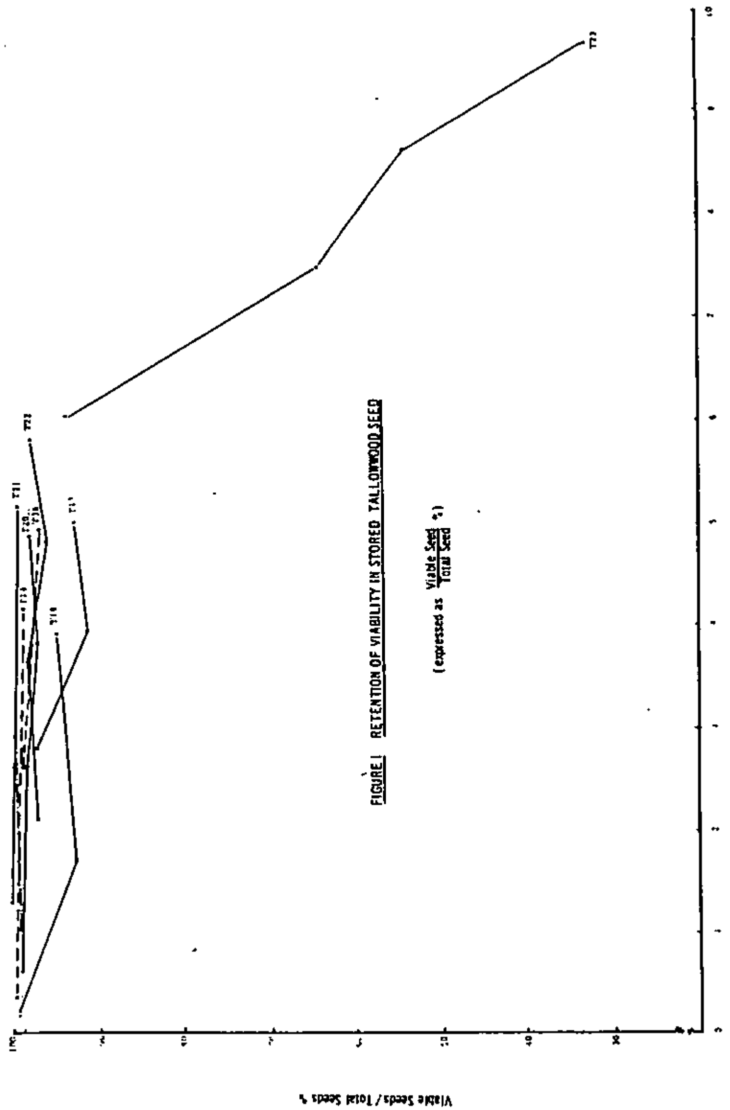


FIGURE I RETENTION OF VIABILITY IN STORED TALLOWWOOD SEED

(expressed as $\frac{\text{Viable Seed}}{\text{Total Seed}}$ %)

Similar tests are conducted on three lots of Blue Gum seed, two of New England Blackbutt seed and one of Brush Box. Figure 2 shows a marked decrease in viability of Blue Gum seed in the first five years of similar storage. This decrease was tested by performing an analysis of variance on the arcsin transformation of the percentage of viable seeds to total seeds, and differences between years were highly significant.

The storage potential of New England Blackbutt is subject to doubt while the only lot of Brush Box included in this test shows no decrease in viability up to age three years.

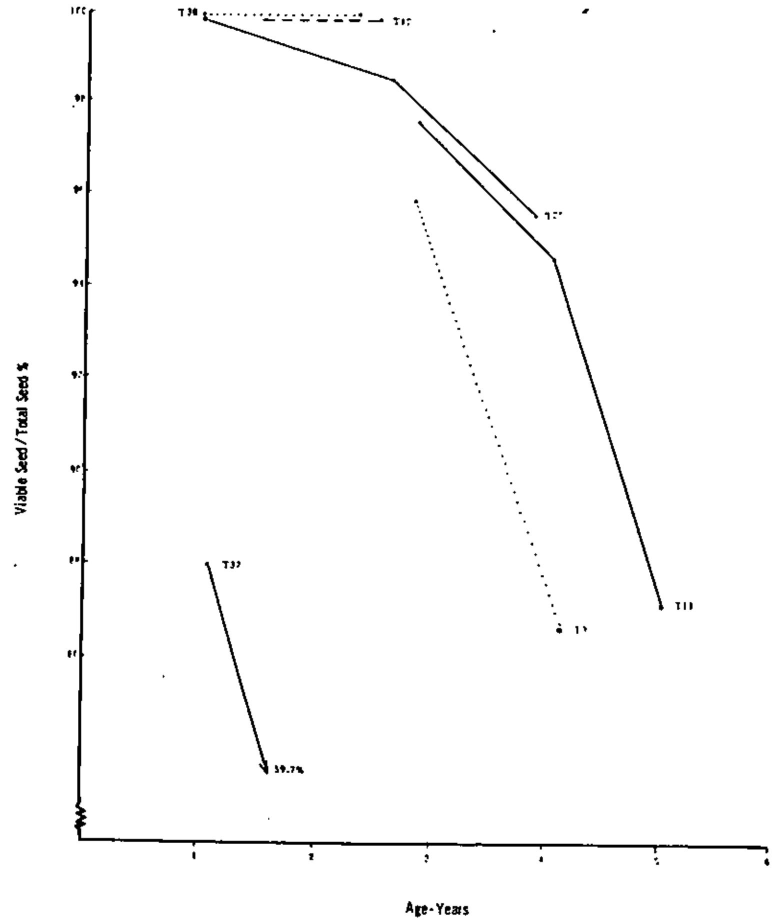


FIGURE II RETENTION OF VIABILITY IN STORED SEED

(expressed as $\frac{\text{Viable Seed}}{\text{Total Seed}}$ %)

Sydney Blue Gum
New England Blackbutt
Brush Box

(c) Optimum Temperature

A series of tests was conducted to determine the optimum temperature for germination for the main species in the type. Five lots of twenty subsamples each containing 30 fertile seeds were selected for Tallowwood and Blue Gum and five lots of ten such subsamples for New England Blackbutt and Brush Box. One lot of each species was then germinated at each of five temperatures varying from 56 °F to 106 °F.

Due to lack of adequate thermostat control on the oven used, the temperatures could not be adjusted finely but were raised at approximately 10 °F to 15 °F intervals. Table 1 gives results of these tests.

TABLE 1

Showing optimum temperature range for germination of main species

Temperature Range	Approx. Temp.	Germination				Day of Maximum Germination			
		TW*	sbG	eBB	bB	TW	sbG	eBB	bB
		%	%	%	%				
56 °F- 62 °F	59°	98·8	98·7	99·3	82·7	13	12	13	21
69 °F- 71 °F	70°	98·5	99·1	97·6	98·9	7	6	7	10
83 °F- 87 °F	85°	96·9	98·2	95·6	98·9	5	4	7	7
94 °F- 97 °F	95°	93·2	97·1	60·6	72·0	5	5	9	11
104 °F-106 °F	105°	1·0	5·5	0	98·2 (unhealthy)	..	..	..	18

* Note: Species symbols are from the Forestry Commission booklet, *Forest Species of New South Wales*, Form FC88, published 1963.

TW = Tallowwood.
sbG = Sydney Blue Gum.
eBB = New England Blackbutt.
bB = Brush Box.

It can be seen that both Tallowwood and Blue Gum reach their optimum temperature for germination somewhere between 83 °F and 97 °F, but probably in the lower range, while New England Blackbutt and Brush Box definitely require temperatures below the 94 °F to 97 °F range, but above 65 °F. A temperature of 88 °F is now used for routine germination tests.

The speed of germination varies greatly with temperature; for Tallowwood the number of days to maximum germination drops from thirteen at approximately 59 °F to seven at approximately 70 °F. The average daily mean temperature in Taree is slightly less than 60 °F from May until September and slightly above 70 °F for the period December to March (Anon., 1956). The summer mean relative humidity is approximately eighty per cent.

(d) Stratification

Twenty samples of 0·1 g of Tallowwood seed were weighed. Ten of these were stratified at 30 °F for three weeks while the remaining ten samples were stored at room temperature for the same period. At the end of the three weeks a normal germination test was set up. Results were:

	Stratified	Unstratified
Germination Capacity	94·2	100·0
Viable Seeds per pound	31,300	37,200
Day of Maximum Germination ..	3	3

Statistical analysis shows that there is no apparent effect of stratification on germination. At no stage during these investigations did any of the species exhibit signs of primary or secondary dormancy which have been demonstrated in alpine and sub-alpine eucalypts of Southern Australia (Grose, 1963; Cunningham, 1960).

(e) Peroxide Soaking

Trappe (1961) recommended the use of 30 per cent solutions of hydrogen peroxide for short periods to sterilise seed coat and stimulate germination of pine seed.

Two series of tests were conducted on Tallowwood seed. In the first, ten sub-samples of ten seeds each were counted out and each was treated for different lengths of time with 30 per cent hydrogen peroxide. Germination testing was then carried out at 80 °F. Results are shown in Table 2.

TABLE 2

Showing effects of soaking in 30 per cent hydrogen peroxide on germination of Tallowwood seed

	No. of days of test	Germination	Seeds Retaining Viability
		Per cent	Per cent
Control—soaked in water for 30 minutes	20	96·2	79·0
Soaked in H_2O_2 for 15 minutes	20	91·3	92·0
Soaked in H_2O_2 for 30 minutes	20	98·7	78·0
Soaked in H_2O_2 for 60 minutes	20	94·0	83·0

Conclusion

Soaking in 30 per cent hydrogen peroxide makes no difference to speed or number of germinates.

In a visual observation test, four groups of five sub-samples of 0·1 g of Tallowwood seed were weighed out. These were treated in four different ways.

(a) Control—untreated.

(b) Soaked in 6 per cent H_2O_2 for 30 minutes.

(c) Soaked in 6 per cent H_2O_2 for 60 minutes.

(d) Soaked in 6 per cent H_2O_2 for 120 minutes.

These were then germinated at a temperature range of 101 °F to 107 °F. Results were:

(a) Fungus commenced on second day.
(b) Fungus commenced on fourth day.
(c) Fungus commenced on fourth day.
(d) Fungus commenced on fourth day.

Hence, soaking Tallowwood seed in weak solutions of hydrogen peroxide appears to have an inhibitory effect on fungus production. As fungus production may be one of the inhibitors of seed germination this could have some application. However, in routine germination tests, conducted at 88 °F, fungal infestation rarely occurs.

SECTION II. FLOWERING AND SEEDING

In order to observe the periodicity and pattern of flowering and seeding of the main species in the Tallowwood-Blue Gum type, nine stationary seed traps (installed in six stands) were used to collect information. Additional seed traps were arranged within regeneration treatments to study seedfall per unit area based on the method of Wilm (1946). The results of these unit area studies are referred to in section IVe on rates of sowing.

The seed traps were designed as described and illustrated by Cunningham (1960). Traps were made of canvas material with ⅜-inch steel rod framing, the top frame being 3 ft by 3 ft, and collections were funnelled into gauze bottomed tins.

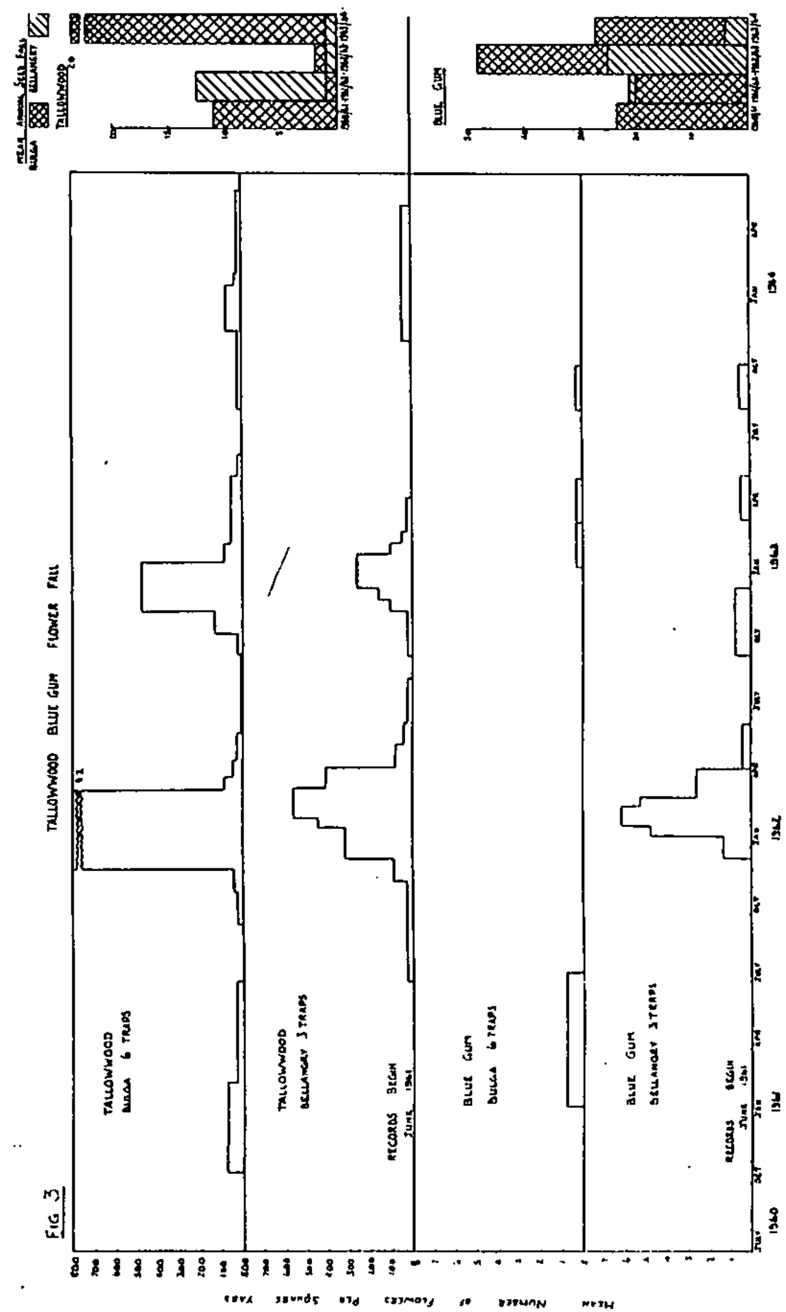
Seed trap contents were macroscopically examined by species for: inflorescence primordia, inflorescence bracts, immature buds, first opercula, mature buds, flowers, second opercula, immature and mature fruits, fertile seed and chaff. Trap contents were dried at room temperature, the dry contents were then sieved and the fraction between 0·078 inch and 0·0073 inch screens was microscopically examined using a ten times binocular head-piece magnifier.

Unfortunately the mesh of the gauze at the bottom of collection tins was large enough to allow part of the chaff to pass through, thus rendering chaff data unreliable, while it was not always possible to arrange trap collections at four-weekly intervals as was intended.

When comparing data from all traps in use at the one time in various areas it becomes apparent that altitude has a large influence on stages of flowering and seeding. The time of flowering and seedfall on Myall River (elevation 800 ft-1,200 ft) precedes Bulga-Dingo (1,800 ft-2,200 ft) by one to two months, while Bellangry (2,800 ft-3,000 ft) follows Bulga-Dingo by a similar margin.

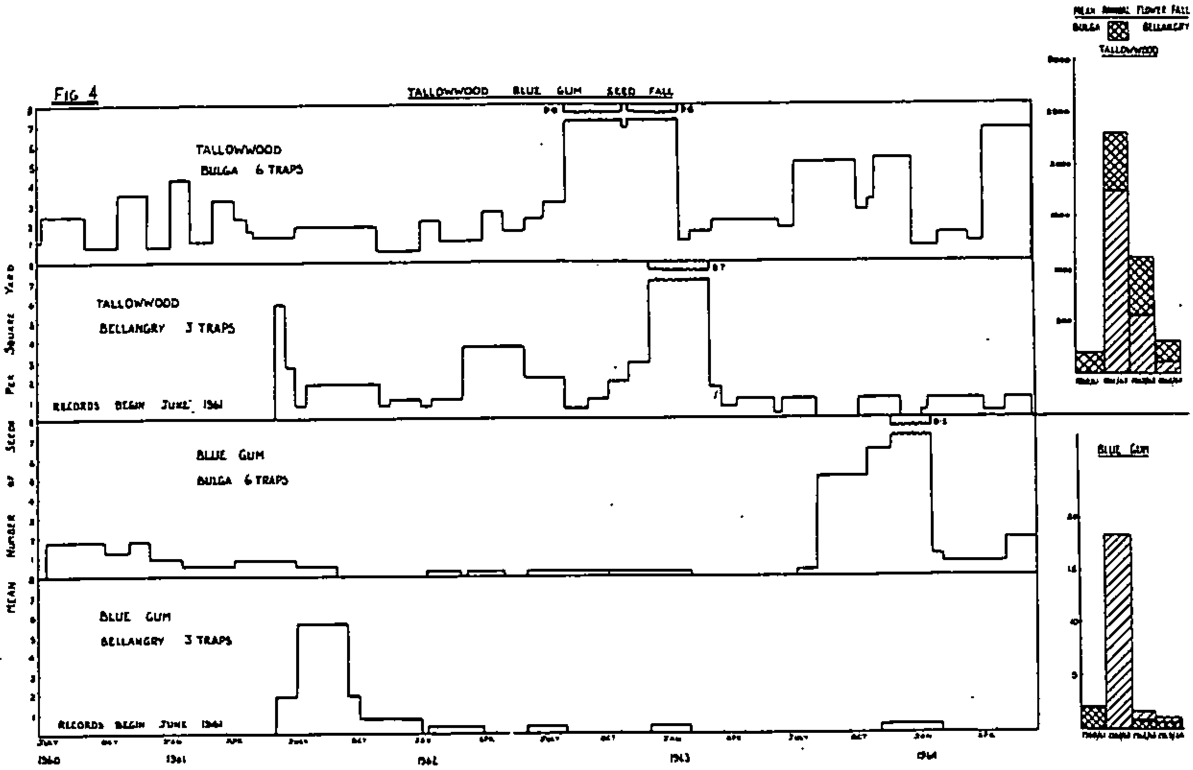
(a) Tallowwood Seedfall

Tallowwood flower and seedfall for both Bulga-Dingo (six traps) and Bellangry (three traps) are shown in figures 3 and 4, for the four-year period June, 1960 to June, 1964. Insets in each figure show corresponding seed and flower falls for the same period on a mean annual basis.



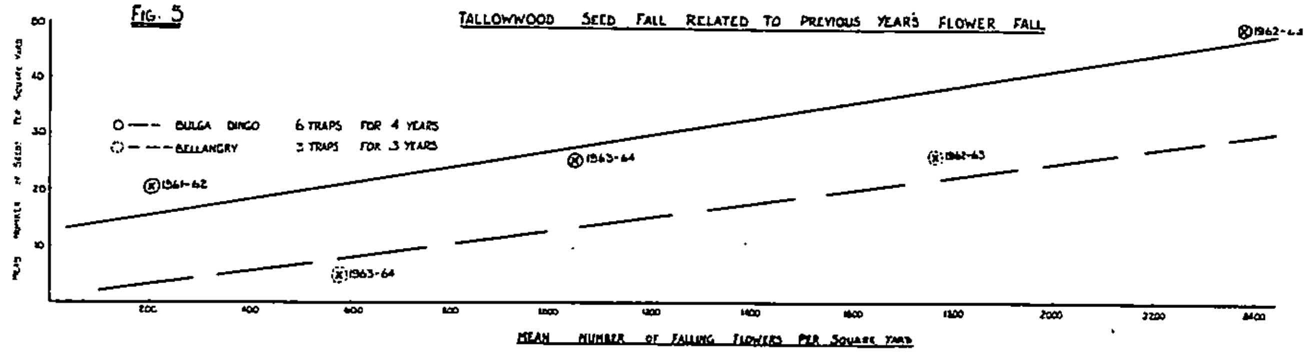
14

Fig 4



15

Fig. 5



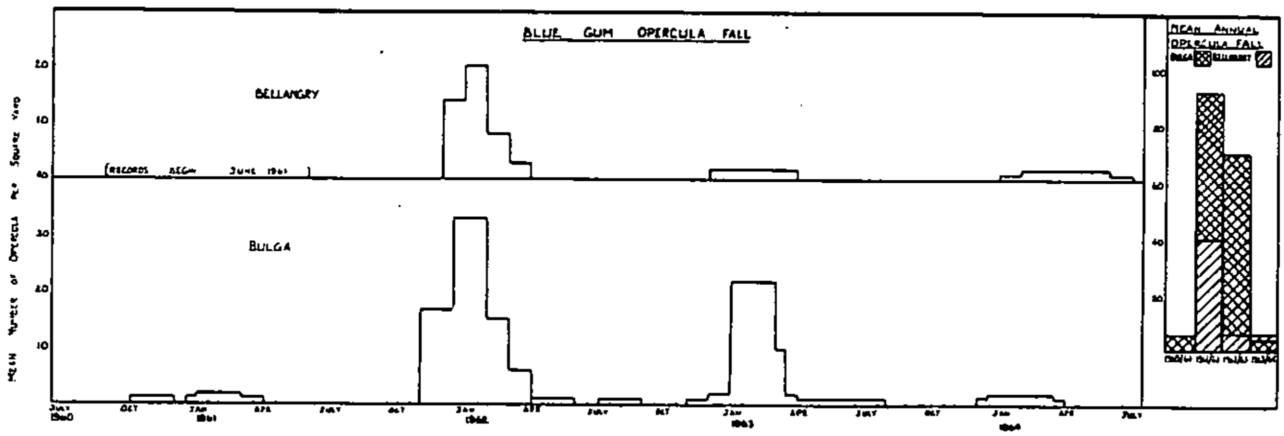


Figure 5 shows seedfall related to the previous year's flower fall and indicates a good linear relationship between the two. Indications are that the number of flowers falling is directly related to the number of capsules maturing and that seedfall follows some twelve months later. This enables the size of the seed crop to be forecast some twelve months in advance of site preparation.

This is in contrast to many other species in the genus. Florence (1961) shows a two year lapse between flowering and seeding for Blackbutt; Cunningham (1960) shows for *E. regnans* that, although seed of this species matures one year after flowering, it is not generally shed until the second or third season after flowering. Grose (1960) states that in *E. delegatensis* flowering occurs in February and March and the resulting seedcrop remains on the trees for at least two years. Blue Gum also shows a two year interval as will be shown in the next section.

This early seedfall from Tallowwood capsules can probably be attributed to the fragile nature of the capsule, pedicel and peduncle as compared with other eucalypts, resulting in very rapid drying out of the inflorescence after it matures. Tallowwood capsules often shed seed while green and most capsules have fallen from the tree within two months after seedfall has occurred.

The results of opercula counting were very disappointing; in all cases the number of fallen flowers exceeded the number of opercula and in no way could the opercula count be used to estimate the number of flowers remaining. The reasons for this are obscure, but it is suggested that repeated wetting and drying in the trap while awaiting collection may have caused disintegration of the opercula. Bud and inflorescence primordia fall showed no clear relationship, while chaff data is unreliable due to known losses prior to collection.

Annual seedfall figures for Tallowwood are shown in Table 3.

TABLE 3

Annual Tallowwood seedfall, 1960 to 1964

Year	Bulga-Dingo	Management Area	Bellangry	Management Area
	Per trap	Per acre	Per trap	Per acre
1960-61	22·3	107,932	..	..
1961-62	20·0	96,800	21·3	103,092
1962-63	48·5	234,740	25·0	121,000
1963-64	26·8	129,712	4·3	20,812

As germination tests have indicated a mean number of 80,000 Tallowwood seeds per pound, annual seedfall at Bulga-Dingo ranged between 1 lb 3 oz and 2 lb 15 oz per acre, while Bellangry totals are between 4 oz and 1 lb 8 oz. However, it should be realised that the mean distance from these traps to seed trees is 37 feet, which is the equivalent of at least eight Tallowwood seed trees per acre.

The loss of Tallowwood flowers is considerable, trap collections indicating that less than one percent of flowers reaches maturity.

(b) Numbers of Tallowwood Seeds per Capsule

Tallowwood capsules were collected from twelve trees on a range of sites in the Bulga-Dingo and Bellangry management areas. Capsules were allowed to dry out in the laboratory until gentle shaking produced no more seed or seed particles. Results are shown in Table 4.

TABLE 4

Number of Viable Tallowwood Seeds per Capsule

Locality	Elevation	Date of Collection	Date Seed Extraction Terminated	Number Capsules	No. Seed Particles	No. of Viable Seed
	feet					
....	..	28-4-61	19-7-61	20	1,700	5
....	..	28-4-61	19-7-61	20	1,700	18
....	..	28-4-61	19-7-61	20	1,550	31
Bulga-Dingo	2,000	..	19-7-61	14	1,102	12
Bulga-Dingo	1,800	9-5-61	19-7-61	96	Not counted	55
Bulga-Dingo	..	..	19-7-61	64	Not counted	63
Bulga-Dingo	2,400	12-7-61	19-7-61	40	Not counted	35
Bulga-Dingo	..	15-8-61	21-8-61	53	Not counted	119
Bulga-Dingo	..	15-8-61	21-8-61	26	Not counted	12
Bellangry ..	2,800	16-11-61	8-1-62	10	Not counted	23
Bellangry ..	2,800	16-11-61	8-1-62	16	Not counted	26
Totals ..				379		399

This indicates a mean number of viable seeds per capsule of 1·05, while the number of seed particles per capsule (where determined) averaged 81·8. The number of viable seeds per capsule varied from 0·25 to 2·24 in collections from different trees.

(c) Blue Gum Seed Fall

The traps used for Tallowwood results were also sampled for Blue Gum. The mean distance from trap to Blue Gum seed tree was 67 feet, as compared with 37 feet for Tallowwood.

Results for flowers, seed and opercula are presented in figures 3, 4 and 5. These figures indicate that in Blue Gum it takes two years for a flower crop to produce a seed crop.

Mean annual Blue Gum seedfall is shown in Table 5.

TABLE 5

Annual Blue Gum Seedfall, 1960 to 1964

Year	Bulga-Dingo		Bellangry	
	Per trap	Per acre	Per trap	Per acre
1960-61	11·2	54,200	..	..
1961-62	0·5	2,400	12·0	58,100
1962-63	1·2	5,800	0·7	3,400
1963-64	29·0	14,000	0·7	3,400

Germination tests for Blue Gum show an average number of 415,000 seeds per pound. Annual yields at Bulga therefore ranged from 0·08 oz to 2·08 oz per acre, and for Bellangry from 0·13 oz to 2·24 oz per acre.

SECTION III. SEED BED PREPARATION

The fact that some form of seed bed preparation is essential to regenerate the type has been realised for a long time. The dense nature of the understorey and surface litter prohibits contact between seed and mineral soil and the lack of natural regeneration and advance growth is a notable feature of cut-over stands.

Basically, burning and tractor clearing are the only two methods of exposing mineral soil available to the silviculturist. Provided an adequate seed source is available and climatic conditions are favourable, Tallowwood germination will occur on soil exposed by either method. However, survival, subsequent growth and costs vary between treatments.

(a) Burning

Wildfire has been responsible for some excellent stands of Tallowwood (e.g., those on Compartments 5, 6, 7 of Bulga State Forest which originated in 1942), and the first intentional regeneration burn with seed trees in 1947 at Doyles River produced a very good stand.

Photo 1.—Bulga/Dingo Management Area, Experiment No. 9 (50 per cent shade including 2 tallowwood seed trees per acre) ready for burning. November, 1960.

Photo 2.—Bulga/Dingo Management Area—Experiment No. 11 (2 Tallowwood seed trees per acre) ready for burning. October, 1960.

Due to the moist nature and density of the understorey, some felling of understorey is often required to ensure an adequate burn. The amount of felling required varies from stand to stand depending on composition, logging intensity, understorey, topography, etc.

The cost of felling (with or without seed trees) and burning at Bulga State Forest for the period February, 1958 to January, 1961 averaged $22.40 per acre (minimum $14, maximum $32). These costs were obtained over ten separate experiments, totalling 903 acres. Seed bed classifications of these experiments show that an average of 14 per cent (minimum 9 per cent, maximum 27 per cent) of the areas provided an unsatisfactory seedbed due to absence of, or a very poor, burn.

At Bellangry similar costs for four experiments (total 72 acres) in 1960-61 averaged $34 per acre.

The number of occasions on which fire can be used for seed bed preparation in the type is limited, and on several occasions (Bulga Compartments 96 and 103) areas felled for regeneration burns had to be abandoned due to the early arrival of summer rains.

The practice of burning has many additional disadvantages. Seed trees left to provide or augment seeding may be burnt without adequately fulfilling their function, while the danger of fire escape from silvicultural burns cannot be overrated.

All regeneration areas were sampled by the use of permanent millacre quadrats (1/1,000th acre) at one chain intervals on random lines. The number of quadrats sampled varied between 30 to 50 per treatment and each quadrat was assessed for absence of germinates, number of germinates by species, height of tallest seedling of each species, and distance to nearest Tallowwood seed tree. Each quadrat was also classified as to the type of seedbed and the degree of shade occurring.

The percentage of millacres stocked is considered the most reliable guide to indicate effective stocking of an area, and has been used to compare results of seedbed preparation trials.

For the germination of Tallowwood a burnt seedbed is usually satisfactory. Table 6 shows percentage stocking figures at age six months for burnt areas where seed supplies were considered adequate (either minimum 2 Tallowwood seed trees per acre or sown at a minimum rate of 3 oz per acre—see rates of sowing section).

TABLE 6

Showing Percentage Stocking of Tallowwood (Millacre Quadrats) on Burnt Sites—Age 6 months

Experiment No. (see Appendix 3)	Stocking Tallowwood (age 6 months)
	per cent
1	71
3	31
6	26
8	64
9	9
11	40
12	32
13	25
15	80
16	30
18	95
For 11 trials	Mean = 45

The only badly failed treatment (experiment 9) occurred when the majority of seed trees, providing the seed source, were burned down in the fire.

Weeds

A burnt seed bed is rapidly colonised by weed species so that within six months the area is generally overgrown with fire weeds and vines (Photo 3). Some of the weeds occurring are annuals, some are frost susceptible, others continue their competition with the tree seedlings indefinitely. In four out of the twelve experimental burns (Experiments 3, 5, 12, 13), extremely dense stands of wattle (*Acacia irrorata* and *A. elata*) resulted, virtually completely suppressing Tallowwood germinates.

Photo. 3—Bulga/Dingo Management Area, Experiment No. 9 (50 per cent shade including 2 Tallowwood seed trees per acre) showing weed growth. November, 1963.

The common weeds occurring are:

Sago Bush	*Helichrysum diosmifolium*
Ink Bush	*Phytolacca octandra*
Wild Tobacco	*Solanum mauritianum*
Wild Tomato	*Solanum armatum*
Stinking Roger	*Tagetes minuta*
Peach-leaved Poison Bush ..	*Trema aspera*
Fire Weed	*Senecio lautus*
Cobblers Peg	*Erigeron canadensis*
Hop Bush	*Dodonea triquetra*
Soldier Vine	*Kennedia rubicunda*
Lantana	*Lantana camara*

Rubus moluccanus and *Rubus moorei*

Browsing

A lush weed crop attracts cattle and marsupials in search of food and many seedlings are repeatedly browsed, accentuating their battle with the weeds. In six Tallowwood seeded burns where observations on browsing were made, 28 per cent of Tallowwood seedlings suffered browsing damage (see Table 7).

TABLE 7

Showing Percentage of Tallowwood Seedlings Browsed

Experiment No.	Browsed
	per cent
1	57
5	25
8	13
9	30
10	25
11	20
Mean	28

At Bulga State Forest, scrub wallabies (*Wallabia rufogrisea*) are outnumbered by pademelons (*Thylogale thetis*), and the comparatively low stature of the latter seems to indicate that seedlings over five feet are fairly safe from serious browsing. The initial slow growth in height of Tallowwood makes it doubly susceptible.

The control of dingoes by trapping and shooting, encouraged by the Pastures Protection Board Dingo bonus, and the implementation of fire protection are contributing factors to a substantial increase in marsupial population in recent years.

As exclusion of protected fauna from regeneration areas seems impracticable the problem may best be overcome by ensuring a high initial seedling stocking.

Tallowwood stocking on burnt sites gradually diminishes. Those experiments which have been re-assessed over a 30-month period show the trend clearly (see Table 8).

TABLE 8

Percentage Tallowwood stocking (Millacre Quadrats) at various ages on burnt sites

Experiment No.	Stocking			Mean Dom. Height at Age 30 months
	6 months	15-18 months	27-30 months	
	per cent	per cent	per cent	feet
1	71	67	61	3·0
3	31	15	7	3·8
6	26	23	10	3·1
8	64	78	69	4·2
9	9	9	7	8·8
11	40	33	33	3·1
Mean	40	36	31	4·5

As it is difficult to consider all 30 months old germinates "established", it would appear that an initial stocking level of 30 per cent, as considered adequate for most species, may be too low for Tallowwood and that the optimum stocking at age six months should be at least 40 per cent.

Tallowwood height growth is disappointing, at age 30 months the mean dominant height is only 4·5 feet. The slowness is well illustrated in Table 20, Section Vc, where heights at age 45 months are compared for Tallowwood and seven other species.

Conclusion

1. The critical point in burning for regeneration is when to burn. The high rainfall and moist nature of the type limits the number of occasions on which fire can be used and this may well be an overriding factor for management on a large scale.

2. Having obtained the burn, subsequent weather must be suitable for germination and establishment. Rainfall data indicate that January may be the best time for sowing.

3. When seedtrees are used to supply or augment seeding, it is essential that the seedfall has not occurred prior to burning, while seedtrees are often burnt down in the fire before fulfilling their function.

4. Under conditions of high soil fertility and adequate moisture the dense colonisation of weeds may be the dominating factor affecting tree seedling survival and growth. The weed problem makes it essential to sow with a minimum delay after burning.

5. Costs for felling (including understorey) to obtain an adequate burn can be substantial.

6. The method creates a large risk to fire protection. There are numerous instances of fire escapes from silvicultural burns.

7. Where part of the canopy is retained the fall of scorched leaves can seriously hinder germination.

(b) Tractor Clearing

As the suitability of snig tracks as a seed bed has long been appreciated, seed bed preparation by means of tractor clearing was incorporated in the first series of regeneration treatments.

Full Clearing

The fact that clear felling and burning involved considerable expenditure ($22.40 per acre at Bulga and $34.60 at Bellangry) meant that a comparable but more economic method was worth considering. The early tractor clearing experiments set out to clear as much mineral soil as possible.

Unit costs for tractor clearing closely approximated those for felling and burning at Bulga in 1960 (see Table 9).

TABLE 9

Comparing Costs and Efficiency Between Burning and Tractor Clearing

Experiment Number	Tractor Clearing		Burning	
	Soil Exposed	Costs/acre	Soil Exposed	Costs/acre
	per cent	$	per cent	$
1	..	..	73	26.00
2	77	31.80	..	..
3	..	..	87	32.00
4	88	29.40	..	..

The number of experiments involving full tractor clearing is insufficient to allow valid comparisons between the treatments. Only five tractor clearings were incorporated in the 1960 and 1961 series, two of these under maximum canopy. However, it has been established that for the germination of Tallowwood a tractor-cleared seed bed is usually satisfactory (see Table 10).

TABLE 10

Showing Percentage Stocking of Tallowwood (Millacre Quadrats) on Tractor-cleared Sites—Age 6 Months

Experiment No.	Stocking Tallowwood
	per cent
2	75
4	39
7	12
10	14
14	27
Mean..	33

A tractor-cleared seed bed remains receptive for a relatively long period, weeds are generally slow in getting established and clearing does not result in dense Acacia stands, as happens following burning treatments.

In a quantitative study of dry matter production of each major weed species one year after burning or tractor clearing, Floyd (1965) found "that the burnt site produced 1,343·2 Kgm of dry matter per acre in comparison with 392·1 Kgm on the tractor cleared site". The reduction in weed growth also results in less intrusion by animals and reduced browsing damage. The continued receptivity of seed bed and increased survival chances are particularly important when Tallowwood seed trees are employed to provide seed or shelter. In contrast to burning, where all seed on the trees falls almost immediately after the fire and no new seed crop can be expected for many years, tractor clearing does not interfere with the current or future seed crops. Seedshed, therefore, is more gradual and prolonged and adverse climatic conditions at any one time are less pronounced.

Survival figures for tractor clearing bear this out well. Stocking figures at age 18 months exceed those for age 6 months (see Table 11).

TABLE 11

Percentage Tallowwood Stocking (Millacre Quadrats) at Various Ages on Tractor-cleared Sites

Experiment Number	Tallowwood Stocking			Height at Age 30 months
	6 months	15-18 months	27-30 months	
2	75	63	54	3·2
4	39	20	15	1·2
7	12	76	50	0·9
10	14	23	31	4·6
14	27	50	45	1·8
Mean Tractor Clearing ..	33	46	39	2·3 *
As Against Burning (Table 8).	40	36	31	4·5

This reversal of initial stocking in favour of burning to an established stocking in favour of tractor clearing was also demonstrated by Floyd (1962) for the *E. pilularis* association. The reduced height growth on tractor-cleared sites is offset by a similar reduction in weed growth, allowing greater establishment figures at age 30 months, than for burning treatments.

The trend clearly indicates that seed trees can play an important part on tractor-cleared seed beds. The retention of non-merchantable Tallowwood trees is therefore recommended, provided that the number per acre is small enough to permit sufficient light. It is considered, however, that all merchantable stems should be removed in logging. This will reduce the canopy and alleviate the need for a second logging, while improvements in sowing techniques should ensure adequate stockings.

Time of year is not a limiting factor in tractor clearing and only excessively wet conditions limit the use of machinery. The relatively dry spring period from August to December is very suitable, allowing sowing to be carried out in late January-February.

Conclusions

1. Time of year is not a limiting factor in preparing a seed bed mechanically, as is the case with burning.

2. Slower weed establishment allows a substantial time lapse between site preparation and seeding.

3. Seed trees, where left, are not subject to damage and contribute to stocking over a number of years.

4. Less weed growth results in reduced competition between tree seedlings and weed species and tree seedling losses through etiolation are reduced.

5. Costs are not significantly higher than those for burning.

(c) Snigtrack Extension

In the original tractor clearing experiments described above the main aim of the treatment was to clear as much mineral soil as possible. It was soon realised that a less complete operation could reduce costs and still produce sufficient seed bed disturbance to promote adequate regeneration.

After logging operations, a certain portion of the surface is already cleared in the form of snig tracks. This amount varies depending upon logging intensity, topography, type of tractor and operator, etc., but seems to vary between 10 per cent and 20 per cent of the area. Assessments in the Tallowwood-Blue Gum type indicate that, including log dump sites, approximately 16 per cent of logging areas is tractor disturbed.

Although no provision was made to test the "snigtrack extension" method against burning or tractor clearing, a few small experiments have tested this method since 1962 (Experiments 19, 20, 21 and 22). The results lack the conviction of a properly planned experimental series, but they clearly show the possibilities of the method.

Using the original tracks as main arteries a network of new tracks can be dozed fairly quickly, avoiding major obstacles. The seed bed area can be increased by burning the area between tracks without incurring all the disadvantages associated with clear felling and burning. However, due to subsequent litter fall and increase in weed population, this practice is not to be encouraged unless less than 50 per cent of the site has been tractor disturbed.

Table 12 illustrates the costs and percentage of seed bed disturbance achieved by this method.

TABLE 12

Showing Costs and Percentage of Seed Bed Disturbance Achieved by Snigtrack Extension Method

Expt No.	Area Treated in acs.	Area Original Snig-track	Area Additional track Snig-	Area Cleared	Area Burnt	Area Disturbed	Area Nil Disturbance	Cost per acre	Type Tractor
		per cent	per cent	per cent	per cent	per cent	per cent	$	
19	11	16	55	71	Nil	71	29	4.40	D7
20 21	27 34	12	48	59	29	89	11	7.60 5.60	D6 D6
22	110	Not observed		47	30	77	23	11.00	D4

In only one case (Experiment 21) was useless overstorey removed after extensions; the low felling cost of $8 per acre was attributed to easier working conditions. The full cost for the experiment was $13.60 per acre, for which all overstorey other than two Tallowwood seed trees per acre was removed and 89 per cent of the total area was made seed receptive. When compared with costs quoted in Table 9 (approximately $30 per acre) for burning or tractor clearing this appears very satisfactory.

The results of canopy experiments, rate of sowing and new species trials illustrate the advantages of minimum canopy on Tallowwood establishment. In three of four snigtrack extended areas overhead was not removed promptly, and this has almost certainly had a detrimental effect on Tallowwood stocking.

TABLE 13

Showing Percentage Stocking (Millacre Quadrats) after Snigtrack Extension at Age 6 Months

Experiment Number	Year	Overhead Removal	Stocking Tallowwood at age 6 Months
			Per cent
19	1962	Nil	21
20	1963	Nil	47
21	1963	All	49
22	1964	Nil	13
Mean			32·5

The low stockings for Experiment 22 are believed to be caused by heavy shade accentuated by the narrow tracks cleared (D4 clearing).

The removal of overstorey poses several problems, particularly if the proportion of species other than Tallowwood is large, as a large seedfall from these species prior to or concurrent with Tallowwood sowing will certainly affect Tallowwood survival. The felling of useless overstorey prior to snigtrack extensions will seriously hinder the tractor and increase costs and the problem may best be overcome by felling immediately after tractor work is completed, thus virtually limiting seed cast to areas covered by tree heads.

Type of machinery used plays an important part. A D4 tractor used in Experiment 22 proved unsatisfactory; its narrow gauge tracks severely limited the slope which could be worked, the narrow blade cleared only narrow tracks which remained heavily shaded by adjacent understorey, and lack of power prevented the shifting of occasional heavy obstructions. A D7 with "powershift" seems highly suitable. Further experiments should determine the most economic machine for the purpose and whether certain modifications to blade or frame are advantageous.

Topography does limit the area that can be treated but this is not considered a serious disadvantage as steep sides and gullies seldom regenerate well, regardless of treatment.

As the snigtrack extension method makes a smaller percentage of the site receptive than does burning or full clearing, it is considered that maximum use should be made of the reduced area to ensure adequate stocking. This can be achieved by reducing spacing, increasing the plant percent, or the planting of stock raised in jiffy pots.

Tractor operators new to the snigtrack extension system should be closely supervised initially as the tendency to over-clear, and thus increase costs, appears to be a natural one.

(d) No Site Preparation

On one experiment in the series (Experiment 17) no site preparation was carried out. Thirty-four random millacre quadrats located in the treatment failed to show any Tallowwood germinates.

SECTION IV. SOWING AND SEEDFALL RATES

In Section IIIa it was suggested that a 40 per cent stocking of millacre quadrats was desirable if an area was to be considered adequately regenerated. The quantity of seed required to achieve this stocking was investigated by spot sowing areas at different rates and by sampling natural seedfall in roving traps.

The rate of sowing trial at Bulga on a burnt seed bed consisted of a 2 x 4 x 2 factorial design with two levels of spotspacing, four levels of number of seeds per spot and two levels of insecticide in three randomised blocks. At Bellangry, also on a burnt seed bed, all seed used was treated with insecticide and the 2 x 3 design consisted of two levels of canopy cover and three levels of number of seeds per spot. The results from these experiments are treated in the following sub-sections. The percentages of spots stocked per plot were transformed to angles by arcsin transformation before analysis.

(a) Seed Robbers

The importance of seed robbing insects in the regeneration of the eucalypts has been discussed by Cunningham (1960). The Bulga sowing trial enabled a comparison of the percentage of spots stocked with Tallowwood seedlings on 24 plots in which the seed had been dusted with 25 per cent dieldrin powder (1 teaspoon per 1 pound of seed) with a similar number of plots in which no dieldrin was used.

The mean percentages of spots stocked for all sowing rates and spacings after back transformation were:

Dieldrin * .. .. 28·9 per cent
No dieldrin .. .. 8·6 per cent

This inexpensive precaution in dusting seed before sowing resulted in a highly significant ($P > 0{\cdot}01$) improvement in percentage stocking.

Moreover, when seed is not treated with insecticide the variability within and between treatments becomes very large, possibly because of variations in the insect population and because, if a spot of seed is discovered, it will probably be completely robbed no matter how many seeds are present. Because of this increase in variability the remaining treatment comparisons are confined only to plots which had been treated with dieldrin.

(b) Rate of Sowing and Spacing—Bulga

Seed was sown in spots by means of a three-inch diameter shaker, the top of which was drilled with 28 holes of $\frac{3}{32}$-inch diameter (designed to deliver four ounces of seed per acre in 680 shakes). Because of the large size difference between Tallowwood seed and chaff it was suspected that continued shaking while sowing could cause a separation of seed from chaff in the tin and result in a seed delivery gradient as the shaker was emptied. An attempt to reduce this variation was made by purifying the seed by screening through a $\frac{1}{16}$-inch screen.

The four sowing rates tested consisted of one and two shakes of unsieved seed and one and two shakes of sieved seed. At intervals, as the experimental area was sown and seed levels in the shakers dropped, 24 samples of 10 shakes each were collected from both the sieved and unsieved seed shakers and these samples were subsequently germinated in the laboratory. Results from the germination tests gave an average delivery rate of $16{\cdot}4 \pm 22{\cdot}3$ per cent viable seeds per shake of unsieved seed and $30{\cdot}1 \pm 26{\cdot}2$ per cent for the sieved seed. Therefore it was concluded that sieving did not reduce the variability of delivery rates, but approximately doubled the delivery per shake. This means that two of the four sowing rates tested were nearly equivalent. These rates were:—

(a) 1 shake unsieved seed = 16·4 seeds per spot,
(b) 2 shakes unsieved seed = 32·8 seeds per spot,
(c) 1 shake sieved seed = 30·1 seeds per spot,
(d) 2 shakes sieved seed = 60·2 seeds per spot.

These rates of sowing per spot were applied both at 8 feet x 8 feet spacing and 4 feet x 4 feet spacing in three random blocks and the mean percentages of spots stocked at age 6 months are shown in Table 14.

TABLE 14

Back Transformed Mean Percentage of Spots Stocked—Bulga

Rate—Seeds per Spot	Spacing 4 x 4	Spacing 8 x 8	All Spacings
Per cent	Per cent	Per cent	Per cent
16·4	25·9	28·6	27·6
30·1	32·2	28·3	30·2
32·8	31·9	35·2	33·5
60·2	50·5	26·4	38·5
All Rates	35·1	29·8	32·5

The analysis of variance performed on the transformed data showed a significant interaction between spacing and rate. This interaction is attributed to the large difference in stocking between the two spacings at the highest delivery rate. The interaction between spacing and rate was not expected, and is believed to be false until new evidence is obtained. Although there is a trend of increased percentage stocking with rate, no main effect was statistically significant.

(c) Rate of Sowing and Shade—Bellangry

In the Bellangry experiment all spacings were at 8 feet x 8 feet, all seed was dusted with dieldrin and only three sowing rates were used because of the equivalence of two shakes of unsieved seed with one shake of sieved seed. Samples were gain taken from the shakers and germinated to determine the mean delivery of viable seeds per spot. The three sowing rates were replicated twice in the no shade treatment and once in the 50 per cent canopy treatment. Unfortunately one plot in the shaded treatment was accidentally oversown and because of the loss of this plot and the differing numbers of replications in each treatment, normal analysis could not be carried out. However the transformed data were analysed by the method of fitting constants (Snedecor, 1956, p. 388). This method allows an analysis of variance to be carried out and gives unbiased estimates of the population means. The actual and estimated means are given in Table 15.

TABLE 15

Back Transformed Mean Percentage of Spots Stocked—Bellangry

Rate Seeds per Spot	Shade Estimated	Shade Actual	No Shade Estimated	No Shade Actual	All Estimated	All Actual
	per cent	per cent	per cent	per cent	per cent	per cent
19·3	21·5	17·6	53·4	56·6	36·7	40·0
36·7	33·7	22·3	66·8	74·5	50·3	53·6
73·4	48·1	81·1	79·8	69·5	64·8	74·1
All ..	34·0	40·3	67·1	66·9	50·6	54·4

The analysis of variance showed that the presence of cover (50 per cent canopy) significantly reduced the percentage stocking. The main effect due to sowing rate was not significant, but again a trend is clearly evident.

It appeared that in both the Bulga and the Bellangry experiments, much of the sums of squares due to rate could be explained by a regression of stocking percentage on rate. Nevertheless, the high error variance occurring in these experiments demonstrates that more replications are required for sensitive tests and that those factors unaccounted for in the experimental designs are of considerable importance. It would appear that a more basic approach is required in the study of the ultimate fate of seed placed on a mineral seed bed, particularly with respect to factors of the micro-environment which have been ignored in these experiments. The large differences in percentage stocking between Bulga and Bellangry, which occurred for similar treatments in 1961, remain unexplained and there is some evidence from previous experiments that in other seasons the trend may be reversed.

(d) The Relationship Between Rate of Sowing and the Number of Seedlings per Unit Area

Although the percentage of stocked spots tends to increase with increasing rates of sowing, differences in rates were rarely significant. However, these trends may be expressed quantitatively by regression equations. In order to obtain some degree of comparison with those areas which were assessed by millacre sampling rather than marked spots it was decided to use the regression of the number of Tallowwood seedlings per acre on the number of viable seeds per acre. Theoretically it may be expected that such a relationship would pass through the origin. When the data is graphed a linear relationship appears to exist but the variance of Y (Number of seedlings per acre) appears to vary with X (number of viable seeds per acre). Thus the data can be fitted to regression model 1A (Snedecor, 1956, p. 153) in which the regression coefficient

$$b = \Sigma \frac{(y/x)}{n}.$$

This model is particularly interesting since the ratio y/x is an expression of plant percent. Four regressions were calculated based on the treatment differences already mentioned for the sowing trials. The coefficients, their standard errors and confidence intervals at the 95 per cent level are given in Table 16.

TABLE 16

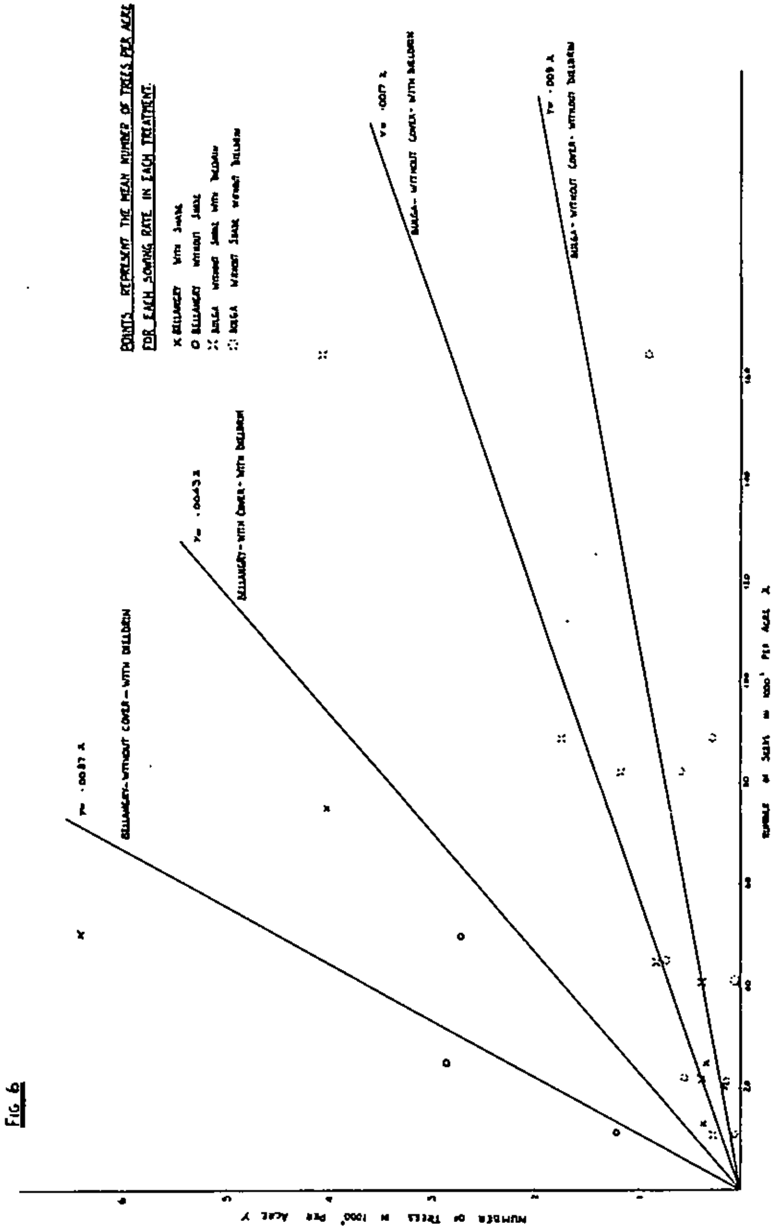
Regressions of number of seedlings per acre (y) on number of seeds per acre (x). $(y = bx)$

Treatment	b	S_b	$t_{(.05)} \times S_b$	n	Significance
1. Bulga—No Dieldrin ..	0·00884	0·00333	0·00687	24	*
2. Bulga—Dieldrin ..	0·01690	0·00262	0·00541	24	*
3. Bellangry — Dieldrin — Shade	0·04302	0·01823	0·04690	6	N.S.
4. Bellangry — Dieldrin — No shade	0·08738	0·01908	0·03310	9	*

Corresponding plant percents are 0·88, 1·69, 4·30 and 8·74 for treatments 1 to 4 respectively. The coefficient for treatment 3 is not significantly different from zero and the differences between treatments

1 and 2 and 3 and 4 are not significant, although the trend is obvious and differences approach significance. These regressions are shown graphically in figure 6.

FIG. 6



These regressions can be used to calculate the quantity of seed per acre required to give the recommended millacre stocking of 40 per cent. There is a good relationship between the number of seedlings per acre and the percentage of millacres stocked and in general 40 per cent stocking is equivalent to 1.100 seedlings per acre. Thus the required quantity of seed per acre (x) can be calculated for each area and treatment by dividing 1.100 by the appropriate regression coefficient.

$$x = \frac{1,100}{b}$$

(e) The Quantity of Natural Seedfall per Unit Area

The previous sections demonstrate the importance of the quantity of seed delivered together with the effects of dieldrin and retention of cover. Moreover, plant percents for the 1961 season were consistently higher at Bellangry that at Bulga.

In comparing large scale empirical experiments on natural regeneration involving such comparisons as seed bed preparation, canopy cover, and the number of seed trees present, it is implicit that alternative treatments have comparable seed sources. This is normally attempted by regulating the number of seed trees per acre again on the assumption that all seed trees behave in a comparable way.

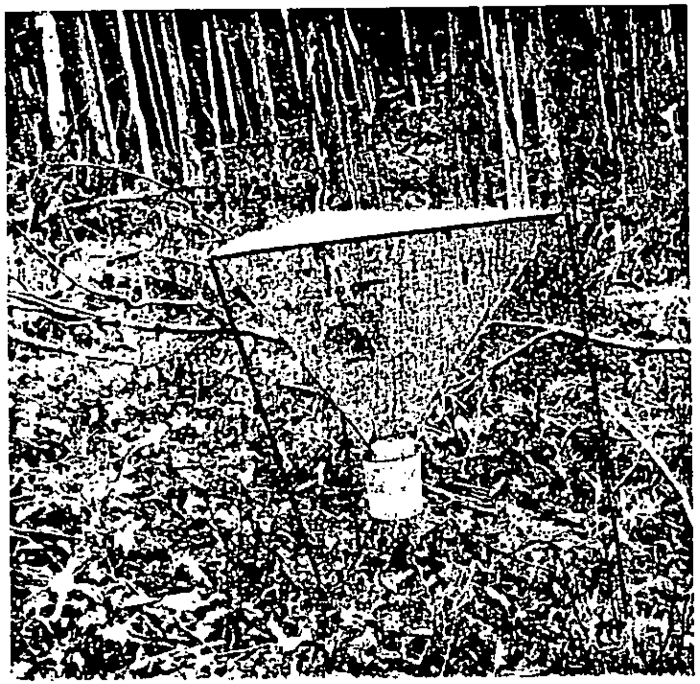


Photo 4.—Metal seed traps used to sample seed fall during burning treatments.

However, routine Tallowwood seed collection work demonstrates that seed yields vary both between individual trees and between adjacent compartments, and the assumptions made in large scale experimental treatments may not be justified unless some attempt is made to relate the quantity of seedfall to treatment effects.

Accordingly, some of the experimental areas were sampled for seed fall by the roving trap technique as described by Cunningham (1960). Two traps were randomly placed in each treatment and removed to new random positions after each short sampling period. Because of the fragile nature of Tallowwood capsules and the severity of regeneration burns, seed commences to fall almost immediately after burning treatments. Therefore several metal traps were constructed for the initial sampling period and these traps were set up just prior to burning in order to sample the immediate post-fire seedfall (Photo 4). Subsequently these traps were replaced by the light-weight canvas traps for roving.

The average seedfall per square yard for the first six months after treatment has been estimated for six of the experimental areas, using the method suggested by Wilm (1946). The results are given in Table 17.

TABLE 17

Viable Tallowwood Seeds per Square Yard

Experiment Number	Seed Trees	Seeds	Standard Error	Coeff. Variation
	per acre	sq. yd		per cent
8—Burnt	Many	29·0	11·7	40·3
9—Burnt	2	5·4	1·7	33·3
10—Tractor-cleared ..	Many	14·0	5·2	37·1
14—Tractor-cleared ..	Many	7·5	1·6	21·3
15 Burnt	2	14·9	10·8	72·5
18—Burnt	1	16·4	6·4	39·0

It is apparent from the high standard errors that the means have very wide confidence limits. The sampling technique can be improved by using more traps and sampling at shorter intervals. This is particularly so for burnt areas where the majority of seed trapped fell in the first time period after burning.

Nevertheless, the results do lend weight to the suspicion that the number of seed trees is not a good guide to the quantity of seed to be expected and that treatment comparisons can be erroneous in the absence of seedfall data.

(f) Comparison of Large Scale Trials with Rate of Sowing Regressions

The number of Tallowwood seedlings per acre on those large scale experiments for which seed quantity data is available can be compared with the regressions obtained from the rate of sowing trials. However, there are no regressions available for Bellangry in which no dieldrin was used, or for Bulga under 50 per cent canopy, but the regressions do form a basis for limited interpolation. These experiments are listed in Table 18 and are shown graphically on figure 7.

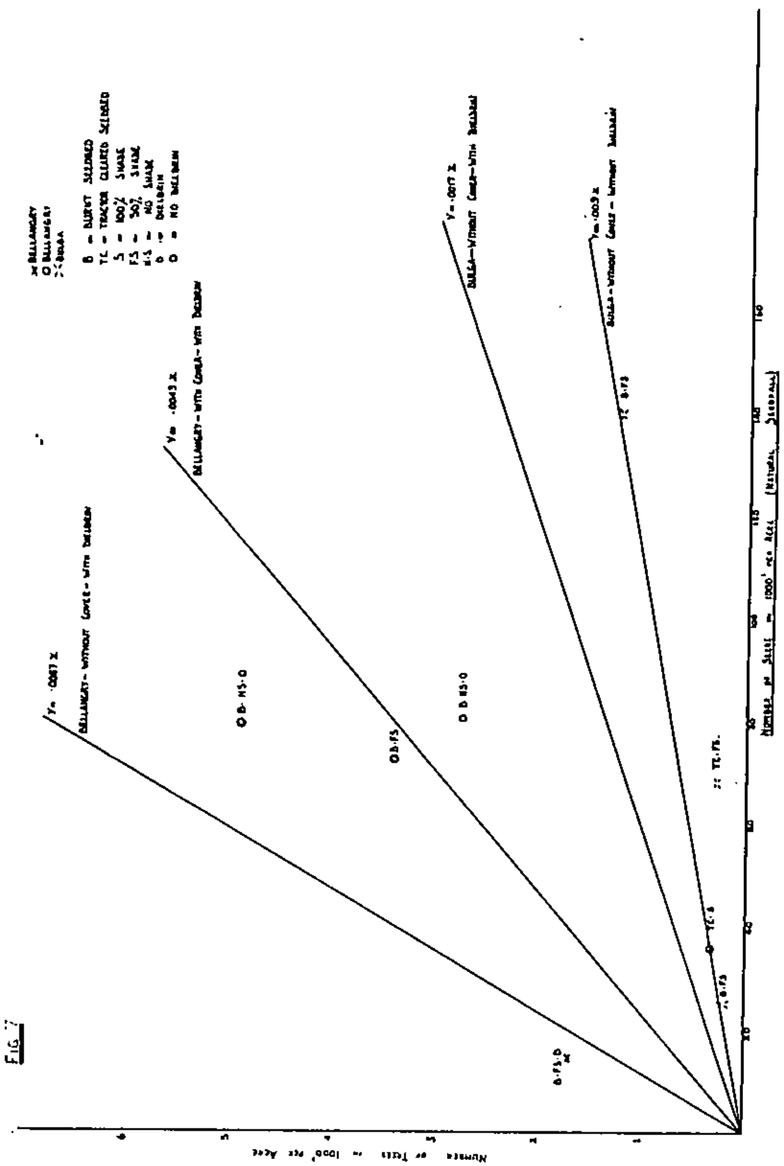


Fig. 7

TABLE 18

Large Experimental Areas for which Seed Supply has been Estimated. Stocking at Age 6 Months—Tallowwood

Experiment No. and Treatment	Thousands of Seeds	Thousands of Seedlings	Stocking (Millacre Quadrats)	Approx. Ounces of Seed
	per acre	per acre	per cent	per acre
8. Burnt—50 per cent canopy—No dieldrin	140·4	1·22	64·0	28·1
9. Burnt—50 per cent canopy—No dieldrin	24·7	0·17	9·5	4·9
10. Tractor—50 per cent canopy—No dieldrin	67·8	0·39	14·0	13·6
14. Tractor—100 per cent canopy—No dieldrin	36·3	0·33	27·5	7·3
15. Burnt—50 per cent canopy—No dieldrin	72·1	3·44	80·0	14·4
16. Burnt—50 per cent canopy—Dieldrin	13·1	1·66	29·7	2·6
18. Burnt—0 per cent canopy—No dieldrin	79·4	4·94	95·0	15·9
—. Burnt—0 per cent canopy—No dieldrin	81·3	2·73	70·0	16·3

Examination of figure 7 shows that these data generally lie within the expected range of stockings and that agreement with the regressions is quite reasonable. Plant percents appear to be similar whether the seed falls naturally or is sown artificially in spots. However, the large increase in plant percent which is available from dieldrin treated seed cannot be obtained by seed tree methods. Nevertheless, if an area is to be regenerated by seed tree methods pertinent information on seed tree spacing is given in the next section.

SECTION V. OTHER REGENERATION ASPECTS

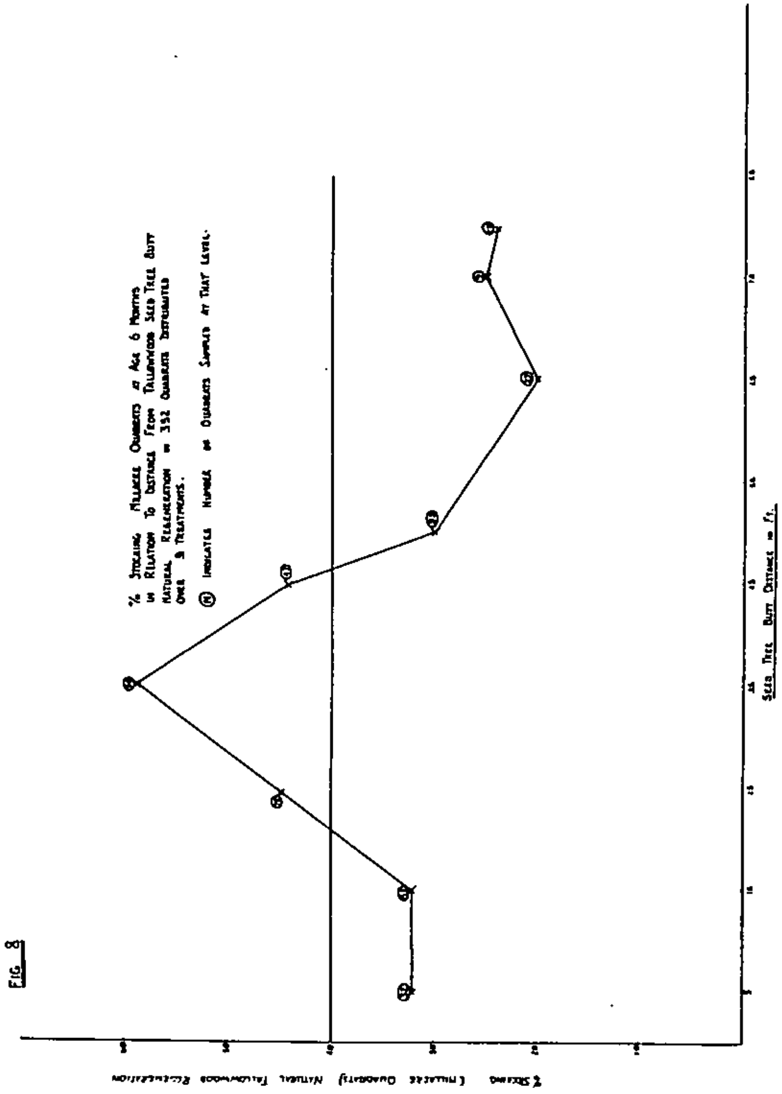
(a) The Use of Seed Trees

Previous reference has been made to Tallowwood seed trees in relation to their production in the sections on flowering and seeding (Section IIa) and rates of sowing (i.e., quantity of seed per unit area—Section IVe).

In nine experimental treatment areas where Tallowwood seed trees were employed as the only seed source (experiments 6, 7, 8, 9, 10, 11, 14, 15, 18) observations were made on the relation between percentage stocking (millacre quadrats) and distance to the base of the nearest tallowwood seed tree.

For a total of 352 quadrats in these areas figure 8 shows that to ensure an initial stocking (age 6 months) of 40 per cent, the distance from a seed tree butt should not exceed 50 feet, while even for 30 per cent stocking 55 feet is the maximum distance permissible (i.e., 100 feet to 110 feet between seed trees).

FIG. 8



Therefore if seed trees are to be used as the only seed source, a minimum of four evenly-spaced Tallowwood seed trees (approximately 24 inches d.b.h.) should be left per acre. In some stands this number may not be present, while where they are, their use can prove very expensive. Due to the high inflammability of the soft fibrous bark, which is persistent to the smaller branches, Tallowwood is a very fire susceptible species and seed tree losses in regeneration burns are frequently high.

Bulga-Dingo Management Plan assessment data show an aver[illegible] royalty value for a merchantable 24-inch Tallowwood to be [illegible]. Therefore the use of four seed trees per acre risks royalty losses amounting to $33.07. Should these seed trees survive the regeneration burn without either heavy losses or the occurrence of serious defect, a second logging operation will be necessary with an inevitable reduction in stocking.

(b) The Effect of Cover

Throughout the experimental treatments three main cutting systems were used to observe the effect of cover upon the germination and survival of Tallowwood. The systems are:—

(a) Full canopy retention;

(b) 50 per cent canopy retention;

(c) Clear felling (with or without seed trees).

The wide variations which occur between treatments due to differences in locality, time of treatment, site preparation and, in particular, quantities of seed supplied per unit area prohibit statistical analyses of the effect of cover on germination and percentage stocking of Tallowwood (although Bellangry rate of sowing trials (Section IVc) show shade to be significantly adverse).

By confining observations to 1961 treatments on burnt seed beds (in order to reduce these variations as much as possible) we can clearly notice trends in species composition and early height growth.

As the canopy, where retained, has a major influence on the composition of the regenerated stand, tables used in this section quote stocking percentages (millacre quadrats) and mean heights for "other species" as well as mean heights for Tallowwood. "Other species" include *E. saligna*, *E. campanulata*, *E. quadrangulata*, *E. laevopinea*, *E. acmenioides*, *E. globoidea*, *E. gummifera* and *Tristania conferta*.

Table 19 shows the percentage stocking (millacre quadrats) for "other species" with varying degrees of shade and compares mean heights at age 15 months for Tallowwood and other species.

TABLE 19

Showing Effect of Shade on Tallowwood and Other Species and Differences in Mean Heights

Degree of Canopy Retention	Experiment Number	No. of Millacre Quadrats Assessed	Stocking (Millacre Quadrats)		Mean Dom. Heights at Age 15 Months	
			Other Species	TW*	Other Species	TW
			%	%	feet	feet
Full Canopy	6	39	20	(23)	0·2	0·5
50 per cent Canopy ..	9, 15, 16	139	52	(37)	4·1	2·7
Clear Felled ..	11, 18	80	8	(59)	2·6	4·1

* N.B.—Tallowwood stocking figures are not comparable due to varying seed quantities.

An examination of Table 19 suggests that:

(1) The retention of full canopy adversely affects early height growth of germinates.

(2) The retention of 50 per cent canopy creates a high stocking of less desirable species, which are able to outgrow Tallowwood in the early stages.

(3) Clear felling minimises competition from less desirable species and promotes early height growth of Tallowwood.

(c) Introducing New Species

The slow growth rate of Tallowwood and the poor quality of second growth Blue Gum prompted an investigation into the introduction of suitable new species.

Many useful species are associated with the Tallowwood-Blue Gum type, such as *E. pilularis*, *E. cameronii*, *E. grandis* and *E. campanulata* while *E. cloeziana* and *E. obliqua* were also considered worthy of trial.

Trial sowings were replicated in square chain plots under no shade and 50 per cent shade both at Bulga and Bellangry.

Both the 50 per cent shade replications proved ineffective, probably due to an extremely heavy stocking of natural germinates of shade-providing species (see also the effect of cover, Section Vb), while the no shade Bulga plots also failed (here a 30-day lapse between burning and sowing assisted in creating very severe weed competition). The Bellangry no shade treatment now shows an interesting stand, the results of which are summarised in Table 20.

TABLE 20

Showing Percentage Stocking and Heights for Eight Species in the New Species Trial

Species	Spots Stocked		Heights in feet, age 45 months	
	Age 9 months	Age 45 months	Best	Mean
	per cent	per cent		
E. grandis	90·0	51·5	32·0	25·0
E. campanulata	62·5	42·1	25·0	20·0
E. pilularis	60·0	40·6	30·0	19·5
E. saligna	100·0	56·2	20·0	18·0
E. cameronii	62·5	34·5	22·0	11·0
E. obliqua	22·5	14·0	20·0	10·0
E. microcorys	92·1	42·1	16·5	5·5
E. cloeziana	37·5	No Survivors		

The way in which Tallowwood is outclassed in height growth is striking, and the relative success of *E. pilularis* (probably the most desirable species) is encouraging. *E. grandis* performed very well, but as young stands of this species have recently been proved to be very defective, its introduction cannot be recommended.

Both *E. campanulata* and *E. cameronii* show up well, but *E. obliqua* and *E. cloeziana* appear less suitable.

E. laevopinea was not included in this trial but the performance of this species on similar sites warrants its inclusion in further trials.

It is suggested that the introduction of *E. pilularis* and *E. laevopinea*, either by sowing or jiffy pot planting, could be further tried on a semi-routine basis, preferably by snig track extension treatments.

CONCLUSIONS

The results from this series of experiments tend to illustrate that many difficulties are still associated with regenerating the type to Tallowwood.

The extremely slow height growth of this species, even in those experiments where conditions would be expected to approach the optimum for its development, make the practice of Tallowwood regeneration of doubtful benefit.

Seed trees have proved to be of only limited use; seedfall can occur throughout the year and it is extremely difficult to forecast the time and quantity of seedfall in any one period in one year and in any one stand, while a minimum of four seed trees is required per acre to obtain adequate stocking.

As seed bed preparation by means of burning is generally both costly and hazardous, while also providing maximum competition (and the disadvantages associated with this), mechanical clearing followed by sowing or planting appears the best method available to obtain a satisfactory stocking. Taking costs into account, the method of snigtrack extensions (preparing approximately sixty per cent of the mineral soil) seems the most promising method available.

This method of clearing combined with the introduction of more vigorous species, such as *Eucalyptus pilularis* and *E. laevopinea*, either by spot sowing or Jiffy pot planting, is recommended for further trial.

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the contribution throughout this report of Mr R. A. Curtin, Research Forester at Taree, whose valuable assistance has been immeasurable, and who has been largely responsible for the presentation of the section on Rates of Sowing.

I am also grateful to Mr A. G. Floyd, of Coff's Harbour, who criticised the original draft, and to Mrs M. Dawson for her assistance in preparing the section on germination testing and flowering and seeding.

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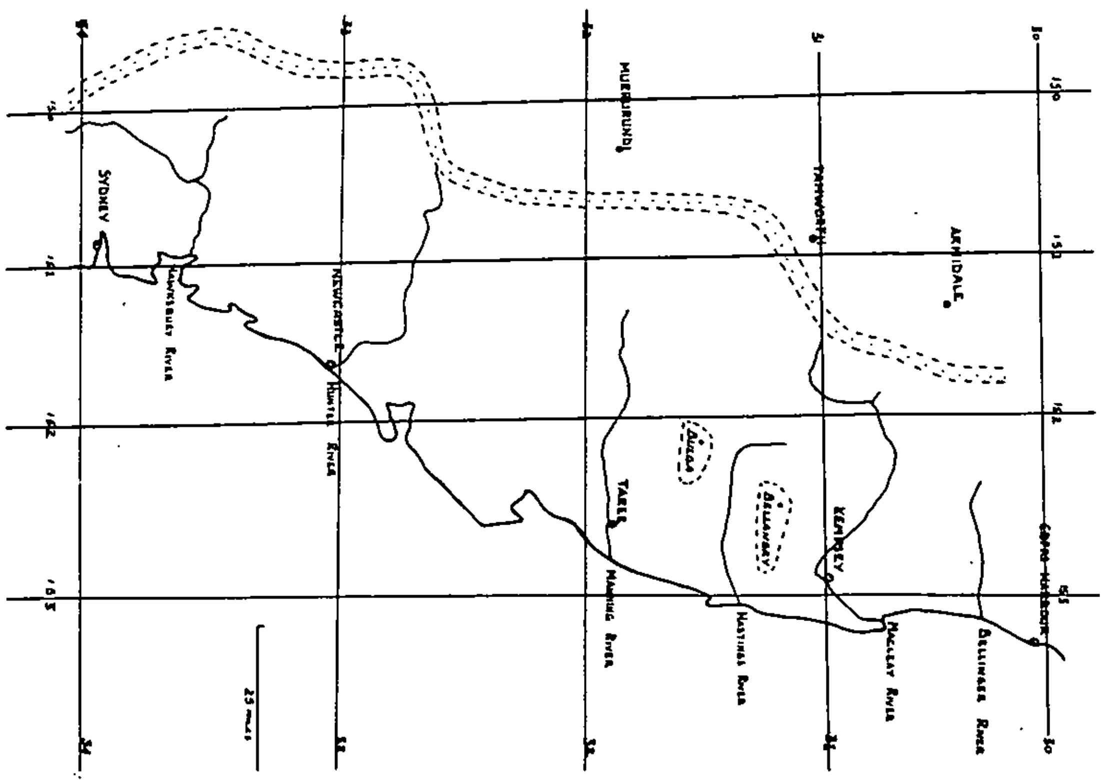
APPENDIX 1

LIST OF SPECIES MENTIONED IN TEXT

Botanical Name	Common Name	Family
Acacia binervata D.C.	Two-veined Hickory Wattle.	Leguminosae.
Acacia elata A. Cunn.	Cedar Wattle	Leguminosae.
Acacia irrorata Sieb. ex Spring.	Black Wattle	Leguminosae.
Ackama paniculata Engl.	Corkwood	Cunoniaceae.
Callicoma serratifolia Andr.	Callicoma	Cunoniaceae.
Casuarina torulosa Ait.	Forest Oak	Casuarinaceae.
Cryptocarya rigida C. Meissner	Rose Maple	Lauraceae.
Dodonea triquetra Wendl.	Hop Bush	Sapindaceae.
Drimys spp.	Drimys	Magnoliaceae.
Duboisia myoporoides R. Br.	Duboisia	Solanaceae.
Elaeocarpus reticulatus Smith	Blueberry Ash	Elaeocarpaceae.
Endiandra sieberi Nees	Pink Walnut	Lauraceae.
Erigeron canadensis L.	Cobblers Peg	Compositae.
Eucalyptus acmenioides Schau	Narrow-leaved White Mahogany.	Myrtaceae.
Eucalyptus cameronii Blakeley & McKie.	Diehard Stringybark	Myrtaceae.
Eucalyptus campanulata R. T. Bak. & H. C. Sm.	New England Blackbutt	Myrtaceae.
Eucalyptus cloeziana F. Muell.	Gympie Messmate	Myrtaceae.
Eucalyptus delegatensis R. T. Baker	Alpine Ash	Myrtaceae.
Eucalyptus globoidea Blakeley	White Stringybark	Myrtaceae.
Eucalyptus grandis Hill ex Maiden	Flooded Gum	Myrtaceae.
Eucalyptus gummifera Gaertn.-Hochr.	Bloodwood	Myrtaceae.
Eucalyptus laevopinea R. T. Bak.	Silvertop Stringybark	Myrtaceae.
Eucalyptus microcorys F. Muell.	Tallowwood	Myrtaceae.
Eucalyptus obliqua L'Herit.	Messmate	Myrtaceae.
Eucalyptus pilularis Sm.	Blackbutt	Myrtaceae.
Eucalyptus quadrangulata Deane & Maiden.	White-topped Box	Myrtaceae.
Eucalyptus regnans F. Muell.	Mountain Ash	Myrtaceae.
Eucalyptus saligna Sm.	Sydney Blue Gum	Myrtaceae.
Helichrysum diosmifolium Vent.	Sago Bush	Compositae.
Kennedya rubicunda Vent.	Soldier Vine	Leguminosae.
Lantana camara L.	Lantana	Verbenaceae.
Orites excelsa R. Br.	Prickly Ash	Proteaceae.
Phytolacca octandra L.	Ink Bush	Phytolaccaceae.
Rubus moluccanus L.	....	Rosaceae.
Rubus moorei F. Muell.	....	Rosaceae.
Schizomeria ovata D. Don.	Crab Apple	Cunoniaceae.
Senecio lautus Forst. ex Wild	Fireweed	Compositae.
Solanum armatum R. Br.	Wild Tomato	Solanaceae.
Solanum mauritianum Scop.	Wild Tobacco Tree	Solanaceae.
Syncarpia glomulifera Sm.	Turpentine	Myrtaceae.
Synoum glandulosum A. Juss.	Scentless Rosewood	Meliaceae.
Tagetes minuta L.	Stinking Roger	Compositae.
Trema aspera Blume	Peached-leaved Poison Bush.	Ulmaceae.
Tristania conferta R. Br.	Brush Box	Myrtaceae.

APPENDIX 2



Locality map showing areas of main Field Trials

APPENDIX 3

DETAILS OF FIELD EXPERIMENTS

Expt No.	State Forest	Month Year	Cutting System	Seed Source	Seed bed Preparation
1	Bulga/Dingo	Jan., 1960	All trees removed except seed trees	4 TW/acre + 4sbG/acre ..	Burnt.
2	Bulga/Dingo	Jan., 1960	All trees removed except seed trees	4 TW/acre + 4sbG/acre ..	Tractor-cleared.
3	Bulga/Dingo	Jan., 1960	Clear felled	Spot sown—3 oz/acre.. ..	Burnt.
4	Bulga/Dingo	Jan., 1960	All trees removed except 3 per acre of species other than Tallowwood.	Spot sown—3 oz/acre. Nil TW seed trees.	Tractor-cleared.
5	Bulga/Dingo	Jan., 1960	Clear felled	Nil seed trees—not sown ..	Burnt.
6	Bulga/Dingo	Jan., 1961	Full canopy retained	Full seed tree source	Burnt.
7	Bulga/Dingo	Jan., 1961	Full canopy retained	Full seed tree source	Tractor-cleared.
8	Bulga/Dingo	Jan., 1961	Species other than Tallowwood removed to create 50 per cent canopy.	All TW left as seed	Burnt.
9	Bulga/Dingo	Dec., 1960	50 per cent canopy retained, including 2 TW per acre.	2 TW/acre	Burnt.
10	Bulga/Dingo	Jan., 1961	Species other than Tallowwood removed to create 50 per cent canopy.	All TW left as seed	Tractor-cleared.
11	Bulga/Dingo	Oct., 1960	All trees removed except seed trees	2 TW/acre	Burnt.
12	Bellangry ..	Feb., 1960	All trees removed except seed trees	2 TW/acre	Burnt.
13	Bellangry ..	Feb., 1960	All trees removed except seed trees	2 TW/acre ringbarked—sown 3 oz/acre.	Burnt.
14	Bellangry ..	Feb., 1961	Full canopy retained	Full seed tree source	Tractor-cleared.
15	Bellangry ..	Jan., 1961	50 per cent canopy retained, including 2 TW/acre	2 TW/acre	Burnt.
16	Bellangry ..	Jan., 1961	All Tallowwood removed, 50 per cent canopy retained.	Spot sown. Nil TW seed trees.	Burnt.
17	Bellangry ..	Jan., 1961	50 per cent canopy retained, including 2 TW/acre	2 TW/acre	No preparation.
18	Bellangry ..	Jan., 1961	All trees removed except seed trees	2 TW/acre	Burnt.
19	Bulga/Dingo	Dec., 1961	All trees removed except seed trees	2 TW/acre	Snigtrack extension.
20	Bulga/Dingo	Nov., 1962	50 per cent canopy retained, including 2 TW/acre	2 TW/acre	Snigtrack extension.
21	Bulga/Dingo	Nov., 1962	All trees removed except seed trees	2 TW/acre	Snigtrack extension.
22	Bulga/Dingo	Dec., 1963	50 per cent canopy retained, including 2 TW/acre	2 TW/acre and sown ..	Snigtrack extension.

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Natural regeneration in wet sclerophyll forest with an overstorey of Eucalyptus microcorys, E. saligna *and* Lophostemon confertus

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Forestry Commission of N.S.W., Wauchope, N.S.W. 2446.

Summary

Natural regeneration in wet sclerophyll forest dominated by *Eucalyptus microcorys, E. saligna* and *Lophostemon confertus* in the mid north coast of New South Wales was investigated by survey and relating past silvicultural history to present stocking.

At all sites examined sufficient regeneration was obtained to replace the sclerophyllous overstorey with or without post-logging burning. The principal sclerophyll overstorey species present prior to logging were all present in the regeneration irrespective of the silvicultural treatment. Post-logging burning increased regeneration stocking and favoured the establishment of *E. saligna*. Soil disturbance and overhead cover were found to be important factors in regeneration establishment and development respectively.

Introduction

Wet sclerophyll forest dominated by *Eucalyptus microcorys* F. Muell. (tallowwood), *E. saligna* Sm. (blue gum) and *Lophostemon confertus* R. Br. (formerly *Tristania conferta*) (brush box) occupies in excess of 200 000 ha of State Forests in New South Wales. It occurs from Bulahdelah in the south northwards into southern Queensland. It is a highly productive forest type and a major producer of hardwood sawlogs among other forest products.

A survey was undertaken to examine young stands with different known silvicultural histories in an endeavour to relate present stocking of natural regeneration to previous history. Silvicultural practices used previously have included group selection logging, logging with seed tree retention, heavy logging with and without post-logging burning, ringbarking of all standing trees after logging, sowing following burning, and snig track extension and tractor clearing followed by planting. Sites that had been subject to group selection logging or on which seed trees were retained provided the opportunity to assess the effect of greater canopy cover on regeneration establishment and development compared with the sites that had undergone heavy logging. Sites that had been subject to tractor clearing, ringbarking, sowing or planting, were not included in this study of natural regeneration.

Revised manuscript received 5 December 1984

A number of foresters have observed that regeneration rarely becomes established unless mineral soil is exposed sufficiently to allow intimate contact between seed and soil. This can be achieved either by fire or mechanical means such as tractor.

Van Loon (1966) concluded that many difficulties still remained in regenerating this forest type particularly in regard to obtaining a satisfactory stocking of *E. microcorys*. The characteristic dense mesic understorey, vigorous weed colonisation following disturbance and irregularity of seed fall (Van Loon 1966) were all considered to contribute to the uncertainty of successful regeneration. As a result of the rapid weed colonisation there is limited time available for regeneration to become established.

The use of fire as a silvicultural tool is not always possible due to the moist conditions of the site. When burning is carried out successfully the area of receptive seedbed is increased but so too is the subsequent growth of weeds. *Acacia* spp. are often a major component of fire-induced weed populations (Van Loon 1966).

In the Washpool area (For. Comm. NSW 1980) the most moist sections of this forest type (namely those areas with a high proportion of *L. confertus* in the overstorey and a well developed rainforest understorey) were considered difficult to regenerate whereas the less moist sections further up the slopes regenerated satisfactorily.

Regeneration assessments by Van Loon (1966) and Gatenby[1] (pers. comm.) were by means of permanent milacre quadrats ($4 m^2$) at one chain (20 m) intervals on random lines. This was probably not the most suitable method of assessment as small circular plots lack accuracy in all but situations of high stocking unless large numbers of plots are measured (Horne 1976). The number of milacre plots used by Van Loon and Gatenby were generally inadequate to obtain a reliable stocking estimate considering the low percentage of stocked plots often obtained. Overall sampling intensity averaged less than 1%. Horne (1976) also showed that the point-to-plant method is simple and easy to apply and is theoretically suited to the assessment of randomly distributed populations.

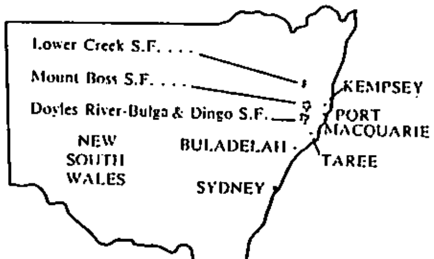

Figure 1. Locating of State Forests sampled in this study.

The study sites

Twenty three study sites were selected at altitudes ranging from 300 to 900 m in escarpment and mountain country adjacent to the river valleys of the mid north coast of New South Wales. They occupied a wide area (125 km x 45 km) between latitude 30°30' and 31°45' South and longitude 152°00' and 152°30' East. They were up to 80 km inland from the coast, from Taree in the south to Kempsey in the north. The study sites (Figure 1) were located on the Bulga-Dingo-

1 Gatenby, M. I., Forester, Forestry Commission of N.S.W.

Doyles River group of State Forest
Mt. Boss State Forest (5 sites) and L
State Forest (2 sites).

Annual rainfall throughout the area
high with a summer maximum. Th
representative sites together with ot
data are given in Table 1. Maximum t
reach 40°C during summer and
temperatures often drop below 0
winter. Frosts often occur in open a
the winter.

Soil types vary from site to site but
deep and moist. They include yellow
red earths and krasnozems and are de
a range of parent materials of both s
and igneous origin.

The wet sclerophyll forest type u
generally has an overstorey of *E. n*
E. saligna and *L. confertus*. Other
eucalypts are generally on drier sites
ridge tops and include *E. acmenoid*
(white mahogany), *E. andrewsii ssp. ca*
R. T. Bak. & H. G. Sm.) (New Engl
butt), *E. cameronii* Blakely & McKi
stringybark) and *E. laevopinea* R
(silvertop stringybark). *Syncarpia g*
(Sm.) Nied. (turpentine) is another
overstorey species particularly at lower
Depending on soil fertility, moisture r
the site and previous disturbance such
mesic understorey can vary from 5 m
height, and on the study sites it is genera
than 10 m. The principal understor
include tall rainforest trees such as *Sc*
ovata D. Don, *Caldcluvia paniculosa* (
Engler. and *Endiandra sieberi* Nees.
common minor understorey species ar
carya rigida Meisn., *Synoum glandulo*
A. Juss., *Trochocarpa laurina* R. B
carpus reticulatus Sm. and *Euopmat*
R. Br.

Following heavy logging the weed grow
prolific, especially if the area has be
Floyd (1966) showed that increased we
will result from burning of logging sl
pared to mechanical seed bed prepar
tractor. Floyd (1976) further showed
weed species composition varied with
sity. The initial vegetation consisting o
and early successional species (weeds) ca
three species of *Rubus*, four species of
four species of *Acacia*, *Kennedia r*
(Scheev.) Vent., *Helichrysum dios*

Table 1. Climatic data for weather stations close to study sites.

	Elevation (m)	Mean annual rainfall (mm)	Temperature (C) Mean min. July	Mean max. January
River (Lower Creek S.F.)	1036	1516	2.8	25.4
ions Camp (Boss S.F.)	869	2155	4.7	23.0
Hill (S.F.)	630	1673	6.3	24.3
River S.F.	838	1431	4.1	24.3

:t and *Polyscias sambucifolia* (Siever ms. The two vines *Cissus hypoglauca* d *C. antarctica* Vent. often form a

of known logging and silvicultural e dating back to 1954, were assessed. inged in area from 2.5 to 27.0 ha.

o-plant method (Cottam and Curtis sed to assess regeneration. In the field d the establishment of parallel grid- e location of plot points a set distance these lines. The first line and the first on each line were randomly located. ception of three sites (68/1, 237 both istance was measured from the plot eneration within a maximum distance om the point and if one or more ere recorded the plot was considered the average distance from point to ded 6 m the stocking would fall below a as follows:—

$$\frac{10000}{(2d)^2}$$

stocking (trees/ha)
mean distance point to plant (m)

er three sites the point-centred quarter ottam and Curtis 1956) was used with n distance from point to plant of 30 m inally collected for another purpose). lated stocking for all sites was then y multiplying it by the percentage of lots. The number of plots on each t site ranged from 31 to 130, with the mbers at the sites of smaller area. This an average sampling intensity of 8.3% uch greater than that achieved by Van

-to-plant method only gives an accurate imate when the population is randomly distributed. Natural regeneration is not always randomly distributed, with aggregation often occurring. Pielou (1959) developed an index of non-randomness using point-to-plant distances and this was used to test results obtained in this study.

Individual plot parameters measured included the distance to the nearest *Eucalyptus* or *Lophostemon confertus* seedling or sapling and the distance to the nearest competitive regenerating tree up to a maximum distance of 6 m from the plot point. The nearest competitive regenerating tree is one that is equal to or greater in height than surrounding regrowth vegetation, considered highly likely to be successful in competition with the surrounding vegetation and with good potential for reaching the overstorey. Both measurements can refer to the same tree, and at times even if a plot is stocked no competitive tree may be present. Finally, for each regenerating tree in each plot, as well as its species identity, a record was made as to whether it had become established on a mechanically disturbed or a burnt substrate. To determine the relationship between regeneration stocking and soil disturbance only recently logged unburnt sites up to seven years post-logging were assessed as the evidence of soil disturbance became obscured after a few years.

Where suitable aerial photographs were available, the species composition of the overstorey canopy before logging was determined together with the percentage canopy retained after logging. Each site was stratified into four cover classes using aerial photographs. The classes were dense (70-100%), mid dense (30-70%), sparse (10-30%) and very sparse (0-10%). Using the area of each stratum and the assessed cover class the average percentage canopy cover after logging was determined for each site. Plant species lists were prepared for each of the 23 sites.

To determine likely survival and growth rates of the regeneration, existing long term growth plots

in the same forest type at Doyles River State Forest and Brooklana State Forest near Dorrigo were examined.

Results

Site similarity

Although sites were separated geographically they had a high degree of similarity in terms of plant species composition (Table 2). All sites were towards the moister end of the wet sclerophyll forest spectrum with a well developed rainforest understorey prior to logging ranging from 10-30 m in height. Twenty six rainforest tree species were recorded that had a capacity to exceed 30 m in height. All sites carried at least two of these potentially tall rainforest species, and 70% of the sites carried four or more species.

Table 2. Similarity of the 23 sites examined in wet sclerophyll forest as indicated by the number of sites at which the same plant species occur.

Species	No. of sites where species occurs
Eucalyptus microcorys F. Muell.	23
Eucalyptus saligna Sm.	23
Lophostemon confertus R. Br.	23
Caldcluvia paniculosa (F. Muell.) Engler.	23
Schizomeria ovata D. Don	22
Cryptocarya rigida Meisn.	22
Archirhodomyrtus beckleri (F. Muell.) A. J. Scott	21
Synoum glandulosum (Sm.) A. Juss	18
Trochocarpa laurina R. Br.	18
Psychotria loniceroides Sieber ex DC.	18
Eupomatia laurina R. Br.	17
Cissus antarctica Vent.	17
Endiandra sieberi Nees	16
Elaeocarpus reticulatus Sm.	16
Acmena smithii (Poir.) Merr. & Perry	14
Rapanea variabilis (R. Br.) Mez	14
Cryptocarya glaucescens R. Br.	13
Cryptocarya microneura Meisn.	13

A few rainforest tree species were recorded at only one or two sites but these did not appear to be indicator species in terms of the likely success of hardwood regeneration, although the limited data did not allow any conclusion to be drawn. None of these species would be considered rare and it is likely that wet sclerophyll forest is a marginal environment for them. In this case the rainforest species included *Sloanea woollsii* F. Muell., *Geissois benthamiana* F. Muell., *Elaeocarpus holopetalus* F. Muell., *Baloghia lucida* Endl. and *Quintinia sieberi* DC.

Total regeneration stocking

When the index of non-randomness developed by Pielou (1959) was applied to the point-to-plant distances and regeneration density it was found that regeneration had an aggregated distribution on 87% of the study sites. Aggregation is probably due to site heterogeneity and reproductive clumping. The fact that regeneration is aggregated means that the point-to-plant method has not resulted in accurate density estimates but rather under-estimates (Cottam and Curtis 1956).

Additionally, the inability to ascribe a true distance value to points where no regenerating tree was found within the arbitrary maximum search radius of 6 m has almost certainly resulted in stockings obtained being slight under-estimates.

Both these weaknesses in methodology result in conservative estimates of regeneration. This is acceptable for this study in order to determine whether successful natural regeneration establishment is possible in this forest type.

A number of factors determined whether the site was burnt following logging, including silvicultural practices current at the time of logging, the availability of tractors, the cost of tractor hire and the post-logging weather conditions. The relative moistness of each area was not the deciding factor. No tractor disturbance additional to that associated with logging was carried out on any of the 23 sites assessed.

On eleven of the assessed study sites involving 894 plots, which had been burnt after logging the median regeneration stocking was 977 trees/ha with a stocking range of 291 to 2384 trees/ha (Table 3). None of the burns covered 100% of their area as the most moist sections of this forest type are almost impossible to burn and will only burn under the most extreme weather conditions.

Twelve of the assessed study sites, involving 1196 plots, received no follow-up post-logging burn. The regeneration stocking range on these sites was 63 to 574 trees/ha and the median was 290 trees/ha (Table 4), which is much lower than that recorded at sites in areas receiving a post-logging burn.

The regeneration stocking was significantly higher on the burnt sites than the unburnt sites ($p < 0.001$, Mann-Whitney Rank Sum Test). There was no relationship between regeneration stocking and time since logging on either burnt or unburnt sites.

Table 3. Regeneration stocking on wet sclerophyll forest sites that received a post-logging burn.

generation age (yrs)	Plots (.01 ha) stocked with regeneration (%)	Regeneration stocking (trees/ha)	Species composition of regeneration: E. microcorys (%)	E. saligna (%)	L. confertus (%)	Other Eucalyptus sp. (%)
3	98	323	36	46	14	4
3	89	539	51	40	9	—
3	84	568	32	10	24	34
4	100	1170	31	22	32	15
8	96	775	34	54	12	—
9	98	1703	16	32	51	1
17	93	291	39	15	46	—
20	100	1312	64	18	18	—
20	100	1479	22	56	4	18
21	100	977	36	36	25	3
21	100	2384	47	53	—*	—
		977	36	36	18	1
		1047	36	31	25	8

* Present but not in a plot

ble 4. Regeneration stocking on wet sclerophyll forest sites which were not burned following logging.

generation age (yrs)	Plots (.01 ha) stocked with regeneration (%)	Regeneration stocking (trees/ha)	Species composition of regeneration: E. microcorys (%)	E. saligna (%)	L. confertus (%)	Other Eucalyptus sp. (%)
3	38	63	30	7	63	—
3	79	311	32	39	26	3
4	73	289	24	14	62	—
4	70	333	63	20	17	—
4	58	396	53	25	22	—
5	49	574	36	17	12	35
7	69	223	38	3	19	40
21	73	338	7	6	87	—
23	77	291	38	1	61	—
25	47	156	46	6	48	—
26	50	135	19	12	69	—
26	82	288	28	5	68	—
		290	34	10	55	—
		283	34	13	46	7

storey species composition was similar
urnt and unburnt sites before logging,
pecies were present in the regeneration
. The percentage of *E. microcorys*
e regeneration was similar at burnt and
sites. The percentage of *E. saligna*
tion was significantly higher on burnt
n unburnt sites ($P < 0.05$), and cor-
ngly the percentage of *L. confertus*
tion was significantly higher on the
sites ($P < 0.05$, Mann-Whitney Rank
)).

tive regeneration and retained canopy

ly possible to examine the relationship
competitive regeneration and retained
canopy cover for those sites shown in Table 6 due to lack of data for the other study sites.

Once seedlings become established the type of

Table 5. Species composition (%) of the pre-logging overstorey and the subsequent regeneration on sites burnt and unburnt after logging, wet sclerophyll forest, northern N.S.W.

Species		Burnt sites	Unburnt sites
Eucalyptus microcorys	Pre logging overstorey	40	41
	Regeneration	36	34
Eucalyptus saligna	Pre logging overstorey	24	21
	Regeneration	31	13
Lophostemon confertus	Pre logging overstorey	21	23
	Regeneration	25	46
Other *Eucalyptus* spp.	Pre logging overstorey	15	15
	Regeneration	8	7

Table 6. Presence of regeneration on logged wet sclerophyll forest sites and its relationship with retained canopy cover

Site	Regeneration age (yrs)	Canopy cover retained (%)	Plots (.01 ha) stocked with regeneration (%)	Total regeneration stocking (trees/ha)	Plots (.01 ha) stocked with competitive regeneration (%)	Competitive regeneration stocking (trees/ha)
173	3	5	79	311	60	186
121/1	4	14	58	396	53	207
6	4	19	73	289	58	185
107	5	31	49	574	46	238
8	7	25	69	223	66	168
96	20	9	100	1479	100	638
94	20	5	100	1312	96	285
15/1	21	9	100	2384	100	536
93	21	24	100	977	71	244
28	21	36	73	338	53	150
25	23	11	77	291	67	171
53	25	55	47	156	20	58
18	26	20	50	135	39	85
18/19	26	25	82	288	64	113

seedbed, burnt or otherwise, is considered to be less significant for seedling development than competition for available site resources. Thus the effect of retained overstorey canopy is shown for both burnt and unburnt sites in Table 6. No relationship is evident between the total regeneration stocking and percentage canopy cover retained. Possibly this is due to the fact that both *L. confertus* and *E. microcorys* are relatively shade tolerant. However a significant relationship ($P < 0.01$) was found between the development of competitive regeneration and percentage canopy cover retained (Figure 2), as follows:

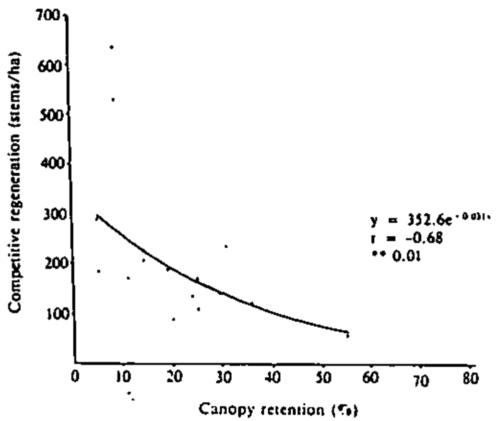

Figure 2. Stocking of competitive regeneration (*Eucalyptus* spp. and *L. confertus*) and retained canopy cover (14 sites).

$$y = 352.6e^{-.031x}$$

y = Stocking of competitive regeneration (trees/ha)

x = Canopy retention of overwood (%)

Thus the stocking of competitive regeneration is inversely related to the amount of retained canopy cover. This means that with a more open canopy following logging more of the *Eucalyptus* spp. and *L. confertus* regeneration will grow fast enough to achieve competitive status.

Regeneration and soil disturbance

The density of regeneration was significantly higher on plots where soil disturbance was evident ($P < 0.05$, paired t test) (Table 7).

Survival and development of regeneration in regrowth stands

The likely mortality and growth rates in regrowth stands may be estimated from data from two long-term growth experiments in the same forest types, one on Doyles River S.F. and the other on Brooklana S.F. (Table 8). In the experiment at Doyles River S.F. the predominant species present is *E. microcorys* with *E. saligna* as an associate whereas at the experiment at Brooklana S.F. the predominant species present is also *E. microcorys* but *L. confertus* is the main associate.

The results in Table 8 indicate there is very little mortality over time in the regeneration from the larger sized trees (> 15 cm diameter breast height

Table 7. Regeneration stocking and its relationship to soil disturbance in wet sclerophyll forest.

Site No.	Time since logging	Soil disturbance present		Soil disturbance not obvious	
		Plots stocked with regen.	Regen. stocking	Plots stocked with regen.	Regen. stocking
	(yrs)	(%)	(trees/ha)	(%)	(trees/ha)
173	3	92	369	46	159
6	4	84	378	48	128
121/2	4	87	542	55	187
121/1	4	71	654	35	118
107	5	76	1218	18	15
8	7	9	360	49	134

over bark at the time of first measurement) which would be of dominant or codominant status in the regenerating stand. It is these trees that are actively growing and are expected to form the overstorey canopy of the future. The best 100 trees/ha in the regenerating stand show a mean annual diameter increment of 1.07 cm at Doyles River and 0.97 cm at Brooklana. This would indicate that a tree of 50 cm diameter could be attained in 50-70 years and a tree of 100 cm diameter could be attained in 100-120 years.

Table 8. Survival of regeneration in growth experiments in wet sclerophyll forest at Doyles River S.F. and Brooklana S.F.

(a) *Doyles River S.F.*

Diameter class at age 15 (d.b.h.o.b.) (cm)	Trees/ha alive age 15	Trees/ha remaining alive at age 35*	No. potential overstorey trees/ha (periodic annual diameter increment >0.5 cm)
5-10	406	187	0
10-15	373	362	33
15-20	329	329	186
Total	1108	878	219

* May not still be in the same size class as at age 15.

(b) *Brooklana S.F.*

Diameter class at age 20 (d.b.h.o.b.) (cm)	Trees/ha alive age 20	Trees/ha remaining alive at age 40*	No. potential overstorey trees/ha (periodic annual diameter increment >0.5 cm)
5-10	457	296	0
10-15	161	136	0
15-20	136	136	12
20+	397	372	136
Total	1151	940	148

* May not still be in the same size class as at age 20.

Discussion

The overstorey of a mature wet sclerophyll forest of the type under study generally has a stocking of 40-65 trees/ha (Horne[1] pers. comm. 1983). They rarely form a closed canopy in a mature forest and the gaps in the canopy may be of varying size. In the study sites these gaps averaged 11% of the area of the forest in the unlogged condition as determined from aerial photographs. For regeneration to be adequate stocking should be high enough, allowing for natural mortality, to achieve a similar result, i.e. at least 89% canopy coverage of the site.

On those sites where an assessment was made of trees with good potential for continuing development (competitive regeneration) sufficient stems were present to provide a full overstorey canopy (at least 89% canopy coverage). On sites 18 and 53 where the stocking of competitive regeneration was relatively low it was still considered to be sufficient as it was more than 25 years of age, of small pole size, and mortality was expected to be negligible.

All areas assessed carried regeneration of the overstorey species present before logging with stockings varying markedly on both burnt and unburnt sites. However, the assessment technique failed to provide the basis for an explanation of the wide range of stocking obtained. There is no evidence to suggest that the unburnt sites were more moist than the burnt sites based on the pre-logging sclerophyllous overstorey species composition (Table 5). The higher stocking levels of *E. saligna* regeneration on burnt sites compared to unburnt sites appears to be related to the burning. It is considered that the removal of the dense understorey vegetation by burning would favour the establishment and survival of the faster

[1] Horne, R. R., Forester, Forestry Commission of N.S.W.
[2] Baur, G. N., Silviculturist, Forestry Commission of N.S.W.

growing more light demanding *E. saligna*. In the unburnt stands the more shade tolerant *L. confertus* regeneration could be expected to survive longer amongst the dense residual understorey vegetation. This was seen to be the case and accounts for the higher percentage of *L. confertus* regeneration on unburnt sites.

In this study all the sites that received a post-logging burn regenerated with stocking levels more othan sufficient to replace the overstorey. The distribution of regeneration through assessment areas was good with 96% of plots (0.1 ha) being stocked with regeneration. Although good regeneration results have been found in this study following post-logging burning it is not a guarantee of success. There have been occasional failures due to lack of seed, frost, and post-burn leaf fall covering the ground preventing establishment (Baur[2] pers. comm. 1982). Nevertheless, the burning has generally been successful in creating a suitable seedbed for seedling establishment.

In this study those sites that did not receive a post-logging silvicultural burn had generally lower stocking levels than the burnt sites, and only 65% of plots were stocked with regeneration. Although the overall mean stocking for each of the unburnt sites was sufficient to again form a wet sclerophyll overstorey in the future, there were some small gaps without regeneration throughout these sites as indicated by the 35% unstocked plots. Some gappiness may be acceptable, as it was not normal for the former undisturbed wet sclerophyll forest to have a continuous closed overstorey. However it is desirable to determine why sclerophyllous regeneration does not develop on some sites so that in future silvicultural manipulation may be possible to ensure regeneration on any potential problem site. Information relating to seed availability, weather conditions and weed growth following logging was not available in this historically-based survey so it was not possible to determine why gaps in regeneration occurred in some places. Further research would need to examine both regeneration establishment and early development under a range of environmental conditions. This could involve the experimental sowing of seeds of the important species at a number of locations and at different times to take account of varying seedbed condition, residual overstorey, position on slope (moisture relations), weed and understorey competition, climatic and other factors.

Conclusion

There are six conclusions concerning reg establishment and development to arise study.

1) In almost all cases the forest mar expect to get sufficient regeneration the sclerophyllous overstorey with o post-logging burning.
2) Regeneration stocking is significant on sites that experience a post-logg
3) Regeneration establishment is grea soil disturbance has occurred.
4) Post-logging burning favours the ment of *Eucalyptus saligna*.
5) Regeneration growth rate decreases reasing residual canopy.
6) There is little mortality over time competitive regeneration of codomin with diameter exceeding 15 cm.

With an increase in the intensity of log will be a reduction in the residual ca increase in the area of soil disturba improved regeneration establishment ai rate. The development of all the reg species will be faster in openings with light.

The options for the forest manager depe future plans for the stand. If his aim to replace the sclerophyll overstorey reasonably heavy logging-only operati be satisfactory. If the manager has a sm market and desires to thin the regenerat it would be necessary following loggin to increase the area of seedbed by bu mechanical means) to gain denser rege

Acknowledgements

I would like to thank the many Forestry Comn who assisted with field work which at times was physically unpleasant. Howard Cooper and Bi contributed more than most. John Lunda and carried out the aerial photograph interpretation. Dick Curtin, John Bruce and Max Gatenby are their constructive comments.

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Floyd, A. G. (1976) — Effect of burning on recen seeds in wet sclerophyll forest. *Aust. For.*

Aust. For., 1976, 39 (3), 210-220.

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Effect of Burning on Regeneration from Seeds in Wet Sclerophyll Forest.

SUMMARY

The importance of dormant buried seeds of understorey species of the wet sclerophyll forests of northern N.S.W. is discussed in relation to their germination ability following fire or mechanical or chemical abrasion.

The optimum temperatures for germination were determined for the more common species.

The intensity and frequency of burning was shown to affect the species composition of the regeneration very significantly.

INTRODUCTION

The occurrence of fire in Australia is generally regarded as preceding the arrival of white man 200 years ago and even that of the aborigines about 30,000 years ago (King 1963, McArthur 1970, Gill 1975). Lightning which is still responsible for the burning of significant areas (Heislers 1975) doubtless caused the burning of large areas of the drier vegetation types at irregular intervals and at varying intensities before the arrival of the aborigines. Heislers (1975) considered fires to be more frequent but of lower intensity during the aboriginal era. Europeans have manipulated the vegetation by planting exotics and by logging practices. This has reduced the total area burnt but has increased the intensity of many wild fires. Control burning has increased the frequency of fire in the wet sclerophyll forests.

Foresters are aware that burning prior to planting eucalypts in clear-felled wet sclerophyll forest in northern N.S.W. produces a much more vigorous crop of unwanted species than does tractor clearing. At Coffs Harbour, twelve months after site preparation, the dry matter produced following tractor clearing was 967 kg/ha; but where burnt, it was 3320 kg/ha (Floyd 1966). Furthermore, where unburnt, 78.4 per cent of the mass consisted of weak annuals, low growing ferns and grasses; whereas on the burnt site, 74.5 per cent of the total mass was of species with well developed

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root systems or vigorous woody plants germinating from buried seed. Another experiment at Timmsvale, west of Coffs Harbour, indicated that fifteen months after clearing, only 15.5 per cent of the ground was covered by vegetation, including 2.5 per cent by *Acacia binervata* DC. which has seeds stored in the ground. When a comparable area was burnt immediately after clearing, the ground cover was 40 per cent, including 24 per cent by the acacia (Internal Report, For. Comm. N.S.W.). As in virgin tropical rainforest, species with buried seed are mainly seral species requiring full light (Chin 1973).

Because those species arising from buried seed dominate the early successional stages, they influence the environment of other plants and animals quite markedly; and therefore a study of the effect of various burning regimes upon the resulting regeneration is considered of practical value.

MATERIALS AND METHODS

The maximum depth from which germinating seedlings can emerge was determined for *Dodonaea triquetra* Wendl., *Kennedia rubicunda* Vent and *Acacia irrorata* Sieb. ex Spreng. by excavating seedlings on burnt wet sclerophyll forest at Pine Creek State Forest, 20 km south of Coffs Harbour, N.S.W.

To determine the depth to which viable seed could be found, soil samples were taken at 0-3, 3-6, 6-9 and 9-12 cm depth beneath a wet sclerophyll forest on Orara West State Forest, 30 km west of Coffs Harbour. Two sites were sampled, one having been burnt by a wildfire 30 years ago whilst the other was reburnt 14 years ago. Each soil sample was divided into four, wrapped in aluminium foil to prevent desiccation and heated in an oven to the following temperatures which were previously found suitable for a range of species (Floyd 1966):— Unheated control, 55°C for 100 min, 75°C for 100 min, and 90°C for 20 min. Temperatures were monitored by thermocouples embedded in the wrapped soil. After heating, the soil was spread out in seed boxes so that all viable seed could germinate and be recorded.

The optimum temperatures and durations of these temperatures for germination were calculated for the following species:— *Acacia falcata* Willd., *A. fimbriata* A. Cunn. ex G. Don. *A. irrorata*, *A. longifolia* (Andrews) Willd., *A. myrtifolia* (Sm.) Willd., *A. silvestris* Tind., *A. ulicifolia* (Salisb.) Court. *Commersonia fraseri*, *Dodonaea triquetra*, *Kennedia rubicunda*, *Phytolacca octandra* L. and *Seringia arborescens* (Ait.) Druce. 100 seeds of each species were embedded in moist soil, wrapped in aluminium foil and heated in an oven for various durations up to 400 minutes at temperatures from 40°C to 100°C in 10° steps. As before, temperatures within the soil were regulated by thermocouples and the oven controls.

RESULTS AND DISCUSSION

Depth of Buried Seed

By excavating around germinating seedlings in the field, it was found that small seeds such as *Dodonaea* can emerge from a maximum depth of approximately 5 cm, whereas the larger seeds of *Kennedia* may appear from depths to approximately 6.5 cm. Viable seeds were found at greater depths at Orara West State Forest, west of Coffs Harbour, where *Acacia maidenii*

F. Muell., *Callicoma serratifolia* Andr., *Zieria arborescens* Sims, *Helichrysum diosmifolium* (Vent.) Sweet and *Piptocalyx moorei* Oliver were all present at 9-12 cm depth (Figures 3-5). As all these species represent different families as well as different habits of growth (trees, shrubs and vines), buried seed is not an unusual occurrence even in moist forests.

Temperatures and Durations of Fires

Following a fire many of the buried seeds germinate. On burning, the most commonly encountered soil temperatures were found to be (Floyd 1966):—

1. *Light Fuel:* Branchlets and dried leaves heaped up to 1.2 m high gave rise to a maximum temperature at 2.5 cm depth of 44°C; negligible heating was observed at greater depths.
2. *Medium Fuel:* Branches and stems up to 20 cm diameter with some leafy branchlets heaped up to 1.8 m high gave rise to a maximum temperature of 85°C at 2.5 cm depth, 67°C at 5 cm and 48°C at 10 cm.
3. *Heavy Fuel:* Large logs up to 120 cm diameter with some lighter material heaped up to 1.6 m high produced a maximum temperature of 76°C at 2.5 cm depth, 68°C at 5 cm and 57°C at 10 cm.

With the heavier fuels, the temperatures were maintained for longer periods than with the lighter fuels, (300 and 25 minutes respectively at 2.5 cm depth). Surface temperature with all fuels exceeded 100°C and killed any seed present in that zone.

Effect of Soil Heating on Seed Germination

The subjection of seed to a range of temperatures from 40°C to 100°C for durations of 10-400 minutes in the laboratory indicates the requirements of several species (Figure 1, Table 1). Clearly the intensity and duration of the fire will determine to a large extent the species composition of the regeneration, as minimal germination will occur without burning. As *Acacia* ~~*irrorata* cannot~~ germinate from greater depths than 5 cm, the light fuel would produce insufficient heating except just under the surface, whereas the heavy fuel would be too hot until at least 2.5 cm below the surface. *Dodonaea* would be favoured by a hot fire and *Phytolacca* by a low fire.

When soil from different depths is heated to various temperatures in an oven before germinating any naturally occurring seed, the result indicates the effect of fire on a range of species (Figures 2-5). Whereas *Acacia binervata* required moderate temperatures of 75°C for 100 minutes for optimum germination, *Helichrysum diosmifolium*, *Callicoma serratifolia*, *Piptocalyx moorei* and *Zieria arborescens* prefer lower temperatures of 55°C for 100 minutes.

Effect of Percussion and Ingestion by Birds upon Seed Germination

The effect of temperature in breaking hard seed coat dormancy appears to be related to the softening of the seed coat and hence its increased permeability to water and/or gases rather than to any chemical change. When the seeds of *Acacia* sp., *Phytolacca* and *Dodonaea* are fractured by a blow, germination usually follows (Table 2).

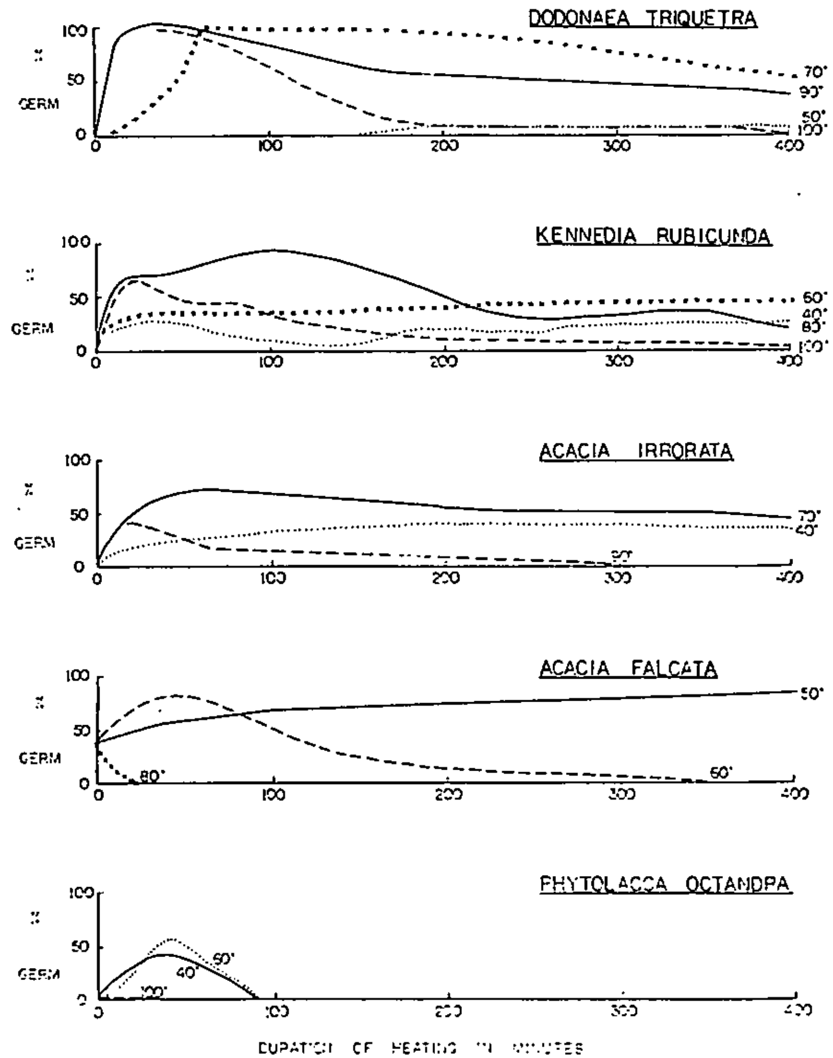

Figure 1
Percentage germination of seeds after heating in soil.

This probably explains why the working of a tractor can cause some seeds to germinate as is often observed, but generally in reduced numbers to that after a fire. *Phytolacca* is exceptional in that it responds only weakly to heat (55% germination) and is perhaps significantly the only exotic species studied. Moreover its juicy fruits contain seeds which are very efficiently disseminated by birds, particularly Silver-eyes and Satin Bower Birds whose digestive juices may attack the hard seed coats thus rendering

TABLE 1

Temperature requirements for germination

Optimum Temperature	Optimum Duration	% Germination Unheated	Heated	Species
90°C	10- 50 mins.	Nil	100%	*Dodonaea triquetra*
80°C	10-150 mins.	6%	100%	*Kennedia rubicunda*
	10- 40 mins.	Nil	75%	*Commersonia fraseri*
		Nil	90%	*Seringia arborescens*
70°C	10-200 mins.	15%	80%	*Acacia fimbriata*
		5%	70%	*Acacia irrorata*
		5%	100%	*Acacia longifolia*
		Nil	80%	*Acacia myrtifolia*
		2%	100%	*Acacia sylvestris*
		10%	80%	*Acacia ulicifolia*
50°C	10-400 mins.	40%	85%	*Acacia falcata*
40°C	20- 60 mins.	10%	55%	*Phytolacca octandra*

TABLE 2

Effect of percussion upon the germination of some hard seeds

Species	Control	Seed Coat Ruptured
Acacia fimbriata A. Cunn ex G. Don	15%	35%
Dodonaea triquetra	Nil	40%
Phytolacca octandra	15%	77%

them more permeable (as has been observed with flock pigeons feeding on some rainforest fruits such as *Cryptocarya glaucescens* R. Br.). As the Australian species studied generally have hard dry fruits, feeding will be destructive due to the seeds being digested for their food value.

Effect of Periodicity of Burning upon Regeneration

In the Orara West experiment, regeneration obtained from heated soil samples from a wet sclerophyll forest site cleared and burnt 14 years ago (burnt) was compared with that of undisturbed forest (natural). Both sites which carry an overstorey of *E. pilularis* Sm. and *E. grandis* Hill ex Maid. were previously burnt by a wildfire 30 years ago. The species which regenerated could be classified into four categories according to their ability to rapidly produce seed, the size of the seed and shade tolerance of the plants.

1. Early Maturers, Shade Intolerant

Acacia binervata and *Phytolacca octandra* are examples of initial colonisers following fire which mature quickly in great numbers, produce many moderately large seeds, die and are replaced by more shade tolerant species. The virtual absence of viable seed throughout the soil profile of the site unburnt for 30 years (Figure 2 and Table 3) might indicate that seed of these two species cannot remain dormant for this period but that it can be stored for 14 years. This hypothesis requires testing. However other species of wattle, such as *Acacia dealbata* Link are known to survive for considerably longer periods. *Daviesia mimosoides* R.Br. will regenerate from hard seeds which have become softened after being in the ground for 15 years without fire (Gill 1975).

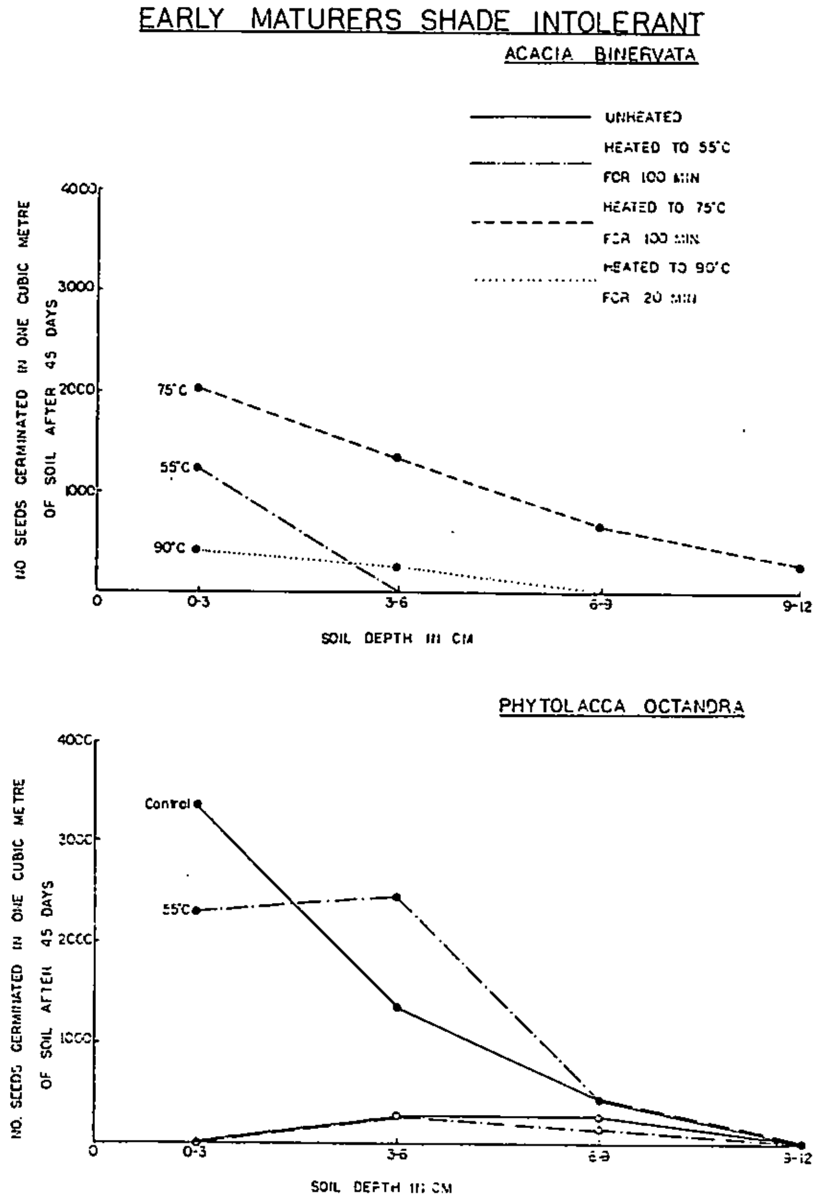

Figure 2

Germination of seeds in heated topsoil from sites burnt by wildfire 30 and 14 years previously (●) and only 30 years previously (O).

2. Early Maturers, Shade Tolerant

Zieria arborescens and *Helichrysum diosmifolium* colonise burnt sites very rapidly and mature quickly as in the previous group; but being shade tolerant, are able to persist and drop seed over the full period under observation. This could account for buried seed being found in soils after both the 14 and 30 years intervals since burning (Figure 3 and Table 3).

3. Late Maturers, Small Seeds, Shade Tolerant

Calliconia serratifolia and *Piptocalyx moorei* are typical rainforest pioneer species requiring many years before flowering commences. Thus on the site burnt 14 years ago, germination of buried seeds is considerably less than that where unburnt for 30 years (Figure 4). Relatively low soil temperatures, below 75°C, are necessary to stimulate germination. Although most viable seed was found in the top 6 cm of soil, some seed was also present down to a depth of at least 9-12 cm. However, because of its small size, it is probable that only seed in the top 6 cm of the soil profile is physically capable of emergence (Floyd (1966) found that *Dodonaea triquetra*, which has a slightly larger seed could germinate from a maximum depth of approximately 5 cm).

Particularly in the case of *Piptocalyx*, frequent burning (i.e. 30 and 14 years ago) has practically eliminated this species (Figure 4). The fire 30 years ago would have promoted germination of the buried seed; and these seedlings would have reached the fruiting stage at about the time of the second fire 14 years ago. Hence the only seed now present is of recent origin, located on the soil surface and thus subject to lethally high temperatures if another fire occurs before its incorporation deeper in the soil profile.

4. Late Maturers, Large Seeds, Shade Tolerant

A. maidenii behaved similarly to the above group, but possibly because of its higher optimum soil temperature for germination of 55-90°C there was less reduction in the stored seed from the fire 14 years ago (Figure 5).

Hence the regeneration capacity of this species was more comparable on the two sites than was the case with the group 3 species. The site unburnt for 30 years had slightly more viable seed than that more recently burnt.

If it is assumed that 30 years could be closer to the "natural" (pre-European) fire cycle than the 14 years "modern" cycle, then from Table 3 it is clear that white man is changing the species composition from mainly *Calliconia serratifolia*, *Zieria arborescens*, *Piptocalyx moorei*, *Helichrysum diosmifolium* and *Acacia maidenni* to that of *Phytolacca octandra*, *Zieria arborescens*, *Acacia binervata* and *Helichrysum diosmifolium* in that order of frequency. Hence the more diverse rainforest understorey is being replaced by quick-maturing, short-lived shrubs overtopped mainly by *Acacia binervata*. The effect of this change in the habitat upon the native wildlife population is not known because only a few species have been studied in any detail elsewhere. Tyndale-Biscoe and Calaby (1975) cited several studies which indicated that low intensity fires seem unlikely to affect the ground-living mammals in some moist forests and may temporarily improve the food supply for some birds. Severe fires in Victoria have also improved the habitat for Leadbeaters possum.

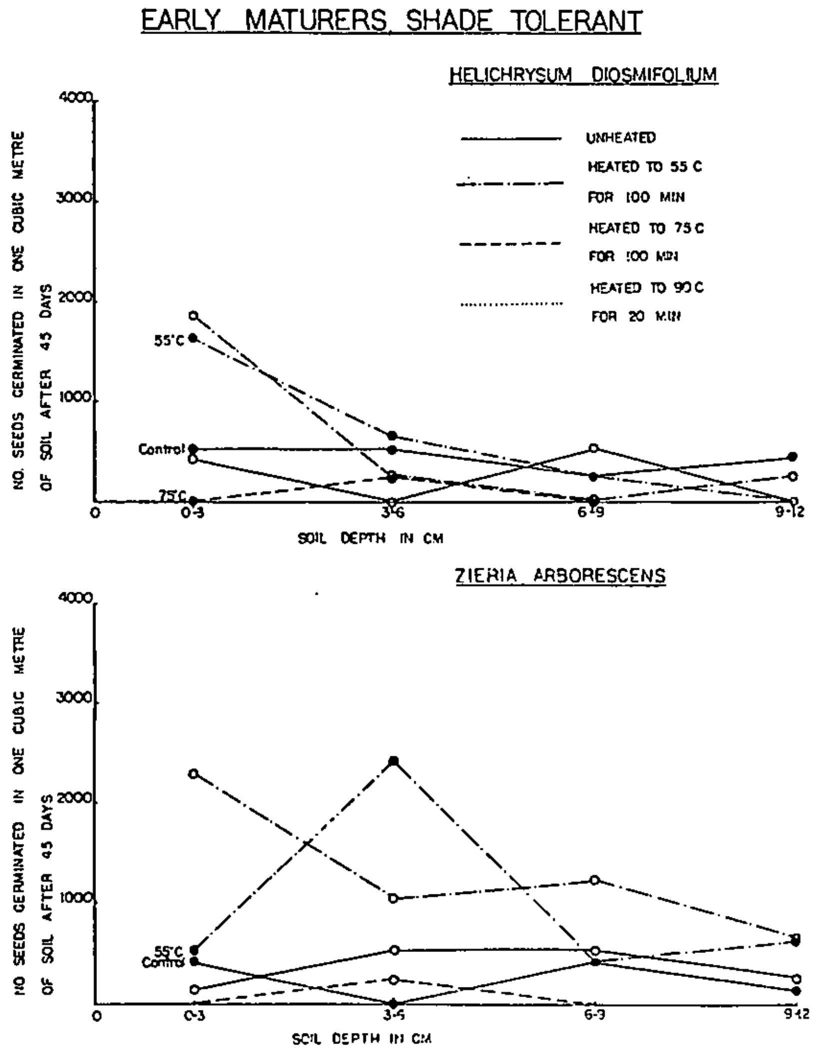

Figure 3

Germination of seeds in heated topsoil from sites burnt by wildfire 30 and 14 years previously (●) and only 30 years previously (O).

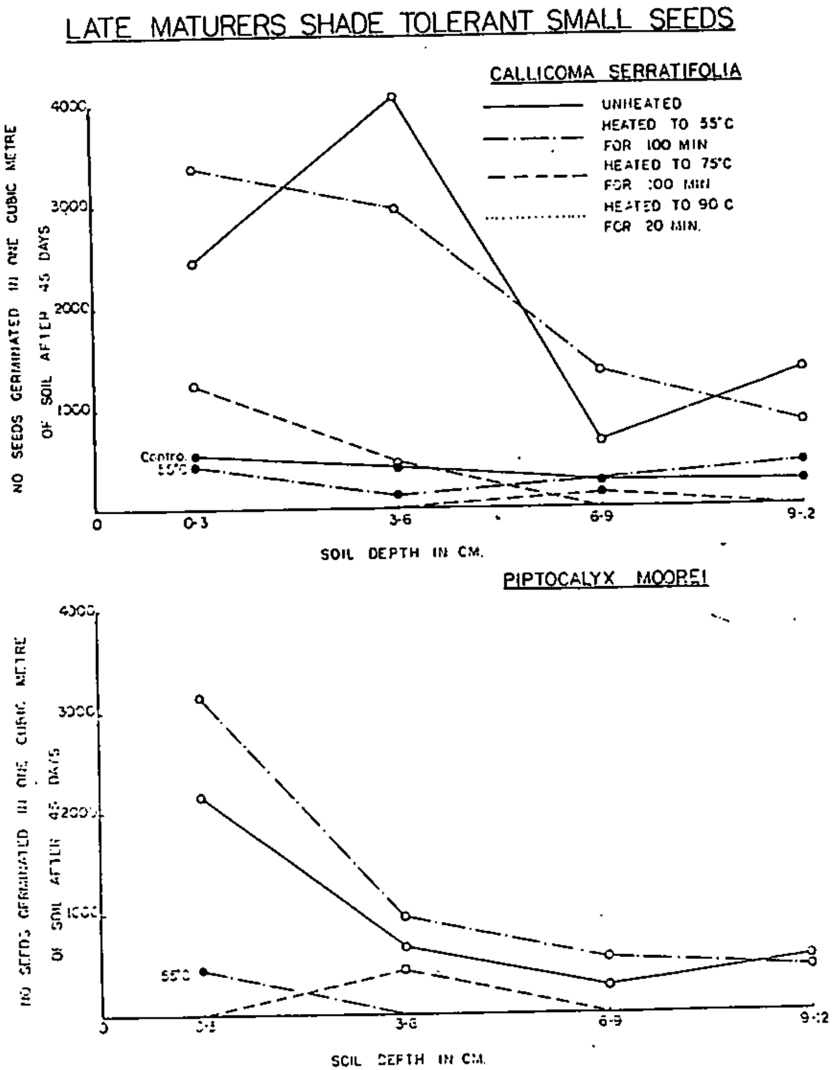

Figure 4

Germination of seeds in heated topsoil from sites burnt by wildfire 30 and 14 years previously (•) and only 30 years previously (O).

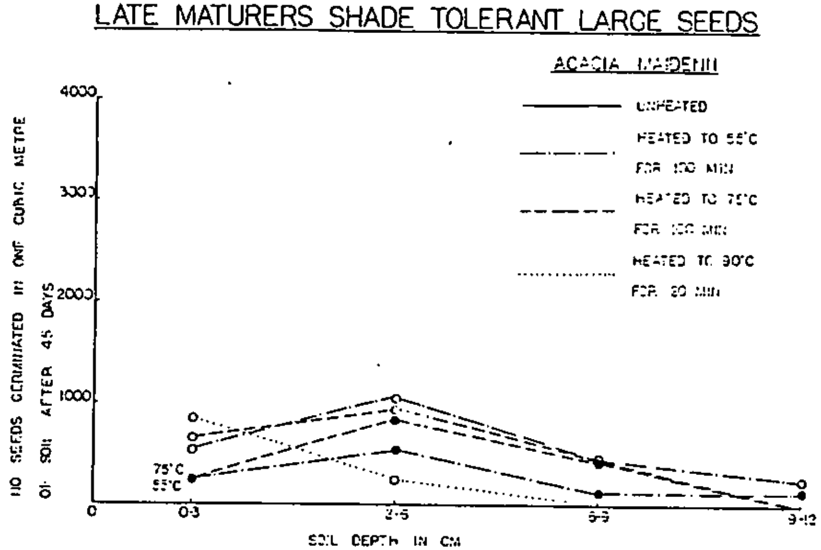

Figure 5

Germination of seeds in heated topsoil from sites burnt by wildfire 30 and 14 years previously (•) and only 30 years previously (O).

TABLE 3

Maximum potential germination of buried seeds throughout the soil profile after heating to the optimum temperatures.

Species	No. of germinating seeds in one cubic metre of soil Burnt 30 years ago	Burnt 14 and 30 years ago
Germination mainly on recently burnt site (14 years ago).		
Acacia binervata	Nil	830
Phytolacca octandra	130	1560
Germination equally on old and recently burnt sites (30 and 14 years).		
Zieria arborescens	1320	1020
Helichrysum diosmifolium	740	740
Germination mainly on old burnt site (30 years).		
Callicoma serratifolia	2540	410
Piptocalyx moorei	1290	100
Acacia maidenii	640	410
Haloragis tetragyna (Labill.) Hook.f.	270	Nil
TOTAL:	6930	5070

CONCLUSION

Many species regenerating in wet sclerophyll forest following fire do so because of their ability to remain dormant and buried in the soil until heated. Because these species have their own particular heating requirements for germination, the intensity and duration of a fire will determine which species will revegetate the area. A hot fire will favour the typical fire weeds, namely:— *Dodonaea*, *Kennedia*, *Commersonia* and many species of *Acacia*. A light fire such as a control burn on the other hand will stimulate the rainforest seral species such as *Callicoma, Piptocalyx, Helichrysum, Zieria* and *Haloragis.*

However, frequent control burning at intervals not exceeding 14 years could result in species such as *Callicoma, Piptocalyx* and *Haloragis* being replaced by more aggressive pioneers such as *Phytolacca* and *Acacia binervata.*

Hence fire intensity and frequency can cause major changes in the understorey vegetation.

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BOOK REVIEWS

A HUNDRED YEARS OF STATE FORESTRY, SOUTH AUSTRALIA

1875 - 1975

by: N. B. Lewis

Bulletin No. 22, Woods and Forests Dept. South Australia. 122 pp., $3.00.

Review by C. G. Stephens

This Bulletin gives a most thorough and fascinating account of the development of the Woods and Forests Department since its political enactment, and the planting of the first trees in 1876.

As is well known, South Australia was not well endowed with forest trees either by size or acreage and the rapid development of plantation forestry, largely in the form of softwood silviculture, was to a large degree foreshadowed even in the earliest activities. Although many species of both hardwoods and softwoods were first tried in large scale experimental plantings, it was clear by the end of the century, that dependence on softwoods would be the future road. Using what were clearly excellent Departmental records, a detailed account of the various stages which were traversed in the search for the most productive and economic species has been presented in a meticulous and absorbing manner.

At a later stage in the Bulletin, an account is given of how the present concentration on *Pinus radiata* came into being. This led to Australia's largest Government plantation forestry activity, supported later by similar private ventures which were inspired by the results which were largely obtained on land in which agriculture had shown little or no interest until the much later era of superphosphate and trace elements.

For a Government publication, the Bulletin is quite remarkable in that a large part of the contents are devoted to the human side of forestry, right from the beginning until the present day. Not only are there personal histories of a series of Conservators and other senior officers of the Department, but, the contribution by a number of families and individuals, many of them without professional qualifications, is acknowledged in a gracious manner which must generate considerable goodwill towards the Department.

Not surprisingly the Bulletin concludes with sections on the environment and how, in this context which is so widely stressed today, pine forests play both a protective and economically productive role which places them in the forefront of crop plants which have been introduced to this continent. Further to this it is emphasised that, in the near future, there will be a development of multiple use which will see considerable increase in recreational use of both pine and indigenous forest.

1975). This could be due to the con-
the inoculation treatments with other
resulting from the design of the trial
he nursery was well fertilised and the
effect could have been reduced.
re also usually much greater in the
background of naturally occurring
infection, e.g. in fumigated soil.

sidiospores onto the soil in nurseries
e a simple, inexpensive and effective
inoculating seedlings of *P. radiata*
eolus. It can be carried out under
mmercial nursery production and
tical, at low labour costs, the inocu-
rge areas of nursery. For example,
of a 10 ha nursery would require
of air-dry sporophores of *R. lute-*
are usually present in great quantities
-10 year old) plantation of *P. radiata*
in April-May and August-September
nursery sowing) and it may require
n-days to locate and collect sufficient
This method can be used to inoculate
lished nurseries either before sowing
edling emergence. It may also be
improve mycorrhiza formation in
advanced seedlings or to increase
numbers in established nurseries de-
effective mycorrhizal population, but
stigations are necessary before such
s are made.

Acknowledgements

I am grateful to Mr J. H. Sedgley of Softwood Holdings Ltd for assistance with these studies and to Mr T. Raftery for technical assistance. The financial assistance of some Australian forest organisations is acknowledged.

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Aust. For., 1984, 47 (2), 79-83

Radiocarbon dating of wood and charcoal in an Australian forest ecosystem

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Summary

Estimation of tree age in various species along the east coast of Australia is made difficult by the lack of identifiable annual growth rings in stem wood and this creates problems in studying long term forest dynamics. It is possible to use radiocarbon dating to obtain general information for this purpose. In an area on the north coast of New South Wales where three forest types were in close proximity, individuals of *Eucalyptus pilularis* (blackbutt) were found to be about 100 years old, *Tristania conferta* (brushbox) between 100 and 1340 years old and subtropical rainforest was between 100 and 880 years old. From these data, together with that from dating of soil charcoal, the frequency of fire (with sufficient severity to result in the production of charcoal) was estimated to be 300 years in the blackbutt forest, 300-400 years in the brushbox forest and in excess of 1000 years in the rainforest. Although only a few results are available, they indicate the potential of radiocarbon dating for use in studies on long term dynamics of forest ecosystems.

Introduction

A requisite to understanding long term dynamics of forest ecosystems is to have information on stand age or time since the occurrence of a critical event or a major disturbance to the system. In studies of this nature in the northern hemisphere, valuable dating information has been obtained by counting rings within the tree stem, the production of annual growth rings being so consistent that long chronologies have been applied to other studies such as historical climatic changes (for example, Fletcher 1975, 1977, Schove 1979).

In Australia, various species can be used for dendrochronological studies (Ogden 1978). However, in the equable east coast climate few tree species have obvious growth rings and for those that do, rings are often not produced on a consistent annual basis. Examples of the few ring-producing species include the deciduous rainforest trees, red cedar (*Toona australis*) and white cedar (*Melia dubia*). Crows ash (*Flindersia australis*) and antarctic beech (*Nothofagus moorei*) possibly form true rings in some cases. Thus, since rings are not reliably present, the ages of the majority of coastal species, and in particular sclerophyllous species, can only be estimated by historical events (for example, dates since known wildfires or recorded logging) or from memory. Considering the relatively short rotation lengths used in forest management, the uncertainty of the correct age of the stand is probably not a great problem, but for longer term studies of ecosystems lack of reliable age information becomes a major limitation. One possible method of estimating ages of trees in some ecosystems is the use of radiocarbon dating.

In ecologically related fields, one problem associated with the use of radiocarbon dating is to obtain suitable material which is sufficiently old and has not undergone extensive decomposition. This is obtained either from tree stems or from stable organics within the soil profile, for example, charcoal or humic compounds. Extensive work on C^{14} dating in pedogenesis, as reviewed by Scharpenseel and Schiffmann (1977), has allowed progress to be made on aspects of soil formation and some of these studies have related soil development to long term vegetation patterns (Cruikshank and Cruikshank 1981).

For Australian forest ecosystems, few data have been reported for the radiocarbon dating of tree or soil samples. Ogden (1978) reviewed tree dating methods and indicated there were very few samples which had been radiocarbon dated. Coaldrake (1962) radiocarbon dated samples from the Cooloola dune system. Wood samples were found to be 40 000 to 45 000 years BP while charcoal samples were 30 000 to 39 000 years BP.

Revised manuscript received 21 February 1984

These samples were used in relation to the dating of sand dunes systems. Similarly, Grimes (1979), using samples of soil charcoal from Fraser Island, found them to be <3880 years BP.

This paper presents data on a series of samples from forests in New South Wales which have been processed by radiocarbon dating methods. One interpretation of these results is discussed to indicate the potential of the method for forest ecological studies.

Sample collection

The major part of the sampling was carried out in Whian Whian State Forest on the north coast of N.S.W. The climate, soils and vegetation of the sites which encompassed a basin in which the geographical strata were layered, have been described by Turner and Kelly (1981). On the floor of the basin, basaltic parent materials had given rise to fertile kraznosems supporting subtropical rainforest. Higher up the slopes the soils were derived from basically enriched rhyolitic materials supporting wet sclerophyll forest dominated by brushbox (*Tristania conferta*), while above this there were drier sites supporting blackbutt (*Eucalyptus pilularis*) (Figure 1). The factors of topography, geology, soil nutritional status and vegetation were very closely correlated at the site.

Based on known fire tolerances of dominant species, it was initially hypothesised that the blackbutt sites had been relatively frequently burnt by wildfires, the brushbox sites less so, while the rainforest had suffered either no fire effects or extremely infrequent effects. Further, the long term wildfire history (that is, fire history

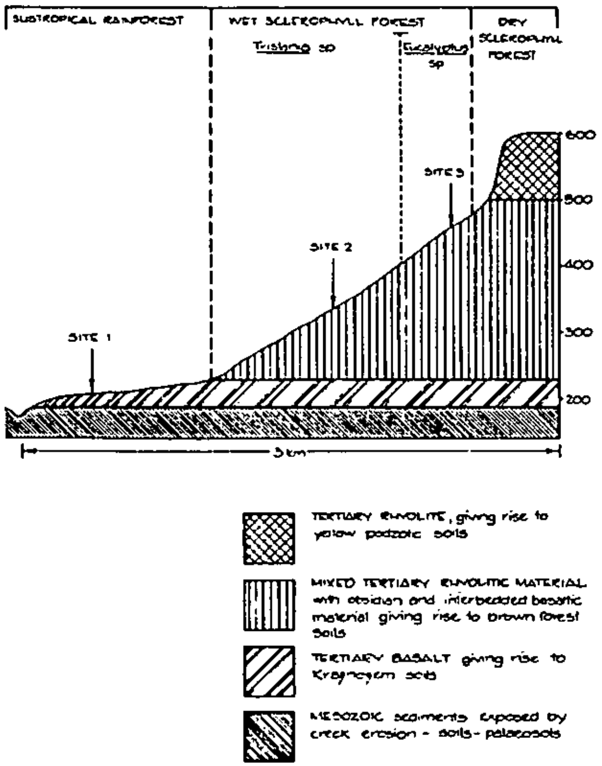

Figure 1. Schematic diagram of relationships between geology, soils, landform and vegetation.

prior to the influence of European settlement) and hence the long term dynamics or stability of the ecosystem could be expected to relate to the major wildfires.

Samples of charcoal within the surface of the mineral soil together with wood samples from trees were taken from all three vegetation types shown in Figure 1. The charcoal samples were collected from various thin layers of soil (2-5 mm) from cores within 10 m² areas. The samples were oven dried, and the charcoal was floated off and re-dried prior to radiocarbon analysis. The number of samples was limited by the cost of the radiocarbon dating analysis (about $A240 per sample) in addition to the cost of collection and pre-treatment.

Within the rainforest site (site 1) only one thin layer of charcoal was found near the soil surface. This layer of charcoal was notable for its consistency of occurrence and could be seen after a little experience on any area of "normal" topography. Samples were not collected from topographical depressions or adjacent to creeks to eliminate any potential effect of overland transport and deposition. In the *T. conferta* site eight layers of charcoal were consistenly detected over the area but only two were separated for analysis. In the blackbutt stand more than twelve charcoal layers were isolated but some yielded only very small quantities of charcoal and only one layer was selected for analysis. In the three undisturbed forest sites it was assumed that a detectable charcoal layer represented a fire, but in stands such as the *E. pilularis* site this may not have been the case as several fires might conceivabl: up as a single layer.

Wood samples were taken from fresl stumps of *T. conferta* and *E. pilularis* tree *T. conferta* trees with different diameters a *E. pilularis* tree were selected. The stum between 1.0 and 1.5 m high and the sampl taken from the centre of the top of eac section. Small hollows (rotted cores) were in several trees and adjustments (as discu the results) were made for this. As no log rainforest areas was being carried out at t of the sampling, two trees felled durin clearing were also used for sampling, thes white booyong (*Heritiera trifoliolata*) a carabeen (*Geissois benthamii*).

The oven dried samples (70°) were se specialist private laboratory (Beta Analyti Gables, Florida) for analysis. The c samples were subjected to alkali pre-treat remove younger fulvic material. Sampl reported using a Libby half-life of 5568

Results

Soil samples

The results for forest type, soil depth an coal age are given in Table 1. The C^{14} age necessarily denote directly the time at wh fire occurred but gives the age of the woo was converted to charcoal at that time. It h assumed that the age of the wood at the the fire would have been less than the i error term of the carbon dating, for exam years for the blackbutt (Table 1).

Table 1. Radiocarbon-dated age of soil charcoal found under three adjacent forest communities in north-eastern N. estimated fire frequency.

Site	Forest community	Depth of soil sample (mm)	C^{14} age (years before 1950)	No. of charcoal layers[2]	fre
1	Subtropical rainforest	20-22	1080 ± 90	1	
2	Wet sclerophyll *Tristania conferta* (brush box)	8 38	950 ± 105 3005 ± 205	3 8	
3	Wet sclerophyll *Eucalyptus pilularis* (blackbutt)	8	1650 ± 70	6	

[1] 1950 is the standard reporting year.
[2] Number of charcoal layers down to, and including, that dated but excluding any charcoal in surface litter.
[3] Calculated from age plus 30 years (from 1950 to 1980) divided by the number of observable charcoal layers. T the wood forming the charcoal, that is the outer layers of the tree, would have an effect but it has not been t account at this stage.

est charcoal sample was dated at ;ears (before 1950 — the year taken ırd reporting year) (Table 1). For the ıx charcoal samples dated, the one : surface was estimated at 950 ± 105 : deeper sample as 3005 ± 205 years. ample analysed from the blackbutt ,ed 1650 ± 70 years. It was assumed that the well defined soil charcoal represented a wildfire of sufficient ause forest regeneration and that the dated age (adjusted for the 1950 ided by the number of charcoal layers e gave an approximation of the ıency of major fires although it could ınderestimate. It was estimated that st burned circa 1100 years ago, and d occurred in the brushbox stand on ear frequency and in the blackbutt 280 year frequency.

·les

or wood samples (Table 2) indicated :s represented a range of ages. The d as "modern" are less than 85 years 1950 baseline) and it is not possible ɔre reliable estimate using the C¹⁴ The white booyong was dated as ars which, when adjusted is 880 years e brushbox ranged between adjusted roximately 110 and 1340 years BP. ıents included those from 1950 (the standard age) plus any rotted pits (ranging from 8-15 cm) based on average growth rates for young trees. (R. Horne* pers. comm.).

Discussion

The results obtained from soil charcoal dating (and using our assumptions) have indicated that, within the rainforest, a single fire occurred *circa* 1100 years ago and this was the only evidence of fire. The white booyong which, with an age of 880 years, was 220 years younger than the fire, was assumed to have developed after this fire. This age estimate is supported by information collected from unlogged stands at Wiangaree State Forest 40 km to the north and from similar soils. Using growth estimates (Table 3), it was predicted that the white booyong would be about 790 years old which is comparable to the estimated 880 years from radiocarbon dating. However, the red carabeen, estimated at 370 years, is very much in excess of the approximate 110 years estimated from radiocarbon dating. The estimates from growth data were averaged results for the dominants and although the white booyong used in this study was in the dominant size class, the red carabeen was of a size class much lower in the canopy. It is most probable that carbon dating growth relationships have the most relevance in a rainforest when applied to dominants.

* R. Horne — Project Officer, Forestry Commission of N.S.W.

Table 2. Radiocarbon age of wood from the centre base of trees in the study area.

·orest community	C¹⁴ age (years before 1950)	Adjusted age[1] (years)	Diameter of stump[2] (cm)
;ubtropical rainforest			
Heritiera trifoliolata (white booyong)	850 ± 65	880	95
Geissois benthami (red carabeen)	modern (< 85)	< 110	52
Vet sclerophyll			
Tristania conferta (brush box)	modern (< 85)	< 110	80
	405 ± 55[3]	485	120
	1030 ± 70	1060	155
	1210 ± 70[4]	1340	165
Vet sclerophyll			
Eucalyptus pilularis (blackbutt)	modern (< 85)	< 110	97

ır year 1980 and any rotted pit.
pproximately 1 m above ground.
ted pit present in tree centre — an assumed further 50 years growth added.
d pit — an assumed 100 years growth added.

The brush box trees increased in size with age so that while the 80 cm diameter tree was approximately 110 years old, the 165 cm diameter tree was more than 1300 years old. The soil evidence shows an average fire frequency of at least 300-400 years over the past 3000 years. However, from data on the frequency of the various diameter classes for brushbox (R. Horne *pers. comm.*) it appears that most stands are of mixed age classes, including trees probably more than 1000 years of age. This implies that not all individuals are killed in a fire of sufficient intensity to leave a charcoal deposit.

The blackbutt stand has had the most frequent fires, approximately every 280 years, and based on C¹⁴ tree age the last severe wildfire was less than 110 years ago. Using blackbutt growth data for stands of known age from within Whian Whian State Forest, the calculated linear relationship (Diameter (cm) = 0.7 Age (years) + 17.5, r = 0.983, n = 32) predicts that the age of approximately 110 years should have produced a tree with a diameter approximately 103 cm. Since the measured diameter was 97 cm, this is not an unreasonable prediction.

It is suggested that, because of the topographic and spatial relationships between the different stands, any fire in the rainforest had to pass firstly through the blackbutt and then through the brushbox stands, while fires affecting the brush box would have passed through the blackbutt. The pooled data indicated that while there have been at least eight wildfires over the past 3000 years, there is evidence of only one passing through to the rainforest and that was about 1000 years ago. Severe fires have passed through the surrounding non-rainforest stands and have occurred approximately every 300 to 400 years.

Conclusion

Although this study has used a very limited number of samples, it has shown the potential for carbon dating in studies of stand age structure and fire frequency. The costs are sufficiently high to limit the number of analyses possible for most projects, but on permanent study sites, the investment in such analysis would be very worthwhile.

Acknowledgements

I wish to thank Mick Williams for assistance with sample collection and my colleague Marcia J. Lambert with preparation of the manuscript.

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Table 3. Diameter increment for *H. trifoliolata* and *G. benthami* from different size classes at Wiangaree S.F.[1]

Size class (cm)	*Heritiera trifoliolata* Diameter increment mean for size class (cm)	*Heritiera trifoliolata* Years[2]	*Geissois benthami* Diameter increment mean for size class (cm)	*Geissois benthami* Years[2]
9.5-20.4	0.07	291	0.09	227
20.5-30.4	0.20	50	0.22	45
30.5-46.4	0.14	114	0.22	73
46.5-60.4	0.13	107		
Mean of population	0.15		0.22	
Sample tree diameter	95		52	
Years of growth to obtain sample tree diameter		793		370
Radiocarbon age (yrs)		880		< 110

[1] Based on data of R. Horne (pers. comm.).
[2] Represents time required to grow from the upper limit of the previous size class to the upper limit of that particular size class.

FCI

FORESTRY COMMISSION, N.S.W.

FORESTRY OFFICE
DORRIGO

198, 408 JM:BC

E.I.S Matters - Chaelundi S.F.
A.P.I Assistance.
R.O. ..2 & 1606.

Assistance from the A.P.I. team will be required for a number of matters in Chaelundi S.F.

1. Forest Typing.

A recent field inspection of the Red Herring/Grass Trees areas of Chaelundi S.F. has highlighted major inaccuracies in forest typing. Of major concern is the extent of Blackbutt type which is more limited in extent to that area currently typed.

Typing in use was completed in 1963 and maps are noted to the effect that there are numerous anomalies and errors in conversion to Research Note 17 types. This has been evident in areas worked to date and retyping of Brown Camp areas was effected in 1988.

A review of typing is necessary for the target areas in Chaelundi (I.E. Pine Ck. area and Red Herring/Grass Trees/Frenchmans Ridge area). As a minimum requirement, the retyping of the Moist Hardwood/Blackbutt areas between Chandler Creek and Stockyard Creek is considered necessary. (approx. 9 000ha). However, this area may need to be extended following further field inspection.

2. Update of Mapping.

Most of the unplotted roads should be covered by S.A.P. flown in April. However, Broadmeadows Road and possible part of Stop a Bit would have fallen outside of the proposal. A.P.I. will be able to assist with improved plotting of the constructed access for mapping update.

3. "Tallowwood Place" Flora Reserve.

Several areas were identified from helicopter reconnaissance as areas worthy of consideration as possible reserves. A.P.I. delineation of these areas will provide some assistance to local staff in making recommendations for a reserve to take the place of, or complement the area already set aside in compartment 185.

✓ 28/6
8 2/8

Summary of Recommendation.

Review of current typing, updating of current mapping, and delineation of proposed reserves within target areas are considered necessary at any early stage in E.I.S. compilation and early provision of assistance from the A.P.I. unit is sought please.

Photography Available.

Gresham 1961	1:15840 (D.O.)
Newton Boyd 1985	1:40000 (Part coverage R.O.)
Coffs Harbour 1973	1:25000 (Part coverage D.O.)
Newton Boyd 1973	1:40000 (D.O.)

D.J. Murray,
District Forester.

25th June, 1990

The Regional Forester,
COFFS HARBOUR JETTY. 2451.

Cop
Dist

FORESTRY COMMISSION, N.S.W.

FORESTRY OFFICE
KEMPSEY API

X8 S. DOBBYNS:PMB
No.

L.O. 1400

Northern Regions API Unit
Annual Report 1989-90
Proposed Works Programme 1990-92
R.O. P544

This report also incorporates the quarterly reviews for 1st April, 1990 to 30th June, 1990.

Completed Work:

1st July, 1989 to 30th June, 1990:

1. Coffs Harbour District, Bruxner Park Flora Reserve No. 3 - species typing and photo-pinning - 440 ha. Report dated 24th July, 1989.

2. Grafton District, Crown Leases 17/4, 17/8, 26/5 and part 29/6, Parish Marara County Gresham (adjoining Marara State Forest No. 628) - species typing - 2950 ha. Report dated 13th October, 1989.

3. Grafton District, Part Crown Lease 30/22, Parish Marara County Gresham (adjoining Marara State Forest No. 628) - species typing - approximately 970 ha. Report dated 3rd November, 1989.

4. Urbenville District, Richmond Range/Yabbra State Forests, Duck Creek (EIS) - stratification into volume/logging classes - 2882 ha. Report dated 5th December, 1989.

5. Tenterfield District, extensions to Gilgurry/Girard State Forests - species typing - approximately 5000 ha. Report dated 21st December, 1989.

6. Wyong District, part McPherson State Forest No. 924 (Warre Warren Aboriginal Place) - species and stand condition typing - approximately 2000 ha. Report dated 19th March, 1990.

7. Kempsey District, Tamban State Forest No. 526, No. 5 Extension (Swan Block) - species typing - approximately 100 ha. Report dated 26th March, 1990.

RF

8. Coffs Harbour District, part Orara East State Forest No. 536 (bound by Convincing Ground Road, Bruxner Park F.R. 3 and private property) - delineation of rainforest areas - approximately 900 ha. No report.

9. Urbenville District, Richmond Range/Yabbra State Forests, Duck Creek (EIS) - follow up volumation - 2882 ha. No report.

10. Kempsey District, Maria River State Forest No. 469, No. 7 Extension - species typing - approximately 365 ha. Report dated 18th May, 1990.

11. Kempsey District, Styx River State Forest No. 339, No. 12 Extension - species typing - approximately 17.5 ha. Report dated 30th May, 1990.

12. Grafton District, Glenugie State Forest No. 26 (proposed additions) Portion 63 and others, Parish Lanitza County Clarence - species typing - approximately 785 ha. Report dated 22nd June, 1990.

13. Assistance with API School - Batemans Bay (F.A. Fisher only).

Proposed Work:

1st July, 1990 to 30th September, 1990:

Project:

1. Coffs Harbour District, Orara West/Boambee State Forests - species and stand condition typing - 10300 ha. Submission has been received and specifications for stand condition typing are to be tested in early July.

Smaller Jobs:

2. Dungog/Cessnock Districts, Chichester M.A. and Mount Royal State Forest No. 297 - Royal Milli typing review - Job has been expanded and is approximately 90% completed.

3. Taree/Wauchope Districts, Bulga/Doyles River/Mount Boss State Forests - API Trial (Fire-Disclimaxed Fringe-Rainforest) - approximately 1000 ha. Specifications to be tested in early July.

4. Wauchope District - investigation of various conversion applications - specifications to be discussed with District.

5. Cessnock District, Gap Creek Forest Preserve, Olney

State Forest No. 124 - boundary location and point pinning.

1st October, 1990 to 30th June, 1992:

Project:

1. Grafton District, Clouds Creek State Forest No. 111 - re - typing to Research Note 17 standards - 17500 ha.

2. Cessnock District, Putty State Forest No. 1015 - species typing - 21297 ha.

3. Urunga District, Upper Bellinger/Tuckers Nob State Forests - stand condition typing and roading pattern design. Subject to investigation into other API requirements in upriver forests within Macksville and Bellinger M.A.'s.

Smaller Jobs:

1. Gloucester District, Barrington Tops - interpretation update of Scotch Broom distribution.

2. Dorrigo District, Part Hyland State Forest No. 659 - species typing.

3. Casino District, new dedication areas - species typing.

4. Glen Innes District, Gibralter Range State Forest No. 352 - investigate areas for relogging and possible access - 3500 ha.

5. Wauchope District, Cockerawombeeba/Marowin Brook Flora Reserves - boundary location and reference point pinning.

6. Grafton District - investigation of possible dedication areas. Specifications to be discussed with District.

7. Kendall District, Camden Haven State Forest No. 684 - species typing - 670 ha.

8. Wyong District - location of Turpentine stands.

9. All Regions, Flora Reserves (various) - species typing.

Future Work:

Coffs Harbour Region:

Dorrigo District:

a) Wild Cattle Creek State Forest No. 488 - volumation of early logged and treated areas - 300 ha.

b) T.R.'s 62230, 72978, R90606; Crown Lease 53/1 Muldiva; Ellis State Forest No. 831, Compartment 74 - species typing and volumation - 1429 ha.

Port Macquarie Region:

Kempsey District:

a) Kempsey M.A. - stand condition and species typing of coastal forests - 20450 ha.

b) Portions 65, 68 and 76, Parish Stuart County Dudley - species typing - 282 ha.

c) Portion 31, Parish Mowle County Clarke - species typing - 180 ha.

d) Species typing Crown timber land in vicinity of proposed Mount Woorong Road.

Wauchope District:

a) Wauchope coastal forests - stand condition typing and check on species typing.

b) Smallwood priority areas 1 - 3 - stand condition typing.

Taree District:

a) Wingham M.A. - stand condition typing of regrowth areas.

Newcastle Region:

Bulahdelah District:

a) Bulahdelah M.A. - stand condition typing - 50000 ha.

b) Boundary location and reference point pinning of various Flora Reserves.

Cessnock District:

a) Pokolbin State Forest No. 716 - species typing of untyped areas.

<u>Glen Innes Region</u>:

Armidale District:

a) Styx River State Forest No. 339 - re-typing to Research Note 17 standard.

b) Yooroonah State Forest No. 1040 and proposed additions - species typing - 2200 ha.

c) Styx River State Forest No. 339, No. 9 and 10 Extensions - species typing - 630 ha.

Glen Innes District:

a) Butterleaf State Forest No. 307 - species typing - 4104 ha.

b) Curramore State Forest No. 763 - species typing over northern two-thirds - 4700 ha.

c) Torrington State Forest No. 320 - species typing - 1593 ha.

Inverell District:

a) Cypress pine volume typing for yield calculation.

This proposed works programme is submitted for your consideration and approval. The jobs scheduled to be undertaken in the next two years are by no means set in concrete and is only the API Forester's idea of relative work priorities. Some juggling can occur if new photography becomes available or if Regions feel that they have a job of higher priority, i.e., for Management Plan preparation, E.I.S.'s, etc. Some feedback on this score would be appreciated.

<u>Miscellaneous</u>:

After being left to its own devices for approximately two and half years, the API unit has acquired a forester. F.A. Fisher should be commended on his smooth running of the unit during that period.

The API unit had another accident free year and a rough guesstimate brings the units hours since a L.T.A. to 462000.

S.B. DOBBYNS,
Forester (API).

The Regional Forester,
PORT MACQUARIE.

1st August, 1990.

FILE No. 410

FORESTRY COMMISSION, N.S.W.

DORRIGO DISTRICT OFFICE
D.O.408 ss\temp

Dorrigo M.A. E.I.S.
R.O. 2423

On 25/6/60, I raised the inadequacy of existing forest typing in the Red Herring/Grass Trees area of Chaelundi S.F. Of particular concern is the extent of Blackbutt type compared with 1963 converted types. H.O. 2115-RS of 16/7/90 advised that L.A.D. would organise programming of A.P.I.

Submissions on the 3 Cpt E.I.S. also highlight inadequacy of typing, e.g.:

NEFA: "Type maps are inaccurate and obviously an inadequate basis upon which to base an assessment."

NPWS: "The Classification and typing of forest types does not appear to accurately reflect the forests of the area."

F.A. P. Fisher has recently briefly checked part of the typing and is of the opinion that retyping would be necessary. It was also evident from the recent retyping of Browns Camp area that the existing typing contains numerous errors.

I am of the opinion that all of the target areas should be retyped to Research Note 17 standards. However, the tight schedule to which we are working will exclude the prospects of typing both areas. It is, however, necessary to retype the eastern target area where moist hardwood areas have been previously typed as blackbutt types or vice versa.

Details of various sections are as follows:

1. Eastern Target Area (south of Stockyard Ck):

   Cpts 249-256, 225-227, 238-248 — 4362 ha

2. Eastern Target Area (north of Stockyard Ck):

   Cpts 249-256, 273-284 (dry hardwood) — 3941 ha

3. Western Target Area (Broadmeadows)

   Cpts 180, 193, 197-204, 207, 209-219, 221-224, 302-306 — 6968 ha

26/11 R/S 7/12/90

At some stage retyping of Grasstrees Stage 1 area (Cpts 166-169, 228-237, 259) would also be desirable. This area which could also attract attention consists of moist hardwood, blackbutt stands and represents the only moist hardwood stands not included in the moratorium areas.

Recommendation:

It is recommended that urgent consideration be given to retyping the above areas of Chaelundi S.F., with a view to early commencement of the higher priority areas. Priorities are as listed above and work under 1 & 2 above are rated as minimum requirements for area wide E.I.S.

D.J. Murray
District Forester

21.11.1990

Regional Forester
COFFS HARBOUR

FLORA

NORTH EAST FOREST ALLIANCE SUBMISSION ON "PROPOSED FORESTRY OPERATIONS - DORRIGO MANAGEMENT AREA, ENVIRONMENTAL IMPACT STATEMENT OCTOBER 1992."

Prepared by Dailan Pugh

INDEX

INTRODUCTION

At the North East Forest Alliance meeting with the Regional Manager Grahame King on 2.11.1992 he agreed that unpublished documents referenced in EIS's would be made available at district offices in order to enable a proper evaluation of EIS's. A list of such documents were requested from the Dorrigo District Office on the 6.12.1992 but despite District Forester John Murray's willingness to provide such documents Grahame King also refused to allow them to be provided except under FOI.

Subsequently on the 23.12.1992 the above documents were requested in a new FOI application. While the FOI application still had not been determined or even apparently considered by the Forestry Commission's FOI manager the District Forester took it upon himself to provide most of the information on the 13 January 1993, over five weeks after it had been requested. This information was collected on that day and further information was supplied in bits and pieces over the next three weeks.

When Mike Hickman was contacted by telephone by me on the 18.1.1993 no progress had been made on the FOI application of the 23.12.1993 and Mr. Hickman was unaware of the events that had occurred (he had been away on holidays and when I had phoned the Forestry Commission in his absence he was informed that nothing would be done until Mr. Hickman returned). Mr. Hickman was adamant that documents that came under schedule A should still be supplied without an FOI, which is contrary to the stance taken by Mr. King.

When the FOI application was finally determined the provision of the results of Forestry Commission owl surveys, economic information and yield information requested was mostly denied. Documents authored by non Forestry Commission people have not been supplied, access to these is still being sought.

This delay and refusal in providing pertinent information has greatly hampered the ability to make a comprehensive submission and most particularly to assess the information upon which the EIS is reputedly based. The short time available to assess the information made available has been particularly frustrating and has not enabled the fauna data to be assessed in the detail required.

There is some confusion as to what area the EIS specifically attempts to asses. Some maps (e.g. Fig. 3.4) show the Little Nymboida River and part of the Coramba Road forming the eastern boundary of the MA, though there doesn't appear to have been any attempt to asses areas east of the Bobo River/Coopernook Creek (the old MA boundary). This appears to be a belated attempt to expand the scope of the EIS though clearly this additional area can not be considered to have been assessed.

The three compartments in Chaelundi SF are explicitly excluded. These are an integral part of the MA and should have been included, particularly as the EIS done for those compartments is totally inadequate and does not satisfy the requirements of the EPA Act. That EIS is refered to herin as the 3 compartment EIS.

Crown Leasehold, Profit a Prendre and Vacant Crown land have also not been considered (aside from a couple of mentions - e.g. p3-15, p8-31, p8-64) and thus can not apparently be considered to be included within the scope of the EIS.

There is no mention of plantations in the MA so pressumably these are not covered by the EIS. As these are an integral part of the socio-economic environment they should have at least been included in that assessment.

The EIS repeatedly states that rainforests will not be logged and thus makes no attempt to assess the impacts of proposed operations upon rainforest. The question of rainforest definiton has not been addressed so pressumably this extends to include rainforest as ecologically defined. As there has been no attempt to assess the impacts of roading in rainforest it is also assumed that no roading in rainforest is permissable under this EIS either.

There is also concern that the EIS makes no valid attempt to asses peviously logged forests in that there is no attempt to identify the resources avaiable from such forests, they are ignored in the socio-economic assessment, very little attempt was made to survey their floristics or identify rare and endangered plant species they contain (e.g. see map in EIS Appendix H), there is no assessment of logging impacts upon them (e.g. EIS p 8-34), there is very little mention made of logging such stands and they are not included in the order of working 1992-2010 (EIS Fig. 4.2, map in App. K). It is of some concern that previously logged forests have not been included as the practice of picking over these stands for remnant oldgrowth elements will have a very significant impact. Such stands also contain significant regrowth resources which could be used to substitute for oldgrowth timbers and thus are a significant part of the resource available under any transition strategy. They should have been assessed and must be included in the new EIS evidently required.

Most noticably there appears to have been no attempt at all to assess the flora and fauna of Ellis, Clouds Creek, Muldiva and Killungoondi State Forests and very little (if any) in Bieldsdown State Forest, and no mention made of logging any of these State Forests in the EIS. Pressumably these too are excluded from the scope of the EIS.

It would appear that the EIS only attempts to asses the flora and fauna of Wild Cattle Creek State Forest, Moonpar State Forest and the Chaelundi Group of forests. Yet within these areas there has been very little attempt to assess the floral values and no attempt to assess the faunal values of any of the identified unlogged and lightly logged areas in Wild Cattle Creek and Hyland State Forests and the Top Creek area in Chaelundi State Forest. The EIS makes only a brief vague reference to logging these areas and they are not included in the order of working for 1991-2010 (EIS Fig. 4.2, map in App. K). These are apparently thus excluded from the scope of the EIS also.

There are thus only two areas which the EIS makes any valid attempt to assess, the two major oldgrowth forest stands in the Pine Creek and Chandlers Creek areas of Chaelundi State Forest.

There has been no attempt to assess the faunal values of the Chandlers Creek area aside from a few point based survey samples by Kavanagh (pers. comm.) for arboreal mammals and owls (which indicate the area is very important for Yellow-bellied Gliders), a few sites sampled by Read for terrestrial small mammals (which indicate the area is very important for Hastings River Mice) and a few peripherial sites by NPWS (which indicate the area is very important for Rufous Bettongs). A proper survey of this area is evidently required.

The Pine Creek area has been more extensively sampled, though still inadequately for most animal groups, and been found to be of outstanding value for species requiring tall moist forest, with regionally and nationally significant densities of Tiger Quoll, Greater Glider, Golden-tipped Bat, Sooty Owl, Powerful Owl, Beech Skink and a barred frog.

On the basis of available information both these stands do have high conservation value and thus cannot be logged until the **"comprehensive, adequate and representative reservation system to protect old-growth forest and wilderness values"** is in place as the National Forest Policy Statement demands.

There thus is no other option for the Department of Planning but to refuse the Dorrigo EIS on the grounds of inadequacy and ensure that an adequate EIS is prepared that covers all the MAs forests. Similarly the National Parks and Wildlife Service must refuse the FIS.

NEFA requests a meeting with the Department of Planning to discuss this sham of an EIS during the assessment process.

Dailan Pugh
North East Forest Alliance
12 February 1993

NORTH EAST FOREST ALLIANCE SUBMISSION ON "PROPOSED FORESTRY OPERATIONS - DORRIGO MANAGEMENT AREA, ENVIRONMENTAL IMPACT STATEMENT OCTOBER 1992."

Prepared by Dailan Pugh

SUMMARY

The Dorrigo Management Area encompases forests of internationally outstanding biological value and biogeographic significance for their flora and fauna. These forests contain a large number of endemic, rare and endangered species, the highest densities of some arboreal mammals and forest owls known in Australia and nationally significant populations of a variety of endangered species. It appears that a number of species once present in the area have already become locally extinct and that unless land management practices are radically altered many more will follow.

The EIS prepared for the Dorrigo MA is a biased and erroneous piece of propaganda specifically prepared to mislead the public and justify the Forestry Commission's determination to log most of the remnant oldgrowth forest without safeguarding the areas outstanding biodiversity and physical integrity.

The soil and hydrology sections of the Dorrigo EIS are appaling. Aside from a basic soil mapping exercise that aggregates soil types into broad categories based on geology there has been no valid attempt to asses impacts upon soils or streams. Specifically the major failings of the EIS are that:

(i) there were inadequate soil samples taken to determine the erodibility and erosivity of soils;

(ii) there is an inadequate assessment of the likelyhood of extreme rainfall events and the effects this will have on erosion;

(iii) incredibly the EIS makes no valid attempt to asses the impacts of forestry activities upon soils or streams;

(iv) there was no attempt to assess the condition of the streams in the MA and only two questionable inspections of logged compartments were undertaken to assess erosion, with one being inspected before there had been any significant rain.

The flora assessment in the Dorrigo EIS is inadequate and fundamentally flawed. Further flora surveys, re-typing of maps and a valid impact assessment are required before the EIS can be

considered to have undertaken a valid floristic assessment. In summary the major problems with the flora assessment are:

(i) the basis of the flora assessment is discredited forest type mapping which was not redone despite Forestry Commission acknowledgement for over two years that re-typing was required for the EIS;

(ii) the vegetation map presented in the EIS is inaccurate and based on broad groupings that don't reflect the diversity of floristic communities in the MA;

(iii) inadequate flora surveys were carried out in most unlogged areas and only token surveys were undertaken in other forests;

(iv) there was no adequate attempt to identify and locate rare and threatened plant species within the MA, with 5 species known or likely to occur in the MA's forests not considered;

(v) rainforests are not defined on an ecological basis and are thus proposed for roading and logging; and,

(vi) only a token literature review of the impact of proposed operations on flora has been attempted and there was no attempt to assess impacts within the MA.

The EIS and FIS prepared for the Dorrigo MA fail to adequately asses the areas faunal diversity and significance, or to properly identify the impacts of forestry activities and ensure responsible measures are taken to mitigate impacts. Most particularly:

(i) There was no survey undertaken of fauna for the EIS, rather inadequate existing information was utilised. While there is good data on some common species at some localities much of the information is out of date (being collected over a decade ago and not accounting for changes in faunal populations since then) or inadequate;

(ii) the only oldgrowth forest for which there has been any attempt (albeit inadequate) to asses at least some of its faunal values is the western stand in Chaelundi SF. There has been no adequate attempt to asses the fauna of the eastern stand of oldgrowth in Chaelundi and the smaller remnants scattered throughout the MA;

(iii) a number of endangered species recorded in the Dorrigo area (including in cited references) have not been mentioned in the EIS or FIS (e.g. Square-tailed Kite, Red-tailed Black Cockatoo, Regent Honeyeater, Pouched Frog). This undoubtedly applies to the species lists as well;

(iv) assessments of forestry impacts are largely based upon discredited propaganda produced by the Forestry Commission for the Wingham and Mt. Royal EISs. Most of the literature on impacts (including unfavorable Forestry Commission results) and ecological principles are ignored;

(v) where they are mentioned prescriptions supposedly to safeguard fauna are deliberately vague and unspecific so as to enable the Forestry Commission to continue buisness as usual without modifing its practices. Recommendations made by the fauna consultant are mostly ignored; and,

(vi) no ongoing surveys or research on most endangered species in the Dorrigo MA is intended.

Before the Department of Planning can make any determination on the EIS or the NPWS on the FIS that allows logging of old-growth forest it is essential that further fauna surveys be conducted in the area (targeting poorly known species) and all existing information be entered into a GIS for predictive modelling and identification of key areas.

The socio-economic assessment undertaken for the Dorrigo Management Area is is fundamentally flawed, inaccurate and deliberately misleading. In summary the major problems with the socio-economic assessment are:

(i) Forestry Commission resource assessments have been proven to be inaccurate and nothing more than erroneous guesses, with the Commission failing to reduce yields to sustainable levels when a shortfall in quota logs of 2 years was identified in 1987;

(ii) the employment statistics provided are inflated fabrications, mills receiving the minority (i.e. less than 5%) of their resource from the MA's State Forests are treated as if their employment is entirely reliant upon it and the significance of timber industry employment in a regional context is overstated;

(iii) the economic benefits of the timber industry and its local and regional significance is pure fantasy with no credibility;

(iv) no cost/benefit analysis of the timber industry was undertaken, with only a greatly inflated and questionable benefit assessment made;

(v) no differentation of the resources provided from State Forests and private land or oldgrowth forest, regrowth forest and plantations is attempted in assessing socio-economic impacts;

(vi) there is no consideration at all of the economic significance of National Parks in the Dorrigo area and the

260 000 annual visitors they attract and some 540 jobs they provide, or of the rapid growth in tourism and the further opportunities for expansion and enhancing the benefits to Dorrigo. There is no mention of a tourism study conducted in the area;

(vii) no valid attempt was made to use accepted means of assessing the economic worth of the natural environment even though one such method had been recently applied in the Dorrigo MA; and,

(viii) the EIS makes no attempt to asses the socio-economic impacts, and means of mitigating such impacts, resulting from ceasing oldgrowth logging despite this being the preference of a significant proportion of the community.

The EIS fails to consider the option of not logging oldgrowth forests, which is preferred by a significant proportion of the community and was deserving of consideration under the Forestry Commission's Act and Wildlife Policy. NEFA's preferred option is:

- ceasing logging in all remnant old-growth forests,
- adopting enhanced management prescriptions in other forests.
- processing all timber to the highest value possible within the Dorrigo MA.
- reducing quota log size from 40-50 cm dbh to 30 cm dbh and eliminating transport rebates.
- undertaking a regional Market Analysis for tourism and developing and implementing a tourism plan for the Dorrigo MA.
- developing and implementing a Structual Adjustment Package incorporating;

  * establishment of commercial plantations on cleared land and undertaking plantings for environmental purposes,
  * thinning and/or prunning of plantations and select regrowth stands to increase productivity and improve timber quality,
  * financial assistance to mills within the Dorrigo MA to purchase equipment to enable processing of smaller timber and increase value adding,
  * compensating and retraining displaced contractors and mill employees.

There is no other option for the Department of Planning but to ensure that the socio-economic assessment is totally rewritten by an independent and competent economist and re-exibited in another EIS.

The existing and proposed reserve system in the Dorrigo MA is not based upon ecological criteria but has obviously been determined on the basis of minimal reservation and minimal loss of timber resources. Specifically the principle concerns are:

(i) there has been insufficient surveys of the biodiversity or the distribution of rare and endangered species within the MA to enable the identification of an adequate reserve system;

(ii) the proposed reserves do not encompass the full range of floristic communities in the MA or encompass sufficient examples of rarer and more productive communities;

(iii) there has been no faunal assessments of most of the proposed reserves and despite claims that existing fauna data has been used as a basis it is evident that fauna have been virtually ignored in determining the proposed reserves and the faunal values of the proposals misrepresented;

(iv) most of the proposed reserves are unloggable or have already been logged, they include very little oldgrowth forest;

(v) the proposed reserve system is not based upon ecological principles or scientifically defensible criteria, but rather upon minimising loss of productive forest and guesswork; and,

(vi) unless the reserve system is redesigned on ecological principles and a precautionary approach adopted it is expected that a variety of additional species will be made regionally extinct.

The proposal is to classify the proposed reserves under the Forestry Commission's PMP system which gives them no legislative protection and leaves it entirely up to the whim of the Forestry Commission as to whether they change their mind and decide to log them. For reserves to have any validity they must be given legislative protection.

The Dorrigo EIS inaccurately delineates unlogged and lightly logged forests while making no valid attempt to assess oldgrowth forests in the MA. The Department of Planning's assistance is requested to complete a trial oldgrowth assessment commenced by NEFA and NCEC for part of the MA.

The Dorrigo EIS and FIS epitomise the short-sightedness of the Forestry Commission and their abject failure to consider the long term consequences of their mismanagement or the predicted impacts of global warming and ozone depletion upon forest productivity and wildlife.

The National Forest Policy Statement demands that a **"comprehensive, adequate and representative reservation system to protect old-growth forest and wilderness values will be in place by the end of 1995"** and that until this is done **"forest management agencies will avoid activities that may significantly**

affect those areas of old-growth forest or wilderness that are likely to have high conservation value."

The western stand of oldgrowth forest in Chaelundi is known to have internationally significant oldgrowth and wilderness values. There has been no valid assesment in the EIS of the conservation values of the other remnant oldgrowth forests in the Dorrigo MA, yet there is sufficient evidence to suggest that most are likely to have high conservation values.

The Environmental Planning and Assessment Act requires that the EIS takes into account to the fullest extent possible all matters likely to affect the environment by reason of that activity. The EIS totally fails to assess the biological values of other Crown lands, regrowth forests, four State Forests and most unlogged forests. The only proposal which the EIS details and attempts to assess is the logging of the two major stands of oldgrowth forest in Chaelundi State Forest.

Unless there is an intention to ignore the National Forest Policy Statement, the Environmental Planning and Assessment Act and the National Parks and Wildlife Act the Department of Planning is left with no other option but to refuse the Dorrigo EIS and ensure the preperation of an adequate EIS that assesses the conservation values of all forests, undertakes a proper evaluation of likely impacts, proposes realistic mitigation prescriptions and includes a responsible socio-economic appraisal.

EXTRACTS FROM "NORTH EAST FOREST ALLIANCE SUBMISSION ON 'PROPOSED FORESTRY OPERATIONS - DORRIGO MANAGEMENT AREA, ENVIRONMENTAL IMPACT STATEMENT OCTOBER 1992".
D. Pugh 1993.

2. FLORA

The flora assessment in the Dorrigo EIS is inadequate and fundamentally flawed. Further flora surveys, re-typing of maps and a valid impact assessment are required before the EIS can be considered to have undertaken a valid floristic assessment. In summary the major problems with the flora assessment are:

(i) the basis of the flora assessment is discredited forest type mapping which was not redone despite Forestry Commission acknowledgement for over two years that re-typing was required for the EIS;

(ii) the vegetation map presented in the EIS is inaccurate and based on broad groupings that don't reflect the diversity of floristic communities in the MA;

(iii) inadequate flora surveys were carried out in most unlogged areas and only token surveys were undertaken in other forests;

(iv) there was no adequate attempt to identify and locate rare and threatened plant species within the MA, with 5 species known or likely to occur in the MA's forests not considered;

(v) rainforests are not defined on an ecological basis and are thus proposed for roading and logging; and,

(vi) only a token literature review of the impact of proposed operations on flora has been attempted and there was no attempt to assess impacts within the MA.

The Dorrigo EIS (p8-3) claims to "*not rely exclusively on the Commission's forest type mapping*" and to also draw upon the various flora surveys undertaken in the area. The map in Appendix H of the EIS shows the sites and transects sampled, which clearly illustrates the abysmal survey effort in areas other than unlogged forests, and that most unlogged areas have also been inadequately sampled. The results from these surveys are not presented in the EIS aside from as a list of forest types in which species were found (Appendix H), though they presumably contributed to the discussion on "plant communities". It is evident from the discussion in the EIS that the assessment is primarily based upon the forest type maps with minimal modification.

The vegetation map provided (Figure 8.1) claims to represent "vegetation groups of the Management Area" yet only reflects generalised groupings and doesn't do this accurately as examination of forest type maps (as recommended in the EIS) clearly shows. Even the generalised level of plant community descriptions given in the EIS mentions 13 eucalypt or Brush Box dominated communities while only nine such "groups" are mapped. The map is entirely inadequate to enable a proper assessment of the MA's forests and certainly not suitable to base a fauna assessment upon as is attempted for Koala's and Glossy Black Cockatoos in the EIS and FIS. The EIS (p 8-4) notes

"Detailed mapping of the vegetation ~~of the vegetation~~ of the Management Area can be obtained from the forest type maps."

The Dorrigo EIS (p 8-4) states *"Considerable study would be necessary to complete a definitive study of the vegetation of the Management Area."* It is apparent there wasn't even enough "study" undertaken to complete even a satisfactory preliminary study of the vegetation of the Management Area.

The EIS (pp 8-18 to 8-23) lists 26 rare and threatened plant species (excluding those found in drier communities in Guy Fawkes River NP) recorded within or near the Dorrigo MA, of which some 16 have been recorded within State Forests, with vague records of a further two species. The EIS (pp 8-23, 8-24) lists a further 10 species of "special interest" and thus deserving of special consideration.

The EIS (p 8-18) notes that *"Most species which occur at lower altitudes in Dorrigo National Park may occur on sites of suitable habitats and low altitudes in the eastern parts of Wild Cattle Creek State Forest."* This includes some 6 listed species for which it is apparent from the map in Appendix H there was very little (if any) attempt to determine their status in the State Forests of the MA.

Gilmore (pers. comm.) considers there are an additional 5 rare and threatened plant species that may also occur in the State Forests of the Dorrigo MA: *Tylophora woollsii* (2E), *Euphrasia ramulosa* (3RC), *Acacia tessellata* (2RC), *Helichrysum whitei* (3RC) and *Gentiana wissmannii* (2RC). He also considers a further eight rare species are deserving of consideration as they may occur as small populations in State Forests: *Eucalyptus approximans*, *Eucalyptus codonocarpa*, *Melaleuca tortifolia*, *Neoastelia spectabilis*, *Zieria* sp. L, *Grevillea beadleana*, *Amorphospernum whitei* and *Diuris venosa*.

A large proportion of the species listed in the EIS and by Gilmore live in "wet sclerophyll" forests and thus will be potentially impacted by the proposed logging and burning operations.

If there is to be any attempt to determine the status of endangered plants in the Dorrigo MA and adopt adequate measures to conserve them then evidently further surveys are required. The priority should be to surveying "wet sclerophyll" forests and the forests to the west and south west in the Chaelundi Group of forests.

2.1 INADEQUACY OF FOREST TYPING

The Dorrigo EIS (p8-3) notes:

> *"The forest type maps for the Management Area are of varying ages, with much of the Aerial Photographic Interpretation (API) having been carried out in the late 1950's or early 1960's. ... Some type maps for the Management Area have been revised and edited in the past six years."*

"It should be borne in mind that botanical knowledge has advanced since many of the type maps were prepared. The mapping was based on a state-wide system which can not recognise all local species associations. Some inacuracies may be due to human error and in conversion of older broad forest typing projects to the more detailed Baur system."

The EIS (p 8-4) further notes:

"Some plant communities correspond closely to one or two forest types whilst others cover a range of forest types. Individual forest types may cover a range of plant communities."

This is evidenced by notes in the EIS at the bottom of each description of "plant communities" given from p. 8-4 to 8-18.

A clear example of the inadequacy of forest typing is provided by comparing forest typing for compartments 111 and 112 Hyland SF and adjacent areas. These compartments were typed in 1984 or 1989 and show a diverse range of forest types - 142 (New England Peppermint), 163b,c (poor to fair New England Blackbutt), 152 (Messmate - Silvertop Stringybark), 161a,b (fair to good Roundleaf Gum), 167 (Silvertop Stringybark), 159 (Mountain/Manna Gum), 138 (Snow Gum), 122 (New England Stringybark), 168 (Silvertop Stringybark - Gum) and small patches of temperate rainforest and 46 (Blue Gum) - while adjacent compartments are simply mapped as 163b (fair New England Blackbutt) which was presumably part of the early typing.

Research Officer, D. Binns (1990), in his comments on submissions to the 3 compartment EIS notes:

"The submissions are generally critical of inadequate vegetation description, inacurate forest typing and insufficient attention to "old growth" values. I agree that the vegetation description is very limited, being based almost entirely on forest typing of possibly doubtful accuracy, and that comprehensive site specific surveys would be desirable to provide adequate vegetation resource data. ... I agree there is a need to attempt to ensure reservation of representative samples of all vegetation types, despite the practical difficulties which that involves."

District Forester, D. J. Murray (1990a), wrote to the Regional Forester:

"A recent field inspection of the Red Herring/Grass Trees areas of Chaelundi S.F. has highlighted major inaccuracies in forest typing. Of major concern is the extent of Blackbutt type which is more limited in extent to that area currently typed.

"Typing in use was completed in 1963 and maps are noted to the effect that there are numerous anomalies and errors in conversion to Research Note 17 types. This has been evident in areas worked to date and retyping of Brown Camp areas was effected in 1988.

"A review of typing as necessary for the target areas in Chaelundi (I.E. Pine Ck. area and Red Herring/Grass Trees/Frenchmans Ridge area). As a minimum requirement, the retyping of the Moist Hardwood/Blackbutt areas between Chandler Creek and Stockyard Creek is considered necessary. (Approx. 9 000ha). However, this area may need to be extended following further field inspection."

"Review of current typing, updating of current mapping, and delineation of proposed reserves within target areas are considered necessary at any early stage in E.I.S. compilation and early provision of assistance from the A.P.I. unit is sought please."

District Forester, D. J. Murray (1990b), wrote to the Regional Forester:

"On 25/6/60, I raised the inadequacy of existing forest typing in the Red Herring/Grass Trees area of Chaelundi S.F. ... H.O. 2115-RS of 16/7/90 advised that L.A.D. would organise programming of A.P.I.

Submissions on the 3 Cpt E.I.S. also highlight inadequacy of typing, e.g.:

NEFA: "Type maps are inaccurate and obviously an inadequate basis upon which to base an assessment."

NPWS: "The Classification and typing of forest types does not appear to accurately reflect the forests of the area."

F.A. P.Fisher has recently briefly checked part of the typing and is of the opinion that retyping would be necessary. It was also evident from the recent retyping of Brown Camp area that the existing typing contains numerous errors.

I am of the opinion that all of the target areas should be retyped to Research Note 17 standards. ...

It is recommended that urgent consideration be given to retyping the above area's of Chaelundi S.F., with a view to early commencement of the higher priority areas ..."

It is incredible that despite the clear recognition by the Forestry Commission in early 1990 that re-typing of all oldgrowth areas in Chaelundi State Forest, at least, was required for the EIS that no apparent attempt was made to do so. This is a clear example that a major failure of the current EIS was recognised well in advance by the Forestry Commission and yet they failed to rectify it in order to enable a more valid assessment to be made.

Given that forest typing is the basis of the vegetation assessment, the basis for reserve assessment, a major component of the fauna assessment and is the basis for yield assessments then the over-riding importance of accurate forest typing becomes clear.

2.2 RAINFORESTS

The Dorrigo EIS (p 8-2) recognises that the Dorrigo Plateau is recognised as one of the six major rainforest areas in NSW.

The Dorrigo EIS (p 8-4) notes:

> *"Another complicating factor is the presence of rainforest underneath tall eucalypt forest. For the purposes of this report such occurrences are discussed under eucalypt forests, although it is recognised that in ecological terms these areas could be considered to be rainforests with Eucalypt or Brush Box emergents (see Floyd 1990a)."*

Richards (1992) recommends "*that under future logging procedures, a buffer zone deemed adequate by the Forestry Commission of New South Wales to retain the microclimate and light regimes normally expected in Rainforest, be provided and maintained.*" While the basis used by Richards to make this recommendation may be flawed, the recommendation itself is valid for numerous ecological reasons and is supported, with the modification that the buffer width, and indeed the definition of rainforest, be determined on ecological principles.

The Forestry Commission's restrictive definition of rainforest is based on aerial photograph interpretation where 20% canopy cover (or in practice even less) by eucalypts or Brush Box is considered sufficient to classify a forest as non-rainforest. This, coupled with often inaccurate typing, is not an acceptable ecological basis upon which to classify rainforest. As a consequence rainforest is still being logged on a 'maximum economic utilization' basis, and surviving rainforest species killed in post-logging burns.

The Forestry Commission is allowing logging to occur up to rainforest margins (by their definition) and is regularly constructing roads through rainforest. Logging of rainforest buffer zones has been found to make the rainforest significantly more vulnerable to fire incursions (Cameron 1991, Roberts 1991). The Victorian government has adopted a policy of not allowing logging within 20 m of rainforest where it is "generally linear in shape" and 40 m of other stands. For long-term fire protection Cameron (1990) recommends an unlogged buffer zone of at least 100 m around rainforest, and Roberts (1991) recommends a buffer of "*two or three mature tree heights.*"

There is a need to define rainforests on an ecological basis (Cameron 1991) and to map such rainforests within the Dorrigo MA. Equally important is the identification of buffer zones required to protect rainforests from altered microclimates and provide protection from fire. This is particularly important in Chaelundi SF where rainforest occurs as remnant pockets (primarily in gully situations) which are particularly vulnerable to destruction or attrition by fire. Logging is often particularly severe on the ecotones of such stands as that is where preferred eucalypts achieve their best growth. It is essential that adequate protection for such stands be provided if their survival over time is to be ensured.

2.3 IMPACTS ON FLORA

The discussion in the EIS on the impacts of the proposed operations on flora is vague, facile, not apparently based on any comprehensive literature review and definitely not based on any assessment undertaken in the Dorrigo MA (e.g. EIS p 8-32). In summary the EIS (EIS pp8-31 to 8-34) admits:

(i) logging causes changes is forest structure, being most pronounced in the more productive forests with a mesic understorey;

(ii) recovery is a complex process, with understorey recovery taking place in concert with canopy reconstruction, though grassy understorey recovery is quicker;

(iii) logging causes changes in the relative abundance of individual species;

(iv) "*highly intensive logging of wet sclerophyll forests*" may result in the proliferation of "*aggressive colonising species*";

(v) soil compaction can result in changes in species composition and the relative abundance of species;

(vi) species diversity in places may be reduced by a combination of grazing and high fire frequencies; and,

(vii) nutrient losses in log form could "*in theory*" result in changes to vegetation, though burning is considered to result in greater losses.

The EIS (p8-33) states "*The available evidence does not show that one-off logging leads to a loss of individual species from a site*". The 3 compartment EIS (Forestry Commission 1990, p119) (one of the cited references) cites D. Binns as stating "*A large proportion of the woody species (90%) which occur in unlogged areas also occur in logged areas.*" - which means that 10% of species are not found in logged areas.

The EIS (p8-33) states "*There is no evidence that current management practices in the Dorrigo area*" are causing a change in the relative abundance of tree species - presumably it would be equally justifiable to say that there is no evidence that it is not causing such changes.

Research Officer, D. Binns (1990), in his comments on submissions to the 3 compartment EIS notes:

"*The reduction in abundance of vascular epiphytes is more of a possible real concern. ...There may be a small number of species* *for which wet sclerophyll forest, particularly forest types 47 and 53, are optimum habitat, but data are insufficient to be certain because epiphytes are usually inadequately recorded in vegetation surveys."*

The extensive disturbance associated with logging favours the growth of quicker-growing and hardy species in regrowth at the expense of slower-growing and sensitive species, thus changing the composition of the forest *(Van Loon 1966, Fox 1983, King and Chapman 1983, Dunning and Smith 1986, Mueck, Griffiths and Muir 1991)*. While this species change is most apparent in wetter forest types it is also evident in drier forests as well. Relogging of forests compounds changes already initiated and will "have a long-term impact on both species richness and community dynamics." *(Mueck, Griffiths and Muir 1991)*.

There are many thousands of hectares of once productive forests in north east NSW in which regeneration of eucalypts has failed. There are often significant areas, particularly in the wetter forests and at higher altitudes, where regeneration of canopy species following logging is retarded or stopped by other species, weeds, grazing or cold *(e.g. van Loon 1966, Forestry Commission 1982, King 1985, Austeco 1992)*. Van Loon *(1966)* notes that steep slopes and gullies seldom regenerate well, regardless of treatment. There has been no attempt in the EIS to assess the adequacy of regrowth in the Dorrigo MA.

A further problem exists where regrowth, particularly Sydney Blue Gum, is killed by heavy infestations of psillids, facilitated by the aggressive Bell Miners excluding other birds (which would otherwise control the psillids) from such heavily disturbed areas *(e.g Loyn 1985)*. Significant areas of northern NSW are now comprised of a sea of lantana overtopped by dead trunks. As forests infested with lantana are picked over for remaining big trees the weed spreads. There is no mention of lantana in the Dorrigo EIS though it is a problem weed in the MA.

The EIS (p 8-25) downplays the impacts of the proposed operations on rare and endangered species potentially occurring in the rainforests of the Dorrigo MA - including those overtopped by Brush Box and eucalypts - though does admit logging operations in "wet sclerophyll" forests and roading in rainforest *"may directly damage populations of rare plants"*. Presumably the 5 listed rare and endangered epiphytic species are particularly at risk.

Of the 9 other listed species the potential impacts are given as unknown for three of them though fire is considered a potential threat to at least four species. One species because of its habitat is not considered threatened by logging and two are thought to benefit from soil disturbances associated with logging.

It is evident that there has not been any attempt to adequately assess the potential impacts of the proposed operations upon rare and endangered species in the Dorrigo MA, which becomes even more apparent when it is considered that the other rare and endangered species expected possibly to occur in the MA by Gilmore are not even considered.

Without any foundation the EIS (pp 9-8, 9-9) speculates that the "*these frequently burnt areas are very likely to have been burnt frequently during Aboriginal times also*" and "*current burning regime may return the forest to a pre-European condition*". These claims are considered to be baseless as this authors opinion is that the current fire frequencies practiced in the higher forests of the MA are far in excess of those practiced in the past. There is some basis for this claim; the work of Catling (1991) in Chaelundi which indicates that more species would have become extinct by now if the current fire regime had been practiced for so long, the apparently remnant nature of most located Hastings River Mice populations in the area which appear to depend upon areas that escape frequent burning (this species is expected to have become extinct long ago if Aborigines burnt as frequently as is currently the case), and the results of the only study ever done in northern NSW by Turner (1984) which determined that the pre-European fire frequency in Blackbutt and Brush Box forests at Terania Creek was measured in terms of hundreds of years not months. Obviously there needs to be some research to determine the pre-European fire frequency in the Dorrigo MA.

Fire has been noted to affect forest flora in a variety of ways:

(i) changing species composition of some communities by favouring more fire-tolerant species at the expense of fire-sensitive species *(Floyd 1964, Gill 1975, Floyd 1976, Ashton 1981, Noble and Slatyer 1981, Forestry Commission 1982)*;

(ii) replacing the normal soil microbiological flora by an entirely different one for a period of years *(Ashton 1981)*;

(iii) killing all surface seed *(Floyd 1976)*; and,

(iv) promoting fire-weeds *(Van Loon 1966)*.

Frequent low intensity fires (prescribed burns) have been noted to:

(i) eliminate the shrub layer and allow grasses and ferns to dominate the understorey *(Gill 1975, McIlroy 1978, Catling 1991)*;

(ii) cause the reduction or elimination of obligate seed-regenerating plants if within their primary non-flowering period *(Gill 1975, Floyd 1976, Ashton 1981, Noble and Slatyer 1981, Lamb 1986)*;

(iii) increase the flammability of the forest by enhancing more inflammable species *(Floyd 1964, Gill 1975, Noble and Slatyer 1981, Hopkins 1981)*;

(iv) reduce volume and diameter increment of some eucalypts by up to 50% *(Floyd 1964)*;

(v) stop eucalypt regeneration *(Floyd 1964)*; and

(vi) favour lignotuberous eucalypts in regeneration at the expense of non-lignotuberous eucalypts *(Floyd 1964)*.

Noble and Slatyer *(1981)* note that even in fire-adapted plant communities a change in the fire regime can result in species elimination.

Frequent hot fires have been noted to cause dominance of bracken and shrubs at the expense of herbs and grasses *(Anon 1984)*. Vegetation change associated with fire has also been observed to be related to the time of year *(Gill 1974, Anon 1984, Catling 1991)*, with spring fires enhancing shrub regeneration and autumn fires enhancing herbaceous species *(Catling 1991)*.

Fire affects timber production by killing and damaging regrowth, retarding growth (through loss and scorching of crown, butt damage and possibly other factors), lowering wood quality (by fire scarring and gum veins), allowing entry of decay organisms and termites through fire scars and in some cases increasing insect pests *(Floyd 1964)*. Floyd *(1964)* notes that in a Spotted Gum forest (near Grafton) subject to annual control burns over a six year period diameter increment was 54% that of an unburnt stand, and that the percentage of total timber volume lost by fire, decay and termites in an unburnt stand of 45 year old Alpine Ash was 5.7% compared to a 37.3% loss in a similar stand burnt at 9 years of age. Post-logging burns frequently result in the loss of retained seed trees of some species (e.g. Tallowwood) *(Van Loon 1966)*.

Floyd *(1964)* notes an instance where regular burning to control lantana and wattle reduced their height and ground coverage (from 74% to 15%) but increased the number of lantana plants by 23% per hectare and wattle plants by 66%, noting that as soon as fire is excluded to obtain regeneration the weeds rapidly capture the site, and choke the small trees.

Floyd *(1964)* notes that in northern NSW the succulent kangaroo grass has been replaced due to fire (mostly instigated by graziers) by the tough and largely unpalatable bladey grass and whisky grass, concluding that "Perhaps the grazier is merely an unwitting slave to the fire over which he claims mastery."

The Dorrigo EIS does not attempt to undertake an adequate literature review the impacts of fire upon the MA's flora and it appears there has been no attempt to assess the impacts within the MA.

The EIS fails to consider or assess the impacts of grazing upon flora. Stock grazing has been noted to affect flora by:

(i) permanently changing the structure and composition of forest ground cover and understorey vegetation *(Hobbs and Hopkins 1990, Wilson 1990, Bennet 1990b, RAC 1992a)*;

(ii) removing nutrients from, and redistributing nutrients within, forests *(Landsberg, Morse and Khanna 1990, RAC 1992a)*;

(iii) assisting the invasion of introduced plants *(Smith and Waterhouse 1988, A.N.P.W.S. 1991)*; and,

(iv) eliminating regeneration of overstorey trees *(Saunders 1979, Bennet 1990a)*.

The Forestry Commission (1989b) note that there are problems with regeneration of Dorrigo White Gum in the Dorrigo White Gum FR, which may be as a result of grazing pressure.

5 ESTABLISHING AN ADEQUATE RESERVE SYSTEM

The existing and proposed reserve system in the Dorrigo MA is not based upon ecological criteria but has obviously been determined on the basis of minimal reservation and loss of timber resources. Specifically the principle concerns are:

(i) there has been insufficient surveys of the biodiversity or the distribution of rare and endangered species within the MA to enable the identification of an adequate reserve system;

(ii) the proposed reserves do not encompass the full range of floristic communities in the MA or encompass sufficient examples of rarer and more productive communities;

(iii) there has been no faunal assessments of most of the proposed reserves and despite claims that existing fauna data has been used as a basis it is evident that fauna have been virtually ignored in determining the proposed reserves and the faunal values of the proposals misrepresented;

(iv) most of the proposed reserves are unloggable or have already been logged, they include very little oldgrowth forest;

(v) the proposed reserve system is not based upon ecological principles or scientifically defensible criteria, but rather upon minimising loss of productive forest and guesswork; and,

(vi) unless the reserve system is redesigned on ecological principles and a precautionary approach adopted it is expected that a variety of additional species will be made regionally extinct.

The proposal is to classify the proposed reserves under the Forestry Commission's PMP system which gives them no legislative protection and leaves it entirely up to the whim of the Forestry Commission as to whether they change their mind and decide to log them. For reserves to have any validity they must be given legislative protection.

5.1 IDENTIFYING AREAS OF PARTICULAR FLORAL SIGNIFICANCE

Table 8.1 of the Dorrigo EIS (p 8-26) represents the presence of various forest types in conservation reserves in the Dorrigo MA, with no consideration of the area of each type conserved. In small print in the notes to the Table (p 8-27) it is stated "*Forest types which are listed on type maps of the Management Area which are not found in conservation reserves in the area (based on existing type maps are): 1, 12, 38, 48, 52, 64, 76, 85, 93, 97, 117, 123, 128, 153.*" Yet on the same page in large type it is stated "**Table 8.1** *shows the occurrence of forest types in conservation reserves in the Dorrigo area. It shows that all forest types are represented in at least one reserve.*" This claim is technically correct in that the Table only gives forest types found in reserves and thus they are indeed all represented in reserves. Though on a more sinister level this can be seen as a blatant and absurd example of a deliberate attempt to mislead people reading the EIS.

There has been no attempt in the EIS to determine if the proposed conservation reserves improve the representation of forest types in the MA. Forest types were thus not apparently a consideration in determining reserves.

As noted in Section 2 of this submission the forest type mapping of the MA is inadequate and inaccurate. To enable a proper assessment of the conservation status of forest types in the MA a revision of the forest type mapping for the whole MA is required. If this is to be done then the mapping should be based on ecological principles and not commercial considerations as it is at present.

The EIS (p 8-25) notes that 28 plant communities identified by Benson occur in the Dorrigo MA of which 10 are inadequately conserved (at least in part of their range) and one is vulnerable and not conserved. The EIS (p 8-30) notes the inappropriateness of using state wide classifications on a regional basis, which emphasises the need for more accurate classification of the plant communities occurring in the Dorrigo MA so as to enable a proper assessment of the conservation status of the MA's plant communities.

Table 8.2 groups the forest types into "plant communities" based on Benson's 1989 generalised State wide classification and includes reserves outside the Dorrigo MA which the notes and discussion indicates doesn't include any or sufficient examples of a range of "plant communities". Listed "plant communities" not reserved in the Dorrigo MA include; Booyong-Stinging Tree-Fig, Black Booyong, Beech-Possumwood and Beech-Kanuka. Many other "plant communities" are considered to be inadequately represented within Flora Reserves in the MA (e.g. EIS pp 8-29 and 8-30).

While the proposed reserves include additional examples of some of Benson's "plant communities" there is no assessment of the total areas proposed for reservation or how this improves their conservation status.

The protection of rare and endangered plant species does not appear to have been a major consideration in determining reserves either. Mention (EIS pp 8-80 to 8-82) is made of four species of such plants being found in the proposed reserves (though there is no indication as to wether one individual or populations were found) and apparently one area has "suitable habitat" for another of these species (though there is no indication as to wether it actually occurs there).

The assessment of the conservation status of plant communities resulting from the addition of the proposed reserves to the existing reserves is based upon "broad forest types" which don't even match the "plant communities" described in the flora section of the EIS (pp 8-4 to 8-18). Presumably these "broad forest types" are groupings of the Forestry Commission's digitised forest types (and thus have an erroneous basis). While the broad forest type groupings are separated to some extent for the existing and proposed reserves they are further aggregated into 5 categories in consideration of status in the Dorrigo MA.

5.2 IDENTIFYING AREAS OF PARTICULAR FAUNAL SIGNIFICANCE

In relation to the 5 vegetation categories adopted the EIS (pp 8-75, 8-76) claims "*These broad categories provide sufficient variety in structure and floral composition to be able to supply adequate habitat/biotype requirements for all fauna species. ... in general, conservation of representative broad vegetation community groupings will provide sufficient diversity of habitat for the fauna assemblages in the Dorrigo MA.*"

This claim is either yet another deliberate attempt to mislead the public or another reflection on the naivety and lack of ecological understanding by the consultant and/or Forestry Commission.

It is important to recognise that species are not uniformly distributed throughout forests, but rather tend to occur in patches of high density (Recher, Rohan-Jones and Smith 1980, Binns 1981, Mackowski 1983, Southwell 1987, Neave and Norton 1990, Recher and Lim 1990, Thompson, Fleming and Heap 1990, Winter 1991, Kavanagh 1984, 1991, Recher *et al.* 1991, Catling 1991, Brooks *et. al.* 1992). These patches have been correlated with richer soils (Recher, Rohan-Jones and Smith 1980, Binns 1981, Mackowski 1983, Southwell 1987, Neave and Norton 1990, Recher and Lim 1990, Recher *et al.* 1991), nutrients in foliage (Kavanagh 1984, Braithwaite *et. al.* 1989), abundant water (Recher and Lim 1990, Catling 1991), moderate topography (Kavanagh 1984, Southwell 1987, Neave and Norton 1990), floristic diversity (Kavanagh 1984, 1991, Recher 1991), aspect (Lunney, Cullis and Eby 1978), long time since severe fire (Kavanagh 1984), forest maturity (Kavanagh 1984, Braithwaite *et. al.* 1989), dense understorey (Catling 1991), and areas with historically high rates of geological change (Brooks *et. al.* 1992). Altitude and temperature become important for birds in winter (Braithwaite *et. al.* 1989).

The only way of identifying areas of particular faunal significance is to undertake sufficient systematic fauna surveys at sites representative of the principle environmental variables of significance to fauna and the range of disturbance histories so as to enable predictive analysis of species' distributions. This also requires the mapping of those variables across the whole area. Further surveys are then required to validate and modify predictions. Such steps are mandatory to enable the identification of "key areas" of faunal significance.

Denny's attempts to undertake this task in the EIS (pp 8-69 to 8-71) are amateurish and invalid. He uses historical data which has not been collected in the mandatory systematic manner (and thus is inheretently biased by the observation effort and methodology utilised at the various locations) and that is often out of date and thus doesn't necessarily represent the current distribution of Koalas. His ranking of the Koala's preferred habitat is simplistic, based on guesswork and scientifically invalid. The broad vegetation groups he utilises have been found to be erroneous and no account has been made of the variation within these broad groups which species respond to. The general concept of predictive modelling is correct but its application by Denny displays his ignorance of the correct process.

As the EIS (p8-71) claims that there is a range of digitised data (forest types, altitude, geology, soils, land tenure etc.) that can be accessed then why wasn't it used?

As noted below there has been misrepresentation of the location of "key areas" as identifiable from the existing data and there has been no valid attempt to use existing fauna data to identify areas of particular conservation significance as a basis for determining a reserve system for the MA.

5.3 ASSESSMENT OF EXISTING AND PROPOSED RESERVES IN DORRIGO MA.

The following assessment is primarily based on information provided in Dorrigo EIS and FIS. This clearly shows that while the existing conservation reserves in the Dorrigo MA do represent examples of some of the area's floristic communities they do little to preserve the array of endangered species within the MA.

EXISTING LEGISLATED RESERVES

There is a relatively minor discrepancy of 27ha (3.4%) between the areas of flora reserves given in the EIS and by the Forestry Commission (1989b). If this type of error extends throughout the rest of the data it could be quite significant.

Moses Rock FR. 61ha.
EIS Table 8.14 gives 54ha eucalypts, 47ha of which are BBT. Figure 3.4 shows it as being logged. The FIS gives localities for Koala, Glossy Black Cockatoo. Forestry Commission (1989b) describe it as "undulating to very steep" and "Covers the steep drop" from the plateau to the river.

Teak Tree FR 20 ha.
EIS Table 8.14 gives 12ha eucalypts, 6ha of which are moist hardwoods or BBT. Figure 3.4 shows it as being logged. The FIS gives localities for Yellow-bellied Glider, Sooty Owl. Forestry Commission (1989b) describe it as "Flat ridge top, falling away E&W".

Edwards Plain FR 35ha (36ha in EIS).
EIS Table 8.14 gives 21ha eucalypts, 15ha of which are moist hardwoods or BBT. Figure 3.4 shows it as being logged. The FIS gives localities for Yellow-bellied Glider, Hastings River Mouse. Forestry Commission (1989b) describes it as "slope of ridge".

Black Bull FR 47ha
EIS Table 8.14 gives 46ha eucalypts, 32ha of which are moist hardwoods or BBT. Figure 3.4 shows it as being logged. The FIS gives

localities for no species. Forestry Commission (1989b) describe it as "gently sloping gully".

Red Cedar FR 46ha (53ha in EIS).
EIS Table 8.14 gives 38ha eucalypts, 38ha of which are moist hardwoods. Figure 3.4 shows it as being logged. The FIS gives localities for Koala, Tiger Quoll. Forestry Commission (1989b) describe it as "Broad ridge top, dropping steeply to south", with "some previous logging".

Mobong Creek FR 14ha.
EIS Table 8.14 gives 5ha eucalypts, 4ha of which are moist hardwoods and 1ha BBT (this includes 1 ha of Flooded Gum). Figure 3.4 shows it as being logged. The FIS gives localities for no species. Forestry Commission (1989b) describes it as "a small gully system".

Dorrigo White Gum FR 21ha (22ha in EIS).
EIS Table 8.14 gives 20ha eucalypts, 7ha of which are moist hardwoods. Figure 3.4 shows it as being logged. The FIS gives localities for no species. Forestry Commission (1989b) describe it as "mostly steep", note there is "little regeneration evident" and state "Monitoring of the effects of cattle grazing in the Reserve is to be undertaken." (there is no mention of this in the EIS).

Norman W Jolly Memorial Grove FR 52ha (53ha in EIS).
EIS Table 8.14 gives 29ha eucalypts, 29ha of which are moist hardwoods. Figure 3.4 shows it as being logged. The FIS gives localities for no species. Forestry Commission (1989b) describe it as "gently sloping".

Blicks River FR 285ha (298ha in EIS).
EIS Table 8.14 gives 271ha eucalypts, 9ha of which are moist hardwoods. Figure 3.4 shows it as being logged. The FIS gives localities for Hastings River Mouse, Parma Wallaby. Red-tailed Cockatoo and Glossy Black Cockatoo have been recorded (Tweedie 1989) though are not shown on FIS map. Forestry Commission (1989b) describe it as "Gently undulating, with steep drops in east and southeast; some cliffs on drop into Hyland Creek.

Nicholii FR 40ha
EIS Table 8.14 gives 40ha poorer eucalypts. Figure 3.4 shows it as being logged. The FIS gives localities for no species. Forestry Commission (1989b) describe it as "gently undulating".

Middle Creek FR 157ha (161ha in EIS).
EIS Table 8.14 gives 96ha eucalypts, 10ha of which are moist hardwoods. Figure 3.4 shows it as being unlogged. The FIS gives localities for no species. Forestry Commission (1989b) describe it as "Moderate to steep sided slope of Middle Creek basin".

Blackbutt Reserve (110ha in EIS).
EIS Table 8.14 gives 95ha eucalypts, 82ha of which are BBT. Figure 3.4 shows it as being unlogged. The FIS gives localities for Glossy Black Cockatoo, Yellow-bellied Glider.

Tallowwood Place (66ha in EIS).
EIS Table 8.14 gives 54ha eucalypts, 6ha of which are moist hardwoods. Figure 3.4 shows it as being unlogged. The FIS gives localities for no species.

Mt. Hyland NR (1 636ha in EIS).
EIS Table 8.14 gives 518ha eucalypts, 9ha of which are moist hardwoods. Figure 3.4 shows it as being logged? The FIS gives localities for Great Pipistrelle, Glossy Black Cockatoo, Sooty Owl.

Part Guy Fawkes NP (18 300ha in EIS).
EIS Table 8.14 gives 17 471ha eucalypts, 605ha of which are moist hardwoods or 163a. Figure 3.4 shows it as being logged, which certainly is not the case for the majority of the area. The FIS gives X localities for Yellow-bellied Cockatoo, Sooty Owl.
Glider

Part Dorrigo NP (3 950ha in EIS).
EIS Table 8.14 gives 529ha eucalypts, all of which are moist hardwoods or BBT. Figure 3.4 shows it as being logged. The FIS gives localities for no species.

Part New England NP
Not given in EIS. Figure 3.4 shows it as being logged.

The above information is considered to be unreliable in that the logging history map and vegetation information is inaccurate, and because of the lack of fauna surveys in most areas, unreliable mapping of occurrences and the reliance upon historical information which may no longer be applicable. Though based on this information (which is what the EIS is based upon) it is apparent that the existing conservation reserves are inadequate to maintain faunal values into our uncertain future.

PROPOSED (and existing) RESERVES

The so-called proposed reserves encompass very little oldgrowth forest additional to what was already reserved or steep and unloggable. Browns Camp Creek, Chaelundi Mountain, Blicks River Flora Reserve Extension, Bieldsdown SF (part) and the wildlife corridors in Hyland SF and along the Nymboida River have apparently either been logged, are unloggable or were already reserved from logging. Karore Creek may contain a little bit of oldgrowth eucalypt forest. The only large area of additional oldgrowth eucalypt forest proposed for reservation is in the head of Galaxis Creek, the area in the head of Pillar Creek is a long-standing proposal for addition to the Guy Fawkes River National Park. It is evident that the proposed conservation reserves can only claim to be reserving an additional 300ha or less of oldgrowth eucalypt forest above what was already effectively reserved.

Browns Camp Creek (564ha)

Incorporates steep unloggable country left in mostly already heavily logged forest and 81ha of unlogged Blackbutt forest in compartment 169 which was already reserved from logging. 162ha is low site quality 163c&b and 247ha Scribbly Gum. There will be no additional oldgrowth forest reserved from logging by this proposal.

The EIS (pp8-86 to 87) claims that this is a "key area" because of its "*high arboreal mammal densities and presence of endangered species*". Though there has apparently only ever been one fauna survey in the area which consisted of a 500 metre spotlighting transect and owl playback along Red Herring Road (which was surveyed on two occasions) which found 4-5 Greater Gliders and Southern Boobook Owls (Forestry Commission 1991a). The derived density of Greater Gliders was 1.9-2.7 per hectare. There is apparently no basis what-so-ever to the EIS's claims.

Chaelundi Mountain (85ha)

Already logged or reserved from logging as rainforest and for Aboriginal significance. 6ha is rainforest and 79ha low site quality 163c&b. Fig. 3.4 shows the area as already being logged. There will be no additional oldgrowth forest reserved from logging by this proposal. No apparent fauna surveys have been conducted in this area.

Blicks River F.R. Extension (115ha)

Cited (EIS p8-81) as reserving "an example of Tableland basalt communities, including Antarctic Beech" yet Table 8.17 shows no rainforest as being included and that the majority of the area is low site quality 163c&b (101ha) or rock (10ha). Fig. 3.4 shows the area as already being logged. There will apparently be no oldgrowth forest reserved from logging by this proposal. No apparent fauna surveys have been conducted in this area.

Pillar Creek (302ha) and Broadmeadows Trig (285ha)

The EIS (p8-86) claims that this would include a "key area" for fauna because of "*relatively high arboreal mammal densities and the presence of at least one endangered species (Golden-tipped Bat)*" and maintains "*Preliminary fauna surveys of this area tend to show that the productivity of native fauna is as high or even higher than that found in other compartments in Chaelundi SF e.g. 198, 180 and 200.*" The Forestry Commission (1991a) apparently only surveyed one 500 metre length of Liberation Trail (on two occasions) and recorded 9-15 Greater Gliders (giving derived densities of 4.5-7.2 per hectare), heard a Sooty Owl on the opposite side of the trail, and heard Yellow-bellied Gliders and a Powerful Owl somewhere to the west of the trail (possibly within proposed reserve). Earthwatch/Forestry Commission surveyed for arboreal mammals along the Liberation Trail, with their transects 1 and 3 corresponding to Broadmeadows Trig and Pillar Creek respectively, they recorded 9 (6 per km and 1.2 per ha) and 24 (12 per km and 5.4 per ha) Greater Gliders respectively.

There appears little doubt that this area has high conservation values and is deserving of reservation though there appears to be no evidence to support the contention that the productivity of native fauna is as high or higher than the three compartments.

The FIS gives Tiger Quoll as being found in this area

Pillar Creek

The Forestry Commission (1985 p47) note that an inter-departmental committee investigated the Guy Fawkes Wilderness as identified by Helman;

> *"The recommendations of the committee were approved and in respect of Chaelundi State Forest, the result was that Commission operations were to continue except on the Pillar Creek area which is of interest to National Parks and Wildlife Service as a potential addition to Guy Fawkes River National Park. On this area, the Commission is required to consult with the Service prior to undertaking or authorising any operations not compatible with 'wilderness values' until such time as final land use is agreed upon."*

There can thus be no claim that this area was available for logging as it is apparent that the NPWS would have pressed its claim on the area. The Forestry Commission (1988) excluded this area from an Environmental Review undertaken for logging the rest of this western section of Chaelundi State Forest, further indicating its unavailability for logging.

Table 8.17 shows that this area contains 27ha of Tallowwood and 125ha of 163a.

Broadmeadows Trig

Table 8.17 shows that this contains 150ha of Tallowwood and 78ha of 163a. This is the only large additional area of high site quality oldgrowth proposed to be reserved from logging in the EIS.

Karore Creek (213ha)

Table 8.17 shows 154ha of rainforest being included and 56ha of moist hardwoods. Fig. 3.4 shows a large proportion of the area as already being logged. Little, if any, oldgrowth eucalypt forest will be reserved from logging by this proposal. No apparent fauna surveys have been conducted in this area.

Bieldsdown (31ha)

Table 8.17 shows 21ha rainforest and 10ha Brush Box. Fig. 8.4 shows the reserve as encompassing some hundreds of hectares, a far cry from 31ha. Fig. 3.4 shows the area as already being logged. There will be no additional oldgrowth forest reserved from logging by this proposal. No apparent fauna surveys have been conducted in this area.

Briggsvale Blackbutt (24ha)

Table 8.17 shows this area as encompassing 9ha of rainforest, 9ha of Blackbutt and 6ha of Brush Box. The forest has apparently already been logged, no oldgrowth eucalypt forest will be reserved from logging by this proposal. No apparent fauna surveys have been conducted in this area.

Wildlife Corridors

Nymboida River (585ha): already conserved as PMP 1.1.6., has a history of logging with "patches of unlogged forest". The unlogged patches are mostly on steep slopes and of poor quality. The FIS gives localities of a Parma Wallaby in this "corridor". No apparent fauna surveys have been conducted in this area.

Part Hyland and Marengo S.F.s (629ha): already logged. This corridor is claimed to be a "key area" (EIS 8-86) with "relatively high" arboreal mammal densities. The only arboreal mammal survey referred to in the EIS which sampled at least part of this corridor (Watts 1989k) found relatively very few arboreal mammals within the corridor, though recorded very high levels to the west of the corridor (see arboreal mammal location map in Watts 1989k), which have apparently been greatly reduced by salvage logging since then. The Hastings River Mouse has been located within and to the west of Blicks River Flora Reserve but not within the proposed corridor. It would seem that the "key area", in Hyland SF at least, is actually to the west of the proposed corridor. The Tiger Quoll, Red-legged Pademelon and Rufous Bettong have been recorded in or near the part within Marengo SF.

Some wildlife corridors will be expanded to extend from 40m to 50m from watercourses, though there is no indication that they will be reserved from logging. There will be minimal, if any, additional oldgrowth forest reserved from logging by these proposals.

5.4 ESTABLISHING AN ADEQUATE RESERVE SYSTEM

The International Union for Conservation of Nature and Natural Resources has recommended that minimum levels of 10% representation of the existing areas of ecosystems in reserves be achieved by the year 2000 (RAC 1992a). This is an arbitrary figure which does not reflect the ecosystems conservation status, threatening processes or species requirements (eg RAC 1992a, Standing Committee on Environment, Recreation and the Arts 1993). As expected the Dorrigo EIS quotes RAC's citing of IUCN's recommendation but fails to mention RAC's reservations about such an arbitrary figure.

The Dorrigo EIS (p8-79) ended up chosing to "*achieve reservation within the whole Management Area (in State Forests and also National Parks and Nature Reserves) of about 10% of each of the five major forest type groups.*" Then goes on to note that an initial assessment recognised that "Moist Hardwoods" weren't adequately conserved. With the existing and proposed reserves Table 8.18 maintains a total of

7.4% of "moist hardwoods" on State Forests are conserved, which rises to a total of 9.1% when National Parks are included. As the justification for the adopted figure of 10% is apparently IUCN's recommendation as cited by RAC the EIS is misleading in not including forests on private lands (which would significantly reduce the overall conservation status in percentage terms of all plant communities in the MA) and not considering the full extent of each "major ecosystem" (i.e. throughout their full range). It is clear that the proposed reserves don't even meet IUCN's criteria.

Reserves should encompass adequate representative samples of all forest types and adequate areas to ensure the conservation of viable populations of all fauna sensitive to disturbance. While some arbitrary percentage may meet the requirement for representativeness it won't necessarily meet the need for maintaining viable populations.

The diversity of native forest dependent fauna has been found to be related to the size of forest patches, with the least common species mostly only found in the larger patches (Bennett 1990b). Brooks *et. al.* (1992) caution that "Large reserves comprising small chunks of many different communities may be as unsuccessful in preserving biodiversity as many small reserves."

The major determinant of reserve size should be the necessity of including viable populations of species sensitive to disturbances associated with human uses.

Where possible reserves should be as large as feasible (Tyndale-Biscoe and Calaby 1975, Soule and Simberloff 1986, Davey 1989, Bennett 1990a, 1990b, Monteith and Davies 1991, Reed 1991, RAC 1992a), have a minimum edge to area ratio (Bennett 1990a, Gilmore 1990, RAC 1992a), and contain complete watersheds (Soule and Simberloff 1986). Reed (1991) cites estimates that any isolated reserve in Australia of less than 500 000 ha will require active, interventionist management if it is to maintain its full complement of species in the long term.

The emphasis should be upon reserving major source areas (e.g. areas of high endemicism and/or with high population densities of target species), refuge areas (areas species are already restricted to, become periodically restricted to, or are predicted to become restricted to as the result of global warming or other factors) and areas with a high diversity of target species. Brooks *et. al.* (1992) consider areas of concentration of endemic (resident) species are important because they have been the focus of biodiversity production in the past, and thus may be 'hot spots' of evolutionary potential for the future.

Faunal diversity and greater population densities of a variety of species have been found to be correlated with more fertile soils and moister sites (Recher, Rohan-Jones and Smith 1980, Binns 1981, Mackowski 1983, Southwell 1987, Neave and Norton 1990, Recher *et al.* 1991), and moderate slopes (Kavanagh 1984, Southwell 1987, Neave and Norton 1990).

The requirements of migratory and wide ranging species need to be considered in reserve design. It is essential that reserves are well linked and incorporate significant altitudinal and latitudinal variation to account for full biodiversity (particularly invertebrates - Monteith and Davies 1991), and the predicted future requirements of fauna resultant from global warming (Busby 1988, Arnold 1988, Main 1988, Page 1989, Norton and Lindemayer 1990)

There are a number of groups of species which require particular consideration in reserve design, including:

(i) large predators (e.g. quolls, owls, hawks) which have large home ranges and require adequate prey (Soule and Simberloff 1986, Bennett 1990, Reed 1991, Schonewald-Cox, Azari and Blume 1991)

(ii) hollow-dependent species (most arboreal marsupials and bats, some carnivorous marsupials, owls, cockatoos, parrots, treecreepers, some lizards and frogs) which have requirements for hollows for roosting, denning and/or nesting;

(iii) nectivorous species (e.g. honeyeaters, parrots, flying foxes, some arboreal marsupials, and a large variety of invertebrates) which require stands of a range of mature plant species in a variety of forest types (e.g. Eby 1991), are wide-ranging and migratory species (e.g. honeyeaters, parrots, flying foxes), and/or provide essential genetic links between stands of plant species (Eby 1991, Reed 1991);

(iv) dense-understorey dependent species (e.g. many medium sized ground mammals, some ground birds, reptiles and frogs) which rely upon the resources of the understorey and the protection from predators it provides.

Species are not uniformly distributed throughout forests, but rather tend to occur in patches of high density (Recher, Rohan-Jones and Smith 1980, Binns 1981, Mackowski 1983, Southwell 1987, Neave and Norton 1990, Recher and Lim 1990, Thompson, Fleming and Heap 1990, Winter 1991, Kavanagh 1984, 1991, Recher *et al.* 1991, Catling 1991, Brooks *et. al.* 1992). These patches have been correlated with richer soils (Recher, Rohan-Jones and Smith 1980, Binns 1981, Mackowski 1983, Southwell 1987, Neave and Norton 1990, Recher and Lim 1990, Recher *et al.* 1991), nutrients in foliage (Kavanagh 1984, Braithwaite *et. al.* 1989), abundant water (Recher and Lim 1990, Catling 1991), moderate topography (Kavanagh 1984, Southwell 1987, Neave and Norton 1990), floristic diversity (Kavanagh 1984, 1991, Recher 1991), aspect (Lunney, Cullis and Eby 1978), long time since severe fire (Kavanagh 1984), forest maturity (Kavanagh 1984, Braithwaite *et. al.* 1989), dense understorey (Catling 1991), and areas with historically high rates of geological change (Brooks *et. al.* 1992). Altitude and temperature become important for birds in winter (Braithwaite *et. al.* 1989).

A conservative approach to the conservation of forest vertebrates requires that for all species sensitive to forestry activities sufficient habitat is retained free of adverse disturbance to ensure their survival into our uncertain future. To maximise species chances to adapt to environmental changes it is essential to preserve genetic diversity within species by maintaining populations throughout a species range.

Given the abysmal ignorance of most species' demography and habitat requirements, it is necessary to select a number of key species, or groups of species, that represent the entire range of organisms to use in determining reservations to conserve viable populations (Possingham 1990, 1991, Scotts 1991, Brooks *et. al.* 1992), monitoring impacts of forestry practices and other disturbances (Norton and Lindemayer 1990, Milledge, Palmer and Nelson 1991, Richards 1991, Goldingay and Kavanagh 1991, Kavanagh 1991, Parsons 1991), and modeling impacts of global warming (Busby 1988).

The 'management indicator species' approach has been criticised on the basis that it is unlikely that one species in a group could have habitat requirements so alike to another species that it could be used as an indicator of the others in its group, it has thus been suggested that monitoring should be of whole groups of species that respond to habitat disturbance in a similar manner (Wilcove 1989).

A variety of species have been proposed as indicator species; Tiger Quoll (Scotts 1991, Possingham 1991), Greater Glider (Kavanagh 1991), Yellow-bellied Glider (Milledge, Palmer and Nelson 1991, Goldingay and Kavanagh 1991, Kavanagh 1991, Scotts 1991), Sooty Owl (Milledge, Palmer and Nelson 1991, Kavanagh 1991, Scotts 1991), Powerful Owl (Possingham 1991), bats (Richards 1991), and fruit flies (Parsons 1991). It is essential to select indicator species from each stratum and not concentrate solely on hollow-dependent species (Kavanagh 1991).

A primary research requirement at this time is thus to identify key species and groups of species, their demography and habitat requirements. Where information is lacking on aspects of a specific species it may be necessary to use ecological characters from well studied members of the same phylogenic group to predict the probable characteristics of the poorly studied species (Brooks *et. al.* 1992). While this approach is unsatisfactory it is better than ignoring species because of lack of information while threatening processes continue.

One of the principle objectives in the establishment of an adequate reserve system should be to ensure the reservation of sufficient habitat to preserve minimum viable populations of all species significantly affected by human activities.

An effective population size needs to maintain genetic variability in perpetuity and provide the genetic means for continued ability to adapt to environmental changes and pressures (Tyndale-Biscoe and Calaby 1975, Soule and Simberloff 1986, Mackowski 1986, Dunning and Smith 1986, Davey 1989, Hopper and Coates 1990, Davey and Norton

1990, Possingham 1990, 1991, Reed 1991, Archer, Hand and Godhelp 1991, Goldingay and Kavanagh 1991, Kavanagh 1991, RAC 1992a). Natural population fluctuations, catastrophes such as fire, drought and disease, along with global warming need to be accounted for in assessing the minimum population of a species needed for it to survive into our uncertain future (e.g. Tyndale-Biscoe and Calaby 1975, Soule and Simberloff 1986, Davey 1989, Possingham 1990, 1991).

Assessments of minimum viable population sizes span a range from several hundred to tens of thousands, depending on the species (Tyndale-Biscoe and Calaby 1975, Davey 1990, Possingham 1990). The context within which a specific population occurs will also affect its viability and thus needs to be accounted for (Goldingay and Kavanagh 1991). On one hand a number of small populations are more likely to become extinct than a single large population, though on the other hand a species restricted to a single locality can be extinguished by a single catastrophe (Possingham 1991).

Possingham and Noble *(1992)* cite research on the maintenance of viable populations of the American Northern Spotted Owl which found that numbers of clusters of 20 or more pairs (10 000 - 30 000 ha) separated by a maximum of 12 miles was the appropriate conservation strategy. Possingham and Noble's *(1992)* model indicated that for Powerful Owls a number of areas of high quality habitat over 20 000 ha are able to maintain populations over time and a relatively isolated population of Greater Gliders in high quality habitat must be capable of supporting at least 50 females to make a significant contribution to the conservation of the species. Possingham and Noble *(1992)* concluded that in south-east NSW "If all state forests are intensively harvested, and in the absence of immigration into the region, the probability of the regional extinction of the powerful owl after: 200 years was 28%, 500 years was 65%, 1 000 years was 94%."

Scotts (1991) cautions against adopting the reservation of *minimum* areas for *minimum* viable populations of old-growth dependent species, because "if the assessments are wrong the opportunity to safeguard this ecosystem will be lost."

Hopper and Coates (1990) note that there can be significant genetic variation between populations of some plant and animal species and recommend "Selection of priority populations for genetic conservation can be based on the level of genetic differentiation between populations, the presence of rare but locally common alleles ... and the level of genetic diversity within each population."

A precautionary approach to reserving suitable areas for minimum viable populations of old-growth dependent species necessitates erring on the side of caution in determining boundaries and ensuring that a number of populations of each species are protected throughout their ranges.

A primary research requirement at this time is thus to identify key species and groups of species representative of the range of forest-dependent species and then to focus research into their distribution and ecological requirements. Where information is lacking on aspects of a specific species it may be necessary to use ecological characters from well studied members of the same phylogenic group to predict the probable characteristics of the poorly studied species *(Brooks et. al. 1992)*.

When used in a computerised Geographical Information System distributional and density data for a species can be analysed in conjunction with climatic, terrain, soil, floristic and disturbance data to develop predictive models of a species distribution. This also enables identification of some habitat requirements which can be refined and enhanced by specific field research. The information generated by this process can then be used as the basis for modelling the sizes of populations of indicator species and areas required to ensure their survival over time.

As noted by Norton and Mitchell *(1993)* "wildlife modelling and population viability analysis are closely linked and, when used systematically, provide an explicit and quantative basis for managing taxa in both space and time."

It is well recognised that the Guy Fawkes River National Park only contains small fragments of the productive forests well represented in Chaelundi SF. Its mostly poorer forests/woodlands do not contain sufficient habitat to maintain viable populations of fauna reliant upon high quality oldgrowth forest on moderate topography.

The Dorrigo EIS notes that:

> *"The Guy Fawkes River area, with its relatively low altitudes and dry climate supports predominantly dry sclerophyll types and patches of dry rainforest."* (p 8-2)
>
> *"The higher altitude, wet forest communities which occur in the western parts of Chaelundi State Forest are not well represented in Guy Fawkes River National Park, which has a drier climate and is generally at a lower altitude. Landsat imagery of the region demonstrates a distinct change in land systems, from areas areas east of Liberation Trail in the State Forest to those west of the Trail in the National Park."* (p 8-31)

The Forestry Commission (EIS Appendix L) in relation to the proposed Guy Fawkes Wilderness note:

> *"The State Forests, on both sides of the proposal, occupy a distinctly different landform to the rugged gorge country which forms the bulk of the study area, with little affinity to it. Their inclusion in the recommended wilderness area appears to have been based on their "conservation" value when is not essential in the central theme of the study."*

It is thus evident that the flora and fauna values of Chaelundi State Forest are not represented in the Guy Fawkes River National Park except in the small fragments along the boundary of the State Forest.

The reserve system proposed in the Dorrigo EIS is not based on any sound ecological principles and if adopted their fragmented nature, relatively small sizes, inclusion of heavily disturbed areas and other inadequacies will doom any species which have large home ranges and are sensitive to disturbances associated with the proposed operations, to regional extinction.

Before any decision can be made to sacrifice the significant populations of endangered species in the Dorrigo MA for short term economic benefit primarily for Boral it is essential that a regional review of the distribution of these endangered species be undertaken and the long term viability of populations effectively isolated by dispersal barriers determined. An adequate system of retained habitat can only then be implemented. In the absence of any such assessment a precautionary approach demands that no further perturbations to the habitats of endangered species sensitive to human induced disturbances occur.

WILDLIFE CORRIDORS

The Dorrigo EIS proposes the creation of a number of 100m wide supposed fauna corridors in the Dorrigo MA "*where it is important for fauna to move between conserved areas*" (EIS p8-73). It is reassuring to know that these have been so well designed that they "*would ensure movement of fauna between areas considered as having wildlife habitat of conservation significance*". The EIS (p 8-82) based the design upon "*utilising a network of 'inaccessible' forest e.g. steep slopes, watercourses and rainforest.*" These corridors are basically expanded filter strips which have already been logged or are presumably proposed to be logged "at a reduced intensity" as is currently the case. Of course the EIS (p 8-82) claims "*It is also important to recognise that the process of selective logging does not remove the value of the forests as habitat for fauna. Logged forests are known to support as many species as unlogged forests and, in some cases, possibly more species. Provided suitable management prescriptions for fauna are in operation within logged forests then movement by fauna between Conservation Reserves would be a logical expectation.*"

Wider corridors are proposed for parts of Wild Cattle Creek and Hyland State Forests though these incorporate either logged or unloggable forests and are thus similarly as farcical.

The Glen Innes EIS and FIS only definatively proposes the Glen Nevis escarpment "*buffer zone for fauna conservation*" as a wildlife corridor. This is an absurd proposal to leave a 100-200 m wide strip of poor quality of forest around the rim of the plateau. There is no scientific credibility to such a proposal as there has been no consideration as to what fauna would use it and the width that they would require. Other proposals for fauna corridors 100m wide, which will apparently be subject to logging, are to be left to the discretion of the Forestry Commission.

In the Glen Innes MA riparian habitats are currently protected by 40m filter strips in all first order streams with catchments of greater than 5-20 ha (average 15 ha), those these are apparently subject to 'modified' logging. Austeco (1992, p4) notes "*This protection is thought to be adequate for erosion and siltation control and the protection of aquatic ecosystems, but may be insufficient to protect the integrity of riparian ecosystems in special circumstances where boundaries extend more than 20m from water courses.*"

The Mt. Royal EIS (p8-24) states "*Filter strips ... would be specified as wildlife corridors. This means that strips of largely undisturbed forest at least 40 m wide, protecting both water quality and gully dwelling wildlife, should be conserved.*" Filter strips are only applied on streams with catchments of 100 ha or more and are allowed to be logged provided they are not entered with machinery - it is misleading to call this "largely undisturbed".

The Mt. Royal EIS (p8-25) states "*Along the major creeks ... the existing 100m wildlife corridors would be extended to encompass the adjacent rainforest and an additional 20 m strip beyond these rainforest areas ... Logging machinery would not be permitted except at nominated points in these corridors.*" It is thus assumed that these wildlife corridors will be subject to logging also. Given that the vast majority of the supposed wildlife corridors will be rainforest and broken at frequent intervals by rainforest on side creeks it is evident that they will only be suitable as movement corridors for rainforest species.

The Wingham EIS (p232-3) claims that because regrowth forests provide "*effective habitat for all species*" and the impacts from logging "*is not significant in most cases*" then "*It is therefore not generally considered necessary to implement special management provisions in these areas located between the proposed Conservation Reserves.*" The only proposed wildlife corridor is a strip of ridge top dry forest that has already been "*extensively logged*" and will in future be subject to modified burning, grazing and logging.

These approaches to designing what are meant to be movement corridors for fauna vulnerable to logging operations is farcical and ecologically indefensible. These so called "corridors" are not apparently based on any surveys or ecological principles relating to corridor design but rather seem to be non-existant as there is no apparent intention to change management practices in any way. They are the corridors you have when you are not having corridors. Proper planning utilising a GIS and based on species requirements and ecological principals is required, not minimally modified erosion mitigation prescriptions.

Corridors of forest need to be retained or established to provide multiple pathways for the dispersal of fauna throughout forests to allow: (i) genetic exchange between isolated populations (Soule and Simberloff 1986,Dunning and Smith 1986, Bennett 1990a, 1990b, Saunders 1990, Winter 1991, Hopper and Coates 1990, Goldingay and Kavanagh 1991), (ii) dispersal to required resources (Saunders 1990, Moon 1990, Goldingay and Kavanagh 1991), (iii) preservation of populations of some species in otherwise unsuitable habitat (Kavanagh 1985a, 1985b, Dunning and Smith 1986, Kavanagh and Webb 1989, Bennett

1990), (iv) for required resources for species utilizing adjacent habitats (Bennett 1990, Richards 1991), and (v) for migration of species in response to predicted global warming (Busby 1988, Arnold 1988, Main 1988, Page 1989).

Dunning and Smith (1986) state "*Results of this study suggest that two corridor systems are necessary for the conservation of arboreal mammals. One continuous gully system should incorporate the unlogged rainforest gullies throughout the study region. This corridor system would preserve rainforest inhabiting species, principally [Rufous Ringtail Possum, Mountain Brushtail Possum and Fawn-footed Melomys]. A second interconnected ridgetop corridor system of unlogged or lightly logged moist hardwood forest will be necessary for conservation of mature hardwood dependent species such as [Greater Glider]. [Greater Glider] cannot be conserved within a rainforest gully corridor system ... The ridgetop corridors may only need to be relatively narrow (approximately 100 m) if they are sited adjacent to or continuous with ...low intensity logging and tree hollow retention zones*".

Dunning and Smith (1986) consider "*The unlogged ridgetop moist hardwood corridor system should have side branches that link up with the rainforest corridors to provide an avenue for movement of species that utilise both habitat types, and to increase the area of contact between logged forest and unlogged source areas for species that can recolonise after logging.*", and "*The proposed corridor system may possibly prevent the isolation of [Greater Glider] populations and allow genetic exchange through juvenile dispersal.*"

It is revealing that Dunning and Smith's recommendation for ridge corridor systems is ignored in the Glen Innes EIS and FIS.

Claridge *et al.* (1991) note "*Currently the New South Wales Forestry Commission does not normally include a contiguous ridge or slope system of unlogged vegetation in logging areas. Instead, in the current logging system, extensive networks of wildlife corridors, with a minimum width of 100 m, are left linking unlogged forest habitats ... These are further increased by streamside filter strips. Unfortunately there are no data available to suggest that these buffer strips will be sufficient for bandicoots to survive in while adjacent logged forest regenerates. Until more data are available it is probably best to be conservative and assume that unlogged habitat from ridge to gully is essential for bandicoots.*"

Wildlife corridors should be as wide as possible and where possible established in natural forest which has preferably not been subject to severe perturbation. Where not existent corridors should be established by plantings (e.g. Shea 1992).

Corridor planning should be undertaken with the assistance of computerised Geographic Information Systems (Shea 1992) and field surveys to identify those areas actually utilized for movement by animals. Planning should be based on a whole catchment or sub-catchment basis (Shea 1992).

In general the Forestry Commission relies upon modified streamside retention strips (implemented for erosion mitigation purposes) for wildlife corridors. These may be strips of vegetation 20 metres each side of streams with catchments in excess of 15, 30 or 100 hectares, which may or may not be subject to logging (but not entered by machinery), or "wildlife corridors" comprised of strips 40 metres wide with the outer 20 m subject to modified harvesting. In some instances (e.g. Eden region) 100 m + strips may be retained.

Narrow riparian strips do not provide habitat suitable or adequate for a variety of species (Mackowski 1984, Kavanagh 1985b, Shields and Kavanagh 1985, Dunning and Smith 1986, Bennett 1990a, Gilmore 1990, Recher *et al.* 1991, Scotts 1991). Even where suitable habitat is encompassed corridors with a total width of 200 m have been found inadequate for some species (Kavanagh 1985b).

Shepherd *et al (1992)* consider the minimum width of major corridors *"must be sufficient to meet at least the habitat requirements of key central place foragers ... and to minimise edge effects such as the invasion of intact forest by exotic plants and animals, and changes in microclimate which can lead to the windthrow of trees, increased flammability of vegetation, etc."* For high quality habitat they recommend that only in very exceptional circumstances should sections of a corridor be less than one kilometre wide and that no areas should be less than 700m.

When designing wildlife corridors it is essential to consider: (i) the species being targeted, their ecology, habitat requirements, and dispersal ability (Bennett 1990a), (ii) the edge effect and its impact on suitability of the corridor for target species (Bennett 1990a, Saunders 1990, Recher *et al.* 1991), (iii) the pathways actually utilized by species for movement (Davey 1989), (iv) seasonal migrations (Smith 1991b), and (v) the necessity of species to migrate in response to global warming (Busby 1988, Arnold 1988, Main 1988, Page 1989, Smith 1991b).

An adequate wildlife corridor system should encompass: (i) multiple pathways linking retained habitat (Bennett 1990a), (ii) reservation of larger areas of suitable habitat at periodic intervals along corridors (Bennett 1990a, Recher *et al.* 1991), (iii) linked riparian and ridge corridors sampling suitable habitat for a full range of target species (Recher, Rhonan-Jones and Smith 1980, Dunning and Smith 1986, Conservation, Forests and Lands 1989, Bennett 1990a, Recher *et al.* 1991) and (iv) a hierarchy of corridors comprised of broad regional corridors established to restore links between isolated forests, major wildlife corridors within production forests to link important reserved areas and a network of smaller wildlife corridors forming common linkages in the system of retained habitat (Bennett 1990a).

Davey (1989) recommends not stipulating constant corridor width and enabling boundaries to maximise the structural and species diversity. Recher, Rohan-Jones and Smith 1980 recommend that the riparian environment should be retained intact. Where rainforest occurs in riparian situations the incorporation of their buffer zones into the corridor system will greatly enhance the corridors value for non-rainforest species. Wildlife corridors should not be subject to logging (Recher, Rhonan-Jones and Smith 1980, Conservation, Forests and Lands 1989, Bennett 1990, Scotts 1991, A.H.C. and C.A.L.M. 1992).

In designing wildlife corridors it is essential to consider the effects of barriers to movement and strategies to facilitate movement across potential barriers (Andrews 1990, Bennett 1990, Saunders 1990, Goldingay and Kavanagh 1991). For example it is essential that movement of fauna be taken into account in highway and railway design by the provision of fauna underpasses (Andrews 1990). Forest roads should have fauna underpasses incorporated as well as ensuring that at strategic locations tree crowns can touch across roads to facilitate movement of arboreal species. Measures need to be identified to ensure that underpasses don't act as funnels to concentrate prey for predators (Andrews 1990). Where possible corridors should not be situated along a road or railway, when they are they should be on one side to maximise effectiveness and minimise fatalities (Saunders 1990).

Byrne (1991) considers that the wildlife corridor concept should be expanded to include representative areas of archaeological importance.

The problem with linking reserves with corridors is that it negates the quarantine advantage of isolated reserves (Soule and Simberloff 1986, Hopper and Coates 1990). Hopper and Coates suggest that where corridors are impractical alternative strategies may involve translocation of individuals and founding of new populations.

6 OLDGROWTH FORESTS

The Dorrigo EIS inaccurately delineates unlogged and lightly logged forests while making no valid attempt to assess oldgrowth forests in the MA. The Department of Planning's assistance is requested to complete a trial oldgrowth assessment commenced by NEFA and NCEC for part of the MA.

The Resource Assessment Commission (1992a) states:

> *"Logging of old-growth forest ... potentially violates the precautionary principle of sustainable development in that an irreplaceable resource is being destroyed ... the values associated with the pristine attributes can not be replaced."*

The National Forest Policy Statement demands that a **"comprehensive, adequate and representative reservation system to protect old-growth forest and wilderness values will be in place by the end of 1995"** and that until this is done **"forest management agencies will avoid activities that may significantly affect those areas of old-growth forest or wilderness that are likely to have high conservation value."**

Old-growth forests are dominated by trees that have reached or passed maturity (maximum height and crown width). In general old-growth eucalypt forests are multi-age forests, with a range of young and old trees resulting from past disturbances *(Mackowski 1987)*. Such forests are often described as ecologically mature. There is no overriding definition of old-growth forests that is applicable to all forest types. Rather for a precise definition it is necessary to assess each forest type and develop a specific definition for each type.

The Resource Assessment Commission *(1992a)* emphasises that old-growth forest is a subset of unlogged forest as many unlogged areas have been burnt out or degraded by other uses, such as grazing. Some forests subject to early light selective logging still retain the ecological attributes of old-growth forest and should also be considered as old-growth.

Some of the values of old-growth forest can be broadly delineated as:

(i) reservoirs of biodiversity within which to retain genetic diversity, natural processes and evolutionary potential;

(ii) provision of a variety of homesites (hollows, large trees, large logs, permanent seepages, etc.), abundant food sources (nectar, invertebrates, fruit, etc.), diverse foraging areas (uneven canopy, canopy gaps, deep litter, logs, large tree trunks, etc) and other attributes upon which a large diversity of fauna depend and which are either unavailable or significantly less abundant in regrowth forests;

(iii) provision of habitat and niches for a variety of flora (eg lichens, mistletoe, epiphytes) and fungi which are either unavailable or less available in a regenerating forest;

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1 November 1990

Mr Noel R. Culbert
Secretary
Commission of Inquiry into
the Conservation of Fraser Island etc.
First Floor
Executive Building
100 George Street
BRISBANE Q 4000

Dear Mr Culbert

Research Paper - Rainforest Definition

As requested in your letter of 19 October, here is the paper commissioned by you. It is longer than you stated, but I have discussed this with Dr Ted Christie who agreed that it was important to provide some ecological perspectives and context for the current problems of rainforest definition in Australia, which are no longer exclusively scientific.

Following our telephone conversation on 30 October, and the matters we discussed, I have pleasure in enclosing a complimentary copy for you and members of the Commission of our recently published book on "Australian Tropical Rainforests - Science, Values, Meaning". The ANZAAS Symposium featuring "the values and meaning of science", especially in relation to the ecological problems of our tropical rainforests, and the publication of the proceedings in this book, were designed to stimulate deeper thinking throughout the community about the ethical and other implications. I hope that you and your Commission will find something of interest and relevance in some of the chapters, especially 11-18 and 19.

I have marked this paper as a draft, and if it is to be published, I would like to make certain corrections and amendments which will occur to me as necessary by that time.

I shall tender an account when I receive the bill from my typist.

Yours sincerely,

<u>Leonard J. Webb</u>
(Honorary Professor)

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LJW

DRAFT

Research Paper – Rainforest Definition

Summary of Points of Significance

1. Historical Background
2. Paleogeographic History
3. The Ecological Perspectives of Vegetation Dynamics
4. Rainforest Classification and Environmental Factors
5. The Definition of Rainforest according to Structure
6. The Definition of Rainforest according to Community Dynamics

References

Annexures

I Definitions of the mature rainforests in Australia (Webb 1959).

II Comprehensive Values and Potentials of Tropical Moist Forests (Webb and Kikkawa 1990).

III Diagrammatic representation of the rainforest optimum and different suboptimal environmental gradients (Kikkawa 1990).

IV Secondary succession pathways in rainforests (Hopkins 1981).

V Radiocarbon-dated age of soil charcoal in three subtropical forests (Turner 1984).

Paper prepared in response to letter dated 19 October 1990

from Noel R. Culbert, Secretary to the

Commission of Inquiry into the Conservation, Management and Use of Fraser Island and the Great Sandy Region

Leonard J. Webb
Honorary Professor
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1 November 1990

DEFINITIONS OF RAINFORESTS IN AUSTRALIA

<u>Summary of Points of Significance</u>

(1) Besides being the most complex terrestrial ecosystems in Australia, the rainforests (tropical, subtropical, temperate) are evolutionary relicts of an ancient, broad-leaved, evergreen flora of moist closed-forests, from which the widespread narrow-leaved, evergreen 'sclerophyll' (scleromorphic) flora such as eucalypts and acacias was derived. In the relatively moist regions of Australia where these two seemingly separate but phylogenetically related floras co-exist, their ecological relationships and transitions are uniquely complex.

(2) In all but optimal sites, the succession following disturbance of increasingly shade-tolerant and fire-sensitive rainforest species, invariably involves distinctive species of sclerophylls e.g. <u>Eucalyptus</u>, <u>Syncarpia</u>, <u>Lophostemon</u>, <u>Backhousia</u>, <u>Casuarina</u>, and <u>Acacia</u>.

(3) Over a period of many centuries which may approximate 1300 years or more (radiocarbon dated) the sclerophylls emergent above the developing/maturing rainforest canopy gradually senesce and disappear on undisturbed sites. At this point, which is now generally rare because of fragmentation of the remaining rainforest areas and increased human-induced disturbance, the rainforest is regarded ecologically as mature/primary/'climax'.

(4) Given an appreciation of dynamic ecology, it is important to realise that all the classical and virtually all the modern definitions of rainforest refer to <u>mature</u> or <u>primary</u> rainforests. Thus the definitions exclude secondary and developing stages, mixtures, and transitions of rainforest (see Annex. I for classical definitions).

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(5) Besides the collapse of senescent large trees, natural disturbance such as gales hastens 'windthrow' to form gaps in the rainforest canopy. If the gaps are large enough and seed rain is available from nearby sclerophyll trees in earlier, secondary stages of rainforest, the gap-phase succession involves sclerophylls if the mineral soil is exposed, as well as pioneer broad-leaved species.

(6) Fast-growing and light-demanding eucalypts and acacias that characterise this secondary succession become dominant, and in turn become emergent over a maturing rainforest understorey. As in all other developments of rainforest, the succession may be deflected or even reversed by disturbance, which under natural conditions is usually wildfires in exposed situations (see Annex. IV).

(7) Thus rainforest areas, except where they are relatively large massifs (many hundreds of km^2), as the result of the most favourable environmental conditions, which can however never exclude all natural disturbance, invariably contain patches and mosaics of mature rainforest and mixed sclerophyll-rainforest especially along the margins and firepaths along ridges.

vegetation

(8) For the present purpose of rainforest definition, to facilitate working rules in the field for its application, it is important to consider the stage and place at which rainforest succession may be deemed to have begun. Certain rainforest elements (i.e. species of different life forms of vegetation such as trees, shrubs, herbs, vines, ferns, epiphytes, as well as associated fauna including micro-fauna) form fragmentary communities, which are scattered in suitable places in sclerophyll forests in moist coastal zones. They may be relicts or recent immigrants.

(9) Moreover, some hardy marginal rainforest species also occur together with sclerophyll species in the low and broken understorey beneath tall sclerophyll forests in relatively moist but frequently burnt places. These are the 'moist hardwood' forests, or early successional 'wet sclerophyll' forests. Since sclerophylls are able to regenerate more or less continuously in these types, and pioneer rainforest species do not generally persist, the latter forests are not considered to be an integral part of rainforest succession or development. Moist hardwood and early wet sclerophyll forests are therefore excluded from the definition of rainforest.

(10) However, where an understorey of mixed rainforest-sclerophyll species continues to develop into a closed, generally uneven canopy of increasing height, beneath an overstorey of scattered sclerophyll tree species, a point is reached where only broad-leaved rainforest seedlings are able to regenerate in small canopy gaps ('diffuse' or 'spot-wise' regeneration). This confirms that that place is an advanced part of a particular secondary rainforest succession.

(11) For the purposes of nature conservation, education, amenity and recreation, soil and water conservation, and other non-consuming uses, as well as the sustainable yield of timber, rainforest areas require management based on the principles of dynamic ecology.

(12) Specific management guidelines need to be established for specific land units and systems, and for the different types of dynamic rainforest communities within them, as a genuine basis for multiple purpose use of particular forest areas.

(13) Where mixed rainforests and adjacent wet sclerophyll forests occur along mature rainforest boundaries, or in fragmented areas, there is a greater fire risk than for large areas of mature rainforest which develop their own 'micro-climate', which tend to exclude surface fire. Specific management guidelines are therefore required to allow for these variations, and for buffer zones.

(14) For soils of limited fertility to be able to support advanced stages of rainforest successions, and which tend to favour flammable sclerophylls and their regeneration in earlier stages (e.g. Fraser Island), any management practices which diminish soil organic matter should be avoided.

(15) The following of realistic and ecologically based procedures such as those noted above should provide a sound basis, from a scientific as well as an operational point of view, for conserving the total values and significance of Australian rainforests for use and appreciation nationally and internationally by present and future generations.

1. Historical Background

1.1 The intrinsic scientific difficulties of defining and classifying rainforests as distinct vegetation types in wetter coastal areas of eastern Australia had been noted by early botanists and plant geographers. These difficulties were partly the result of applying a European nomenclature to the biological intricacies and novelties of the island-continent, which had yet to be studied. Only now are its indigenous scientists freeing themselves from the presumptions of their antipodes (Webb 1990).

1.2 These historic scientific difficulties have become of social and political importance since the early 1970s. Their significance is correlated with (i) the growth of the nature conservation movement ('environmentalism') here and abroad; (ii) the maturing awareness of Australian landscapes as a base for our image of the world; and (iii) the increasingly out-of-date traditions of forestry authorities which became accentuated since about 1970. This was when their practices and policies first came under wide public scrutiny, by a mobile population seeking recreation in natural forest areas along the eastern Australian coast and in Tasmania (Hope 1974). Parallel with this emerging public awareness of the tall moist forests as a 'public good' was the intensification of forestry activities e.g. clear-felling in the south-east to export eucalypt woodchips, and extension of pine plantations by clearing native woodlands. It was also revealed that 'sustained yield' logging volumes had drastically decreased in already logged rainforest areas. Opening up the dwindling areas of virgin rainforest became unpopular but was essential for forestry to make remaining sawmills economically viable (e.g. Dargavel 1988).

1.3 Debate about the role of the community in decisions for future uses of the native forests' other social values besides wood attracted much media attention. This provoked unhelpful reactions by forestry interests who did not welcome community involvement, although the latter was acknowledged as inevitable by the Institute of Foresters of Australia (Hope 1974).

The unpopularity of logging rainforests stimulated forestry semantics from about 1980 onwards, in defence of logging marginal rainforest areas, which in less politically sensitive times had been classified by forestry as 'mixed forest' (Gilbert 1959), or 'mixed rainforest' (Cornish 1977). These forests were accordingly termed 'hardwood forests' by forestry and classified as a particular species type e.g. brush box, blackbutt, where the species occupied more than an arbitrary percentage basal area in the stand (see 3.7).

These so-called hardwood forests fringing fire-sensitive rainforest communities (which also contain mainly hardwood tree species) comprise certain species of the sclerophylls Eucalyptus, Syncarpia, Lophostemon (Tristania) and Acacia, which are adapted and generally restricted to these special rainforest boundary habitats. Such trees are typically emergent above an understorey either dominated by continuously regenerating sclerophylls as a result of regular burning, or increasingly dominated by rainforest species of varying height in rainforest succession where fire is excluded and soil fertility is adequate (see 4.1-4.4).

It should be noted that most rainforest tree species are classified by wood technology as 'mixed hardwoods'. However this definition is ignored by forestry in the interests of separating the commercially valuable tree species of Eucalyptus etc. as particular hardwood forest types, irrespective of their dynamic status as developing rainforest.

1.4 The semantics of rainforest definition to placate the community by avoiding logging 'rainforest' as forestry defined it, reached a climax in the Court of Inquiry into Logging at Terania Creek, Northern New South Wales, in Sydney 1979-81.

2. Paleogeographic History

2.1 In Australia, the vegetation patterns - in which relatively small patches of rainforest of different sizes occur among vast areas of eucalypt woodland, heath, scrub, and other sclerophyll types - are different from anywhere else in the world, because of Australia's unique paleogeographic history. Here, the floristic links between rainforest and adjacent types are obscure - unlike in, say, India or Brazil - so that, as one visiting botanist observed, the Australian forests seem to have descended from two different planets! Recent evidence from fossils, computer analysis of contemporary distribution of rainforest species and genera, and geophysical theory was crystallised at the International Botanical Congress held in Sydney in 1981. It shows that the isolated pockets of rainforests are "the surviving residue of the primitive stocks from which the bulk of the modern Australian flora has been derived ... They are the most ancient Australians still surviving" (Flora of Australia, Vol. 1, p.66, 1981).

2.2 Common inheritance of these floral stocks from the ancient super-continent Gondwanaland over 100 million years ago, explains present day affinities of Australian rainforest floras with those of Africa, Madagascar, India, Malesia (tropical), and of South America and formerly Antarctica (temperate types).

2.3 But not the affinities of Australian sclerophylls! This mainly endemic scleromorphic flora is now thought to have been derived from the ancient moist closed-forests of Gondwanic times, along with the birth of the primitive proteads (Banksia family), on vast areas of infertile sandy soils (Webb 1968, van Steenis, 1979, pp.168-9).

2.4 Sclerophyll evolution continued in the Tertiary over the last 50 million years, as judged by the appearance of sclerophylls such as eucalypts and acacias in the fossil record. The characteristic interspersions of certain elements of both the sclerophyll and rainforest floras in situations suboptimal for mature rainforest development are highly relevant to the current difficulties in rainforest definition in Australia.

From the middle of last century, early plant geographical theories about the origins of the Australian flora assumed that the sclerophylls (scleromorphic flora of eucalypts, acacias, banksias etc.) were the most ancient. The relatively small areas of tropical-temperate rainforests were assumed to be the result of later colonisation by elements from Indo-Malesia and Antarctica-South America respectively. We now believe the truth to be approximately the reverse (see 2.1). Indeed, the question of the origin of the Australian flora - especially in the tropics - may now be considered to be almost the question of the origin of the flowering plants (cf. Barlow and Hyland 1988, p.2).

Nevertheless the early theories have left a legacy in the minds of people, including some scientists, that any modern sclerophyll species is 'separate' from the rainforest, and represents an originally segregated flora in relation to which the rainforest flora is 'foreign'. This legacy may well play a part in the general reluctance to accept sclerophylls as integral members of secondary successions in rainforests under sub-optimal conditions (see 4.3, and Annex. III).

3. The Ecological Perspectives of Vegetation Dynamics

3.1 The term "Rain-forest" or "Rain forest" of early plant geographers such as Schimper (1903) and Warming (1909) was adopted in Australia to describe the patches of forest with closed, more or less continuous canopies, diverse flora and growth forms, which were so different from the all-pervasive open grassy forests, woodlands and scrubs dominated by what seemed superficially to be an entirely different flora. Rain forest was classically defined as moistureloving (mesophytic, hygrophilous), which emphasised rainfall. However, since soils became recognised as a dominant controlling factor of distribution within broad climatic zones in Australia, the spelling "rainforest" has now generally been adopted, following a suggestion by Baur (1968a). This term recognises rainforest as a floristically interrelated and independent 'Formation-group' of vegetation, without giving undue emphasis to rain as an environmental factor in its distribution; and preserves its relationships with similar groups in other parts of the world. It is therefore preferable to the neutral term 'closed-forest' recently adopted by Specht (1970, 1981) and Carnahan (1976).

3.2 The early use by plant geographers of terms such as 'rain forest' was as a 'static' definition, to denote types of vegetation as European visitors saw them in different parts of the world. These travellers understandably lacked appreciation of vegetation dynamics, whereby particular communities undergo characteristic progressive changes in composition (succession), as the result of recent disturbances, or of longer-term environmental changes in secular time. It remained for ecologists and paleogeographers, who became active in detailed vegetation survey only within the last half century, to undertake the denotation of vegetation types, and to appreciate their connotations as dynamic entities on ascertained time scales.

3.3 In Australia, earlier studies of the flora, structure, physiognomy and controlling factors in the distribution of rainforests, which began in the 1920s, generally ignored vegetation dynamics (Webb 1956).

There were, however, some seminal observations which were notable exceptions. The forester Swain (1928) in Queensland, wrote how the sylvic succession in moist coastal Queensland appeared to proceed from "exposure-resisters" to "shelter-seekers", with commercial timber species developing around the centre of the cycle. Thus on more or less siliceous and porous soils along the south Queensland coast, with rainfall above 50mm average for the driest month, Blackbutt (Eucalyptus pilularis) dominated the eucalypt forest together with E. resinifera, E. microcorys, E. grandis, Syncarpia and Lophostemon (Tristania). Swain noted the tendency for rainforest species to replace the tall mature Blackbutt forests in certain situations, resulting in the so-called "bastard scrubs", in which Hoop Pine (Araucaria cunninghamii) and Kauri Pine (Agathis robusta) occur. But except on the most favourable soils, rainforest species could not replace Blackbutt transition forests exposed to regular bushfires. Swain further described the succession of Hoop Pine "scrubs" or "Araucarian jungles" on more favourable soils under somewhat lower rainfall than above, involving Grey Ironbark (E. drepanophylla). With improved moisture, the rainforest species merged with those developed under the Blackbutt "shelter forests".

Also in south Queensland, Tommerup (1934) described rainforest and eucalypt forest patterns in relation to climate and soil factors. Rainforest distribution followed geological boundaries on higher fertility soils derived from basalts, andesites, Gympie slates etc. Tommerup explicitly noted the to-and-fro movement of rainforest-eucalypt forest boundaries in relation to fire.

In the most comprehensive early study of Australian rainforests, Fraser and Vickery (1938) provided one of the few descriptions yet available of subtropical rainforest margins, and their different degrees of stability and advance in adjacent eucalypt forest. Sclerophyll species of Eucalyptus, Syncarpia, and Lophostemon were included in marginal rainforest types described by these authors in northern New South Wales.

Cromer and Pryor (1942) examined rainforest successions in south Queensland, and noted that rainforest was invading adjacent savanna woodland, excepted where stabilised by fire.

Herbert (1951) further recognised that "Eucalypts, intolerant of shade, cannot enter the rainforest, though on its margin they may attain a great size. Rainforest, on the other hand, may invade eucalypt forest ...".

3.4 In recent times, it has been commonly observed that rainforest encroaches into open forest pockets where fire frequency is relaxed for a few decades, as determined from patterns in old and recent air photos. All these observations emphasise the tendency of rainforest to extend its boundaries into adjacent eucalypt forest on suitable soils during fire-free intervals. It was also recorded that the species in these rainforest-sclerophyll mixtures, transitions, or tension-zones were characteristic of such sites, and generally did not regenerate in either direction away from them.

3.5 The efforts of Australian rainforest ecology to understand patterns and processes in native vegetation featured community dynamics from about 1960 onwards. Webb (1959) provided definitions of the <u>mature</u> rainforest formations (Annex. I). While noting that "definition of rainforest is still elusive in Australia", he stated that "There is, indeed, increasing evidence that mixtures of Australian sclerophyll forests with rainforests, whether of tropical or temperate character, represent stages of succession, stabilised under limited soil nutrient levels by regular catastrophic factors such as fire ... (to produce) ... more or less stable transitions ...".

3.6 The most fertile, moist and well-drained soils favour relatively rapid successions of complex rainforest types to the mature stage. Less fertile soils, above a certain minimum of mineral nutrient availability, support slower rainforest successions of simpler types which typically include certain sclerophylls. The role of intact litter, and the development of soil organic matter and characteristic soil microflora, ~~is~~ are only now becoming understood. The most recent and authoritative studies of the generally low fertility soils of Amazonia emphasise that: "... Litter and other organic material on the soil surface are important for a continuing supply of nutrients and sustained crop growth. Management should aim towards maximizing soil organic matter. Practices which destroy organic matter should be minimized" (Jordan 1989).

3.7 However, the dynamic nature of the <u>immature</u> communities in a succession towards mature rainforest was not considered relevant to the purposes of official forestry. For example, the pioneering forester-ecologist Baur (1968b) in New South Wales well appreciated that "throughout the moister regions of NSW, there is an uneasy and constantly changing, boundary between rainforest and eucalypt forest: periods of protection favour the advance of rainforest into the eucalypt forest; repeated fires or other forms of disturbance favour the advance of eucalypt forest ..." (loc. cit. pp 17-18).

Thus Baur's classification of forest types in New South Wales, while based on ecological data in the first instance, "does not attempt to be an ecological classification. Forest types ... emphasise features of forestry, as opposed to botanical significance" (loc. cit. p.17).

Baur stressed that his typology was "essentially based on species composition ... the degree of predominance required to determine indicator species is arbitrarily based, with particular weight given to commercial values. With species of outstanding importance, as little as 20 percent of the stand basal area is regarded as conferring predominance" (loc. cit. p.15-16). For example, with Blackbutt, "... the type classification is developed from communities actually present and includes a number of obviously seral communities" (loc. cit. p.16).

3.8 Baur (loc. cit.) explicitly defined the forestry purposes of his classification (p.9): "... to determine which of the Crown Lands, outside of existing State Forests, had forestry potential, and might thus be sought for dedication as permanent forest estate; to serve as the basis for assessing the growing stock, and for applying silvicultural treatments to the native forests under present or proposed management; and to provide some indication of the suitability of land for plantation purposes". For these purposes, inadequate as they now appear for Australian forestry, Baur's typology proved to be a valuable contribution, which laid the basis for further forestry classifications and definitions elsewhere in eastern Australia, all with the primary objective of wood production.

3.9 It should be clear that these now admittedly restrictive forestry definitions are inappropriate for the wider objectives of forest resource management, especially for those values ('non-wood' or 'non-market') that have now emerged as essential human resources. This is the case not only in the limited moist coastal regions of eastern Australia and Tasmania, but also throughout the moist rainforested regions of the world. The conservation of natural biological diversity, especially in the moist tropics and subtropics, has become symbolic of the moral issues in the ecological crisis of the present day. This is exemplified by worldwide scientific, religious and popular campaigns in recent times, e.g. World Wide Fund for Nature, World Conservation Union, The Assisi Declarations.

A recent paper by Webb and Kikkawa (1990) discussed the additional 'non-market' values which are now emerging as powerful factors influencing the future uses of tropical rainforests (for list of values, see Annex. II).

4. Rainforest classification and environmental factors

4.1 Webb (1968) amplified his earlier structural classification of Australian rainforests (Webb 1959) given in Annex. I, and sketched the complex interactions of climate, soils, topography, fire and other factors that control distribution of mature rainforests and successional or stabilised sclerophyll-rainforest mixtures in marginal situations. Deviations from the inferred distribution occur as the result of fire, and the mixtures have been considered to be "fire disclimaxes" by various authors. The boundaries between rainforest and sclerophyll forest may be abrupt or gradual. On defined sites, these differences can be correlated respectively with the prevalence of surface fires and spring fire seasons in northern Australia, and of running-crown fires and summer-early autumn fire seasons in southeast Australia.

4.2 A general rule is that the wet warm temperate and cool temperate rainforests have wide ecotones (boundary zones) with ~~or~~ sclerophyll mixtures along their boundaries, unlike the wet tropical and subtropical rainforests where the latter occur only on lower fertility soils. The temperate rainforest types are evergreen and relatively simple in structure and flora. Outliers of these types occur in a few high rainfall coastal and montane areas in northern New South Wales and south Queensland on relatively poor soils such as Fraser Island. These constitute a relatively large area of 'wet sclerophyll forests', which reach a much greater development in cooler latitudes farther south in eastern Australia. In New South Wales these were popularly included in 'brush forests'. The term 'wet sclerophyll forests' was defined in the ecological literature by Beadle and Costin (1952) to designate tall eucalypt forests greater than 30 m with an understorey of mixed sclerophyll and rainforest broad-leaved trees and shrubs, with abundant tree ferns and ground ferns depending on stage of succession towards usually temperate rainforest types. It was termed 'sclerophyll fern forest' by Webb (1959) and was discussed by Ashton (1981).

4.3 Following the interpretation of Webb (1968), mature/climax/primary rainforests in the tropical/subtropical/cool temperate climatic regions occupy optimum environmental conditions as at the hub or centre of a wheel (see diagram in Annex. III from Kikkawa 1990). The radiating spokes or arms represent different environmental gradients/habitat types (e.g. moisture, temperature, soil mineral nutrients, soil aeration ± fire) towards various pessima. Of relevance to the present discussion is that away from the optimum, rainforest elements have to compete with sclerophyll elements adapted to low, seasonal, and erratic rainfall; low soil fertility; fire; exposure; seasonal water-logging; salinity, and various combinations of these and other factors. Hence mixed sclerophyll-rainforests typically occur at various stages of succession in suboptimal situations, which generally include wildfires.

4.4 Disturbances (natural or human impacts) in all sub-optimal situations (and even transiently at the optimum) favour invasion/colonisation by sclerophylls, which are fire-tolerant. Sclerophyll shrub and tree species occupy disturbed rainforest sites for varying periods of time, depending on the frequency, intensity and extent of disturbance. Consequently, few sites of the different habitat types away from the optimum are able to develop to the full their potential vegetation type. The result is a mosaic of differently aged regrowth of a given habitat type. Where the site potential is close enough to the optimum for advanced rainforest development (provided seed sources are available), and incursions of fire are thus buffered for several hundred years, the cool moist 'microclimate' of the rainforest is able to exclude all but the most catastrophic <u>surface</u> fires (but not of course cyclones). This is the general rule in northern Australia, but is not likely farther south where devastating <u>running-crown</u> fires occur every few decades (Webb 1968).

4.5 Of relevance to the present discussion is the existence of characteristic secondary successions for different habitat types, which are in turn related to different disturbance types. These are now becoming fairly well understood, and some types of successions classified (see e.g. Hopkins 1981, 1990, and Annex. IV). However, as Hopkins (1990 p.40) warned: "... we do not have a detailed predictive knowledge of many of the important processes which are involved. This is not surprising ... knowledge of one rainforest cannot be unreservedly extended to all others ...".

4.6 On Fraser Island, the sandy substrates are relatively uniform physically compared with clay soils. Thus environment heterogeneity is mainly due to minor topographic differences in relation to leaching/accumulation of mineral nutrients, coupled with exposure to winds including "salt-pruning", fire and other factors. This means that species establishment at a particular site is largely stochastic i.e. probabilistic within certain parameters, except under extremely high or extremely low conditions of mineral nutrient availability. Thus "wet sclerophyll forests" dominated by Blackbutt may be found towards both ends of the continuum of mineral nutrient availability (phosphorus, calcium, potassium, etc.). Advanced and mature rainforest development is however restricted to the upper and moister end of the nutrient continuum (Webb 1969).

These complex interactions in space and time can be fairly satisfactorily interpreted by the ecological theories now available, and which are briefly noted above, for understanding the different stages, trends and rates of succession of sclerophyll-rainforest mixtures towards the potential (climax) rainforest type of each habitat type. In all such cases, the mixtures may therefore be regarded <u>ecologically</u> as secondary/immature/building/developing stages towards the optimal mature rainforest type of the area.

5. <u>The Definition of Rainforest according to Structure</u>

5.1 The floristic classification (i.e. according to species composition of trees etc.) of biologically complex communities presents formidable difficulties of time, taxonomic expertise, and apt methodology depending on purpose. It has rarely been attempted over large rainforested areas. In such cases, especially with complex vegetation such as rainforests, structural classification is necessarily adopted in preliminary surveys. Thus in Australia, the first comprehensive rainforest classification (Webb 1959, 1968) was based on structure, to produce over 20 structural types in different climatic zones.

5.2 A very broad structural classification of Australian vegetation with map was produced by Carnahan (1976), mostly based on Specht (1970) and Beard and Webb (1974). It identified the following vegetation types which may be equated in part with different types of rainforest and rainforest-sclerophyll mixtures and successions:

* Tall open-forest (wet sclerophyll forest) with projected foliage cover (PFC 30-70%).
* Tall woodland, PFC 10-30%; mixed closed forests of rainforest species with tall emergent trees of <u>Araucaria</u>, or of <u>Eucalyptus</u>, which "may be regarded as stages in long-term transitions, the tallest stratum being the relict element (Gilbert 1959, Webb 1959)". (Carnahan 1976 p. 6).
* Medium closed-forest, 10-30 m, PFC more than 70%. Equivalent to predominantly evergreen rainforest.
* Low closed-forest under 10m, PFC more than 70%. Equivalent in part to microphyll vine thickets ± Araucaria (Webb 1968).

5.3 In a further continent-wide account of the major vegetation formations in Australia, Specht (1981) recognised the following types equivalent in part to various rainforest types and transitions:

* Closed-forest of tropical, subtropical, warm temperate eastern Australia.
* Closed-forest of temperate eastern Australia, including Tasmania.
* Low closed-forest of monsoonal northern Australia.

* Tall open-forest of south eastern Australia, on relatively fertile soil with tree ferns in understorey.
* Eucalyptus-open forest (in part) of northern Australia.

These structural classifications, although including lists of some of the common rainforest plants, are only of broad biogeographical value, and are not suitable for local ecological survey, mapping and interpretation.

5.4 Even at a scale of 1:250,000, which required 15 map sheets for the humid tropical coastal region between Cooktown and Ingham, North Queensland, the vegetation types mapped by Tracey and Webb (1975) were primarily structural, assisted by habitat types (rainfall, altitude, soil parent material), and necessarily using floristics for the sclerophyll emergents and co-dominants of the closed rainforests. The types recognised totalled 17 for closed-forest, and 10 for closed-forest with sclerophyll emergents. At this scale, the mapping, and accompanying general description of the types (Tracey 1982), were entirely static, with no room for dynamic interpretations.

5.5 Similarly, when Webb, Tracey and Williams (1984) eventually provided the first floristic classification of Australian rainforest vegetation, based on 561 sites and 1316 tree species, there were eight distinct eco-floristic provinces, and within them a rather arbitrary number of representative floristic elements totalling about 45. Although these data were not sufficiently detailed for conclusions about short-term rainforest successions, they enabled some highly significant deductions about rainforest vegetation dynamics on paleogeographic time scales. Interpretation of the floristic patterns revealed by classifying tree species and genera provided insights into the origins and 'climatic sifting' of ancient elements of the Australian flora, and their fragmented status today. These fresh insights could not have been attained by earlier structural classifications (Webb <u>et al</u> 1984).

5.6 It is clear that the preliminary and very broad structural classifications as by Specht and Carnahan are inadequate for differentiating the diversity of the major structural-physiognomic types recognised by the more specific ecological criteria of Webb (1959, 1968), Webb et al (1976). Hence floristics are necessary but feasible only in much more intensive local survey and classification, which accordingly cannot avoid boundary problems and dynamic interpretations of the forest mosaics, habitat gradients and zonations e.g. on Fraser Island.

5.7 Structural classification, and the use of forest stratification (tree layering), as in the very generalised rainforest classifications noted above by Specht and others (5.2, 5.3) belong to "a static, typologic concept that gives no recognition to the dynamic nature of the canopy" (Whitmore 1978, p.640). The study of structural features alone is inadequate for understanding the seemingly chaotic equilibrium of sclerophyll-rainforest boundaries, as on Fraser Island, so that the floristics of the forest growth cycle must also be considered.

The ecological definition of rainforest in Australia offered by Dale et al (1980), emphasised the similarity of floristic composition between advanced stages of succession and the mature rainforest, except for the presence of emergent sclerophylls in the former:

> "The rainforests are defined ecologically as closed forest vegetation, with a continuous tree canopy of variable height, and with a characteristic diversity of species and life forms. The ecological definition of rainforest includes transitional and seral communities, with sclerophyll emergents, that are of similar botanical composition to mature rainforests in which sclerophylls are absent".

However, forestry chooses to classify such advanced seral stages, as well as earlier ones, on the basis of the tallest and scattered sclerophyll trees, as 'open forest' or even 'woodland'. Such is the absurdity of a strictly structural classification in this dynamic situation!

The resort to structural criteria alone, while ignoring the close floristic affinities of the developing canopy of rainforest species (which may be 20-30 m in height), is unacceptable ecologically, although legitimate as an arbitrary forestry definition to accommodate commercial logging of the emergent hardwoods (cf. 3.7 above).

The Specht classification which defines tall open-forest (50-70% projective foliage cover PFC), forest (50-30% PFC), and woodland (<30% PFC) was originally designed for sclerophyll and non-rainforest vegetation, with an understorey of scattered sclerophyll shrubs, and more-or-less continuous grasses and herbs.

A rationalisation which selects only structural criteria, as in the above classification, does not fit the ecological facts in the dynamic stages of rainforest canopy development and succession. Here, the light-demanding sclerophylls are not regenerating (except as the result of recent disturbance [illegible]) on the forest floor, or in the understorey; and sclerophyll vegetation persists only as scattered trees (interpreted as relicts) in the air above the immature rainforest canopy.

To ignore selectively the modern ecological literature relevant to rainforest dynamics, some of which is noted above (1.3, 2.2, 3.1, 3.3-5, 4.1-6) is unworthy of scientific forestry but is a good example of sophism.

5.8 To understand the dynamic relationships of vegetation is the job of the disinterested ecological scientist. For the pragmatist interested only in the harvesting of wood, and its voluntary regeneration on time scales short enough for profitable and hopefully long-term exploitation, it may be argued that such ecological understanding is irrelevant, or even academic. If, however, all forest values are considered as well as wood, to satisfy currently emerging and future needs and demands of people, then ecologically-based management to optimise the use and appreciation of the widest range of forest properties, would seem to be mandatory for genuinely sustainable development.

6. The Definition of Rainforest according to Community Dynamics

6.1 Some of these dynamic ecological perspectives have already entered the previous discussions. The exclusive use of a static typology based on structural criteria excludes communities with a well-developed rainforest flora, but which have the tallest tree layer composed of 'commercial hardwood' species. This restriction has already been noted as unacceptable by ecological science. It is not possible, however, to touch on more than a few of the desiderata of the latter in this Brief.

6.2 Areas of rainforest vegetation are never homogeneous in biological composition and structure (biodiversity), because of variations in physical environment (habitat), and the inherited effects of past impacts and environmental changes on different time scales. In the second case, on a scale of hundreds to over a thousand years, the scattered occurrence of certain tree species, either as patches of canopy trees or as emergents, may be interpreted as relicts. These persist from an earlier stage of succession as noted earlier (4.4-6), and are due to disappear with age as the rainforest succession advances - provided it is not interrupted by fire.

6.3 In the rainforest ecological literature of other countries, description of the effects of disturbances of different intensity, size, and extent on 'the forest growth cycle' is usually restricted to regeneration of canopy gaps: this process is termed 'gap-phase dynamics'. However, there are no descriptions of boundary interspersions comparable with those in Australia. It is the nature of the interspersion of floristic elements in this case, at the boundaries of closed broad-leaved rainforest and its junctions with the all-pervasive sclerophyll types, that has produced the current controversy (cf. 2.4).

6.4 The regeneration ('succession') proceeds from light-demanding species of pioneer/early secondary stages through increasingly shade-tolerant and fire-sensitive species of the building/advanced secondary/immature stages to climax/primary/mature rainforest. Whereas gap-phase succession is insulated by the surrounding canopy profile, boundary succession is vulnerable to the repeated, although predictably consistent, impacts of fire. Consequently, these boundary/transition communities have evolved a relatively simplified type of gap-phase succession, whose flora is characteristic of a given boundary type and forest habitat.

6.5 Surface fires do not usually penetrate under the rainforest canopy for more than a few metres during years with average or above average rainfall. Sites with high moisture and nutrient availability, and freedom from fire for long intervals, develop a rainforest understorey in which shade-intolerant sclerophylls cannot regenerate, e.g. species of Eucalyptus, Syncarpia, Lophostemon belonging to Myrtaceae, and of Acacia belonging to Mimosaceae. Fragments of charcoal from previous fires can always be found on or just below the surface of the mineral soil, beneath the humified litter layer, of the forest floor. The age of such charcoal, which weathers slowly and persists for hundreds of years, can be determined by radiocarbon dating methods.

6.6 In the well studied case of the mixed rainforest boundaries at Terania Creek, Northern New South Wales (see table in Annex. V), it was estimated that:

(1) In the rainforest, a single fire had occurred about 1000 years ago. One of the old canopy trees (white booyong - Argyrodendron trifoliolata) had wood of radiocarbon age approx. 880 years.

(2) In the brush box mixed rainforest community, the fire frequency was at least 300-400 years over the past 3000 years. Radiocarbon age of wood of the emergent trees of brush box reached approx. 1340 years.

(3) In the Blackbutt wet sclerophyll forest, severe fires were most frequent, averaging approx. every 280 years, with the most recent less than 110 years ago. (Turner 1984).

6.7 The measured ages of these venerable trees, which reach 2 m+ DBH, add an objective dimension to the social and aesthetic values, as well as to the biological complexity of advanced and mature stages of rainforest successions. They are comparable to the 'old growth' forests of Canada and USA whose fate is now the subject of much controversy. Old growth is widely used to describe the virgin forests which originally faced the European settlers of North America. Their areas have dwindled drastically, according to maps recently published for their status, successively in 1620, 1850, and 1989. At present, the largest and most commercially valuable trees are in 'old growth' residues, most of which are publicly owned and subject to forestry-supervised cutting. This greatly accelerates natural processes of senescence and collapse of old trees and 'snags', which initiates further regeneration. Protection of their biodiversity is considered to require the setting aside of 'large, contiguous patches of old growth which can serve as refuges for plants and animals', as well as new forestry techniques in unprotected areas (Dayton 1990).

6.8 Under the lower rainfall and less sheltered topographic conditions of Fraser Island, fire frequency would be expected to be more frequent than at Terania Creek. Nevertheless, the Terania study does provide evidence for the interrupted invasion of adjacent sclerophyll forest by predominantly rainforest understoreys over periods of many centuries, resulting in mixed communities with rainforest understorey reaching 20-30 m, plus emergents 40-60m. Radiocarbon dating, although expensive, would provide 'hard data' to replace the extrapolations and speculations necessary at present to interpret the Fraser Island rainforest boundary communities.

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ANNEX. I

"For the purposes of this paper, the *mature* (italics added) forests and woodlands of eastern Australia are grouped as follows:

(1) Tropical Rain forest, with a predominantly Indo-Malaysian flora, is characterized by the prominence of robust woody lianes, vascular epiphytes, mostly entire leaf margins, many compound leaves of mesophyll size or larger, with drip tips and pulvini, and by a complex flora of both phanerogams and cryptogams. Some of the trees are deciduous.

(2) Subtropical Rain forest, regarded by Schimper (1903) as 'intermediate' or 'impoverished' Tropical Rain forest, has unique ecological features such as the prominence of small mesophyll leaf sizes (for which the term 'notophyll' is proposed), and dominance by Araucaria spp. Subtropical Rain forest is best and asymmetrically developed in the Southern Hemisphere, but outside Australia has a scanty literature, e.g., Phillips (1931) in South Africa and Maack (1948) in south Brazil. It is an ecological entity in a broad latitudinal sense, and is only partly comparable with the African and South American Mid-Mountain and Transition forests of local altitudinal ('Submontane') character which are discussed by Richards (1952).

(3) Temperate Rain forest has a flora with Subantarctic affinities, and is characterized by absence or rarity of lianes (which when they occur are slender and wiry), prominence of non-vascular epiphytes such as mosses, lichens and filmy ferns, toothed leaf margins and mostly simple leaves of microphyll size or smaller. There are few tree species, only one of which (Nothofagus gunnii) is deciduous, but there is a rich cryptogamous flora. Temperate Rain forest is conveniently divided into Cool Temperate and Warm Temperate facies, which are also represented in New Zealand (Robbins 1957)." (Webb, 1959).

ANNEX. II

COMPREHENSIVE VALUES AND POTENTIALS OF TROPICAL MOIST FORESTS

VALUES	DEPENDS ON BIODIVERSITY
A. TRADITIONALLY RECOGNISED VALUES	
(1) Timber supply	±
(2) Non-timber forest products	±
(3) Soil protection	
(4) Stream flow regulation	
(5) Climate stabilisation	
(6) Scientific research	±
B. RECENTLY ESTABLISHED VALUES	
(7) Source of new economic plants	+
(8) Gene pool	+
(9) Education	±
(10) Ecotourism	±
C. EMERGENT VALUES	
(11) Wildlife and Habitat	+
(12) Matrix of evolution	+
(13) Source of knowledge	±
(14) Aesthetic/intellectual experience	+
(15) Spiritual/religious experience	+
(16) Focus on ecological morality/ Environmental ethics	+
D. INDIGENOUS HUMAN VALUES	
(17) Subsistence/culture	±
(18) Natural history	±
(19) Myths/religion	+
(20) The "New Solidarity" (equity)	±
(21) Unknowns	

ANNEX. III

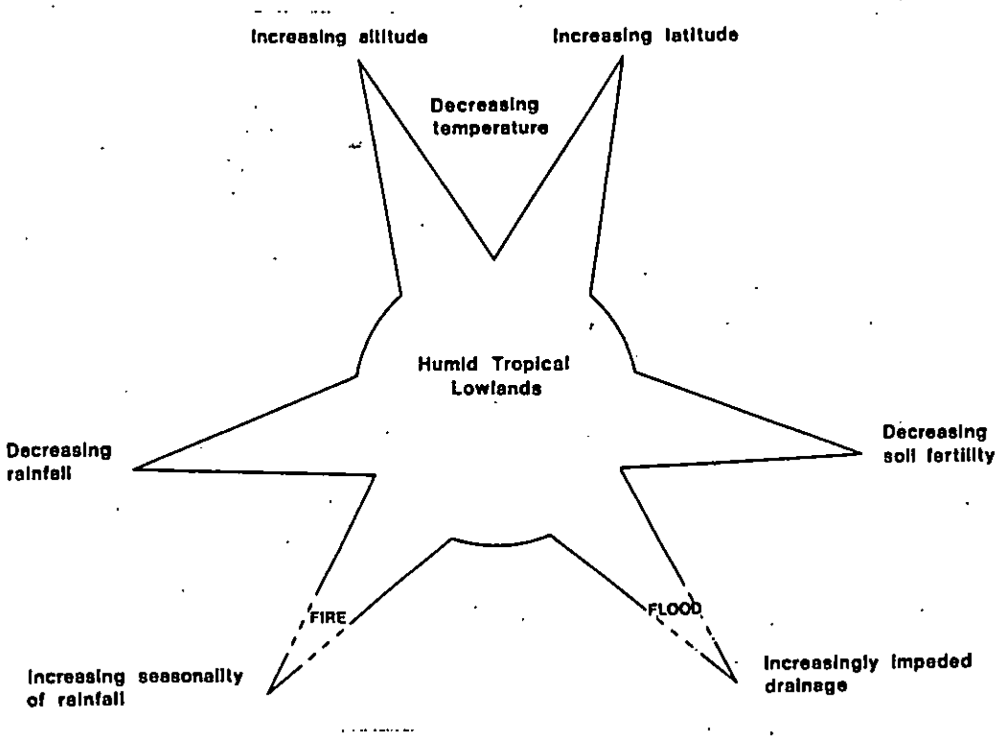
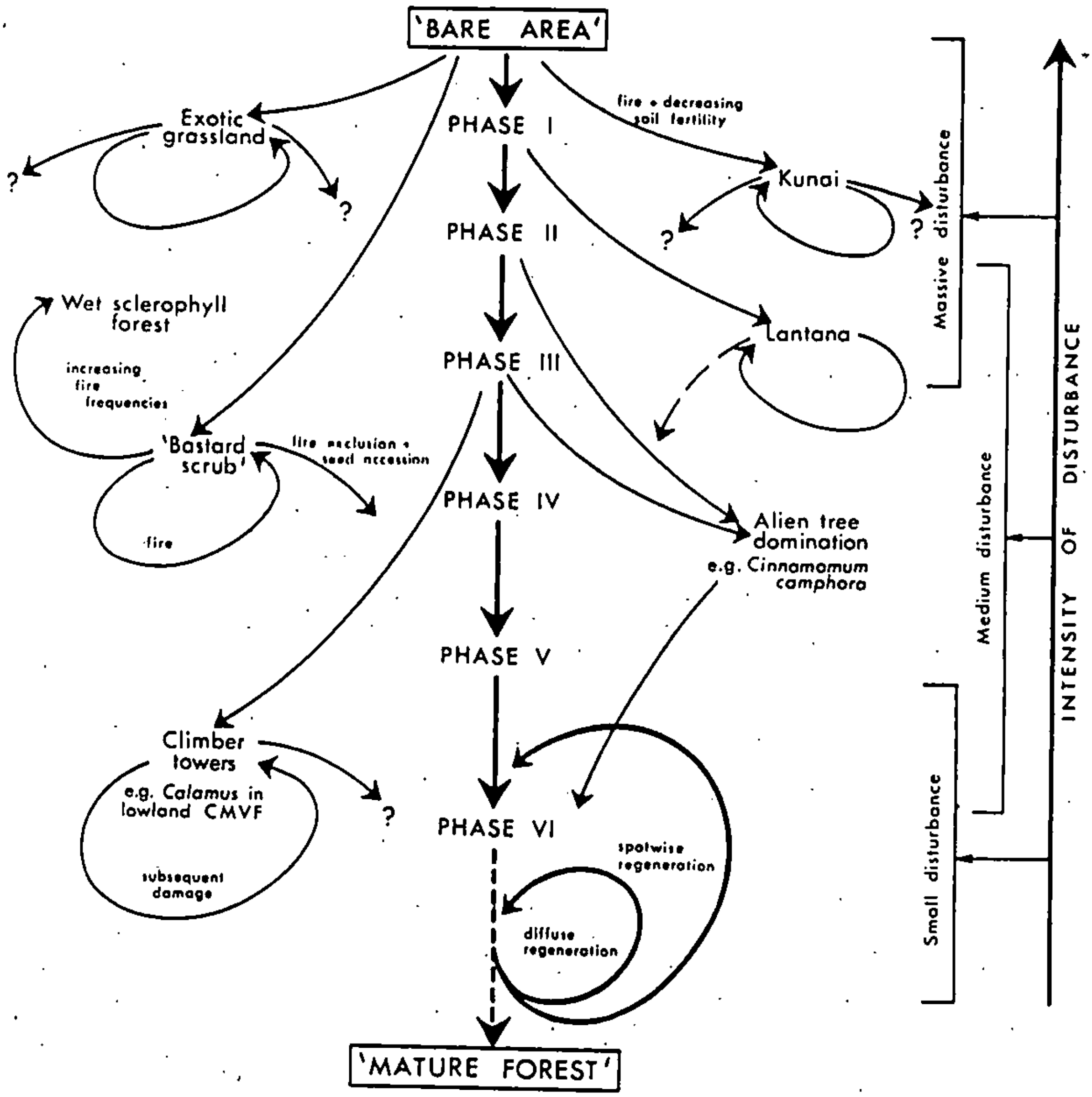


Figure 1
(from Kikkawa, J. (1990): Biodiversity. Paper presented at IUFRO Congress, Montreal, August 1990, MS.)

The hub or centre of the diagram represents the habitat optimum. The radiating arms represent environmental gradients along different pessima, which are of course not independent ecological factors. In all cases away from the optimum (for humid subtropical as well as tropical lowlands), rainforest successions include species of sclerophylls (Eucalyptus, Syncarpia, Lophostemon, Acacia, etc.). Under limiting conditions e.g. of soil fertility, complex rainforest types are replaced by simpler types, plus emergent or co-dominant sclerophylls, throughout the succession. The mature, primary rainforest stage may be attained only in situations protected from fires for over approximately 1000 years or more, according to radiocarbon dating in the wet subtropical environments at Terania Creek, Northern New South Wales.

ANNEX. IV



5.2 Schematic representation of reconstructive secondary succession pathway and natural regeneration in rainforest showing some of the variations (deflections, regressions) that can occur in relation to intensity of disturbance. Phases II–IV of the progressive successional pathway correspond to those depicted in Fig. 5·1. (Hopkins 1981)

ANNEX. V

Radiocarbon-dated age of soil charcoal found under three adjacent forest communities in north-eastern N.S.W. and estimated fire frequency

Site	Forest Community	Depth of soil sample (mm)	C^{14} age (years before 1950) (1)	No. of charcoal layers (2)	Fire frequency (3)
1	Subtropical rainforest	20-22	1080± 90	1	1110
2	Wet sclerophyll *Tristania conferta* (brush box)	8	950± 105	3	325
		38	3005± 205	8	380
3	Wet sclerophyll *Eucalyptus pilularis* (blackbutt)	8	1650± 70	6	280

(1) 1950 is the standard reporting year.

(2) Number of charcoal layers down to, and including, that dated but excluding any charcoal in surface litter.

(3) Calculated from age plus 30 years (from 1950 to 1980) divided by the number of observable charcoal layers. The age of the wood forming the charcoal, that is the outer layers of the tree, would have an effect but it has not been taken into account at this stage.

From Turner, J. (1984): Australian Forestry 47(2), 79-83.

22/12/90

AN OVERVIEW OF THE PROPOSED FOREST OPERATIONS IN NORTH WASHPOOL

LEONARD J. WEBB

PREAMBLE

I visited the Washpool and Gibraltar Range areas, together with other rainforest areas in northern N.S.W. in the late 1950's and 1960's, during ecological surveys when I was employed by CSIRO as a Research Scientist. The surveys were part of general observations throughout eastern and northern Australia which provided the basis for various publications on the classification and environmental relationships of Australian rainforests. My most recent visit to the area was camping for two nights in October 1988 at Gibraltar Range. However, I have made regular visits to the Dorrigo, Northern Rivers and Border Ranges areas, where there are some fragmented examples of the rainforest and associated forest types which dominate the Washpool area.

aff. / aff. aff. aff. aff.

I have read the depositions of Adam, Fox, Gilmour, McGarity, Recher and Olsen which detail in different ways the uniqueness of the Washpool forest mosaics and dynamics, and which comment on the adverse effects of the proposed logging operations on the environment, including the ecological equilibrium of the forests, and their intrinsic values apart from being sources of wood. I wish to say that I thoroughly endorse the scientific substance of these authors' observations, and their criticisms of the E.I.S. of the FCNSW (1980) as superficial, inadequate, and now somewhat irrelevant to proper management of the forests for all values. These unfolding values of the rainforest ecosystems are increasingly recognised as highly significant for the emerging needs of the Australian community, and to satisfy the requirements of national and international science, which recognises their exceptional global cultural and economic values.

1. HISTORICAL PERSPECTIVES

In the last decade of this millenium, industrial forestry has entered the terminal phase in the exploitation of "wild wood" from natural stands throughout the world, except for the boreal forests of the northern hemisphere. Global ecological considerations and newly developing attitudes and needs of people now urgently require the protection of remaining old growth forests as an essential life-support resource. This means that vast reafforestation programmes are urgently required, especially in the moist tropics and subtropics, to provide alternative sources for wood.

These ecological and social considerations, and the economic and related pressures of industrial forestry, are now engaged in open conflict, especially in the conservation, development, and preservation of the most biologically diverse natural moist forests in the developing countries. Examples of this conflict occurred recently at sessions of the Yokohama meeting last August of INTECOL (International Association of Ecology), and of the General Assemblies of IUCN (International Union for the Conservation of Nature, now called World Conservation Union), at Costa Rica (1987) and Perth, Western Australia (last November).

Australia, the least endowed with forest cover of any continent except Antarctica, is in a specially precarious position in this conflict. It is no coincidence that Australia has an active and well-informed organisation of non-government bodies (NGOs). European settlement over the past two hundred years reaped prosperity in primary rural industries at what now appears to be great ecological costs. Excessive clearing and ring-barking for agriculture and grazing have resulted in land degradation of many kinds, some of it irreversible. However, some tracts of State Forests and Reserves were preserved – mostly on agriculturally-unattractive soils and slopes – for hardwood timber supply (mainly eucalypts), and to a minor extent for fancy cabinet woods and pine softwoods from the always small areas of rainforests along the eastern coast and in Tasmania. The more accessible transitional zones between open eucalypt forests and closed rainforests (mixed rainforests/scrubby forests/wet sclerophyll forests/moist hardwoods) became especially sought after for prime hardwoods.

A decline in the logging industry was inevitable in the limited tracts of primary (mature) rainforests and their characteristic fringing forests, maintained on suitable soils by wildfires of varying frequency and intensity. These tracts of remaining moist closed forest were generally on rugged terrain; but in the most accessible areas, cutting clearly exceeded annual growth increments. Since the 1970's, the sustainability of timber yield from the rainforests and associated forest mixtures have become the subject of increasing public debate from both ecological and economic points of view. Moreover, the development of scientific interest in the Australian rainforest gathered momentum, crystallizing at the International Botanical Congress held in Sydney in 1981. This scientific interest soon spread amongst the community because of its cultural implications.

Traditional forestry management centred on wood production from natural forests became increasingly challenged. The widespread appreciation of the national and international significance of the Australian rainforests was recognised by the listing of World Heritage Areas in parts of New South Wales (1986), and in the Wet Tropics of Queensland (1988).

These matters have now begun to assume profound cultural as well as scientific importance for the Australian people. Public visions of the Australian landscape have progressed through what has been termed the early Scientific, Romantic, Colonial, National, and Ecological. The Colonial vision, fired by progress and development but indifferent to the intrinsic values of the land, is still prominent, but is now strongly challenged by the Ecological vision, coupled with a deepening appreciation of Australian heritage and identity.

In 1987, the Institute of Foresters of Australia published a revised National Forest Policy, with twelve categories of forest functions, amenities and values. Besides timber and soil and water conservation, the following values were explicitly recognised: wildlife, wilderness, scientific research, education and miscellaneous products such as pharmaceuticals. it now appears that Australian forestry is faced with novel responsibilities in forest management to ensure the "sustainable development" of all of the "free" goods, services functions, and values of forest ecosystems besides (and, in some places, except) wood production. Appropriate legislation, forestry training, and interdisciplinary research are now urgently required to establish suitable operational guidelines for scientifically-based forest management for all forest values. Wood should be produced from suitable plantation mixtures, enrichment of stagnant regrowth areas, etc. All these are challenges for modern forestry in Australia.

2. ECOLOGICAL PERSPECTIVES

The Australian tropical, subtropical and temperate rainforests are the survivors in evolutionary time of an ancient broad-leaved flora of moist closed forests, which once covered much of the continent. They have persisted in scattered refuges, as an "archipelago of relics" throughout the moister coastal and subcoastal areas of northern and eastern regions. The widespread narrow-leaved, evergreen "sclerophyll" flora (eg. eucalypts, acacias, and the sand heaths) are thought to have been derived, under special conditions of soil fertility, from the ancient rainforests.

The rapid decline and demonstrated extinctions of the original rainforest "islands" of varying size, since the arrival of Aboriginal and most recently European people, demonstrate their vulnerability to human impacts. This is illustrated by their characteristically prompt displacement by the specially fire-tolerant sclerophylls in marginal rainforest areas.
The mixed/transition forests bordering residual patches of primary rainforest represent dynamic "buffer zones", which tend to prevent further attrition of the rainforests. Hence human impacts such as logging, not to mention more drastic forms of disturbance such as partial clearing, exceed the naturally evolved tolerances of the patches, Unless Areas such as Washpool, which contain the full range of secondary succession, from particular types of eucalypt forest to primary/mature rainforest on certain soils, ~~should accordingly be~~ are managed to maintain their natural biotic diversity, Logging initiates regressive succession to secondary types of vegetation of varying permanence, depending on site history. Progressive succession to the mature stage might take over a thousand years, determined by the extent of canopy gaps, exposure of mineral soil, and fire regime. This estimate is extrapolated from the age of

give reference

veteran Brush Box (*Lophostemon confertus*) at Terania Creek, where radiocarbon dating showed emergent trees about 2 metres diameter to be approx. 1300 years old. (Another dating was reputed to be approx. 1700 years old - FCNSW unpublished data).

THE ECOLOGICAL SIGNIFICANCE OF THE WASHPOOL AREA

The Washpool area is the largest area of warm temperate rainforest remaining in Australia, and thus the world. It occupies a key biogeographic position in moist eastern Australia for further studies of the ecological and palaeogeographic relationships of the warm/cool moist subtropical and warm temperate/lower montane rainforest elements including the earliest coniferous forests.

In the quickening evolution of ideas about the Australian past, the rainforests have assumed a symbolic role in the scientific, aesthetic and ethical consciousness of Australians, as noted below.

3. ECOLOGICAL VERSUS FORESTRY DEFINITION/CLASSIFICATION OF RAINFORESTS

See attached page which precedes below;-

Given these restrictions in forestry typology, it is nevertheless of interest that the E.I.S. notes (P. 30) that "Inland Brush Box", is "a tall wet sclerophyll forest up to 55 m in height, which appears to form an intermediate stage in replacement of certain eucalypt types (eg. Tallowwood-Sydney Blue Gum type) by rainforest". Hence although the dynamic nature of the series of forest types in secondary rainforest succession is appreciated, it is not considered relevant by commercial forestry. This attitude is referred to in the 1982 E.I.A. by the D.E.& P. (p. 25, last para.).

INSERT FOR PAGE, 5 5A

4. Ecological versus Forestry definition/classification of rainforests.

Classification depends on purpose. If the ecological interpretation of dynamic status of the forest mosaics at Washpool is accepted as a guide to future trends and rates of change following particular forms of disturbance, then there is no place for expediency in forest management, especially as it is based on a static forest typology.

The dynamic status of sclerophyll-rainforest species mixtures has been explicitly dismissed by foresters as irrelevant to the purposes of official forestry. The classical expression of this forestry attitude is in the Forestry Reports of the pioneering forester-ecologist Baur in New South Wales. For example, he observed that "throughout the moister regions of NSW, there is an uneasy and constantly changing, boundary between rainforest and eucalypt forest: periods of protection favour the advance of rainforest into the eucalypt forest; repeated fires or other forms of disturbance favour the advance of eucalypt forest" (Baur, G.N. 1968. Developing a classification of forest types in New South Wales. Forestry Commission of N.S. Wales, Sydney). His classification of forest types in NSW, although derived from earlier ecological surveys, "does not attempt to be an ecological classification. Forest types ... emphasise features of forestry, as opposed to botanical significance".

~~Baur stated that~~ His typology was "essentially based on species composition ... the degree of predominance required to determine indicator species is arbitrarily based, with particular weight given to commercial values. With species of outstanding importance, as little as 20 percent of the stand basal area is regarded as conferring predominance". Thus, with Blackbutt, "... the type classification is developed from communities actually present and includes a number of obviously seral communities" (Baur 1968).

On the other hand, the E.I.S. is most reluctant to recognise as secondary rainforest any stand with emergent "hardwoods" (eg. eucalypts and *Lophostemon confertus*) even though it has well-developed rainforest strata (pp. 139–141).

The distribution and definition of primary rainforest and secondary rainforest types (cool temperate and warm temperate) in Victoria have been the subject of considerable controversy since the early 1980's. The scattered areas of primary rainforest are small compared to the extensive transitions and mixtures of rainforest elements with eucalypts and acacias. The writer was involved as a consultant to the Victorian Government in this matter. An extract from a discussion paper prepared by David Cameron (September 1990) provides a recent view of the ecological interpretation of the different forest types (See attached).

→ INSERT → 6A, 6B.

4. DESIRABILITY OF FUTURE MANAGEMENT FOR ALL FOREST VALUES

The many properties, functions, benefits, goods and services provided by natural ecosystems such as the rainforests, have, with the exception of wood and so-called "minor" products, been traditionally taken for granted in forest inventories. Given the unparalleled complexity of the rainforests, especially in the moist tropics and subtropics, there is now a great upsurge of interest in so-called "non-wood" or "non-market" values. In Table 1 (Webb & Kikkawa, 1990), the functions 1,3,4,5 are largely independent of species composition and can be supplied by well-developed secondary forests. However, in the case of the relatively complex and species-rich primary rainforests, all of the other values listed in Table 1 reflect the biological diversity and essential inter-dependence of plant and animal species. All of these values are conceived by people as fundamental in some way for their self-fulfillment. It is however clear that with few exceptions (eg. 1,2,7,10) monetary values cannot be measured, although some (eg. 3,4,5,9 and perhaps 11) may be assignable in dollars.

Unfortunately, market values dominate decisions about the use of the forest as human resources. I believe that it would be pretentious to claim that forest management could match

6A

4. Inadequacy of the Environmental Impact Assessment (1980) of Forestry Commission of New South Wales, relating to the proposed logging operations at North Washpool.

4.1 Description of the existing forest environment and its values.

These inadequacies are noted in the "Applicant's Contentions" by J.Corkill, under various headings, e.g., Sections 16-27, 30. Fox, Recher, McGarrity and others are quoted for critical comments.

I agree that the description is very unsatisfactory, and appears to be partly a desk top job e.g. the use of "standard texts" to "prepare a list of all possible bird species" (Section 17); and the inferring of rock types from small scale geological maps (Section 21).

The statement by Recher is quite decisive and authoritative e.g. that the various logging operations "will have significant adverse effects on the old growth ecosystems and associated wildlife in the North Washpool" (Recher's Affidavit P. 4).

Furthermore, the proposed Harvesting Plan (Casino district) for Compartment 695 in the Billilibra State Forest No. 815 appears to be based on superficial and even inaccurate ecological information: the Plan's prescriptions "are limited and inadequate to ensure the long time survival of the fauna that will occur in the Compartment given that logging will aim to retain only a 50 percent canopy cover" (Recher's 1990 Affidavit). Such statements flatly contradict the Forestry Commission arguments by Binns, Curtin and Horne. Furthermore, Recher notes that "the EIS was prepared at a time when knowledge of the importance of old growth ecosystems was limited and when there was much less complete knowledge of the impact of forest fragmentation and logging on forest wildlife" ... the importance of the interdependence of flora and fauna in relation to "the diversity and gradation of plant communities" is completely

6B

ignored.

Recher's statement that the "the Washpool wilderness contains the largest warm temperate rainforest on the planet and is of outstanding national and international value" certainly deserves featuring as a prime argument against human impacts in North Washpool currently under threat.

Olsen's Affidavit of 8/10/90 criticises the EIS as "deficient/ inadequate" ------.

Adam (Affidavit P.5) notes that the mosaic of rainforest and wet sclerophyll forest and its dynamic relationships are exceptionally well displayed.

In Corkill's Contentions (pages not numbered) the EIS is quoted as follows:

> "For the purpose of this Statement, the whole forest area of 88,921 hectares is considered as an island. It is assumed that the area and its fauna are currently in equilibrium with no long term decline of either forest types or faunal species".

Corkill notes this assumption is unacceptable, but gives no explanation. I believe it is most important to consider this further.

or manipulate the subtle processes which are directly or indirectly linked to biodiversity. It follows that any further incursions by humans into any remaining forests and habitats, especially when they are rare and not adequately represented in reserves, should cease. It can be argued that the loss of biodiversity which accumulates as the result of such incursions is not only of economic, aesthetic and ethical significance but also now threatens the very existence of civilisation (See P.R. Ehrlich - Crafoord Lecture, September 1990: Biodiversity and Humanity: Science and Public Policy).

It is therefore relevant for the preservation of the North Washpool area to consider the extent to which the E.I.S. caters for the different values listed in Table 1. Several pages of the E.I.S. are devoted to the "Visual Resource" (pp. 74–78), which is described as of substantial aesthetic value. Further, on pp. 78–80, there is reference to wilderness which is regarded as representing " a range of values rather than a specific concept", since the concept means different things to different people. It must be concluded that attention paid to the non-wood values of the North Washpool forests is inadequate given the comments of experts in relation to environmental attributes such as geology, soils, flora, fauna, hydrology etc. It is relevant that Fox (Affidavit p. 3) refers to her report of February 1982 to the Department of Environment and Planning, Sydney, in which she noted that her recommendation to exclude further logging from the Washpool area was "based on the considerable scenic, wilderness, aesthetic, and scientific value of the area". On p. 6, Fox noted "there is a fundamental and qualitative change when pristine vegetation is modified in any way". It is therefore significant that Binns affidavit 18.10.90) p. 2) asserts that this statement by Fox "is a philosophical difference only. There is no fundamental ecological difference between the processes of logging and natural disturbance events, although they may differ in scale, intensity and frequency..".

The conclusion must be that, given this gulf in understanding between an ecologist and a forester, it should be urged that more real objectivity and conflict resolution would follow if all of the forest values are brought out into the open, for shared humanisitic discussion, instead of denying their existence cf (Webb & Kikkawa, 1990).

ANNEX. II

COMPREHENSIVE VALUES AND POTENTIALS OF TROPICAL MOIST FORESTS

VALUES	DEPENDS ON BIODIVERSITY
A. TRADITIONALLY RECOGNISED VALUES	
(1) Timber supply	±
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(6) Scientific research	±
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(7) Source of new economic plants	+
(8) Gene pool	+
(9) Education	±
(10) Ecotourism	±
C. EMERGENT VALUES	
(11) Wildlife and Habitat	+
(12) Matrix of evolution	+
(13) Source of knowledge	±
(14) Aesthetic/intellectual experience	+
(15) Spiritual/religious experience	+
(16) Focus on ecological morality/ Environmental ethics	+
D. INDIGENOUS HUMAN VALUES	
(17) Subsistence/culture	±
(18) Natural history	±
(19) Myths/religion	+
(20) The "New Solidarity" (equity)	±
(21) Unknowns	

A NEW DEFINITION OF RAINFOREST FOR VICTORIA

DAVID CAMERON

[extract from 'Rainforest Definition in Victoria - A Discussion Paper' prepared by David Cameron for the Rainforest Project Team, Department of Conservation and Environment September 1990]

Rainforest is defined by a combination of ecological, floristic and structural parameters, often supported by correlated environmental attributes. Consistent with the principle of eco-floristic priority, ecological criteria take precedence over floristic and structural criteria, and floristic criteria take precedence over structural criteria.

Rainforest is defined ecologically as a fireproof forest, that is, as forest vegetation which is either uniquely adapted and restricted to relatively fireproof topographic niches, or which, once established, is intrinsically capable of maintaining an internal environment which resists destruction of the canopy by running crown fire. The incursion of low intensity surface fire is recognized as a normal and recurrent phenomenon within at least some rainforest communities, particularly warm temperate rainforests in Victoria, and contributes to the maintenance within many stands of a characteristic assemblage of secondary species and a rich herbaceous flora.

Temperate rainforest in Victoria occurs in a variety of successional stages as the result of disturbance, notably fire. The ecological definition of rainforest includes these transitional (ecotonal) and seral (secondary or mixed) forest communities once they have developed a recognisable understorey canopy of rainforest species below an overstorey of sclerophyll emergents. Where the closed mesic canopy is relatively tall and even, and the community is of similar botanical composition to mature rainforests in which sclerophyll emergents are absent, the presence of occasional remnant sclerophyll emergents does not alter its status as mature rainforest. In some circumstances, a community with a relatively continuous canopy which is itself dominated or codominated by secondary rainforest species may, even in the absence of an emergent overstorey of sclerophyll species, be defined as secondary rainforest, providing it is of similar botanical composition to mature or seral rainforest dominated by primary rainforest species.

Primary rainforest species are defined as shade-tolerant species which are able to establish or perpetuate themselves (either vegetatively or from seed), in the absence of fire, below an undisturbed canopy, or in minor canopy gaps resulting from endogenous processes of renewal within the rainforest ecosystem, such as isolated windthrow or endemic forest pathology. Such species are not dependent on fire for their regeneration. However, certain sclerophyll species which may have regenerated following fire in extensive canopy gaps, and which are invariably found as dominants contributing to, or as emergents above, an immature rainforest understorey in mixed forests, may be defined as secondary rainforest species. A diversity of opinion exists as to the ecological status of some of these species, ranging from their consideration as primary or secondary rainforest species to their consideration as sclerophyll species. Most demonstrate at least some capacity to regenerate in the absence of fire, although this is not necessarily their most frequent mode of regeneration. Because of their longevity and their propensity for long-term vegetative reproduction, particularly in cool temperate regions which may experience very long fire intervals, these species probably warrant recognition as secondary rainforest species. Most of the secondary rainforest dominants listed below have ecophysiological and physiognomic characteristics which distinguish them from most of their strictly sclerophyll congeners. In particular, most have features which contribute to, rather than (or as well as others which may) antagonize, the fireproof quality of more advanced seral or mature rainforest types.

Rainforest is defined floristically as vegetation whose composition is considered to belong to rainforest communities or sub-communities described on the basis of a complete regional or statewide floristic analysis of reliable quadrat data. Rainforest may be recognized floristically in the field, and rainforest boundaries located precisely, by the use of discriminant, diagnostic or indicator species, providing these have been determined using an adequately representative and rigorously collected quadrat data base. Floristic field guides or field keys so derived need to be regionally based and derived separately for each rainforest subformation present in each region. In the case of a region with a strikingly heterogeneous rainforest data base, it may be necessary to derive separate field keys for each rainforest community present.

Primary rainforest species which contribute significantly to the canopy of Victorian cool temperate rainforest communities include Nothofagus cunninghamii, Atherosperma moschatum, Elaeocarpus holopetalus, Telopea oreades, Podocarpus sp. aff. lawrencei, Notelaea (Nestegis) ligustrina, Pittosporum bicolor, Persoonia silvatica, Lomatia fraseri, Tasmannia lanceolata, T. sp. (Errinundra Plateau), Leucopogon maccraei and Dicksonia antarctica. Secondary rainforest species which contribute significantly to, or which may be emergent above, the canopy of Victorian cool temperate rainforest communities include Acacia melanoxylon, A. frigescens, Eucalyptus regnans, E. sp. aff. nitens (Errinundra), Leptospermum grandifolium, Kunzea ericoides, Prostanthera lasianthos and Phebalium squameum.

Primary rainforest species which contribute significantly to the canopy of Victorian warm temperate rainforest communities include Acmena smithii, Tristaniopsis laurina, Pittosporum undulatum, Rapanea howittiana, Acronychia oblongifolia, Eucryphia moorei, Elaeocarpus reticulatus, E. holopetalus, Telopea oreades, Livistona australis, Ficus coronata, Myoporum insulare, Cissus hypoglauca, Dicksonia antarctica and, very rarely, Symplocos thwaitesii. Secondary rainforest species which contribute significantly to, or which may be emergent above, the canopy of Victorian warm temperate rainforest communities include Acacia melanoxylon and Eucalyptus botryoides.

Primary rainforest species which contribute significantly to the canopy of the Victorian dry rainforest community include Pittosporum undulatum, Brachychiton populneus, Acmena smithii, Rapanea howittiana, Elaeocarpus reticulatus, Beyeria viscosa, Celastrus australis, Marsdenia rostrata, very rarely Alectryon subcinereus and, debatably, Tristaniopsis laurina although the latter is more correctly ecotonal with warm temperate riparian rainforest which often abuts dry rainforest stands. Secondary rainforest species which contribute significantly to the canopy of the Victorian dry rainforest community include Acacia implexa and A. melanoxylon. Dry rainforests are noteworthy for the insignificance or absence of sclerophyll emergents, particularly eucalypts, although Eucalyptus melliodora is emergent on the margins of some Victorian stands.

Rainforest is defined structurally as forest vegetation with a rainforest canopy which provides the habitat for a characteristic diversity of dependent life forms. The rainforest canopy is defined as a more or less continuous closed canopy composed of primary and/or secondary rainforest species. Height and density of the rainforest canopy, and the stratification of the forest, are variable and related to the seral status of the community. Mature or primary rainforest is a closed community of relatively even height, usually stratified into two or more discernible layers of trees and shrubs. Immature or secondary rainforest usually contains sclerophyll elements emergent over a more or less closed mesic understorey of more variable height and continuity and often less discernible stratification. The rainforest canopy functions as a continuous `blanket' draped over the crowns of the dominant rainforest trees and climbers, falling to lower levels in more recently disturbed sites and ecotones and dropping almost to ground level within larger gaps which are usually enclosed within the rainforest stand. Dominant rainforest species are usually of tree form (single erect stemmed) and of forest height (minimum 5-8 m) but in environmentally attenuated sites such as exposed altitudinal limits, flood-prone riparian sites or wind-sheared littoral sites, the canopy may be reduced to two metres height and be composed of treelets (dwarf plants of tree form) or extensively layered prostrate trees.

Physiognomically, most primary rainforest species are broad-leaved and evergreen, with leaf texture varying from predominantly mesophytic in the understorey and for shade-leaves of canopy species to sclerophyllous or even xerophytic for exposed sun-leaves in the canopy. Leaf size varies in Victorian rainforests from predominantly nanophyll-microphyll with some leptophylls in cool temperate rainforests to predominantly microphyll-notophyll in warm temperate and dry rainforests. A single facultatively deciduous canopy tree, Brachychiton populneus, is a codominant of dry rainforest. Life forms which depend on the integrity of the rainforest canopy for mechanical support (climbers and epiphytes) or for shade (terrestrial and arborescent ferns) impart much of the distinctive character to each of the physiognomic-structural rainforest types present in Victoria. Thus climbers are the predominant dependent life form in vine forests, epiphytes the predominant dependent life form in moss forests and arborescent ferns the predominant special life form in fern forests. Victorian cool temperate rainforests are classified as microphyll moss forest (MMF) or microphyll-leptophyll moss thicket (MLMT). Victorian warm temperate rainforests are classified as microphyll fern forest (MFF) to simple notophyll vine forest (SNVF), with most stands best described as simple notophyll-microphyll vine-fern forest (SNMVFF). Victorian dry rainforests are classified as simple notophyll-microphyll vine forest (SNMVF).

being examined and suggesting areas for which further investigation may be profitable.

TAREE REGIONAL RESEARCH STATION

NATURAL REGENERATION OF WET SCLEROPHYLL FOREST WITH AN OVERSTOREY OF TALLOWWOOD, SYDNEY BLUE GUM AND BRUSH BOX

This forest type reaches its best development on fertile soils at an altitude ranging from 300-900 metres in north-eastern New South Wales and south-eastern Queensland. The association often borders rainforest areas and in the absence of fire, rainforest species invade the type and a rainforest understorey results. Depending on the fertility and moisture relations of the site this understorey can vary between 5 m and 30 m in height but the majority would be under 10 metres.

As a result of the dense understorey, high rainfall, good soil and vigorous weed colonisation following logging disturbance it had been considered that natural regeneration of the sclerophyllous element could not be guaranteed. In investigating the conditions that are required to achieve a satisfactory stocking of natural regeneration of the sclerophyllous overstorey species, an historical examination has been made of logging areas back to 1954 on Bulga, Dingo, Doyles River, Mt. Boss and Lower Creek State Forests. The principal variables being examined to determine the effect on regrowth are post logging burning, soil disturbance and the percentage canopy retention. Other variables include predominant height of the rainforest understorey, species composition of the rainforest understorey, position on slope, soil moisture, and percentage of brush box in the overstorey prior to logging. Assessment of regeneration was carried out by a point to plant method using a randomised grid layout.

Eleven areas were assessed that had experienced a post logging burn. This involved the measurement of 894 plots.

Table 14. Assessed regeneration stocking and composition of 11 areas of wet sclerophyll forest which had been *burnt* following logging

Site No.	Year logged	Regeneration stocking/ha	% Species Composition of Regeneration			
			Tallowwood	Sydney blue gum	Brushbox	Other eucalypt sp.
185	1975/76	1198	31	22	32	15
206	1971/72	816	34	54	12	—
237	1978/79	323	36	46	14	4
68	1963/64	291	39	15	46	—
196	1971/72	1703	16	32	51	1
197	1975/76	582	32	10	24	34
15/1	1959/60	2384	47	53	—	—
93	1959/60	977	36	36	25	3
94	1960/61	1479	22	56	4	18
171	1975/76	539	51	40	9	—

Table 15. Assessed regeneration stocking and composition of 12 areas of wet sclerophyll forest which had *not been burnt* following logging

Site No.	Year logged	Regeneration stocking/ha	% Species Composition of Regeneration			
			Tallowwood	Sydney blue gum	Brushbox	Other eucalypt sp.
6	1977/78	289	24	14	62	—
8	1974/75	223	38	3	19	40
237	1978/79	84	30	7	63	—
107	1976/77	574	36	17	12	35
18	1954/57	135	19	12	69	—
18/19	1954/57	288	28	4	68	—
25	1958/59	291	38	1	61	—
28	1960/61	338	7	6	87	—
53	1956/57	156	46	6	48	—
121/1	1977/78	396	53	25	22	—
121/2	1977/78	333	63	20	17	—
173	1978/79	311	32	39	26	—

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RECOVERY OF RAINFOREST FOLLOWING LOGGING

Ross Horne.

Forestry Commission of New South Wales

Prepared for the Rainforest Conference

Organised by the Geographical Society of N.S.W.

Sydney University.

2nd May, 1981.

Whole Report

The problem of logging rainforests

It is generally recognised that rainforests are structurally and botanically complex and that a large number of factors are held in some sort of dynamic balance, interacting with each other in an unknown way to form the ongoing ecological entity that we observe to be rainforest.

Since it has been impossible to measure all the factors and their interactions, some concern has arisen as to the question of recovery, following disturbance by logging. That is, will a rainforest ever recover to the position that it would have proceeded to, if it had not been disturbed? This is tantamount to saying - Will it ever recover to the n^{th} degree?

This question is so difficult to answer that many academics and others have been led to declare that rainforests should not be logged until more is known about the effect of logging disturbance. This is fair comment, but in the meantime much folkloric knowledge has come forward concerning the condition of rainforests following logging. This folklore avers in various forms - that rainforests are destroyed by logging; that there are massive changes and reversion to early successional stages; that residual trees die back; that weeds run rampant; that the rainforest as we know it is lost forever or at best for a very long time indeed. Clearly though, observational experience has tended to confirm these conclusions and with the passage of time there has been a degree of popular acceptance of them.

There has been however, a history of rainforest logging in New South Wales extending over 40 or so years and a positive approach to the problem would be to examine these forest stands to determine *the extent* of changes considered likely as a result of logging. Is the rainforest as we know it gone forever if it is logged? Will the component species be permanently changed? Will a substantial part of what is left following logging, die from exposure? Will the forest ever achieve aesthetic beauty again? If it does recover will it take 100, 500 or 1000 years?

It is the indication from the data of the *extent* of the change that has been considered here.

The data

The Forestry Commission of N.S.W. has collected data on individual tree growth using rainforest experimental plots measured at regular intervals over the last 15 - 30 years. These data apply to a variety of rainforest types at a number of locations.

In addition, some assessments of logged rainforests have recently been carried out in Washpool State Forest and the Hastings River catchment rainforests.

An index of forest recovery (graph I)

Since total recovery of rainforest following logging is difficult to quantify, it would be an advantage to identify some plateau which reasonably epitomises recovery. It is submitted that such a recovery plateau would be the reconstitution of the tall forest canopy, since it is, in a sense, the backbone on which the rest of the forest system depends.

The canopy can be viewed as the master regulator of the micro environment and its reconstitution would bring about conditions suitable for complete recovery to proceed. The recovery of the tall forest canopy in terms of tree number, tree size and species composition is seen therefore as a useful index and a measurable precurser of the total recovery concept. Hence, the rainforest growth data have been analysed in this way to determine if recovery is possible and if so how long it would take.

(a) The potential of the rainforest to recover overstory canopy following logging

The most obvious effect of logging rainforest is that the erstwhile complete canopy of the forest has been opened up, exposing under-canopy trees and the forest floor to light. If the residual forest is to be able to replace the forest canopy, under-canopy trees must exhibit the potential to grow. Additionally, germination and survival of sufficient overstory species must occur on the forest floor to ensure replacement, in time, of those canopy trees removed or damaged by logging.

The available data suggest that the under-canopy trees *do* respond in growth following logging, and that *in every case* the regeneration is more than adequate to ensure replacement of the overstory trees in time, *even under conditions of very heavy logging*. For example, a sample of the moderately heavy logging that took place in warm temperate rainforest, logged during 1965 in Washpool State Forest, revealed regeneration in excess of 20,000 seedlings of overstory species per hectare. Also, very heavy logging which reduced the overstory trees from 105 trees per hectare to 16 trees per hectare in Doyles River State Forest in coachwood-sassafras rainforest during 1975-1977, has left 9000 overstory species seedlings and advance growth per hectare to replace the lost canopy.

(b) The time taken to reconstitute the rainforest overstory following logging

The data show that the recovery time is dependent on the intensity of logging. Experimentally, several intensities of logging have been carried out in sub-tropical rainforest at Wiangaree S.F. The treatments varied from removal of 30% of the basal area of the overstory to 85% of the basal area.

From this data a growth model has been devised which allows residual trees to grow at a decelerating rate until the prelogging level of canopy basal area per hectare and number per hectare are reached. These results are shown in graph II.

The graph shows that 40% basal area loss of canopy (which is approximately equivalent to the so called "50% canopy retention" logging) or less recovers in about 80 years, whereas heavy logging, takes over 200 years to recover.

(c) Changes in tree species composition brought about by logging (graph III)

Conventional successional theory indicates that rainforest will revert to an earlier successional level if severely disturbed by logging or fire. Fears are also held that tree species such as wattle and callicoma or camphor laurel will predominate in logged rainforest stands or at least increase in frequency following logging.

In the heavily logged coachwood-sassafras rainforest at Doyles River quoted earlier, the data showed that 3-5 years following logging, there were 9 wattle trees/ha in the logged forest. This was in contrast to none in the unlogged. The logged forest included 16 callicoma trees/ha with 6 in the unlogged. There was no camphor laurel in either the logged or unlogged.

Further, using the growth model quoted earlier, the relative frequency of overstory tree species in the recovery canopy could be compared with the unlogged canopy. The results are shown in the graph III.

Clearly, the model forecasts a composition shift in the species which make up the recovered canopy. Slow growing corkwood, abundant in the unlogged canopy has to some extent been replaced by the fast growing olivers sassafras and golden sassafras which are of low frequency in the unlogged canopy. The other major overstory species would be expected to recover to about the same frequency as before logging. Although this represents a definite shift, it is not a massive shift and it can be reasoned that if the stand is left unlogged, the relative abundance of corkwood in the understory will eventually allow the return of the overstory to approximately its original species proportions.

(d) Tree dieback as a result of exposure following logging

Rainforest and in particular warm temperate rainforest can often exhibit the phenomenon of "dieback" following logging. Coachwood is the rainforest species most prone to dieback.

Dieback is the term applied to a general shrinking of the crown away from the branch tips toward the trunk of the tree, leaving dead branches and twig ends which are easily visible against the skyline. The occurrence of dieback following logging is generally proportional to the intensity of logging. However, it can be extremely variable - for example often not significant after heavy logging or often severe after a more moderate logging. Dieback can also give the appearance of becoming worse with the passage of time following logging.

Although the experimental evidence lends support to the conclusion that logging increases crown dieback, three points should be emphasised:

1. There is often considerable crown dieback in unlogged rainforest stands. Logging it appears, extends rather than initiates dieback. However, the dieback in unlogged stands, is not readily apparent to an observer because of the normally close proximity of tree crowns in the unlogged stands.

2. The effects of increased dieback following logging may be limited. After about 20 years or so, the residual tree crowns show some recovery and the visual stark skyline symptoms of dieback have rotted away.

3. Despite the poor appearance of trees showing the symptoms of severe dieback, actual deaths of these trees is less certain than a casual observation following logging, might forecast.

From observation it would appear that some forest stands contain little inherent dieback and can be logged without a significant increase, whereas other forest stands which contain numerous affected trees prior to logging are more prone to extensive post logging dieback. Therefore the extent to which crown dieback manifests itself in the unlogged forest can be used as an index to forecast the post logging effect.

(e) The introduction of weeds and undesirable species into the rainforest following logging

The logging of rainforest can cause the germination of many wind and bird dispersed weeds, such as lantana, gahnia, solanum and rubus species. These weeds, although unsightly, form a protective cover for the regenerating rainforest plants. Eventually the rainforest regeneration grows through the weed cover causing the weeds to die from lack of light.

Assessments of rainforests logged over 15 years ago have not shown the persistence of these weeds nor have they shown the presence of undesirable exotic tree species such as camphor laurel.

Conclusions

The conclusions drawn here, refer in essence to the effect of a single logging on the types of virgin moist rainforest that is found in northern New South Wales. The effect of multiple logging on rainforest of these types even if spread over a long period of time cannot be determined from the data.

(a) It is not denied that the spectacle of rainforest, the aesthetic grandeur, is impaired by logging. However the entity of the rainforest, that is its ability to continue to flourish as an ongoing recognisable forest form, *is not* impaired by logging.

The rainforest will regenerate and in time reconsitute itself, and hence there is no question of extinction of rainforest by logging.

In this context, however, it must be noted that there is a clear distinction between the *logging* of rainforest within state forest and the *clearing* of rainforest for agricultural use on freehold land.

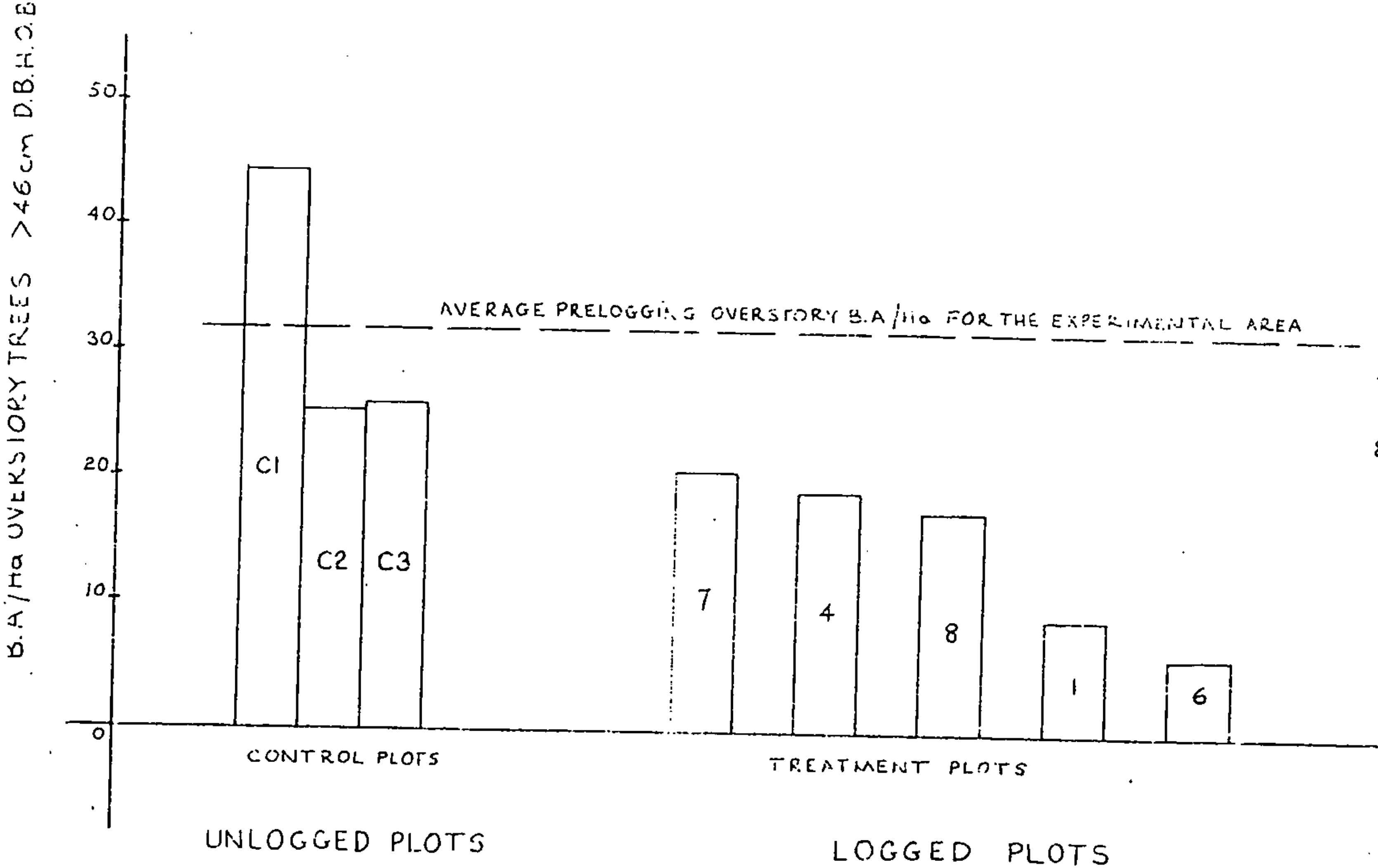
(b) The time taken for the rainforest to reconstitute the overstory structure in terms of height and size of individual canopy trees depends on the intensity of logging. A growth model has forecast that recovery would take over 200 years for sub-tropical rainforest which was completely merchantably logged. The time of recovery for the so-called 50% canopy retention was in the order of 80-100 years for the same forest.

(c) The same growth model forecast that logging may cause changes in the frequency of some rainforest species when the overstory is reconstituted. These changes were not shown to be extensive or permanent.

SUBTROPICAL RAINFOREST LOGGING - WIANGARIE S.F

GRAPH I

GRAPH SHOWING THE REDUCTION OF THE OVERSTORY CANOPY (TREES >46 cm D.B.H.O.B) FOLLOWING VARIOUS LOGGING INTENSITIES. THE TIME TAKEN FOR THE LOGGED PLOT OVERSTORY TO RECOVER TO THE AVERAGE PRELOGGING B.A./ha IS AN INDEX OF RAINFOREST LOGGING RECOVERY

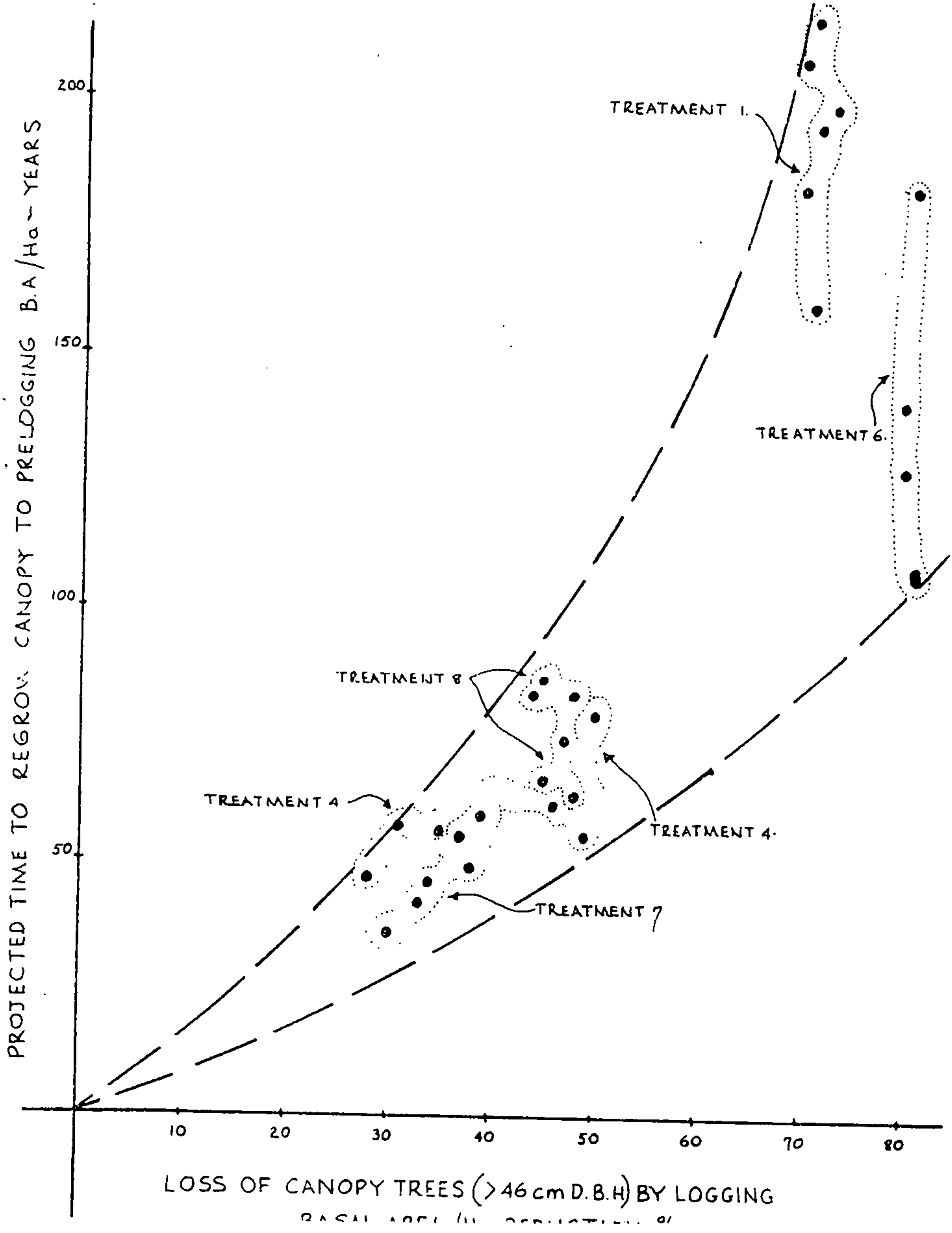


KEY TO TREATMENTS

1. ALL MERCHANTABLE STEMS LOGGED. ALL USELESS STEMS POISONED.
4. ALL MERCHANTABLE STEMS >46 D.B.H.O.B LOGGED EXCEPT SOME SEED TREES. ALL DAMAGED AND SURPLUS SMALLER TREES FELLED
6. ALL MERCHANTABLE STEMS LOGGED USELESS UNDERSTORY STEMS REMOVED
7. MERCHANTABLE STEMS LOGGED SO AS TO RETAIN 50% CANOPY
8. AS FOR 7 BUT MORE MERCHANTABLE STEMS LOGGED.

SUBTROPICAL RAINFOREST LOGGING - WIANGARIE S.F.

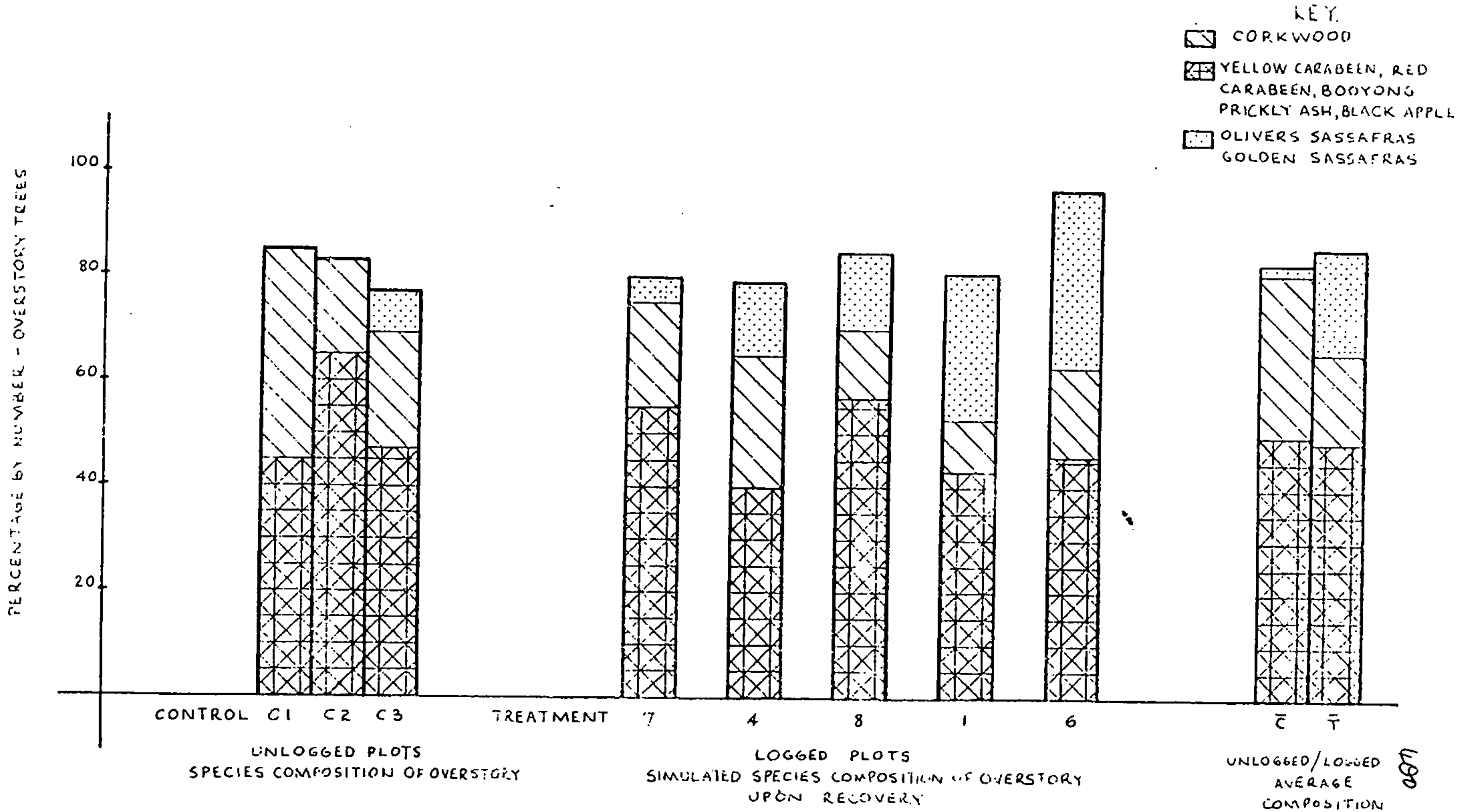
A GROWTH SIMULATED PREDICTION OF THE TIME TAKEN FOR THE OVERSTORY CANOPY TREES TO RECOVER TO THE PRELOGGING BASAL AREA PER HECTARE LEVEL



GRAPH III

SUBTROPICAL RAINFOREST LOGGING - WIANGARIE S.F.

PROJECTED CHANGE IN SPECIES COMPOSITION FOLLOWING CANOPY RECOVERY AFTER LOGGING



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The mean regeneration stocking was 1055 stems/ha with a stocking range of 291-2384 stems/ha. Generally the burn did not cover 100% of the area as the most moist sections are almost impossible to burn silviculturally and would only burn under the most extreme weather conditions. Generally the overall stocking/ha of regeneration was most satisfactory but the very moist unburnt sections still require further investigation (Table 14).

Twelve areas were assessed that had been logged at varying intensities but received no follow-up silvicultural treatment such as a post-logging burn. This involved the measurement of 1196 plots. The mean regeneration stocking obtained of 285 stems/ha was much lower than that achieved in areas that had experienced a post logging burn.

The regeneration stocking range was from 84-574 stems/ha (Table 15).

The stocking of moist hardwood regeneration in the areas that received no post logging silvicultural treatment in some cases was below an adequate level and in some cases only marginally satisfactory. Regeneration was not evenly distributed throughout the areas and current investigation is directed towards those sections of areas where regeneration stocking is low or absent. The majority of plots that had experienced soil disturbance were stocked with regeneration (Table 16).

Table 16. Effect of soil disturbance on percentage stocking (sclerophyllous regeneration) of areas *without* post-logging burning

Site No.	% Plots Stocked	
	Soil disturbance present	Soil disturbance absent
6	84	48
8	91	49
107	76	18
121/1	71	35
121/2	87	55
173	97	46

Kershaw

Corkill & NEFA vs Forestry Commission NSW - May 1993

AFFIDAVIT

1. I, Arnold Peter Kershaw, am a Reader in the Department of Geography and Environmental Science and Director of the Centre for Palynology and Palaeoecology at Monash University. I hold the degree of Bachelor of Science having graduated with Honours from the University College of Wales, Aberystwyth, in 1966, the degree of Master of Science conferred by the University of Durham in 1967 and the degree of Doctor of Philosophy conferred by the Australian National University in 1974. My studies were in the disciplines of geography, geology and zoology at Aberystwyth, in ecology at Durham and in biogeography at the Australian National University. The subject of my doctoral thesis was 'The late Quaternary vegetation of the Atherton Tableland, north-east Queensland, Australia'. I have been a Reader in Geography at Monash Universty since 1990 and before this I was a Lecturer from 1973 to 1979, and a Senior Lecturer from 1980 to 1989 within the same department.

2. My teaching and research interests are multi-disciplinary reflecting my geographical and ecological background. I am a member of 10 scientific and environmenal organisations and until recently was President of the Palynological and Palaeobotanical Association of Australasia. I have published, on my own or jointly, some 6 books and 74 articles, the majority in international journals, and am a member of the editorial board of Elsevier Publishers' 'Journal of Palaeobotany and Palynolgy'. I have supervised the theses of about 50 honours, masters and doctoral students and been awarded 46 government, university and industry grants. My major research focus has been directed towards an understanding of the present day vegetation landscape of eastern Australia, with an emphasis on rainforest, from an examination of vegetation and environmental history, largely through pollen analysis. Here I have been supported continuously since 1974 by Australian Research Council grants. My interpretations of the evidence for the vegetation history of the Australasian region through the last 20 million years are summarised in Kershaw (1988), for the Quaternary period (ie the last 2 million years) of southeastern Australia in Kershaw *et al.* (1991a), for the history of rainforest in Australia in Kershaw *et al.* (1991b), for the history of temperate rainforest in Kershaw (1992a) and for the history of tropical rainforest and rainforest/sclerophyll boundaries in Kershaw (1992b). These interpretations are based substantially on the pollen analytical research of myself and my students supported by the research of respected colleagues in refereed journals. Past vegetation reconstructions and their interpretation rely heavily on a knowledge of present day vegetation patterns and processes and, in this area, I have been involved through research on the Australian rainforest inventory (Kershaw and Whiffin 1989), editing books covering all major aspects of Australian rainforests (Werren and Kershaw 1987,

1991a, 1991b) and the supervision of research students on vegetation dynamics and the biogeography and ecophysiology of plants. Annexed hereto and marked with a letter "A" is a true copy of my curriculum vitae which contains a full listing of my reseach publications and other relevant information.

3. I have been requested to consider the sections of three environmental impact statements relevant to my experise on the past and present ecology and biogeography of rainforests and rainforest/sclerophyll forest transitions. These statements are Forestry Commission of New South Wales (1990) 'Proposed Hardwood Operations Compartments 180, 198 and 200, Chaelundi State Forest, Environmental Impact Statement', referred to herein as the '3 Compartment EIS'; Forestry Commission of New South Wales (1991) 'Proposed Hardwood Operations Compartments 180, 198, 200, Chaelundi State Forest, Environmental Impact Statement Report', referred to herein as 'Report on 3 Compartment EIS', and Forestry Commission of New South Wales (1992) ' Proposed Forestry Operations - Dorrigo Management Area, Environmental Impact Statement' referred to herein as 'Dorrigo M.A. EIS'. I will:-

a. assess the accuracy of relevant statements made in the EIS's and identify misleading claims or available relevant research not referred to; and

b. make recommendations for measures which would allow the preparation of an adequate environmental impact statement for forestry operations in oldgrowth and regrowth native forests in north-east New South Wales; and

c. comment on or identify base line information required to evaluate both assumptions and predictions of short term and lonf term impacts.

My particular concern is that proposed logging practises, in the areas identified within the GIS's, will lead to a reduction in an already restricted and fragmented distribution of the highly significant rainforests of the region, with an associated degradation of the environment. I will base my contentions on a definition of rainforests based on ecological criteria, the dynamics of rainforest, and on the past record of rainforest decline in response to increasing levels of disturbance. The historical record provides a firm base for assessment of the likely long term effects of logging and associated disturbances on rainforests and for the design of forest practises and research that will reduce or reverse the pattern of rainforest decline.

4. The rainforests within the areas identified in the EIS's form part of an extremely important, though restricted, component of Australia's rainforest vegetation. They embrace a broad range of subtropical, warm temperate, cool temperate and dry rainforest types that were once much more extensively distributed (Truswell 1990), contain high floristic

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fragmented or too small to act as refuges for future recolonization of logged

The Dwarf Crowned Snake was only encountered once during the fieldwork, as an opportunistic sighting a few days prior to the formal survey. Its favoured habitats are Rainforest, which are not intended to be logged, and Moist forests, some of which will be logged.

The two protected frog species, Fletcher's Frog and *Litoria glandulosa*, are unlikely to be greatly affected by the operations provided that the usual mitigation measures, such as the protection of filter strips along watercourses, are strictly enforced. Fletcher's Frog is often found breeding in small pools and ponds within Moist forest and is therefore more susceptible to disturbance from logging operations than species inhabiting substantial water bodies, such as creeks and rivers.

Research into the effects of logging and fire on herpetofauna habitat is urgently required as there is a grave lack of detailed knowledge on the subject. Probable adverse impacts include the loss of old logs used for shelter by reptiles, due to fire, and the charcoaling of logs, where nearly all parts of a log are fire damaged. Casual observations suggest that reptiles are not found under heavily charred logs. The relationship between vegetative cover and reptile and amphibian numbers is poorly understood. The removal of understorey vegetation by fire may expose more areas of the ground to sunlight thereby creating more sunning areas for reptiles, or conversely, the lack of cover may result in increased predation.

The recommended research should therefore be designed to assess, in addition to amphibian and reptile species and numbers present, herpetofauna microhabitat in representative areas that are planned for logging or subject to regular fire. Post-logging or post-fire assessment of the same parameters will provide specific data on the reduction or increase of microhabitat. These parameters should include depth of leaf litter; number and size of logs; vegetation type, height, species composition etc.; and the number, size and distribution of rocks and rocky areas. Details of fire intensity and spatial distribution, and a description of any apparent direct effects on herpetofauna or habitat should be gathered following fires that occur at established study plots.

diversity including a number of primitive flowering plants, and are considered to have given rise to many other components of Australian vegetation including the now extensive eucalypt-dominated sclerophyll vegetation (Webb and Tracey 1981). The only exhaustive study of Australian plant geography identified the region from southern Queensland to northern NSW, containing the areas identified in this affidavit, as possessing ' a flora of sufficient distinctiveness to make it a definite phytogeographic (plant geographic) province' and that it 'may be regarded as a refugium of a special kind and of particular interest for the phytogeographer' (Burbidge 1960). It is the rainforests that provide this distinctiveness as indicated by their recent nomination for inclusion on the World Heritage List (Government of Australia 1992).

5. It is repeatedly stated in the EIS's that rainforests are to be excluded from logging (eg. section 2.3, Report on 3 Compartment EIS; page vii and section 8.1.11, Dorrigo M.A. EIS). However, the Forestry Commission has adopted a restricted definition of rainforests that fails to account for the successional dynamic of rainforests and their temporal relationships with surrounding sclerophyll vegetation. I contend that some rainforest vegetation is included within proposed logging areas. The definition of rainforests accepted by the Ecological Society of Australia and to which I was a signatory, includes the following. 'The rainforests are defined ecologically as closed, broadleaved forest vegetation with a continuous tree canopy of variable height, and with a characteristic diversity of species and life forms. The ecological definition includes transitional and seral communities with sclerophyll emergents that are of similar botanical composition to mature rainforests in which sclerophylls are absent' (Dale *et al.* 1980). These transitional communities are generally included in the categories 'moist hardwood types' (3 Compartment EIS) or Tallowwood-Blue Gum Open-Forest, Brush Box Tall Open Forest and Blackbutt Forests (Dorrigo M.A. EIS) and classified as open forests rather than rainforests. They have a variable cover of eucalypts or *Lophostemon confertus* (Brush Box) above an understorey composed predominantly of rainforest species. It is, however, acknowledged that the identified transitional communities could be considered to be rainforests with eucalypt or brush box emergents (Dorrigo M.A. EIS p. 8-4).

6. The classification of these transitional communites as open forest, rather than rainforest allows their inclusion within areas to be logged and this has major consequences for the long term survival of many components of the rainforests. Although it is stated that logging is unlikely to have a significant impact on the structure and species composition of the forests (3 Comparment EIS, pp 119-120), this conclusion is based on studies undertaken within logged areas over the last 30 years, a period too short to provide any indication of

real impact. This is clear from the disasterous consequences of increased disturbance levels on rainforest in the past. In the mid Tertiary, from about 40 to 20 million years ago, rainforest covered almost the whole of the Australian continent. Towards the end of this period, a reduction in rainfall resulted in the contraction of wetter rainforest coastwards. However, in many places wet rainforests were replaced by drier types. particularly those dominated by *Araucaria* (Hoop pine and Bunya Pine) but, in those areas that experienced high levels of climatic variability, fire became an important factor and led to replacement by sclerophyll vegetation. Recent pollen evidence from sediment cores in northeastern Australia shows that the mix of rainforest remained relatively stable for at least10 million years before about 140,000 years ago (Kershaw *et al.* 1993a, Martin and McMinn 1993). From this time, there was a dramatic reduction in rainforest, resulting in the isolation of rainforest patches. As there is no evidence from anywhere in the world of a change in the climatic pattern at this time, the cause is attributed to an increase in burning with the arrival of Aborigines (Kershaw *et al.* 1993a). Vegetation changes certainly correspond with increases in charcoal in the sediment cores. As northern NSW has a similar range and similar patchy distribution of rainforest to north-east Queensland, I believe that it experienced a similar history. There is certainly some indication of a reduction in the extent of rainforest in different parts of eastern Australia within the last 100,000 years or so, where evidence exists (Kershaw and Nanson 1993). Continent-wide, rainforest had been reduced from the dominant vegetation type to an area occupying less than 1% at the time of arrival of Europeans. This total has been at least halved within the last 200 years. Although much of this can be explained by clearance, there has no doubt been a reduction due to unintentional vegetation disturbance. In Victoria, where the rainforests have not been major targets for clearing or logging, a regional assessment of degree of vegetation change since the arrival of Europeans, from a comparison of pre-European and modern pollen samples, shows that cool temperate rainforest has been reduced by about 50% (Kershaw *et al.* 1993b).

7. Throughout geological time climate and soils have been the controlling factors over the nature and distribution of rainforest, but fire has has been the major agent responsible for the replacement of rainforests by open vegetation. It is stated in section 4.2. p. 61 of the 3 Compartment EIS that the 'aim is to maintain the fire regime which has been applied to the area in the past'. I presume this to include the different identified fire regimes practised by graziers and foresters. From the pollen evidence, I contend that the continuation of existing fires regimes will result in further reduction of rainforest in the long term. It has now been established that transitional forests will form rainforest in the absence of fire because of the inability of the sclerophyll eucalypts and *Lophostemon* (brush box) to

regenerate under a rainforest cover. The continuation of logging and burning in these areas will lead to an elimination of the rainforest element and inevitably eat into adjacent rainforest which presently does not contain sclerophyll taxa. Fire has the effect of making the vegetation more vulnerable to further fire by opening up the canopy thereby reducing the humidity of the microclimate, and by changing the species composition to a more fire-resistant or fire-promoting assemblage (Jackson 1968). In the short term rainforest may appear to be invading sclerophyll vegetation but the degree of variability in the climate combined with the proposed impact of people will inevitably result in sufficient ignition to continue the long term trend towards replacement of rainforest by sclerophyll vegetation. A complicating factor in the attempt to maintain the existing fire regime (already identified as being composed of more that one regime) is that there is insufficient historical or pre-historical evidence available to allow any assessment of the fire regime to which the system may be adjusted. Fire regimes have probably changed frequently in the past, even within the lifetime of the now dominant trees.

8. Once rainforest is removed from a site, it is extremely difficult for it to recolonise. In addition to the problem of higher burning levels that occur in adjacent sclerophyll forests, there are other environmental effects of sclerophyll colonisation, particularly changes to the soil, that inhibit rainforest colonisation. Evidence for a substantial expansion of mangrove vegetation in north Queensland in association with the destruction of rainforest about 140,000 years ago (Kershaw *et al.* 1993a) is explained by an increase in mangrove habitat resulting from massive erosion of soil from the de-stabilised catchments and its deposition offshore. It is likely that much of the Australian landscape has suffered in a similar manner from a replacement of rainforest by sclerophyll vegetation. Recolonisation by rainforest is possible as indicated on the Atherton Tableland after the last dry glacial period (Kershaw 1992a). However, after rainfall increased sufficiently to allow rainforest expansion, it took at least 3000 years for the rainforest to migrate some 10-20km over the Tableland from retreats occupied during the dry period and, in some areas, the combined influence of soils and fire have prevented rainforest expansion in climatically suitable areas.

9. The likely reduction in rainforest extent has severe consequences for the maintenance of biodiversity. Rainforests may contain up to 50% of the species in Australia within its presently very restricted area and there is no doubt that a significant proportion has been lost since the arrival of people. The records from northeastern Australia indicate the loss of a previously well represented rainforest genus, *Dacrydium*, from the Australian mainland, within the last 25,000 years. The difficulty of identifying plants to species

level, a problem exacerbated by a still incomplete knowledge of the taxonomy of present day rainforest plants (Kershaw and Whiffin 1989), has no doubt inhibited detection of substantial extinction at the species level.

10. One significant causal factor in species extinction is the separation of rainforest into genetically isolated patches and the present disjuct (broken) nature of rainforest is probably a relatively recent development. The records from northeast Queensland indicate that the drier *Araucaria* forests suffered the greatest decline with the initiation of 'Aboriginal' burning. It is likely that there was previously a fairly continuous rainforest gradient from the wet coastal rainforests through the drier araucarian forests to the semi-arid deciduous vine thickets. This would have facilitated species movement in response to changing climatic conditions. Burning had greatest effect in the sub-humid environments where there was sufficient fuel to carry frequent fires but where the forest was not too wet to burn. Consequently there is now a great expanse of eucalypt forests and woodlands between the wetter coastal rainforests and the dry patches of vine thicket inhibiting species movement and genetic interchange. The present distribution of rainforest in southeastern Queensland and northern NSW shows a similar and importantly more complete gradient with better representation of moist araucarian rainforests. It is probable that the less seasonal climate of this area in comparison to northeastern Australia has facilitated this survival and assisted in the reconstruction of spatial rainforest changes in northern Australia..

11. An important inference of this reconstruction is that rainforest/sclerophyll boundaries or transitions would have been less common and probably less abrupt than prior to the time of arrival of people. Rainforest would also have been more protected by a larger component of relatively fire sensitive species from genera such as *Callitris* (native pines) and *Casuarina* (she-oaks) in the sclerophyll forests that can be demonstrated to also have suffered relative to the eucalypts with the increase in burning. It should be noted that *Callitris oblonga* is noe regarded as a rare plant within this area (Dorrigo M.A. EIS, section 8.1.11.). The encouragement of eucalypt regeneration along rainforest margins in forestry operations increases the threat to the rainforests.

12. The suggestion that the present day transitional forests may be of very recent origin brings into question the status of Brush Box. Species of this genus (*Lophostemon*) and the closely related genus *Tristania* show interesting distributions from what can be regarded as true rainforest associates to strictly open forest inhabitants. I consider that the open forest species are rainforest remants within areas that once carried rainforest and, being more

fire resistant than their associates, have survived within the conquering sclerophyll vegetation. If this is the case, *Lophostemon confertus*, can be regarded as a true rainforest species that naturally occurs as an early successional plant within more disturbed areas or as a dominant of simple rainforest types that do not demonstrate a complex successional development. It is certainly restricted to rainforest margins (Webb 1980). On a geological timescale, a similar rainforest origin is likely for the eucalypts and casuarinas but here the fossil record clearly shows that they have been divorced from rainforest for many millions of years. In the case of the eucalypts it is difficult to find any certain present day links with its rainforest ancestory. In the case of the casuarinas, the genus has a tenuous link with the related genus *Gymnostoma* represented by one species with a limited distribution in the Cape Tribulation rainforests. Fossil evidence supports a rainforest origin for the group because prior to about 20 million years ago, when rainforest covered much of Australia, the only identifiable fossil evidence is of *Gymnostoma*. It can be expected that, through time, *Lophostemon* will be replaced by eucalypts as increased disturbance levels and associated changes in soil nutrient status favour a more sclerophyllous vegetation.

13. The historical record provides a factual though generalised framework for understanding the dynamics of rainforest and rainforest/sclerophyll transitions. This perspective should be applied in the first place to ensuring that rainforests, defined in their broadest sense, are protected from disturbance to the greatest degree, and in the second place to help formulate research projects that will lead to a better understanding of the dynamics and distribution of rainforests in this region that can be applied to their long term management.

14. In ensuring rainforest protection within the nominated areas, I believe that the following steps should be taken.

   a. Adoption of the ecological definition of rainforest of Dale *et al.* (1980) which will exclude logging from all transitional areas containing *Lophostemon confertus*, and those areas of eucalypt with a continuous or semi-continuous understorey composed predominantly of rainforest species.

   b. Retyping of transitions to ensure that all rainforest defined on this true ecological basis are excluded from proposed logging areas.

   c. Maintainance of buffer zones of natural vegetation around rainforests to protect them from disturbance caused by logging and regeneration burns, and from weed invasion.

   d. Fire breaks should be prepared beyond the buffer zones to reduce the chances of wildfire, originating within drier forests, impinging on rainforest margins.

d. Roading, to gain access to timber, should avoid rainforest areas.

15. I consider that reseach should be directed into two areas.

a. Improvement of the forest typing system that takes into account the whole of the forest, not simply the canopy dominants. Here, satellite imagery, that allows detection of forest microclimatic conditions may be useful as would predictive models such as BIOCLIM (Busby 1991) that provides information on potential rainforest distributions in relation to climate and other environmental factors.

b. Monitoring of the dynamics of the different types of transitions over a longer period of time than has been undertaken to date, in order to better understand the impact of logging. Extension of the experimental record could be achieved by incorporating fine resolution pollen studies from bogs, lakes or reservoirs into the monitoring program.

16. The opinions I express in this affidavit are based on my own research, my reading of the scientific literature, which is accepted in refereed journals and books, and the authors of which are accepted as experts in the field, and from discussions with a range of ecologists.

17. The publications to which I have referred are as follows.

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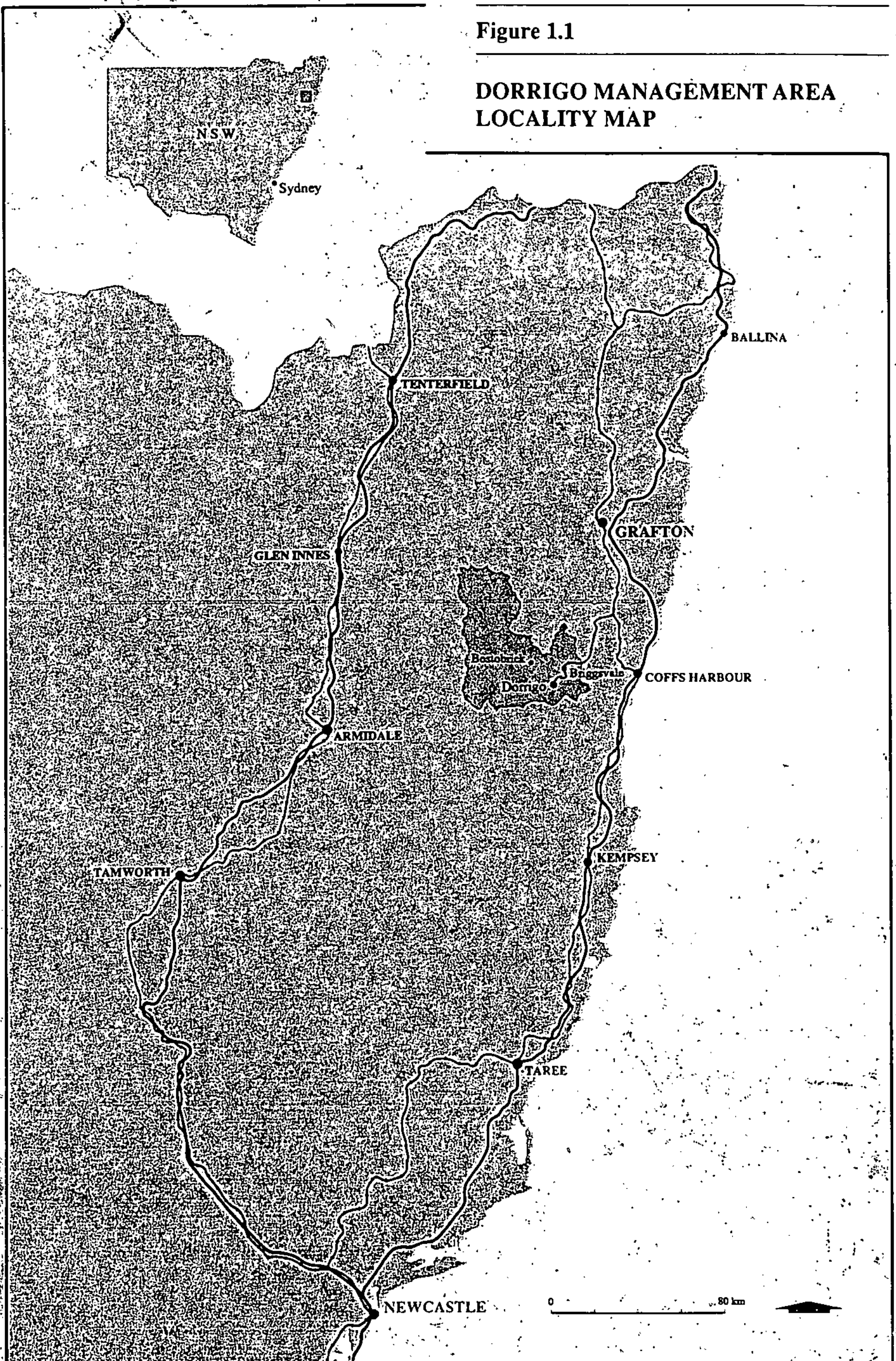
Figure 1.1

DORRIGO MANAGEMENT AREA LOCALITY MAP



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Notes on the Silviculture of Major N.S.W. Forest Types

1. Moist Coastal Hardwood Types

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Forestry Commission of N.S.W.
Sydney

23rd September, 1982.

NOTES ON THE SILVICULTURE OF MAJOR N.S.W. FOREST TYPES

1. MOIST COASTAL HARDWOOD TYPES

1. INTRODUCTION

These notes are intended to summarise the existing recorded information relating to the silviculture of the Moist Coastal Hardwood (M.C.H.) types in N.S.W. - types that since the 1970's have yielded about a quarter of the State's hardwood sawlog production.

As understood here the types are essentially those forming the Sydney Blue Gum/Bangalay* League, described in For. Comm. Res. Note No. 17 (Forestry Commission of N.S.W., 1965), but excluding the Flooded Gum type (no. 48), which is proposed for separate coverage, and types confined to the South and Central Coasts. Nonetheless the features described here probably apply equally well to the latter group of types.

These types are typically tall, high yielding, wet sclerophyll forest stands, usually with a dense, mesic understorey and with Tallowwood, Blue Gum and Brush Box well represented. Whilst often thought of as typical of the escarpment zone, between the coast and tablelands (a point rendering the "Coastal" in their name rather inappropriate), they also occur in more coastal districts and at lower altitudes.

The types are commonly considered difficult to regenerate, and in an effort to determine some of the factors influencing their regeneration patterns a substantial research programme into the types was carried out in the late 1950's and through the 1960's. A number of internal Forestry Commission reports resulted from this programme, and these provide the basis for much of the information in these notes: Floyd (1957? and 1959), Curtin (1960) and Van Loon (1965); the last of these was subsequently substantially published as For. Comm. Res. Note No. 19 (Van Loon, 1966).

2. FOREST ECOLOGY

2.1 The Types

The types making up the Moist Coastal Hardwood types include, from Res. Note No. 17:

46. Sydney Blue Gum
47. Tallowwood-Blue Gum
49. Turpentine
51. Dunn's White Gum
53. (Inland) Brush Box
54. Whitetopped Box

Besides the species giving their names to these types, other hardwoods (eucalypts and related genera) that may be significantly present in the overstorey include Flooded Gum, Narrowleaved White Mahogany, Silvertop and Diehard Stringybarks and New England Blackbutt. Other species may also be present in local or marginal sites, though even a relatively low proportion of Blackbutt is usually regarded as sufficient to take the stand out of these types and into a Blackbutt community.

Forest Oak often occurs as an understorey tree, sometimes over 30 m in height, and the less common Brush Cypress Pine has its main occurrence in these types, resembling Forest Oak in size.

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*For botanical names, see Appendix 1.

Stands commonly exceed 40 m in height and individual trees may exceed 60 m. Virgin stands typically yield between 30 and 100 m^3 of timber per hectare, and on exceptional sites may exceed 300 m^3.

Rainforest species are commonly present in the understorey, and in the absence of fire or other disturbance they may gradually develop into a mature rainforest which assumes possession of the site when the hardwood overstorey trees finally die, though this full sequence probably only rarely reaches such a conclusion. Fire will alter or interfere with the sequence, and other understorey combinations usually indicate differing fire histories. These other understorey species include wattles, Tickbush and such vines as wild raspberries, native grapes, Soldier Vine and Hibbertia spp. Ferns may sometimes densely cover the ground, while grass may dominate the understorey in sites that are fairly regularly burnt.

Differences between and within individual types reflect in part changing physical conditions, but undoubtedly also are strongly influenced by historical accidents, such as the frequency, severity and timing of past fires. Tallowwood and Blue Gum can be regarded as the two key species, though either may be absent from particular areas (e.g. Tallowwood from Allyn River area of Chichester State Forest), and either can completely dominate whole stands. Of the two, Blue Gum probably has a greater need for sites with deeper soil and possibly moister and more sheltered conditions, though it commonly occurs on ridgetops in the moister areas. Features of the occurrence of other major associates include:

- Brush Box - predominates in moister sites, often in more sheltered gullies adjacent to rainforest, but may occupy ridges where rainforest is widespread.
- Turpentine - again tends to favour moister sites.
- New England Blackbutt - usually on drier, ridge sites, sometimes with Diehard Stringybark.
- Narrowleaved White Mahogany - most common at lower altitudes and warmer parts of types' range.
- Silvertop Stringybark - higher altitudes.
- Whitetopped Box - rather spasmodic, usually on steep, escarpment sites on fertile soils; occasionally on less favourable sites.
- Flooded Gum - on broad alluvial flats and adjacent slopes; Dunn's White Gum has rather similar occurrence in a few sites on far North Coast.

Indications of the broadacre composition of these types are given by the following figures, from Curtin (1960) and Forestry Commission of N.S.W. (1980a):

	Bulga-Dingo Management Area	Washpool Study Area Very Moist Sites	Washpool Study Area Drier Sites
Tallowwood	39%	40%	40%
Blue Gum	21	15	20
Brush Box	18	40	5
Other spp.	22	5	35

(Other species at Washpool is New England Blackbutt).

The types support a rich and varied fauna. For the Washpool Study Area it is noted that 80 per cent of the mammals expected in the area (39 out of 49 species) would be associated with these moister hardwood types, and 62 per cent of the birds (100 out of 160 species), while in the Hastings district 35 out of the 38 mammals present (excluding bats) occur in the moist forests. Complexity and variety of forest structure, foliage height diversity, branch and stem hollows, nectar resources, berry-bearing plants, and the high nutrient status of the forests generally are among the factors contributing to the high wildlife productivity. Appendices 4 and 5, taken from the Washpool environmental impact statement (Forestry Commission of N.S.W., 1980a) and based upon observations in a number of North Coast forests, indicate the range of mammal and bird species, respectively, occurring in the M.C.H. types.

2.2 Ecological Relationships

The Moist Coastal Hardwood types appear to show fairly close ecological relationships, and are usually associated with the occurrence of rainforest. Broadly, these types and rainforest could both equally occupy the same sites. In any locality, rainforest tends to be confined to the more sheltered and moister sites, with hardwood in the sites more prone to periodic burning: an environmental change that often also coincides with a fertility gradient. Probably there are no M.C.H. sites that would not support some type of rainforest under present conditions given indefinite protection from fire, though in some cases the combination of soil fertility and rapid drainage would result in rainforest of low site quality. These conditions, however, tend to ensure that such sites burn from time to time, thus perpetuating the hardwood.

Radiocarbon dating at Whian Whian S.F. has shown Brush Box trees in excess of 1000 years old; Tallowwood probably has similar longevity. With such trees one severe fire in a millenium is all that is needed to maintain the type. In fact at Whian Whian several ages of trees (of overlapping size range) are present, suggesting fires at intervals of 300 to 400 years. Such fires allow the survival of the fairly fire-resistent hardwoods, and provide conditions for these intolerant species to regenerate. The virgin stands we see today are probably the end result of numbers of such fires, each helping to add to the stocking of trees present by providing conditions for regeneration in the gaps and openings that have occurred (by natural mortality, storm damage or the previous fire) since the area was previously burnt.

Besides rainforest, where two distinct types of forest vegetation are involved, the M.C.H. types also merge into a number of other hardwood forest types, of which the most important are the Moist Tableland Hardwoods, Blackbutt, and the moister phases of the Grey Gum - Grey Ironbark and Spotted Gum types.

2.3 Environment

Climatic averages for eight stations occurring in M.C.H. sites, with altitudes varying from 9 to over 1000 m, and latitudes from 28° 36'S to 33° 6'S, are given in Appendix 2. The major features of silvicultural significance are:

- High annual rainfalls (usually over 1 200 mm), with highest falls in late summer-early autumn.
- Dry late winter-spring, when rainfall over 3 months may average less than 200 mm.
- Cold winters.

All stations probably experience occasional summer days approaching 40°C, while frosts would be regularly experienced in suitable openings adjacent to all stations, and at the higher altitudes can be frequent and severe through the winter and early spring.

Soils are typically deep and of moderate to high fertility, usually well drained but with fair to good moisture-holding capacity. They can be derived from a wide range of parent materials. Basalt soils may sometimes be excessively drained in their surface layers, creating regeneration difficulties, though they can subsequently support high quality stands. Variations in soil characteristics are undoubtedly important factors influencing changes in productivity, composition and other features of these types, as demonstrated by Turner and Kelly (1981) in their study of soil/vegetation relationships in the Terania Creek basin, near Lismore.

The types can occur on a wide range of topographic situations, from gullies to plateau surfaces, and sometimes including steep slopes. The changes associated - from sheltered gully with deep enriched soil to drier ridgetop; from cool, moist, south-facing slope to fire-prone western slopes - influence the nature of the types and their relationship with other communities.

Fire has to be recognised as a major factor in the occurrence of these types, as discussed in Section 2.2. It is the basis for the regeneration of the hardwood overstorey in Nature. It also strongly influences the nature of the understorey. Frequent fire will result in a ground cover of grass or bracken; severe fire will often create dense wattle stands (e.g. *Acacia binervata*, *A. irrorata*), which can persist for 20 to 30 years before significant break up occurs. Elsewhere fire may be followed by Tickbush thickets, while infrequent fire allows rainforest to develop. Fires also cause damage to the overstorey trees, leading to wood damage and sometimes to the death of the trees.

Seldom, if ever, will a fire burn evenly over a tract of M.C.H. forest. Some sites, such as the ridges, will burn regularly, but the fire will rarely penetrate into the more sheltered parts. Yet these typically develop very high fuel loadings that, on the fortuitous conjunction of drought conditions, extreme fire weather and an ignition source, can result in a severe fire. As previously noted, the incidence of such fires might only be once every few centuries, but usually it seems to be much more frequent than this. Not all such fires result in tree death or the establishment of persisting regeneration, since the overstorey stems are usually quite fire resistent and may survive numbers of such fires with little long-term visible evidence.

As already discussed (Section 2.1), the M.C.H. types provide a rich wildlife habitat.

3. OCCURRENCE

While the individual major species have a wider range, the main occurrence of the M.C.H. types is in the hinterland escarpment zone of the North Coast, at elevations between about 300 and 1000 m - the area described in the Indigenous Forest Policy (Forestry Commission of N.S.W., 1976) as "the more mountainous and less accessible forests behind the coastal plain." It extends discontinuously from the foothills of the Barrington Tops, north of Dungog, along the various ranges of the North Coast to the McPherson Range, and hence into Queensland. Lower altitude occurrences are found fairly widely along the North Coast, usually in association with other high site quality forest stands; one such major centre is in the Bulahdelah district. Related communities occur widely in the Watagans group of forests and elsewhere in more southern locations.

The general occurrence of these types is shown (as "Moist Coastal Forest") on the N.S.W. forest type map (Forestry Commission of N.S.W., 1978). Management areas with significant areas of these types include Chichester, Gloucester, Wingham, Marsh, Wauchope, Kempsey, Bellinger, Dorrigo, Coffs Harbour, Grafton, Casino West, Urbenville and Kyogle, the eastern edge of most areas along the New England Tablelands, and, at lower altitudes, Wyong, Cessnock, Bulahdelah and Murwillumbah.

Two inventories providing estimates of forest type areas have been undertaken in N.S.W., in 1963 and 1971/72 (Hoschke, 1976). Neither used quite the same type definitions as are used here. The earlier inventory showed 67 000 ha of Tallowwood - Blue Gum type and 124 000 ha of "semi-moist hardwoods", much of which would be attributable to the M.C.H. types, as would some of the "Flooded Gum and gully sites". In all, probably 200 000 to 250 000 ha of M.C.H. types could be regarded as existing on State Forests. The latter study used type groupings from Res. Note no. 17: for the relevant types, two groupings were recognised, Tallowwood - Blue Gum (type no. 47) and "Moist Hardwood - Gully" (types 46, 48 - 54), the latter including some communities excluded here. Areas shown by the inventory were:

Type	Area on State Forest	Total Area
Tallowwood - Blue Gum	80 000 ha	126 000 ha
Moist Hardwood - Gully	211 000	600 000
Total	291 000	726 000

For the types considered here, these areas probably reduce to something in excess of 200 000 ha for State Forests, and to perhaps 500 000 ha for the State as a whole.

4. UTILISATION

The M.C.H. types have in recent years been of major importance as producers of hardwood sawlogs, with the three main species, Tallowwood, Blue Gum and Brush Box ranking second, third and fourth in gross volumes of sawlogs cut from Crown forest lands (not, however, all from these types) in 1979-80 (Forestry Commission of N.S.W., 1980b). The current high use reflects the types' often rather remote location: operations have progressively moved into these areas while the more accessible forests are allowed to accrue volume following long periods of earlier logging.

The properties of the main timber species in the types are summarised in Appendix 3, using data from Bootle (1971). The timbers of any species can vary considerably in quality from site to site, with termites, rot, gum veins and loose rings being the major defects.

The timbers are mainly used for sawing, sometimes with follow up operations for posts or sleepers. Girders may also be produced. Turpentine still yields some excellent piles, while some of the more accessible regeneration areas have been thinned for mining timber and poles. During the 1970's a small but continuing market for Forest Oak shingles has developed. Rainforest logs may be obtained from some understorey areas.

Little use is made of the types for other products, though Duboisia leaf has been harvested in the past. The sites are not normally highly regarded by apiarists, though Brush Box sites may be prized.

Large areas carrying the types are covered by grazing leases, but much of the types, with their dense undergrowth, is little used by stock. Frequently burnt areas are the exception.

The types' location in areas of high rainfall ensures their importance as stream catchments, while the combination of escarpment scenery and tall, moist forest gives them high recreational potential which is however limited by their usual remoteness and difficult access. These in turn are factors which give some areas wilderness value. The types support a rich and varied fauna and flora.

5. HISTORY OF USE AND MANAGEMENT

Harvesting of timber in the Moist Coastal Hardwood types would almost certainly have first occured last century in some of the lower altitude stands of relatively easy access on parts of the coastal plain (e.g. parts of Bulahdelah district).

This early timber harvesting, as opposed to clearing for agriculture, would have been highly selective with only scattered, large trees of outstanding form and quality being felled, to leave a scattering of relatively small openings and narrow tracks through the forest. Logging of this nature probably occurred over the same area on a number of occasions, and almost inevitably the stands were periodically burnt, either accidentally by wildfire or more deliberately by some form of burning off, though occasional sites may have escaped any burning.

Although such treatment would not conventionally be regarded as appropriate for the regeneration of these types, in fact it usually resulted in regeneration establishment in the openings - less generally, than the forester would have liked, but enough to maintain a productive stand over a period. In this it probably resembled, in somewhat accelerated form, the way Tallowwood and Brush Box often became established in Nature.

Some logging, from local bush mills, had taken place in the escarpment forests long prior to World War II, but following the war these areas gradually became increasingly important in meeting the State's timber needs. Because of their usual remoteness and the high costs of access, logging normally aimed to recover as much timber as possible in the one operation; for exactly the same reasons, the standard of log acceptable to the sawmills was higher than in more accessible sites, so that often a considerable quantity of unmerchantable trees remained after logging. For a long period much of the Brush Box component was included as unmerchantable because of problems in seasoning this species.

As experience was gained with these types, a post-logging burn was usually given to the stands to aid regeneration establishment. Occasionally merchantable stems were left as seed trees and were salvaged a year or so later; sometimes the unmerchantable component was removed, by ringbarking or, after the introduction of chain-saws, by felling, either immediately after logging or following the regeneration burn. Probably most usually the unmerchantable stems were retained to save the cost of removal or as a seed source insurance: more recently this retention has been further rationalised as providing "a continued acceptable forest environment....of defective and smaller trees" (Forestry Commission of N.S.W., 1976) or as wildlife habitat.

When a large stocking of unmerchantable trees was retained, regeneration was usually substantially restricted; if no post-logging burn occurred, it was at times non-existent. On the other hand, often many of the retained trees subsequently became acceptable to the mills, so that many stands with retained stems now offer a useful supplementary source of timber to extend the first cutting cycle in the upland forests of these types. Where regeneration has established between the retained trees, this further logging will inevitably cause some loss of regrowth.

Usually natural sources were relied upon for regeneration, but in the 1960's artificial sowing was often used to supplement the natural regeneration, and subsequently jiffy pot seedlings (seedlings raised in small peat pots) have been used for enrichment planting on snig tracks and dump sites, or in a few localities for complete plantation establishment.

Whilst there were undoubted failures in regeneration establishment, particularly in some of the moister sites, heavy logging and burning usually resulted in adequate stockings of hardwood seedlings. However at a time when Tallowwood was certainly the most favoured species, and was often regarded as the only worthwhile species in these types, difficulties in establishing this species and stockings less than were considered optimum led to the belief that these types were particularly difficult to regenerate, and resulted in the research programmes of the 1950's and 1960's

6. REGENERATION REQUIREMENTS

6.1 Seeding Habits

Tallowwood can flower from early spring to early autumn, with a usual summer peak which tends to be later at higher altitudes than at lower ones. The extent of flowering varies from year to year. Blue Gum has a more variable flowering period, but autumn is the most likely season for peak flowering.

Both species carry some viable seed throughout the year, and this can be shed when conditions are suitable. Maximum Tallowwood seedfall is usually about 12 months after peak flowering though the capsules are probably ripe after about 6 months, but tend to hold their seed until warm, dry weather occurs, usually in late spring and early summer. Empty capsules fall about 2 months later. With Blue Gum peak seedfall is usually 2 years after flowering, though from studies on the closely related Flooded Gum it seems that again the seed is probably ripe on the tree within about 6 months of flowering (Hodgson, 1975). Less is known about the associated species, but casual observation suggests that New England Blackbutt, Brush Box and Turpentine can also provide some seed throughout the year if conditions are suitable.

All species vary in seed production from year to year. Over five seasons (1960-64), Van Loon at Bulga S.F. recorded two high, one moderate and two medium-low production years for Tallowwood, and one high, two low and two poor years for Blue Gum.

The hardwoods all possess the typical very small, granular seeds of the capsular-fruited Myrtaceae, produced with much infertile "chaff" (Tallowwood seed is somewhat flattened). Table 1, from Van Loon (1965) and Boland et al. (1980), gives typical seed weight figures.

Tallowwood seed is slow to be released from the capsules: Floyd (1959) showed that after 17 days' exposure to warm, dry conditions, 19 per cent of the viable seed was still retained in the fruit; extraction was not complete until 29 days.

Tallowwood seed retains its viability for up to 6 years when stored at room temperature, but Blue Gum, New England Blackbutt and Brush Box are losing viability at this time. Tallowwood germination shows no advantage from stratification.

In seed trap studies over 3 to 4 years, Van Loon obtained annual seed productions of from 52 000 to 580 000 viable Tallowwood seeds per hectare and from 5 900 to 143 000 seeds per hectare for Blue Gum. The comparison is not stictly valid, since the traps averaged only 11 m from Tallowwood trees, but 20 m from Blue Gum.

Table 1

Numbers of Viable Seeds per Kilogram

Species	Average	Range	Source
New England Blackbutt	145000	- 516000	Boland (1980)
" " "	160000	98000 - 189000	Van Loon (1965)
Brush Box	273000	-	Van Loon
Whitetopped Box	594000	- 1590000	Boland
Flooded Gum	652000	- 2100000	Boland
Sydney Blue Gum	538000	- 1540000	Boland
" " "	880000	290000 - 2175000	Van Loon
Narrowleaved White Mahogany	140000	- 230000	Boland
Silvertop Stringybark	51000	- 96000	Boland
Tallowwood	205000	- 770000	Boland
"	165000	105000 - 245000	Van Loon

The warm, dry conditions which promote capsule opening are often associated with winds which assist in disseminating the seed: Floyd (1959) records capsular-bearing Tallowwood branchlets up to 60 m from the base of the nearest tree. Floyd, Curtin and Van Loon produce conflicting figures on effective seed spread for Tallowwood. Floyd suggested twice height of seed tree (say 60 m from a 30 m tree), Curtin two-thirds height (20 m), and Van Loon reduced this to 17 m. Figures for other species are not known, but in practice something close to Curtin's suggestion, say about 40 m between 30 m trees, should provide for adequate seed distribution over the whole logging area. This is equivalent to about 6 to 8 seed trees per hectare.

6.2 Regeneration Establishment

The Moist Coastal Hardwood types can be among the most difficult in the State to regenerate successfully. The dense rainforest understorey precludes hardwood regeneration without major disturbance; some of the most important species are relatively slow growing in their younger stages; weed growth after disturbance can be prolific and vigorous.

Part of the problem is one of time-scale. We are faced with stands containing trees sometimes up to 1000 years of age. They have resulted from a number of waves of regeneration, each in the wake of a fire. Sites unregenerated after one fire are likely to respond to subsequent fires, possibly 50 or 100 or more years later: after some centuries, the differences in age are hard to pick. The stands are then logged, and the forester is upset if he cannot fully regenerate the site immediately. Our expectations tend to be too high for the time available.

Nonetheless certain actions can be taken to increase the levels of regeneration establishment, and these involve satisfying three main requirements.

- Adequate source of viable seed,
- Receptive seed bed,
- Appropriate protection after establishment.

Although most species are lignotuberous, in these moist forest types regeneration usually develops from newly germinated seedlings, not from a pool of suppressed lignotuberous advance growth. Similarly coppice growth is usually unimportant in these types. Direct seeding (spot sowing) and planting have been used to supplement (and sometimes replace) natural seed sources.

Spot sowing was widely used in the late 1950's and early 1960's, using large pepper shakers calibrated to yield a given quantity of seed per shake. Sowing rates for Tallowwood were usually in the range of 200-300 g/ha, to deliver about 30000 to 50000 viable seeds per hectare. Sowing was usually carried out immediately after seed bed preparation, shortly before or during the wet season (January to March). Some good results were obtained, but the technique was subsequently abandoned in favour of planting eucalypt seedlings raised in jiffy pots, which gave consistently more reliable results.

Some plantings in M.C.H. sites date from the 1940's, but the technique was not extensively used until a cheap technique for raising eucalyts in small peat pots (jiffy pots) was developed in the late 1950's. This technique, in its current form, has been described by Horne (1979). Coupled with mechanical clearing, jiffy pots have been used for routine scale plantation at Watagan (main species Blueleaved Stringybark), Dungog (Silvertop Stringybark) and Murwillumbah (Flooded Gum and Blackbutt), and in other areas for enrichment planting on log dumps and snig tracks (sometimes deliberately extended to provide more planting space). Because of its slower early growth, Tallowwood has been little used for planting.

The resultant plantations are mostly very impressive, with average volume MAI's of 14 m^3/ha/an estimated for Silvertop Stringybark at Dungog at age 20 years. However they are often in sites where adequate natural regeneration will in any case appear: in such cases their effect is to alter species composition or to ensure high early yields of small timber for particular industries, with the remaining stems progressing to sawlogs. Elsewhere they can ensure hardwood regeneration in sites that might otherwise be difficult to establish with an adequate stocking of commercial species.

6.3 Germination

From either natural seedfall or artificial sowing the seed must be able to germinate and then survive for establishment to occur. For all hardwood species involved, germination will occur rapidly from viable seed in contact with moist mineral soil. It will not occur if the seed bed is dry, and is likely to be inhibited by very low or high temperatures (Table 2). Thus the best season for germination is usually summer and autumn; an unusually moist spring is also suitable, but such occurrences are rare.

Table 2

Germination Conditions

Temperature Range	Day of Maximum Germination			
	TW	sbG	eBB	bB
13 - 17° C	13	12	13	21
20 - 21	7	6	7	10
28 - 31	5	4	7	7
34 - 36	5	5	9	11
40 - 41	No germination		-	18

Species: TW: Tallowwood eBB: New England Blackbutt
sbG: Blue Gum bB: Brush Box

Ungerminated seed is lost rapidly from the site by removal by ants and other insects. Van Loon reports tree percents of from 3.4 to 12.7% for dieldrin-treated spot-sown seed, compared with 0.6 to 0.9% for untreated seed. Seed that has to lie on the seed bed for a period before conditions suitable for germination occur runs a high risk of heavy loss.

6.4 Seed Bed

While germination is possible on virtually any forest seed bed, a suitable receptive bed is necessary if the germinates are to become established. In the M.C.H. types with their dense understorey, this particularly means some form of fairly massive disturbance, in Nature normally provided by fire opening up the understorey and exposing the mineral soil. This need for disturbance is greater in some sites than others, and is particularly needed in the moister sites.

The earlier regeneration successes after logging these types usually were associated with wildfires that burnt the logging debris and understorey, to expose the soil to seedfall. Particularly in the earlier days, with lighter logging intensities and lighter logging equipment, logging without fire usually resulted in little or no regeneration; the success that did occur with what was often virtually selection logging (e.g. Myall River S.F.) was probably usually attributable to occasional fires, accidental or deliberate.

Deliberate post-logging burns started to be applied to these types in the late 1940's and led on to substantial field trials (many supervised by M.T. Gatenby at Wingham) and routine practice in the 1950's. For these burns some felling of the woody understorey was often carried out.

The regeneration resulting from burning was usually successful when followed by good rains. Thus summer burns were usually successful, and winter burns followed by a wet spring. There were some failures:

- At Clouds Creek, clearfelling and burning allowed subsequent severe frosts to convert former high forest to frost-maintained grassland, similar to some of the local high altitude "plains".
- At Ellis, failure of regeneration from a January burn was apparently due to the seed trees shedding their seed prior to the fire.
- At Mt. Boss, fire burning into a moist gully only singed the understorey trees; subsequent leaf drop blanketed the ground and precluded establishment.

Nonetheless success was usual with summer or late spring burns, whereas on unburnt blocks regeneration was confined to snig tracks and similar disturbed sites. Curtin refers to 4 burnt blocks with an average of 55% of milliacre ($4m^2$) plots stocked with Tallowwood or Blue Gum regeneration; by comparison on an unburnt block, 46% of plots on snig tracks were stocked, but only 5% of those away from snig tracks. In these blocks the average height of regeneration on burnt plots was 1.4 m, on the unburnt block only 0.2 m. Sometimes, of course, reasonable results have been obtained even on undisturbed sites. G.C. King, from Bulga State Forest, has recorded regeneration on three areas logged between 1977 and 1979, and assessed in 1981; none of the areas was burnt:

		Plots Stocked	
Cpt.	Plots Disturbed	Disturbed Sites	Undisturbed Sites
173	72%	97%	46%
121A	61	71	35
121B	65	87	55

However, the superiority of the disturbed sites is still most evident.

Prelogging burns were also tried. While good regeneration was often obtained, this was largely destroyed in the subsequent logging, while the moister sites were almost impossible to burn both successfully and safely. The pros and cons of prelogging burning have been well summarised in some notes by R.R. Richmond, and these are attached as Appendix 6.

The difficulty of the safe regeneration burn is in fact a major problem in the M.C.H. types. Prolonged summer rains mean prepared sites may have to be abandoned, while the conditions suitable for burning the moister sites are those associated with moderately severe wildfires. Escapes from the regeneration burn are a real risk, while trees retained for seed may be killed by the heat of the fire and sometimes even the seed capsules consumed on the trees. This occurred in a site on Wild Cattle Creek S.F., where only a dense wattle crop was produced.

Dense wattle is not unusual after a hot fire, though the faster hardwoods can usually keep pace with it initially, and then outgrow it, while the slower but more tolerant species, such as Brush Box and to some extent Tallowwood, can persist below the canopy and then assume more active growth when the wattle stand finally starts to break up, usually after 20 to 30 years. Other weeds may also be promoted by burning.

Top disposal is sometimes used after logging, but more as a fuel reduction measure than to obtain regeneration. The burning is often done in winter, but may produce regeneration if a wet spring follows; its value for regeneration is probably greatest on the drier, ridge sites. With heavy logging, and hence heavy slash, top disposal is synonymous with broadcast post-logging burning. Top disposal depends upon logging slash, and in these M.C.H. sites this slash deteriorates as fuel after about 12 months unless burning in a fire-dangerous period is contemplated. Thus there is normally a period of only one year available after logging in order to obtain an effective burn.

Because of the problems with fire and the success of regeneration on snig tracks in unburnt areas, the development of more powerful tractors, capable of clearing the understorey, led to wide use of tractor-clearing for seed bed preparation in the M.C.H. types. Early efforts to clear the whole site were followed by more limited clearing ("snig track extension") which could still expose the soil of up to 70% of the total area at relatively low cost, while the network of tracks meant that the remaining debris could often now be more safely burnt. Subsequently, higher standards of utilisation and consequent heavier logging have often produced similar levels of site disturbance without further snig track extension, as is shown by G.C. King's assessments from Bulga State Forest, referred to above.

The mechanically cleared sites are usually satisfactory for regeneration establishment, though some unsuitable, compacted sites are often present. Germination is somewhat slower than on burnt sites, possibly due to less favourable moisture conditions, but the sites tend to remain receptive for much longer, sometimes up to 18 months. This is due in part at least to less aggressive weed growth: Floyd reports the production of 3300 kg/ha of plant dry matter in a year on a burnt site, compared with only 390 kg on a tractor-cleared site.

Somewhat lower, but still adequate, regeneration stockings occur on the tractor-cleared sites. Van Loon reports comparable blocks where 45% of milliacre plots were stocked on burnt sites and 33% on tractor-cleared sites. Early growth on the tractor-cleared sites tends also to be slow: average regeneration heights quoted by Curtin for natural regeneration at Bulga S.F. at age 6 to 7 months are:

	Tallowwood	Blue Gum
Burnt	94 mm	63 mm
Tractor-cleared	38 mm	56 mm

Because of the lesser weed growth, this slower early growth was regarded as of little consequence.

Van Loon suggested that tractor-clearing should be carried out from August to December, with a view to direct sowing in January or February. This timing should also be suitable for natural seedfall.

Apart from the preparation techniques, steeper slopes may be difficult to regenerate because of soil washing from the roots of the young germinates, while excessive drainage in some gravelly or excessively porous soils (including some basalt soils) may cause difficulties in regeneration establishment.

6.5 Canopy

Even where complete clearfelling is intended, logging will rarely remove all trees. A scattering of excessively faulty trees, occasional clumps of younger, "growthy" stems, and odd individuals with good form and the capacity for further worthwhile growth will remain. The extent to which these are present depends on the economic location of the forest, the nature of the stand itself and the intensity of supervision by the forester.

For the Washpool Study Area (Forestry Commission of N.S.W., 1980a) it was estimated that logging in the moister phases (about 40% Brush Box) could be expected to remove up to 60% of the overstorey canopy, while in the more extensive drier sites (more New England Blackbutt) only about 40% would be removed. Because of economic location most other forests would be more accessible and therefore logging would tend to remove more overstorey.

Such remaining trees serve as a seed source. Trees with growth potential will grow on to a later cutting cycle. However most retained trees will be those currently considered unmerchantable:

- Despite their unmerchantability, these trees are usually acceptable as a seed source. Faultiness in these old hardwoods usually appears to be more due to fire and other historical events than to genetic weakness.

- Merchantability is a reflection of current markets. Trees unacceptable to mills 30 years ago may be sought after to-day, while new markets (e.g. pulpwood) may develop for wood unsuitable for the sawmills.

- Large, standing trees will severely interfere with regeneration development over a considerable area; a stocking of such trees will "sterilise" a substantial part of a logging area.

- However in particularly frost-prone areas the retention of adequate canopy may be needed to prevent local frost-hollow creation.

Studies by Van Loon, supported by general observation, confirm that in most sites, the less the remnant canopy, the better the regeneration stocking and growth.

The unmerchantable stems have often been removed by ringbarking or felling in a silvicultural "timber stand improvement" (TSI) operation carried out about the time of any regeneration treatment. Sometimes also stems can be salvaged for use for sleepers, fence posts or other products. Culling has often removed many trees that would subsequently have been considered saleable, while ringbarking produces standing dead trees that can damage regrowth as they break up and that can be a severe hazard during fire. Because of improved utilisation standards, fewer such trees are left today than in the past. These are sometimes culled, but probably more usually are retained - chiefly to save expense, but often rationalised as retaining "wildlife habitat" or "possum trees" or as contributing to the vegetation cover. These rationalisations should not be accepted too uncritically: their objectives are desirable enough, but sometimes the means used to achieve them are opportunist rather than effective.

6.6 Regeneration Damage

As noted frost can damage regeneration and, in extreme cases, convert forest to grassland once opened up. Its risk is greatest on higher altitude sites with impeded air drainage. Tallowwood tends to be more susceptible than Blue Gum to frosting. Weeds, particularly annuals, can sometimes offer useful protection to the young eucalypts from frost.

Weed competition is one of the most distinctive features of the M.C.H. types, particularly after fire. On burnt sites, seed bed receptivity may be lost after a few weeks because of weed growth, and weeds may completely blanket the site within 6 months. Weed species include annuals (e.g. Cobblers Peg, Inkweed, Stinking Roger), ground cover (Soldier Vine, Wandering Jew), shrubs (Tickbush, Wild Tobacco), scramblers (Lantana, Wild Raspberries), pioneer rainforest species (Poison Peach, Giant Stinger), wattles, and coppice from some rainforest species. Some are frost susceptible and last only till the first winter; most are longer lived and can offer severe completion to the young hardwoods.

The faster eucalypts can usually keep pace, and ultimately outgrow, the weed crop. Tallowwood, with its slower growth, is at a disadvantage here, but because of its greater tolerance often survives in the weed layer, to win through as the weeds die off. Brush Box is even more tolerant.

Besides their competitiveness, the presence of dense and often prickly weed crops makes very difficult the task of assessing regeneration and makes it hard to estimate visually the extent of desirable regeneration present.

The vigorous growth in regeneration areas is attractive to many animals, leading to browsing damage. Domestic stock can cause damage where present, but native mammals (wallabies and possibly some possums) appear a more common cause, and can produce high levels of damage: Curtin recorded 57% of milliacre plots with signs of browsing damage at Bulga and 43% at Myall River, but only low levels of damage at Mt. Boss S.F., where wallabies were regarded as scarce. Whilst browsing need not destroy seedlings, it certainly retards their growth, with Tallowwood's slower early growth making it susceptible for longer periods. At times, however, the mortality from browsing can be highly significant.

Insects also cause damage, both through seed removal, as noted, and by attack on established regeneration: severe infestations of the Gum Tree Scale, *Eriococcus coriaceus*, in particular, can at times occur on, and affect the growth of, both Tallowwood and Blue Gum.

6.7 Early Development

Initial establishment of seedlings is usually followed by a gradual diminution in stocking over the next few years, though on tractor-cleared sites stocking may increase for a period because of continuing germination on beds that remain receptive for longer periods: figures showing these effects, from work by Van Loon, are given in Table 3.

Table 3

Early Establishment and Growth

	Burnt Sites	Tractor-cleared Sites
No. Blocks	6	5
% Milliacres Stocked-Tallowwood		
at 6 mo	40	33
15 - 18 mo	36	46
27 - 30 mo	31	39
Height at 30 mo		
Mean	1.4 m	0.7 m
Range	0.9 - 2.7 m	0.3 - 1.4 m

More recently G.C. King has assessed regeneration on a range of sites in the Port Macquarie Region, logged from 2 to over 20 years previously. All carried reasonable hardwood regrowth stockings, though local sites (usually moister areas with a significant rainforest component) were often deficient. Stocking in sites with no treatment other than logging was in the range 175 to 265 stems per hectare; on burnt sites, 300 to 2000 stems per ha. In all cases spots on disturbed soil were well stocked (71 to 100% stocking rate), whereas those on undistrubed soil were less satisfactory (18 to 55%). Species composition varied considerably:

Species	Regeneration Composition	
	Average	Range
Tallowwood	37%	17 - 63%
Blue Gum	28	3 - 64
Brush Box	24	6 - 62
Other spp.	11	0 - 40

Whilst stockings on unburnt sites are in some cases marginal, King's results support the visual impression that the Moist Coastal hardwood types in fact usually regenerate successfully, except for some of the very moist sites.

Height growth in the regenerating stands varies greatly. The following figures, from a variety of sources, indicate the trends to be expected over the first 5 years:

Age	Tallowwood		Sydney Blue Gum	
	Average	Top Range	Average	Top Range
1 yr	0.3 m	1.3 m	0.8 m	1.8 m
3 yr	1.6	4.5	3.4	5.0
5 yr	3.0	6.0	5.0	7.2

The "top range" values are those to be expected under most favourable conditions. The slower early growth of Tallowwood is typical; Brush Box would be slower again.

Because of weed growth, regeneration assessments in the early years following logging are hard to organise and carry out, while visual examination can be misleading (failures tend to be in the less accessible, moister sites). Thus recognition in advance of sites likely to have problems in regenerating is often more important than being able to take subsequent corrective action.

7. GROWTH AND YIELD

A number of growth plots have been maintained in regrowth stands of the M.C.H. types for periods of up to 30 years. They include some series of plots where different thinning regimes have been applied. These plots are listed in Table 4.

The plots were selected in part because they carried well stocked stands, and they almost certainly represent better than average growing conditions. Any growth trends from them should be regarded as indicative of the upper range of growth expected in these types, rather than of average conditions. More representative information should ultimately result from the permanent growth plots which are currently being established in some districts.

Table 4

Growth Plots maintained in Regrowth Stands

Identifier	Plot No.	State Forest	Date of Regen'n.	Details	Measured since
H6/2.1	1-9	Styx River	1946	Thinning-Blue Gum, New England Hwds	1956
H6/2.2	1A - 3F (18 plots)	Clouds Creek	1935	Thinning-Blue Gum	1960
H6/2.3	1 - 4	Moonpar	1937	Thinning-Tallowwood, other spp.	1955
H6/3.1	1	Brooklana	c.1930	Growth-Tallowwood, Brush Box	1953
H6/3.2	A,B,C	Doyles River	1947	Growth and early spacing, Tallowwood and others.	1951
H6/3.3	1,2	Bulga	1942	Growth and early spacing, Tallowwood and others	1956
H6/3.3	3	Bulga	c.1928	Growth, Tallowwood and others	1956

While measured regularly, there have been no recent efforts to analyse the growth data held. However a brief, graphical review of the periodic summaries gives the trends summarised in Table 5.

Table 5.

Growth Trends shown in Plots

		Age - years						
		10	20	30	40	50	60	70
MEAN D.B.H. SELECTED STEMS(1)								
Average	(cm)	19.4	27.6	33.6	38.4	42.4	46.0	49.4
Best Plots(2)	"	29.4	41.0	49.0	54.2	58.5	62.0	65.0
MEAN DOM. HT.(3)	(m)	12.5	21.4	27.0	31.2	34.0	36.4	38.6
VOLUME/HA (4)								
Average	(m^3)	-	50	114	190	256	306	-
Best Plots(2)		32	132	236	328	390	-	-
MEAN D.B.H.								
Tallowwood-Blue Gum	(cm)	13.8	19.0	23.2	26.6	30.0	33.1	35.9
Brush Box		6.0	9.6	13.0	16.2	19.2	21.4	23.6

Notes: (1) Selected Stems: about 100 best stems per ha, selected in field, regardless of species.
(2) Best Plots: upper range of plot data and their likely future trends.
(3) Mean Dom. Ht: Mean height of selected dominant stems in plot, regardless of species.
(4) Volume: calculated from appropriate stem BA/Mean Dom. Ht. equation.

There are some interesting points about this data:

1. The material represents a pooling of growth information from plots of varying species composition, stocking and history.

2. Despite the slower early growth of Tallowwood, in these older plots there was no evident difference in the rates of diameter growth between Tallowwood and Blue Gum. Tallowwood in fact provided the highest rate of diameter growth (H6/2.3, plot 3) and Blue Gum the slowest (H6/2.1, several plots), but the overlap of values was such that the two species can be regarded as having similar rates of diameter growth over the range of ages, sizes and sites covered.

3. By contrast, Brush Box shows much slower rates, though these are probably further depressed because, in all plots where it occurs, the Box is growing beneath a taller overstorey of faster eucalypts.

4. The selected stems can be regarded as constituting the future sawlog component of the stand.

5. Volume estimates show MAI's peaking at about 5 m^3/ha at age 50-60 years on average, and at about 8 m^3 on the best plots. Eucalypt plantations on similar sites show MAI's of about 14 m^3/ha at age 20 years. For widespread areas of natural regeneration, volume increments of 2-2.5 m^3/ha/an would appear reasonable.

Other estimates of Tallowwood diameter growth have been provided by Curtin, from trees present in primarily Blackbutt growth plots, and by Fisher (1978), from open forests in the Blackbutt Range, Qld. Both sources tend to represent poorer conditions for the species than the sites considered here. These estimates, compared with those from Table 5, are shown in Table 6.

Table 6

Comparison of Tallowwood Diameter Increment

Fisher (1978)		Diam. Range	Diam. P.A.I.	
Diam. Range	Diam. P.A.I.		Curtin (1960)	Table 5
15 - 20 cm	.02 cm	10 - 20 cm	.51 cm	1.10 cm
20 - 25	.24	20 - 30	.58	.70
25 - 30	.46	30 - 40	.71	.51
30 - 35	.42	40 - 50	.38	.38
35 - 40	.72	50 - 60	-	.34
40 - 45	.39			

Whilst the growth plots show responses to thinning, particularly in diameter growth, analysis is inadequate to indicate the order of such response. However the tolerance of Tallowwood suggests that this species will probably show satisfactory growth in rather denser stands than, say, Blackbutt.

All three of the major species can reach massive size: figures provided by Forestry Commission of N.S.W. (1981 - Appendix 6) indicate the following upper limits:

Tallowwood	height 74 m	DBH 3.4 m
Blue Gum	65 m	2.5 m
Brush Box	54 m	3.0 m

Volumes of individual trees can exceed 100 cubic metres. As discussed, Brush Box may exceed 1000 years in age, and Tallowwood probably has similar longevity, whereas Blue Gum is usually assumed to have a much shorter life span, possibly in the order of 400 years, though this may not be correct.

8. DAMAGE TO OLDER STANDS

The damage agencies affecting the M.C.H. types are essentially those characteristic of the moister eucalypt forests in N.S.W. generally.

Snowfalls occasionally damage younger stands, up to about 10 m in height, through breakage and bending. It is most likely at the higher altitudes. Wind squalls may sometimes produce similar damage.

As discussed, fire is a major factor in the occurrence of these types; it is also a major source of damage. Most hardwoods are fairly resistent to fire damage (Brush Box is probably least resistent of the major species), but may be killed in severe fires. Secondary insect and fungal attack may follow fire damage.

The response of the types to fire varies considerably. Whereas the drier phases will often burn under prescribed conditions, in the moister sites fire may only occur under fairly extreme, and uncontrollable, conditions. Hazard reduction burning is normally confined to the drier sites.

Blue gum is probably more susceptible than other major species to insect attack in regrowth stands. Psyllids (lerp insects) are a common pest, and while outbreaks usually follow the normal course of insect build up and then collapse as natural control mechanisms come into play, sometimes the attack becomes almost permanent: apparently this is due to bell-bird populations preferentially feeding on predators of the psyllids. A leaf-miner attack on Blue Gum at Cumberland S.F. seems to follow a similar pattern. Such attacks will reduce growth rates and lead to the death of weaker, and at times even dominant, trees.

All species suffer from internal defect, associated with termites, wood root, borers, gum veins or other causes.

9. PRESERVATION

Many examples of M.C.H. types have been set aside in preserved areas on the north Coast, and the preservation record is probably better than for any other major commercial forest type in N.S.W., except rainforest. One reason for this is that many stands have remained inacessible until recent times, so that better opportunities to preserve undisturbed areas have existed than for most other communities. Another reason is the undoubted magnificance of many of the stands.

National Parks containing significant stands of these types include:

Barrington Tops N.P. Total area	16 300 ha
Dorrigo N.P.	3 900
Gibraltar Range N.P.	17 300
Limpinwood N.R.	2 400
New England N.P.	23 600
Werrikimbe N.P.	14 300

The Forestry Commission's Native Forest Preservation programme (Forestry Commission of N.S.W., 1981) includes 26 Flora Reserves, with a total area of 4 100 ha, and 24 Forest Preserves, with a total area of 3 800 ha, containing one or more of the types included here. Between them, they sample most of the variation present in these communities. These preserved areas are listed in Appendix 7.

As previously noted, the types contain many trees of outstanding size. A number of these, listed in Appendix 6 of Forestry Commission of N.S.W. (1981), have been specifically recorded and preserved; they include:

Tallowwood	8 specimens
Brush Box	6 "
Forest Oak	5 "
Sydney Blue Gum	2 "
Brush Cypress Pine	2 "

and one each of New England Blackbutt, Dunn's White Gum and Turpentine.

10. MANAGEMENT ASPECTS

10.1 Objectives

The manner in which any forest area is managed depends greatly on the local objectives of management. Most forests containing significant areas of M.C.H. types have their objectives expressed in fairly similar terms. A typical management plan (for Chichester Management Area; Forestry Commission of N.S.W. 1980 c) lists these objectives as:

1. To supply sawlogs at commitment level for as long as possible, subject to periodic review in the light of resource data and progressive adjustment, if possible under suitable industry conditions, to a level that can be sustained in perpetuity.

2. To supply part of the pulpwood requirements for a possible future paper pulp industry.

3. To supply poles, piles, mining timber and other timber products in accordance with availability and demand.

4. To maintain the State Forests generally under natural forest vegetation adequate to:

    a) Conserve the soil resources and water catchment capabilities;

    b) Maintain a diversity of habitat suitable for wildlife indigenous to the area;

    c) Retain an aesthetic forest environment acceptable to the public generally.

5. To minimise, to the extent practicable, damage to the State Forests by wildfire and prevent the escape of fire to adjoining lands.

6. To maintain any unique or rare, ecological, historical, floral, faunal or other scientific values occurring within the State Forests.

7. To provide for use of the forests for public recreation, in accordance with the Forestry Commission's general policy on recreation in State Forests, and also for educational purposes.

8. To provide for grazing and other forest uses where compatible with other management objectives.

9. To maximise net financial returns to the extent possible under the other management objectives.

Timber production is given a predominant position in this list, but this use is then restricted by other objectives (especially 4 and 6), by the broader provisions of the Indigenous Forest Policy (Forestry Commission of N.S.W., 1976), and by other policy statements and prescriptions e.g. Standard Erosion Mitigation Conditions for Logging.

In the case of the more remote forest areas, the Indigenous Forest Policy carries constraints that represent a restriction on investment in future wood production and that have been interpreted by some as a policy of regarding these areas essentially as a source of timber for the present, rather than as a continuing wood production unit. Emphasis is given to creating a green vegetation cover of any tree type after logging, not necessarily regeneration of commercial species:

> "In types such as moist hardwood where regeneration establishment is difficult, a continued acceptable forest environment should be sought, either through promotion of regeneration by burning techniques or the retention of an adequate forest cover of defective and smaller trees of the original stand. The essential feature of post-logging management of these areas is to obtain an acceptable forest cover preferably of commercial quality. Where this would require additional investment, any forest cover should be accepted as an alternative".

While this provision does not apply to the more accessible areas, it is the less accessible ones that probably represent the greater proportion of the area of M.C.H. types under forest management. However the provision may be modified by more specific prescriptions appearing in individual management plans.

10.2 Management Problems and Practices

The main problems relating to the management of these types have been previously noted:

- Often remote location and difficult topography, so that standards of utilisation are poor. Many stems that would be sold in other sites are rendered unmerchantable.

- Difficulties in regeneration relating to need for site disturbance and opening, dense weed growth, and short period of seedbed receptivity.

- Relatively slow early growth of the major species, Tallowwood.

- Related to their location, the low priority accorded to much of these types for treatment, compared with other forest areas of similar productivity on more economic sites.

Added to this is the often close and intimate association with rainforest. Any restrictions on harvesting rainforest trees must inevitably affect the management of the M.C.H. types where rainforest trees are frequently present in the understorey, or where undoubted stands of rainforest adjoin the hardwood stands or have to be traversed to gain access to the hardwoods.

Management of these types has to be carried out within the context of these constraints.

The detailed interpretation of the management objectives vary from area to area, but in broad terms it involves the harvesting and sale of all merchantable stems in a logging coupe, except for:

- those retained in creekside strips, steep slopes or other nominated sites;

- stems judged capable of making useful growth over the period of a further cutting cycle (usually the occasional younger, healthy stems);

- stems deliberately retained as a seed source or for aesthetic or wildlife purposes or, as stated in some management plans, "to maintain an adequate forest cover".

Burning may follow logging, and some enrichment planting may be carried out. In some areas, complete clearing and planting may occur. Regenerated stands may subsequently be thinned to provide small timber for a variety of purposes.

As seen, this practice usually results in satisfactory regeneration and development, but some more specific guidance points, for implementation as appropriate, can be noted.

10.3 Guidance Points

Based on the information reviewed here, the following points are made:

1. The Moist Coastal Hardwood types can be managed in some areas by a selection or group selection system. Such a system will usually produce good clumps of regeneration on the drier sites, but the moister and more sheltered sites may be slow to regenerate and require a series of fires (often very difficult to arrange) if local seedbed receptivity is to be restored on a number of occasions. Alternatively, tractors may be used to develop a patchwork of small, disturbed seedbed areas. In these moister sites the slower growing and more tolerant hardwoods are likely to appear, and there is a risk that the lower value species, Brush Box and Turpentine, may dominate the regrowth.

2. More usually, a more concentrated logging operation is desirable to open up the canopy and expose the mineral soil.

3. The major species appear to carry at least some seed at all times. However it seems desirable to maintain a stock of seed of these species, and regularly to check on the status of the seed crop during logging operations. In the event of a seed crop failure of a general nature in any area (i.e. not just one species), arrangements should be set in hand for the subsequent use of artificial regeneration either by spot sowing or, preferably, by planting.

4. Sufficient seed trees should be retained to disseminate their seed over the area logged. If burning of the slash is not intended, and seed is to come primarily from the heads of logged trees, then four or five stems per hectare should be retained as an insurance. However, if the slash is to be burnt so that seed must then come from the retained trees, six to eight well spaced trees per hectare should be kept. Unmerchantable stems of desirable species are normally acceptable as seed trees, provided they have healthy crowns.

5. During the logging operation, as much mineral soil should be exposed and, subject to the need for retaining seed trees and young, growthy stems, as much of the canopy should be opened up and removed, as possible. If practicable, areas where additional clearing is needed should be identified in advance and efforts made to have these disturbed during the logging operation. Soil exposure, however, should not be to the extent that soil loss may occur.

6. In general, efforts should be made to burn the logging debris after logging. This may be in the form of isolated top disposal or may be by a fire of more general extent. Subject to fire safety, the most appropriate time for the burn appears to be late spring or early summer, when fairly reliable follow up rains can be expected; earlier burns risk seed shed and germination into a dry period, when the young germinates will die; an autumn burn is a more acceptable alternative, but may occur when most seed on the trees has already been shed during the preceding summer, so that little remains to germinate after the fire. However, if logging has resulted in a high level of disturbance and exposed soil, burning might be omitted. (Against this, heavy disturbance usually means heavy fuel levels, which it may be desirable to remove as a protection measure, and often also a fuel body broken into discrete units, allowing for their more ready removal by fire). The comments on prelogging burning (Appendix 6) should also be considered in this context.

7. Where logging results in the retention of an appreciable cover of currently unmerchantable trees, the future of these needs to be carefully considered. They will severely inhibit the establishment and growth of subsequent regeneration, but on the other hand their unmerchantability may be a temporary affair that will alter

in a few years with a change in economic or market conditions. If the defect is such that a significant improvement in merchantability seems unlikely (e.g. heavy rot or termite infestations), then a culling treatment should if possible be applied immediately following logging, by felling or, less desirably, by ringbarking. However if a change in merchantability seems possible, then retention of the currently unwanted trees is to be preferred: in this case management will approach a selection system as outlined in (1), above. If the guess was wrong, and merchantability does not improve to the extent needed to warrant a further harvesting, then the choice of culling and burning will remain for the future if it is still desirable to improve the productive capacity of the site.

8. Justifying the retention of unmerchantable trees on the grounds of wildlife habitat or aesthetics needs to be looked at carefully. It would seem that greater contributions in both directions would often be made by increasing the retention of trees close to watercourses or along the moist rainforest margins, and by seeking a more even and vigorous establishment of regeneration over the bulk of the logging area.

9. The treatment outlined in (4), (5) and (6), above, will usually result in the establishment of an adequate stocking of regeneration of desirable species. Planting should rarely be needed, except possibly on dump sites, to ensure their speedy recovery, or where plantation programmes have previously been approved and supply commitments made based on the higher yields to be expected from plantation crops.

10. Other exceptions may be the general failure of a seed crop (see 3) or the existence of particularly moist sites, often close to rainforest stands and with a well developed rainforest component in the understorey, where natural regeneration establishment is difficult to achieve. Local experience will often indicate sites of this type, and in these cases logging (and burning, if feasible, though this is often difficult in these moist sites) should be followed by low density enrichment planting of suitable eucalypts in appropriate openings. It should however be recognised that such potential failure sites are much less frequent than is commonly believed. These moist sites are often very high yielding, and potentially highly productive if successfully regenerated to hardwood, but their management involves positive decisions on the relative values of different forest benefits, some of a rather intangible nature.

11. Every opportunity should be taken to check, visually or by assessment, on the regeneration present in logged areas, particularly in the moister sites away from the usual ridgetop access. Because of the often almost impenetrable weed growth that follows logging and burning, post-logging regeneration is undoubtedly difficult and unpleasant. Nonetheless it should, if at all possible, be carried out on a regular basis on these MCH types. Most districts would only need to assess a couple of areas in any year. If significant areas (say over 2 hectares) lacking regeneration are located, consideration should be given to applying some special regeneration treatment to these sites, e.g. planting scattered advanced seedlings; limited bulldozer clearing of track lines, followed by enrichment planting. Such treatments may in fact rarely be practicable, and the real value of regeneration assessment or other checks lies in building up a factual body of information about the development of regeneration under various conditions, as a guide to modifying future treatment.

12. As the regrowth develops, opportunities for the commercial thinning of the stand should be watched for. Thinning should aim to promote the growth of the best stems for sawlog production

Finally, it should be stressed that, with suitable treatment associated with logging and involving adequate canopy opening and soil disturbance, regeneration is usually far more reliably obtained in these types than has often been stated or imagined.

10.4 Further Research

Much of the material in this review is based on the results of a substantial silvicultural research programme carried out during the 1950's and 1960's, and supplemented by limited more recent studies and by considerable field experience on the part of many field foresters. The information available, however, is of course never enough for reviews of this type, and one result of the review - possibly the only positive one - is to identify some areas where further work is needed. These include:

1. Seeding characteristics of species other than Tallowwood and Sydney Blue Gum; Silvertop Stringybark, New Engand Blackbutt and Brush Box should receive highest priority.

2. Analysis of existing growth data, and establishment of further growth plots covering a greater range of conditions.

3. Efforts to identify in advance sites with the greatest problems in regeneration establishment and to develop techniques to minimise or overcome these problems.

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Plant Species mentioned in Text

Common Name	Botanical Name
Bangalay	*Eucalyptus botryoides*
Blackbutt	*E. pilularis*
Blackbutt, New England	*E. andrewsii* ssp. *campulata*
Box, Brush	*Tristania conferta*
Box, Whitetopped	*Eucalyptus quadrangulata*
Bracken	*Pteridium esculentum*
Coachwood	*Ceratopetalum apetalum*
Cobbler's Peg	*Erigeron* sp.
Cypress Pine, Brush	*Callitris macleayana*
Duboisia	*Duboisia myoporoides*
Grapes, Native	*Cissus* spp.
Gum, Blue	*Eucalyptus saligna*
Gum, Dunn's White	*E. dunnii*
Gum, Flooded	*E. grandis*
Gum, Sydney Blue	*E. saligna*
Inkweed	*Phytolacca octandra*
Lantana	*Lantana camara*
Mahogany, Narrowleaved White	*Eucalyptus acmenioides*
Oak, Forest	*Casuarina torulosa*
Peach, Poison	*Trema aspera*
Raspberry, Wild	*Rubus* spp.
Soldier Vine	*Kennedia rubicunda*
Stinger, Giant	*Dendrocnide excelsa*
Stinging Roger	*Tagetes minuta*
Stringybark, Blueleaved	*Eucalyptus agglomerata*
Stringybark, Diehard	*E. cameroni*
Stringybark, Silvertop	*E. laevopinea*
Tallowwood	*E. microcorys*
Tickbush	*Helichrysum diosmifolium*
Tobacco, Wild	*Solanum mauritianum*
Turpentine	*Syncarpia glomulifera*
Wandering Jew	*Tradescantia albiflora*
Wattle	*Acacia* spp.

Appendix 2

Climatic Averages: Moist Coastal Hardwood Sites

Station Localities

Altitude	Latitude 33°	32°	31°	30°	29°	28°
700 m+			Styx R.			
600					Girrard	
500				Clouds Ck.		
400						
300					Whian Whian	
200						
100	Olney		Bellangry			
0		Coolongalook			Lismore	

OLNEY S.F. - Latitude 33° 6'S Longitude 151° 15'E Elevation 152.4 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C) Mean	26.5	26.3	23.5	22.7	17.2	15.4	14.2	15.4	19.1	20.1	23.2	23.6	20.6
Daily Minimum Temperature (C) Mean	14.0	16.4	13.4	11.5	8.1	7.1	5.0	6.3	8.5	11.5	12.7	15.1	10.8
Rainfall (mm) Mean	152	197	177	152	129	214	71	103	74	104	111	130	1614
Raindays (No) Mean	12	12	12	10	7	9	8	7	8	9	8	10	112

COOLONGALOOK S.F. - Lat 32° 12'S Long. 152° 19'E Elevation 38.1 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C) Mean	26.7	27.3	26.5	24.6	20.6	18.4	17.3	18.6	22.2	22.9	26.0	26.3	23.1
Daily Minimum Temperature (C) Mean	15.3	16.4	13.9	11.8	6.7	3.4	3.1	4.3	8.0	10.1	12.3	14.6	10.0
Rainfall (mm) Mean	122	159	174	100	85	121	60	78	55	82	73	96	1205

BELLANGRY - Lat. 31° 20'S Long. 152° 35'E Elevation 152.4 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	26.7	27.3	25.6	23.5	19.8	17.3	17.1	18.1	21.6	23.4	25.6	25.6	22.6
Daily Minimum Temperature (C)													
Mean	16.4	17.2	15.8	13.8	10.8	9.6	7.7	8.8	11.1	12.7	14.2	15.9	12.8
Rainfall (mm)													
Mean	168	255	181	129	78	114	51	89	58	112	96	129	1460
Raindays (No)													
Mean	16	17	12	5	7	7	6	7	6	6	8	11	108

STYX RIVER S.F. - Lat. 30° 37'S Long. 152° 11'E Elevation 1036.3 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	25.4	21.4	20.9	19.3	13.5	11.8	11.9	13.7	13.4	17.2	21.9	22.9	17.8
Daily Minimum Temperature (C)													
Mean	14.6	13.2	11.9	9.2	5.7	3.4	2.8	4.9	3.0	8.8	11.2	11.6	8.4
Rainfall (mm)													
Mean	204	208	207	106	81	120	81	81	62	105	112	149	1516
Raindays (No)													
Mean	15	14	15	11	9	10	7	8	7	10	11	13	130

CLOUDS CREEK S.F. - Lat. 30° 6'S Long. 152° 36'E Elevation 550 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	26.9	26.4	25.4	23.6	19.8	17.5	16.4	17.3	20.5	23.8	26.2	26.7	22.5
Daily Minimum Temperature (C)													
Mean	14.8	15.2	11.8	8.7	5.0	2.3	-0.3	2.7	4.8	9.0	11.0	12.9	8.2
Rainfall (mm)													
Mean	228	188	172	83	62	89	62	68	49	109	122	165	1397
Raindays (No)													
Mean	15	16	18	13	7	9	6	8	8	13	11	14	138

GIRARD S.F. - Lat. 28° 54'S Long. 152° 18'E Elevation 670.6 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	26.0	26.1	24.5	23.1	18.2	15.8	15.0	16.2	20.3	22.6	26.0	24.7	21.5
Daily Minimum Temperature (C)													
Mean	14.0	13.4	12.4	10.1	5.8	4.5	1.5	3.5	5.5	9.3	10.0	12.7	8.6
Rainfall (mm)													
Mean	206	211	210	92	73	96	85	52	52	94	98	162	1431
Raindays (No)													
Mean	14	15	17	12	8	8	8	6	7	10	9	12	126

LISMORE P.O. - Lat. 28° 48'S Long 153° 17'E Elevation 9.4 m.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	29.6	29.4	28.1	26.2	22.6	20.4	19.9	21.4	24.1	26.6	28.2	29.4	25.5
Daily Minimum Temperature (C)													
Mean	18.9	19.0	17.3	14.4	10.5	8.3	6.0	7.6	9.8	13.3	15.8	17.6	13.2
Rainfall (mm)													
Mean	166	183	184	122	110	98	86	60	54	75	93	118	1349
Raindays (No)													
Mean	13	13	16	12	11	9	8	7	8	9	9	11	126

WHIAN WHIAN S.F. - Lat. 28° 36'S Long. 153° 23'E Elevation 381.0 m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	25.7	25.3	23.8	22.1	18.5	16.5	15.5	17.0	20.5	22.7	26.0	24.1	21.5
Daily Minimum Temperature (C)													
Mean	16.7	16.3	14.9	13.0	9.5	8.2	5.8	6.8	8.8	12.1	13.4	15.5	11.8
Rainfall (mm)													
Mean	352	382	318	189	155	194	146	103	74	149	135	191	2388
Raindays (No)													
Mean	15	18	18	14	11	11	8	8	11	10	10	13	147

Properties of Major Timber Species: Moist Coastal Hardwood Types

(Derived by K.R. Bootle: "Commercial Timbers of N.S.W and Their Uses"
Abbreviations: L-S, Lyctid-susceptible; G, green; S, seasoned; B, basic (re density)

mmon Name (tandard Name)	Botanical Name	General Properties	Density kg/m^3	Durability	Strength	Sawlog Group	Uses	Other Notes
ackbutt, ew England	Eucalytus andrewsii ssp. companulata	Light brown. Mod. fine texture. Gum veins common.	G:1150 S:900 B690	2-3 L-S	B/S3	B	General building construction.	Prone to surface checking on back-cut surfaces. Some collapse.
:, Brush	Tristania conferta	Pinkish brown. Fine texture. Interlocked grain common. Dresses well. Very good wearing qualities.	G:1170 S:900 B:690	3(1-2 for termites) Little Lyctid attack	B/S3	D	Flooring, panelling. Cladding, general building. Decking, bearings, industrial flooring, wharfage.	Slow in drying; some distorts badly. Not suitable for bent work.
, Whitetopped	Eucalyptus quadrangulata	Light yellow-brown. Fine texture. Very hard.	G:1230 S:1020 B:800	1-2 Seldom Lyctid attack	A/S3	A	Heavy engineering construction. Poles, sleepers.	
ress Pine, Brush	Callitris macleayana	Light yellow brown. Typical Cypress Pine odour. Fine texture. Less knotty than inland species.	S:580	2	D/S6	(Bwd) B	Cladding, flooring, panelling, building framework.	Dries quickly.
Flooded	Eucalyptus grandis	Pink to light red. Straight grain. Rather coarse texture. Easy to work. Gum veins common. Variable in density.	G:990 S:700 R:560	3 Seldom Lyctid Attack	C/S3	B	General construction, joinery, plywood, panelling, boat-building, flooring. Paper pulp.	Slow drying. Some collapse. Not suitable for bent work.

Properties of Major Timber Species: Moist Coastal Hardwood Types

(Derived by K.R. Bootle: "Commercial Timbers of N.S.W and Their Uses"
Abbreviations: L-S, Lyctid-susceptible; G, green; S, seasoned; B, basic (re density)

Common Name (Standard Name)	Botanical Name	General Properties	Density kg/m^3	Durability	Strength	Sawlog Group	Uses	Other Notes
Gum, Sydney Blue	Eucalyptus saligna	Pink to red. Grain straight. Mod. coarse texture. Gum veins common. Easy to work, fix, dress and finish.	G:1150 S:910 B:690	3 L-S	B/S3	B	General construction, flooring, cladding, panelling.	Rather slow to dry; may check on back-cut surface. Only fair for bent work.
Mahogany, Narrowleaved White (White Mahogany)	Eucalyptus acmenioides	Light yellow-brown. Gum veins. Fine texture. Grain often interlocked. Not difficult to work.	G:1180 S:990 B:780	1 Seldom Lycid attack	B/S2	C	Heavy engineering construction. Poles, sleepers, crossarms. Flooring, cladding.	Dries slowly.
Oak, Forest (Rose Sheoak)	Casuarina torulosa	Dark red with large, coloured rays. Rel. fine texture.	G:1200 S:930 B:770	2-3	A	D	Flooring, Roofing shingles & shakes. Decorative turnery and woodware.	Slow to dry. Prone to check on back-sawn surface.
Stringybark, Silvertop	Eucalyptus laevopinea	Light brown; sapwood not clearly distinguishable. Mod. fine texture. Grain sometimes interlocked.	G:1040 S:690 B:530	2-3 L-S (but sapwood narrow)	C/S4	B	General building construction.	Slow drying. Some collapse.
Tallowwood	Eucalyptus microcorys	Yellow-brown, greenish tinge. Mod. coarse texture. Grain interlocked. Greasy nature. No gum veins.	G:1230 S:990 B:800	1 L-S	A/S2	A	Heavy engineering construction. Sleepers, poles, crossarms. Sills, cladding, flooring.	Dries slowly. Some surface cheking and warping. Not recommended for bent work.

Properties of Major Timber Species: Moist Coastal Hardwood Types

(Derived by K.R. Bootle: "Commercial Timbers of N.S.W and Their Uses"
Abbreviations: L-S, Lyctid-susceptible; G, green; S, seasoned; B, basic (re density)

ommon Name (Standard Name)	Botanical Name	General Properties	Density kg/m3	Durability	Strength	Sawlog Group	Uses	Other Notes
ırpentine	Syncarpia glomulifera	Red-brown. Fine, uniform texture. Interlocked grain. Turns well. Takes high finish. Resistent to wear; does not splinter readily. Dulls cutting tools. Does not readily burn.	G:1140 S:910 B:670	1 Seldom Lyctid attack. Very resistent to marine borers.	B/S3	D	Marine piling, ship-building, wharf decking, flooring, bearings, mallets. General building construction.	Slow drying. Some collapse.

Family _Vespertilionidae_

Miniopterus schreibersii
- Bentwinged bat

Epesticus pumilus
- Little bat

Chalinolobus gouldii
- Gould's wattled bat

Nycticeius rueppellii
- Greater broad-nosed bat

RODENTIA

Family _Muridae_

Rattus fuscipes
- Bush rat

R. lutreolus
- Swamp rat

I. _R. rattus_
- Black rat

I. _Mus musculus_
- House mouse

Melomys cervinipes
- Fawn-footed melomys

CARNIVORA

Family _Canidae_

I. _Canis familiaris_
- Dingo

Family _Felidae_

I. _Felis catus_
- Feral cat

(I. = introduced species)

Mammals to be Expected in Moist Coast Hardwood Types

(from Forestry Commission of N.S.W., 1980a)

MONOTREMATA

Tachyglossus aculeatus
- Echidna

MARSUPALIA

Family Dasyuridae

Antechinus flavipes
- Yellow-footed marsupial mouse

A. maculatus
- Pygmy marsupial mouse

A. stuartii
- Brown marsupial mouse

A. swainsonii
- Dusky marsupial mouse

Dasyurus maculatus
- Tiger cat

Phascogale tapoatafa
- Brush-tailed phascogale

Sminthopsis murina
-

Family Peramelidae

Isoodon macrourus
- Brindled bandicoot

Perameles nasuta
- Long-nosed bandicoot

Family Phalangeridae

Trichosurus caninus
- Mountain possum

T. vulpecula
- Brush-tailed possum

Family Burramydae

Acrobates pygmaeus
- Feather-tailed glider

Family Petauridae

Petaurus australis
- Yellow-bellied glider

P. norfolcensis
- Squirrel glider

P. breviceps
- Sugar glider

Pseudocheirus peregrinus
- Ring-tailed possum

Schoinobates volans
- Greater glider

Family Macropodidae

Macropus dorsalis
- Black-striped wallaby

M. giganteus
- Grey kangaroo

M. parma
- Parma wallaby

Potorous tridactylus
- Potoroo

Thylogale stigmatica
- Red-legged pademelon

T. thetis
- Red-necked pademelon

Wallabia bicolor
- Swamp wallaby

Family Phascolarctidae

Phascolarctos cinereus
- Koala

CHIROPTERA

Family Pteropodidae

Pteropus poliocephalus
- Grey-headed flying fox

P. scapulatus
- Little-red flying fox

Family Molossidae

Tadarida norfolkensis
- Eastern little mastiff-bat

Birds to be expected in Moist Coastal Hardwood Types

(from Forestry Commission of N.S.W., 1980a)

Crested Hawk
Whistling Kite
Collared Sparrow Hawk
Grey Goshawk
Brown Goshawk
Wedge-tailed Eagle
Little Falcon
Brush Turkey
Black-breasted Button Quail
Red-crowned Pigeon
Wompoo Pigeon
Topknot Pigeon
White-headed Pigeon
Spotted Turtledove
Brown Pigeon
Peaceful Dove
Bar-shouldered Dove
Emerald Dove
Common Bronzewing
Wonga Pigeon
Glossy Black Cockatoo
Yellow-tailed Black Cockatoo
Galah
Sulphur-crested Cockatoo
Rainbow Lorikeet
Scaly-breasted Lorikeet
Musk Lorikeet
Little Lorikeet
Double-eyed Fig Parrot
Swift Parrot
Crimson Rosella
Eastern Rosella
Brush Cuckoo
Fantailed Cuckoo
Rufous-tailed Bronze Cuckoo
Golden Bronze Cuckoo
Indian Koel
Channel-billed Cuckoo
Pheasant Coucal
Powerful Owl
Boobook Owl
Barking Owl
Masked Owl
Sooty Owl
Marbled Frogmouth
Tawny Frogmouth
Azure Kingfisher
Laughing Kookaburra
Forest Kingfisher
Sacred Kingfisher
Dollar Bird
Noisy Pitta
Superb Lyrebird
Albert Lyrebird
Rufous Scrub Bird
Tree Martin
Black-faced Cuckoo Shrike
Cicada Bird
Yellow-eyed Cuckoo Shrike
White-bellied Cuckoo Shrike
White-winged Triller
Varied Triller
Scaly Thrush
Rose Robin
Eastern Yellow Robin
Pale Yellow Robin
Crested Shrike Tit
Olive Whistler
Rufous Whistler
Golden Whistler
Rufous Shrike Thrush
Grey Shrike Thrush
Black-faced Monarch
Spectacled Monarch
Leaden Flycatcher
Rufous Fantail
Grey Fantail
Spine-tailed Chowchilla
Eastern Whipbird
Superb Blue Wren
Variegated Wren
Large-billed Scrub Wren
Yellow-throated Scrub Wren
White-browed Scrub Wren
Brown Thornbill
Striated Thornbill
Brown Warbler
White-throated Warbler
Varied Sitella
White-throated Tree Creeper
Red-browned Tree Creeper
Red Wattlebird
Noisy Friar Bird
Blue-faced Honeyeater
Bell Miner
Lewin Honeyeater
Yellow-faced Honeyeater
Yellow-tufted Honeyeater
White-eared Honeyeater
White-naped Honeyeater
Brown Honeyeater
Eastern Spinebill
Scarlet Honeyeater
Mistletoe Bird
Spotted Pardalote
Striated Pardalote
Silvereye
Red-browed Firetail
Figbird
Olive-backed Oriole
Spangled Drongo
Satin Bower Bird
Australian Regent Bird
Green Catbird
Paradise Riflebird
Australian Magpie
Pied Currawong
Australian Raven
Forest Raven

Notes on Prelogging Burning in Moist Coastal Hardwood Types

by R.R. Richmond (Fire Control Officer)

Prelogging burning has always had some appeal although the difficulties in moist sites may well be insurmountable. The potential benefits, however, even if it remains confined to the drier and more exposed sites and aspects, are:

- It breaks the area up, fuel-wise, rendering postlogging burning much easier to manage without the need for costly control lines. It also allows postlog burns to be conducted in more severe conditions resulting presumably in a better seed bed.

- Advance growth, seed trees, possum trees and other retained stems have a much better chance of surviving.

- The incidence of fire weeds following postlogging burning, being confined to the patches occupied by tree heads, ought to be somewhat less.

- Removal or at least dessication of mesophytic understorey by prelogging burning can probably be accomplished while a canopy remains to inhibit weed growth.

On the other hand premature seedfall and damage to regeneration by logging are risks; organising the whole enterprise so as to phase it in with licensed logging operations is difficult and finally the problems in carrying out a safe prelogging burn under conditions when moist understorey will burn cannot be easily overstated, although two-stage burns (ridges from the top down early in spring and lower levels from the bottom up a little later) offer a partial solution. This is the sort of thing that a knowledgeable forester might have a go at.

Postlogging burning then becomes top disposal.

The implication is of course that all these burns must take place in the same season. Coupling this with an overriding fire safety proviso and that in both respects there is a long learning curve to be negotiated, it would certainly be necessary to avoid the suggestion that the practice has immediate widespread application, but there nevertheless seems room for it.

Preserved Areas carrying Stands of Moist Coastal Hardwood Types

Flora Reserves

Tooloom Scrub F.R. No. 652253. Beaury S.F. 705 ha. Includes Tallowwood - Blue Gum, Brush Box and Dunn's White Gum types.

Bruxner Park F.R. No. 73036. Orara East S.F. 57 ha. Includes Brush Box.

Kerripit Beech F.R. No. 79931. Barrington Tops S.F. 243 ha. Includes Blue Gum and Whitetopped Box.

Sheepstation Creek F.R. No. 79945. Wiangaree S.F. 162 ha. Small areas of Brush Box and Tallowwood - Blue Gum types, with rainforest.

Mt. Lindsay F.R. No. 79950. Mt. Lindsay S.F. 117 ha. Includes Tallowwood - Blue Gum type.

Sugar Creek F.R. No. 79958. Wallingat S.F. 85 ha. Includes Blue Gum type.

Jerewarrah F.R. No. 79964. Ewingar S.F. 243 ha. Good example of Tallowwood - Blue Gum type.

O'Sullivans Gap F.R. No. 79966. Bulahdelah and Wang Wauk S.F.'s. 320 ha. Includes Tallowwood - Blue Gum type.

Rowleys Rock F.R. No. 79971. Bulga and Dingo S.F.'s. 146 ha. Includes Tallowwood - Blue Gum and New England Blackbutt types.

Mines Road F.R. No. 79974. Bellangry S.F. 20 ha. Includes Tallowwood - Blue Gum type.

Blue Gum F.R. No. 79975. Stewarts Brook S.F. 292 ha. Fine stand of Blue Gum; also Whitetopped Box.

Edwards Plain F.R. No. 79976. Wild Cattle Creek S.F. 35 ha. Blue Gum regeneration fringing grassland "plain".

Mobong Creek F.R. No. 79978. Wild Cattle Creek S.F. 14 ha. Tallowwood - Blue Gum and Brush Box types present.

Mt. Nothofagus F.R. No. 79981. Donaldson S.F. 650 ha. Includes Brush Box and Tallowwood - Blue Gum types.

Black Bull F.R. No. 79982. Wild Cattle Creek S.F. 47 ha. Turpentine in sheltered parts.

Chapmans Plain F.R. 79984. Clouds Creek S.F. 25 ha. Blue Gum fringe to grassland "plain", then subsequent invasion by rainforest.

Teak Tree F.R. 79985. Wild Cattle Creek S.F. 20 ha. Some Tallowwood - Blue Gum type with much Narrowleaved White Mahogany.

Lorne F.R. 79986. Lorne S.F. 54 ha. Some Brush Box type on lower slopes.

Minyon Falls F.R. 79986. Whian Whian S.F. 110 ha. Extensive Brush Box, also Turpentine, in gully.

Nightcap Track F.R. No. 79990. Whian Whian S.F. 375 ha. Some Brush Box and Turpentine types.

Big Scrub F.R. No. 79991. Whian Whian S.F. 196 ha. Includes some Brush Box and Turpentine types.

Brysons Camp F.R. No. 79992. Myall River S.F. 18 ha. Some Tallowwood - Blue Gum and Brush Box types.

Norman W. Jolly Memorial Grove F.R. No. 79998. Moonpar S.F. 52 ha. Excellent stand of very large Tallowwood, with some Blue Gum and Brush Box, over rainforest.

Boomerang Falls F.R. No. 79999. Whian Whian S.F. 24 ha. Some Brush Box type.

Madmans Creek F.R. No. 80001. Conglomerate S.F. 92 ha. Includes Brush Box and Turpentine types.

Wonga Wanga F.R. No. 80002. Orara West S.F. 25 ha. Includes Brush Box type.

Forest Preserves

19. Tinebank F.P. Kippara S.F. 132 ha. Good examples of Tallowwood - Blue Gum and Brush Box types.

38. Forty Spur F.P. Mebbin S.F. 8 ha. Brush Box and Turpentine types present.

41. Mt. Clunie F.P. Koreelah S.F. 375 ha. Includes Dunn's White Gum type.

49. Cambridge Plateau F.R. Richmond Range S.F. 11 ha. Some Brush Box type.

85. Grange F.P. Grange S.F. 24 ha. Some Brush Box type.

107. Middle Creek F.P. Marengo S.F. 154 ha. Includes Tallowwood - Blue Gum types.

117. Killiecrankie F.P. Oakes S.F. 126 ha. Some Brush Box type.

120. Leagues Scrub F.P. Oakes S.F. 36 ha. Includes Tallowwood - Blue Gum and Brush Box types.

123. Kingsgate F.P. The Brothers S.F. 53 ha. Blue Gum, Tallowwood and Brush Box present.

124. London Bridge F.P. London Bridge S.F. 45 ha. Blue Gum type present.

126. Fenwicks F.P. Doyles River S.F. 80 ha. Brush Box type present.

129. Waterfall F.P. Mt. Boss S.F. 45 ha. Excellent example of Tallowwood - Blue Gum type.

130. Red Cedar F.P. Wild Cattle Creek S.F. 30 ha. Includes Tallowwood - Blue Gum and Blue Gum types.

135. White Beech F.P. Girrard S.F. 37 ha. Brush Box and Tallowwood - Blue Gum types present.

148. Tirril Creek F.P. Bulga S.F. 156 ha. Tallowwood - Blue Gum, Brush Box and New England Blackbutt types; includes very large Blue Gum.

156. Felton's F.P. Carrai S.F. 27 ha. Almost pure Whitetopped Box.

160. Cedar Pit F.P. Styx River S.F. 91 ha. Includes Tallowwood - Blue Gum type.

165. Shannon Creek F.P. Boundary Creek S.F. 240 ha. Includes Brush Box type.

171. Redbank F.P. Washpool S.F. 120 ha. Includes Tallowwood - Blue Gum and Brush Box types.

173. Daisy Patch F.P. Enfield S.F. 560 ha. Includes Blue Gum type.

174. Twelve Sixty F.P. Bagawa S.F. 305 ha. Includes Tallowwood - Blue Gum and Brush Box types.

175. Filmy King Fern F.P. Mt. Boss S.F. 149 ha. Some Tallowwood - Blue Gum and New England Blackbutt types.

177. Careys F.P. Doyles River S.F. 110 ha. Includes Tallowwood - Blue Gum type.

179. Lynchs Creek F.P. Wiangaree S.F. 900 ha. Brush Box and Tallowwood types present.

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FLORA SURVEY, WINGHAM MANAGEMENT AREA, PORT MACQUARIE REGION

by

D. BINNS and W. CHAPMAN

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INTRODUCTION

This report presents the results of a flora survey undertaken in State Forests of the Wingham Management Area, northwest of the township of Wingham, New South Wales. The survey was in the context of management of the area for commercial forestry purposes. The location, general environmental features and management history of the area are described by Forestry Commission of New South Wales (1990). Most of the field work was carried out by W. Chapman and P. Murphy. D. Binns and T. Brassil surveyed a small number of sites and carried out searches for rare species in less accessible areas. Most of the field work was completed during July-August 1991.

METHODS

1. Plot Location

Survey methods followed guidelines being developed for use in New South Wales State Forests (York *et al.*, 1991). Floristic data were mostly derived from a series of non-permanent plots established within the study area. Plots were initially marked on 1:25 000 topographic maps using stratified random sampling. The plot sampling strategy was as follows:

(a) Stratification was based on mapped Forest Types (Forestry Commission of New South Wales, 1989) derived from aerial photograph interpretation with field checking (Forestry Commission of New South Wales unpublished maps). The area has fairly uniform geology and although all geological substrates were sampled, no attempt was made to subdivide forest type strata on the basis of geology.

(b) The basis for allocation of number of plots per stratum was the assumption that more extensive Forest Types are likely to be floristically more heterogeneous and require more plots to represent the range of variation.

(c) An emphasis was placed on those potentially commercially productive Forest Types occurring in essentially unlogged areas. For these unlogged areas, plots were allocated to strata according to the total area of each stratum mapped as unlogged (Forestry Commission of New South Wales, 1990). Arbitrary numbers of plots were set as follows:

>1000 ha	4 plots
500-1000 ha	3 plots
<500 ha	2 plots

A few Forest Types which were of very limited extent and occurred only in one or a few small aggregated patches were allocated a single plot.

(d) For each of the Forest Types in (c), an equal number of plots was allocated to logged areas, except that: i) Forest Type 47a had been intensively sampled from a previous logging impact study (Forestry Commission of New South Wales unpublished data) and was not further sampled; ii) types 62b, 64b, 65 and 163 have low commercial timber volume, would be little affected by logging and logged plots were not sampled. As far as possible, sites were selected in two logging age classes, 7-13 yr post-logging and 25-35 yr post-logging, to indicate short term and medium term impacts. Although the numbers of plots are similar, this gives a lower sampling intensity for logged areas which cover a larger area than unlogged areas.

(e) For the remaining Forest Types (rainforest types and non-commercial types) a minimum of one plot and up to four plots were allocated to each type, depending on extent but regardless of management history.

(f) Vegetation sampling used all previously established fauna survey plots. Plots required to satisfy the above criteria (in points a-e) included those established for fauna survey where appropriate. The strategy used to locate fauna survey plots is described elsewhere (York, 1992).

(g) Plots were located randomly, subject to being a maximum of 500 m from the nearest vehicular access, unless more remote plots were unavoidable. The purpose of this constraint was to minimize unnecessary travelling time. As the area is well served with roads, the only bias expected was omission of the few areas of difficult access. The major such area, in the vicinity of Bobin Creek gorge, was specifically surveyed separate from the general strategy.

In the field, plots were positioned as far as possible within a relatively homogeneous patch of vegetation. The standard size was a 50 m x 20 m (0.1 ha) rectangle, although some habitats required a variation in size or shape to ensure homogeneity within one plot e.g. longer or narrow plots were used for riparian vegetation, and smaller plots for vegetation of restricted extent. A total of 122 plots was surveyed during the present survey, and compatible data were available from a further 5 plots surveyed previously, (Binns, 1987, unpublished data) giving an overall total of 127 plots. Approximate locations are shown in Figure 1. Table 1 shows the distribution of sample plots among mapped vegetation units. There are some discrepancies from the initial strategy due to minor mapping inaccuracies.

In addition to survey plots, extensive traverses of botanically potentially interesting areas, including most rock outcrops, were made to search for rare or unusual plant species.

2. *Floristic and Vegetation Structural Data*

All plant species which could be distinguished within a plot were recorded and identified as far as possible to species level. Vertical heights of vegetation strata were subjectively defined and recorded for each plot. Stratum limits of 0-1 m, 1-6 m, 6-20 m and 20-35 m and >35 m, intended to broadly correspond to ground cover, shrubs, tall shrubs/subcanopy, forest overstorey and tall forest overstorey respectively, were used as a guide for the coding of structural data, even though actual heights were recorded.

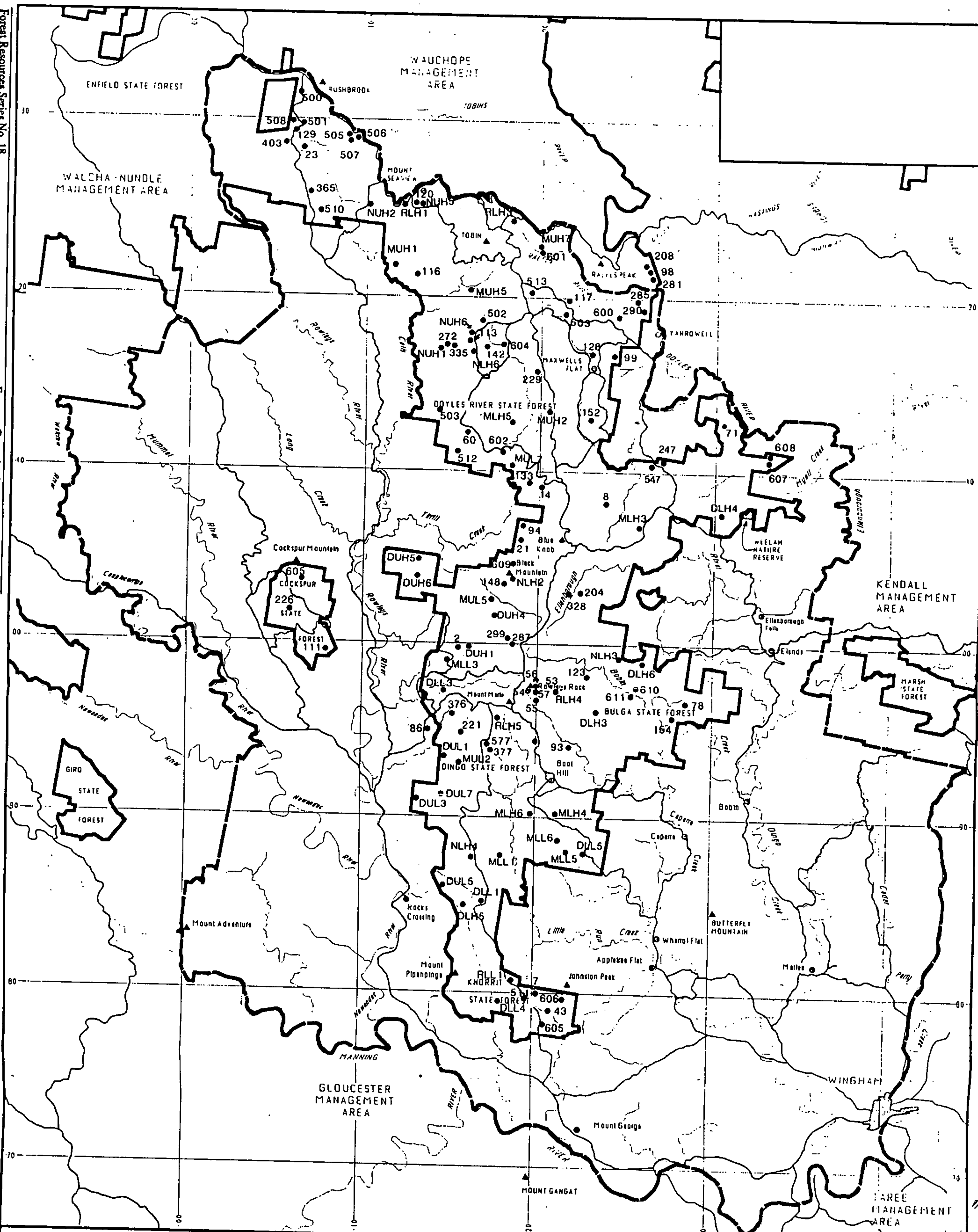
Cover codes, based on projected canopy cover, were estimated for each species within each vertical stratum. Where a species occurred in more than one stratum, an overall cover code for the plot as a whole was also recorded. Codes are as follows:

Cover Code	Projected Canopy Cover
1	< 5%, few individuals
2	< 5%, any number of individuals
3	6-25%
4	26-50%
5	51-75%
6	> 75%

The number of stems over 10 cm dbhob were recorded in 10 cm diameter classes by species, for stems less than 50 cm dbhob. Diameters were recorded for all larger stems, by species. The number of eucalypt stems greater than 2 m high but less than 10 cm dbhob was recorded by species. These data were used to estimate basal area and density for each tree species.

The locations of any occurrences of significant species noted while traversing the area, additional to those occurring in plots, and any species not previously recorded in plots, were also recorded.

The map unit in which each plot was located was recorded and a subjective assessment made of the Forest Type (Forestry Commission of New South Wales, 1989) to which the vegetation would be most appropriately allocated.



LEGEND

- Roads and Tracks
- Rivers and Creeks
- Management Area Boundary
- State Forest Boundary

Figure 1. Location of Flora Survey Plots.

Plot Location •

WINGHAM MANAGEMENT AREA

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NORTH

0 1 2 3 4 5 10 KM.

Table 1. Areas of Forest Types and sampling intensity, Wingham Mangement Area.

Forest Type	Unlogged Area (ha)	Total Area (ha)	Unlogged	No. of plots Logged	Total
1,1/3,2/3		3740			6
12c		3068			3
23,26		3323			3
36	224	1269	2	2	4
37a	472	2685	2	2	4
37b	230	1122	1	3	4
46	878	2662	3	3	6
47a	2024	7427	3	2	5
47b	1669	6884	4	6	10
47c	174	235	2	2	4
48	11	153		2	2
53	988	4908	4	3	7
60	218	1820	2	2	4
62a	733	3507	3	5	8
62b	807	2885	4	4	8
64a	57	407	1	2	3
64b	105	128	3	-	3
65	496	745	2	-	2
96	-	-	1	-	1
122a	103	203	2	2	4
122b		605	1	-	1
138		5	-	-	-
152a	98	144	2	-	2
152b	240	295	2	2	4
152c		37	-	-	-
163a	1532	3610	4	3	7
163b	1230	3064	5	6	11
163c	309	660	-	-	-
168	518	1501	2	4	6
234		536	5	-	5

3. *Habitat Data*

At each plot, slope (in degrees), altitude, aspect, topographic position, drainage, percentage cover and particle size of surface rock and cover of outcropping bedrock were recorded. An assessment was made of previous disturbance by logging or fire, on the basis of any available visual evidence. An estimate of intensity and time since disturbance was recorded. Estimates for logging were checked against historical records. Any other unusual feature was also recorded.

4. *Limitations*

Most of the field work was carried out in winter and early spring, following a year of below average rainfall. Some ephemeral species may have been overlooked, and late spring or summer flowering geophytes, including many Orchidaceae and many Liliaceae, would have been generally overlooked. These normally form a minor component of forest flora in New South Wales and their omission is not expected to affect the community analysis. Some species, especially monocotyledons, may have been overlooked due to absence of active growth or vegetative similarity to common species. Although the area was traversed comprehensively both by road and on foot, the survey was not exhaustive and further species would be recorded with additional effort.

5. *Taxonomy and Nomenclature*

Taxonomy and nomenclature follow the National Herbarium of New South Wales. This is mostly as published in Jacobs and Pickard (1981), Jacobs and Lapinpuro (1986) or Harden (1990, 1991, 1992), whichever gives the most recent treatment.

Some taxa could not always be determined to species level due to inadequate material. The main genera were *Carex, Cyperus, Entolasia, Galium, Gnaphalium, Hydrocotyle, Pyrrosia, Ranunculus* and *Xanthorrhoea*. Epiphytic orchids may have been overlooked or occasionally misidentified due to their inaccessibility in tree crowns. Difficulties were also experienced with the following species or groups, mostly due to lack of suitable material:

Backhousia myrtifolia An unusually small-leaved form from Bobin Creek gorge has been tentatively assigned to this taxon pending further collecting.

Eucalyptus intermedia May include records of *E. gummifera*.

Eucalyptus propinqua/biturbinata Some records may have been incorrectly assigned.

Eucalyptus acmenoides/carnea/eugenioides/globoidea Some records may have been incorrectly assigned.

Lastreopsis decomposita/microsora Some records may have been incorrectly assigned.

Notelaea venosa/longifolia Some records may have been incorrectly assigned.

Poa sieberiana Probably includes *P. labillardierii*

Prostanthera This genus requires revision and assigned names may not be reliable.

6. *Data Analysis*

Floristic data were classified into vegetation communities using a numerical hierarchical agglomerative classification process, using the Bray-Curtis association measure on percentage cover and a flexible UPGMA sorting strategy (part of 'FUSE') with beta = 0.0 (Belbin, 1988). Although the procedure provides a repeatable and explicit method of defining communities, there are a number of critical decisions required which are essentially subjective and which may substantially affect the final community composition. The most important of these are the choice of beta and the choice of an appropriate level in the dendrogram to define communities. A beta value of zero was chosen to minimise distortion and most realistically reflect actual associations.

A community analysis must be regarded as only a guide to the tendency of certain groups of species to co-occur, as a result of the ultimately subjective nature of any community classification process and the dependence of perceived communities on scale. It is a convenient means of examining vegetation patterns rather than a definitive statement of vegetation composition. Both horizontal patterns and vertical structure require consideration. In forests, some degree of vertical layering is usually discernable, and patterns vary among strata. Overstorey and the various understorey strata respond differently to environmental factors and an analysis of all strata combined may obscure spatial patterns, but it is impossible to set height limits which will allow separate examination of strata across a range of vegetation types. As eucalypts as a group form a distinct ecological entity in New South Wales forests, the approach adopted here for eucalypt forests is to consider eucalypts and other sclerophyll myrtaceous species (*Lophostemon confertus* and *Syncarpia glomulifera*) which commonly form a forest overstorey, as the canopy stratum and all other species as "understorey". An analysis of all strata combined appears to be more successful for non-eucalypt communities (rainforest and shrub-dominated communities). Three separate analyses were performed: 1. basal area of all stems >10 cm dbhob of all species; 2. basal area of all stems >10 cm dbhob of eucalypts, *L. confertus* and *S. glomulifera*; 3. cover of all species excluding these taxa. Since only cover-abundance codes were recorded for understorey floristic data, for analysis these were converted to percentages, as the mid-point of the cover class for cover >5% and using 1% and 3% for codes 1 and 2 respectively.

The ordination technique of hybrid multi-dimensional scaling was employed to examine logging impact on community composition, using the MDS module in the computer package PATN (Belbin, 1988). This technique is robust to variations in underlying species response models (Faith *et al.*, 1987), but the results depend on the number of dimensions chosen. In addition, unrealistic distortions may result if the data are very heterogeneous. To avoid the latter problem, separate analyses were undertaken on three subsets of the data, derived from imposing a threshold value of 0.8 on the floristic dendrogram. To test both the robustness of the method and assist in the choice of an appropriate number of dimensions, analyses were run with 2, 3 and 4 dimensions, and ordination distances were plotted against dissimilarity values for each analysis (Shepard diagram, Green *et al.*, 1989). The minimum number of dimensions which yielded an acceptably linear relationship between ordination distance and compositional dissimilarity was chosen for examining logging impact. This was three dimensions for all plot groups.

RESULTS

1. *Floristics and Vegetation Communities*

A total of 439 vascular plant taxa (433 native and 6 naturalised) was recorded during the field survey. Appendix 1 lists frequency of occurrence of each species by broad overstorey community group and logging history to indicate ecological distribution. Broad overstorey community groups are based on Broad Forest Types as listed in Forestry Commission of New South Wales (1990), but are derived from the classification of plot data rather than mapped forest types.

2. *Overstorey Communities*

Basal areas of trees greater than 10 cm dbhob by species have been used to classify overstorey floristic data, as described above. Twenty forest overstorey communities may be recognized, comprising 15 eucalypt and 5 rainforest communities, in 13 groups. Figure 2 is a composite dendrogram resulting from analyses 1 and 2 described above, truncated at the 20 class ("community") level.

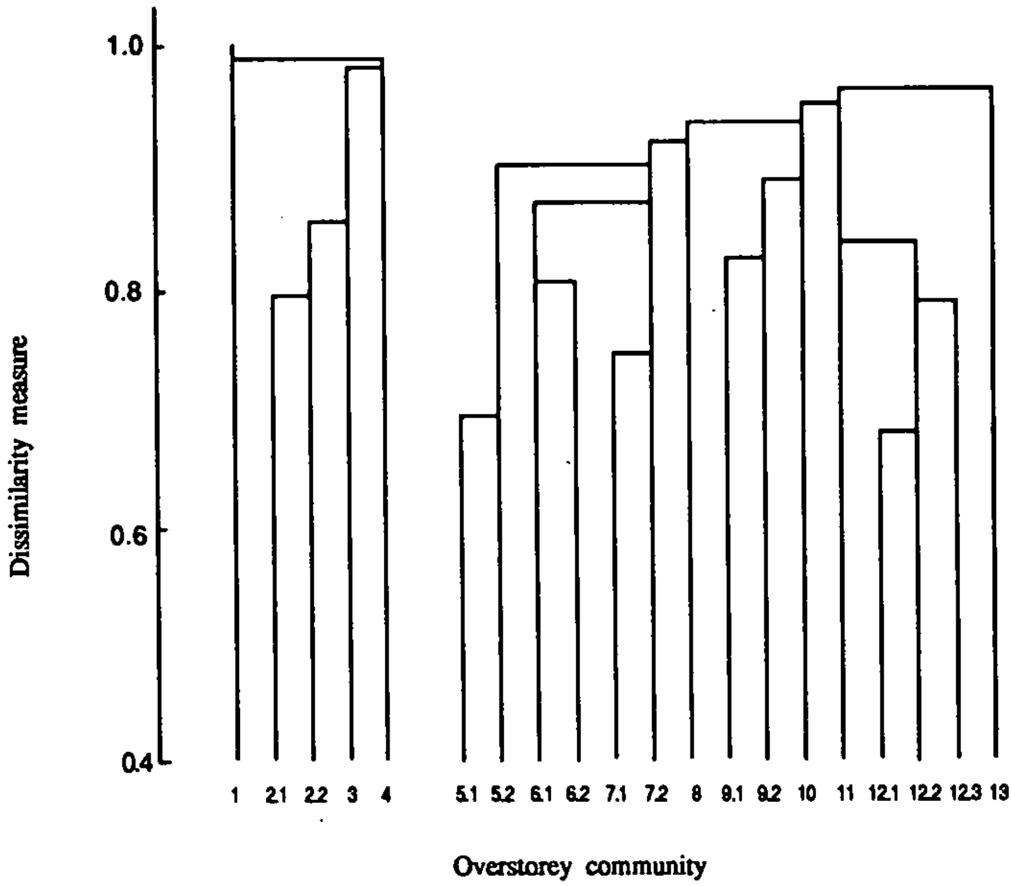


Figure 2. Composite dendrogram from floristic classification of basal area of all tree species >10 cm dbhob, truncated at the 20 class (community) level.

The communities are briefly described below and comparisons are made with Benson's (1989) associations (for eucalypt forests) and Floyd's (1990) suballiances (for rainforests). Logged and unlogged plots were analysed as a combined data set. Some heavily logged plots, with few residual canopy trees and low basal areas of regenerating stems, were grouped separately in the analysis. This was either due to the very low tree basal area or unusual species composition of residual overstorey following removal of selected species, or both. These have not been considered as separate communities, but are discussed below under the most likely original community. In the following descriptions and elsewhere in this report, overstorey communities in the Management Area are prefixed with "WINov".

WINov 1. Dry Rainforest

Backhousia sciadophora (plots 605, 608)

Low closed forest (10 m canopy height) to closed forest, mostly growing on very steep to precipitous stony scree slopes at mid altitudes. Dense canopy dominated by *B. sciadophora*, with occasional taller trees of other species (e.g. *Argyrodendron actinophyllum, Brachychiton acerifolius*). Floristically, this community has very little in common with any other vegetation in the Management Area, including other rainforest communities. It is clearly equivalent to Floyd's dry rainforest suballiance No. 28: *Backhousia sciadophora-Dendrocnide-Drypetes.*

WINov 2. Warm Temperate/Subtropical Rainforest

2.1 *Lophostemon confertus-Tristaniopsis laurina-Ceratopetalum apetalum* (plot 610)

This community of variable structure occurs as a narrow band along Bobin Creek, especially at low altitudes (250 m) in the deeply incised Bobin Creek valley. It may also occur along other creeks with similar topography in the Management Area. *L. confertus* with occasional *Gmelina leichhardtii* typically forms a tall upper stratum (50 m) above a closed canopy of *T. laurina* and *C. apetalum*. This community cannot be readily related to any suballiance described by Floyd. It has some similarities to the dry rainforest suballiances 26: *Waterhousea floribunda-Tristaniopsis laurina* and 29: *Backhousia myrtifolia-L. confertus-Tritaniopsis*, but lacks the principal dominants of either.

2.2 *Sloanea woollsii-Ceratopetalum apetalum-Doryphora sassafras* (plots 601, 603, RLH3, RLH4)

This is possibly the most widespread rainforest type in the area, occurring mostly above 700 m altitude (median 780 m), on sheltered slopes and along creeks. The three character species occur in all plots, although not always as dominants. Frequent associates include *Caldcluvia paniculosa*, *Orites excelsa* and *Quintinia verdonii*. This community matches the *Ceratopetalum apetalum-Sloanea woollsii* variant of Floyd's suballiance No. 33.

WINov 3. Subtropical Rainforest

Argyrodendron actinophyllum (plots 606, RLH5, RLL1)

A fairly widespread rainforest type occurring in similar habitats to 1 but tending to occur at slightly lower altitudes (median 630 m). Composition generally similar to 1, except that *S. woollsii* is usually absent and *C. apetalum* and *D. sassafras* are infrequent. Logged plot RLH1 may have originally been of this community. This community appears closest to Floyd's suballiance 7: *Argyrodendron actinophyllum*, but all plots have been logged and the canopy composition may have been altered by selective removal of favoured species.

WINov 4. *Backhousia myrtifolia* mixed forest (plot 602)

This community is represented by a single plot above Tyrrill Creek which is probably a composite of several distinct communities. Woodland of *E. campanulata*, *Angophora floribunda* and *Allocasuarina torulosa* occurs with dense stands of *B. myrtifolia* and *Tristaniopsis laurina*. The latter assemblage occurs as narrow bands along many of the larger creeks in the area (e.g. along Big Creek) and may be broadly equated to Floyd's suballiance 29: *Backhousia myrtifolia-L. confertus-Tritaniopsis*. More extensive areas of *B. myrtifolia*, without *T. laurina*, occur on the steep slopes into Bobin Creek gorge. Although *L. confertus* is absent from the sampled plot, it is present in similar vegetation which was not sampled elsewhere in the Management Area.

WINov 5. *Lophostemon confertus* wet sclerophyll forest

5.1 *Lophostemon confertus* (plots 002, MUH2, MUH7)

Tall open forest, up to 50 m, with *L. confertus* as the sole sclerophyll overstorey species, usually with high basal area. Occurs mostly on sheltered mid to lower slopes at moderate altitudes (630-840 m), often adjoining rainforest. Dense subcanopy and understorey of mesophytic trees and shrubs such as *Caldcluvia paniculosa*, *Schizomeria ovata*, *Cryptocarya glaucescens* and *Cryptocarya rigida*. Beadle (1981) includes the *L. confertus* alliance under subtropical rainforest and regards it as occurring mainly on headlands, although stands dominated by *L. confertus* are much more generally widespread in northeastern New South Wales. Benson also describes the *L. confertus* association as occurring on headlands. It is not clear whether the subcoastal and escarpment occurrences are best included as headland *L. confertus* or as a variant of his *E. grandis-L. confertus-E. microcorys* association.

5.2 *L. confertus-E. microcorys-E. saligna* (plots 014, 116, MLL1, MLL6)

This community has most likely been created by logging, as a result of selective removal of the more favoured species (*E. microcorys, E. saligna*) to leave *L. confertus* much more prominent than it would have been pre-logging. The single unlogged plot, 116, has *E. saligna* dominant and may be regarded as transitional between communities 5.1 and 7.1.

WINov 6. *E. microcorys-E. acmenoides* group

6.1 *E. microcorys* (plots 120, 226, DUL5, MLL5, MUL2)

Tall open forest (median canopy height 45 m, range 40-50 m) occurring mostly on sheltered slopes at low to mid altitudes (250-580 m, median 450 m). *E. microcorys* is usually dominant, associated with *E. saligna, E. acmenoides, Lophostemon confertus, E. intermedia* or occasionally *Syncarpia glomulifera*, and a subcanopy of *Allocasuarina torulosa*. Commonly a moderately dense to dense tall shrub understorey, although some areas have lower shrub density and more well developed ground cover. Logged plots 014, 060, MLL1 and MLL6 probably would have originally belonged here. May be broadly equated to Benson's *E. saligna-E. microcorys*, although *E. saligna* is a minor component of most stands and is sometimes absent.

6.2 *E. acmenoides*

(plots 007, 094, 148, 547, DLH4, DLH5, DLL1, DLL4, DUH1, DUH4, DUH5, DUH6, DUL6)

A very widespread community on slopes at low to mid altitudes (270-700 m, median altitude 625 m). Open forest and woodland to tall open forest (canopy height 25-40 m, median 35 m) with *E. acmenoides* present in all plots and usually dominant, and often a subcanopy of *Allocasuarina torulosa*. Frequent associated overstorey species, each usually making a minor contribution, are *E. microcorys, E. saligna, E. intermedia* and *E. biturbinata*. Mostly moderately dense ground cover with scattered shrubs. Common ground cover species are *Lomandra longifolia, Poa sieberiana, Imperata cylindrica* and *Dianella caerulea*. In more mesic sites there is a more dense shrub understorey, sometimes including rainforest elements such as *Cryptocarya rigida* and *Synoum glandulosum*. This community broadly equates to Benson's *E. acmenoides-E. propinqua* association, although the species of grey gum is *E. biturbinata* rather than *E. propinqua*.

WINov 7. *E. saligna* group

7.1 *E. saligna*

(plots 027, 060, 111, 128, 129, 204, 503, 512, MLH3, MLH4, MLH5, MUL3, MUL7)

A community of similar structure and in similar habitats to 6.1 but dominated, often solely, by *E. saligna*. Other species, which occur infrequently and as a minor component of the stand, include *E. microcorys* and *L. confertus*. Some plots, notably 503 and 512, are transitional with community WINov 6.2. This community is readily equated to Benson's *E. saligna* association.

7.2 *E. laevopinea-E. saligna* (plots 328, 365, 501)

A tall open woodland to tall open forest with mostly dense mesophytic shrub understorey. The two character species are solely co-dominant except for logged plot 328 which lacks *E. saligna*. Probably closest to Benson's *E. laevopinea* association.

WINov 8. *E. grandis* group

Eucalyptus grandis wet sclerophyll forest (plots 511, 605)

A tall woodland to tall open forest of limited extent sampled only by two logged plots. Occurs as small stands on lower slopes at low altitudes (below 410 m), associated with a dense mesophytic shrub understorey. A well defined community which equates to Benson's *E. grandis* association.

WINov 9. Dry coastal hardwood group

9.1 *E. propinqua* (plots 008, 086, 099, 208, 281, 290)

A fairly widespread community occurring at low to moderate altitudes (390-660 m, median 515 m) on a range of aspects on mid to upper slopes. *E. propinqua* is usually dominant in this community, while *E. acmenoides* occurs rarely and as a minor component. Frequent associated species are *E. microcorys*, *E. intermedia*, *E. campanulata* and *Allocasuarina torulosa*. This community is difficult to relate to previously described associations. Subcoastal and lower escarpment dry forests on the New South Wales north coast in general appear to have been inadequately documented, at least partly because they commonly occur as complex mosaics of various species assemblages. This community is best matched with Benson's *E. propinqua-E. siderophloia* association, although *E. siderophloia* is absent from stands sampled in the Wingham Management Area.

9.2 *E. tereticornis* (plots 071, 098, 133, 385, DLL3, DUL7, MUH1)

A fairly widespread community, mostly at low to mid altitudes (250-670 m, median 460 m) and often on exposed slopes. Open forest or woodland to 35 m canopy height, generally low basal area. Main associated canopy species are *E. intermedia* and *Angophora floribunda*, with a subcanopy of either *Allocasuarina littoralis* or *A. torulosa*, usually with dense grassy understorey. Clearly related to community 9.1, but tends to occur on drier sites.

WINov 10. *E. resinifera* group

E. resinifera (plot 600)

A single plot of *E. resinifera*, *E. campanulata*, *E. intermedia* and *Allocasuarina torulosa*. Other limited areas dominated by *E. resinifera* were not sampled. This appears to be a local variant of Benson's *E. resinifera-E. acmenoides* association.

WINov 11. *E. pilularis* group

Eucalyptus pilularis

(plots 078, 123, 154, 221, 287, 299, 376, DLH3, DLH6, MLH6, MUL5)

Tall woodland (logged plots) to tall open forest (canopy height 35-50 m), widespread at moderate altitudes (430-760 m, median 600 m) on crests to mid-slopes. *E. pilularis* is clearly dominant in most plots but is rarely the sole overstorey species. Most plots include at least a minor component of *E. microcorys*. *E. campanulata* is common at higher altitudes and is co-dominant in some plots (078, 123, 221), which provide a link to community group 12. Other less frequent species include *E. saligna*, *Syncarpia glomulifera* and *Angophora floribunda*. There is often a subcanopy of *Allocasuarina torulosa*. Understorey varies from grassy to dense, tall mesophytic shrubs. This community broadly equates to Benson's *E. pilularis* association. Some plots (notably 154, 287 and 376) belong to the *E. pilularis-E. microcorys* association described by Beadle (1981) but apparently not recognised by Benson. Neither Benson nor Beadle recognise *E. campanulata* as a major associate of *E. pilularis*.

WINov 12. *E. campanulata* group

12.1 *E. campanulata* (plots 023, 113, 117, 152, 229, 247, 272, 335, 377, 502, 504, 513, NLH3, NLH4, NUH1, NUH5, NUH6)

A community of mostly tall open forests (median canopy height 40 m, maximum 50 m), although some plots have a woodland or open woodland structure from recent logging. This is the most widespread community at moderate to higher altitudes (600-950 m, median 830 m), occurring in a range of habitats but mainly on crests to upper-slopes. It often occurs immediately upslope from group 6 or 7 communities. *E. campanulata* is usually clearly dominant, but is co-dominant with *E. cameronii* in some stands (plots 023, 229, 502, NUH5) which could be recognized as a separate community. Other species occur infrequently and as a minor component of the stands, the most common being *E. microcorys*. A subcanopy of *Allocasuarina torulosa* is often present. Understorey varies from grassy to dense tall mesophytic shrubs.

12.2 *E. obliqua-E. cameronii* (plots 403, 506, 507)

Tall open forest (40-45 m) occurring on mid to upper slopes at high altitudes (950-1040 m). *E. obliqua* and *E. cameronii* occur with approximately equal abundance in all three plots, associated with *E. campanulata* in plots 506 and 507. This community is restricted to a small area in the far north-west of the Management Area, associated with a basalt influence. The understorey usually includes some tall shrubs. This community probably best equates to Benson's *E. obliqua-E. campanulata* association, although plot 403 may belong to the vulnerable *E. obliqua-E. cameronii* association.

12.3 *E. campanulata-E. laevopinea*

(plots 142, 505, 510, 577, NLH2, NLH6, NUH2)

A fairly widespread community occurring at moderately high altitudes (750-1010 m, median 800 m) on mid to upper slopes. Tall open woodland (logged plots) to tall woodland (30-45 m, median 40 m) with generally low overstorey basal area. Other species, which are infrequent and form a minor component of the stands, include *E. cameronii* and *E. saligna*. Benson does not recognise a separate *E. campanulata-E. laevopinea* association and this community could be broadly equated to his *E. campanulata* association.

WINov 13. *E. obliqua* group

Eucalyptus obliqua (plot 508, 509)

Tall (40-45 m) open forest with very high overstorey basal area, restricted to a small area of basalt at high altitude (1070-1130 m) on sheltered slopes. Plot 509 includes *E. nobilis* as an associate and has a dense understorey of rainforest trees and shrubs, including *Doryphora sassafras*, *Cerapetalum apetalum* and *Acradenia euodiiformis*. This represents the extreme moist end of the scale for this community. Plot 508 has a grassy understorey and *E. laevopinea* as the associate species. This community may be regarded as a local variant of Benson's *E. obliqua-E. viminalis* association.

3. *Comparison of New South Wales Forestry Commission Forest Types as Mapped and Overstorey Floristic Communities*

There is a reasonable degree of correspondence between the mapped Forest Types and overstorey floristic communities at a broad level (Table 2). Inconsistencies result from two main factors:

i) Map units have a coarse resolution, of the order of hectares, relative to the finer resolution of 0.1 ha plots. Details of variation in overstorey composition recorded on a plot basis are obscured in map units. Some map units are very variable in overstorey floristic composition in any case, by definition.

ii) There appear to be some mapping inaccuracies possibly due to difficulties in identification of closely similar species from air photos.

Appendix 3 provides brief descriptions of mapped Forest Types, mainly on the basis of plot data but with some general observations recorded while traversing the area.

4. *Non-eucalypt ("Understorey") Floristic Communities*

Thirty communities were derived from classification of floristic survey data, excluding eucalypts. In subsequent discussion these are referred to with the prefix "WINus". Figure 3 is the dendrogram resulting from the classification, truncated at the community (29 class) level. The 29 communities are described in Appendix 2. For the vast majority of the survey plots (116 out of 127), the understorey falls into one of three major structural and floristic groups. These may be broadly interpreted as a rainforest group (WINus 4), a wet sclerophyll group (WINus 7) and a dry sclerophyll/grassy group (WINus 9). An additional diverse but small group, along with several isolated plots, appear to represent stands which are transitional between, and link, the wet sclerophyll and dry sclerophyll groups. The rainforest group appears more isolated. The remaining 9 plots sample 6 communities which are floristically very distinct from each other and all other groups. These are a dry rainforest community and several shrub dominated communities. Table 3 shows the relationship between overstorey communities and understorey communities.

Table 2. Summary of distribution of the 127 floistic survey plots in Wingham Mangement Area by map units (Forest Types, Forestry Commission of New South Wales 1989) and overstory communities (as defined in the text). T=transitional or unplaced plots. NA=overstorey stem basal area not measured (mostly non-forest).

	Overstorey community																					
Map unit	1	2.1	2.2	3	4	5.1	5.2	6.1	6.2	7.1	7.2	8	9.1	9.2	10	11	12.1	12.2	12.3	13	T	NA	Total
1				1																			1
1/3			2	1						1													4
2/3																					1		1
12c			3																				3
23					1																		1
23/26	1			1																			2
36									1							3							4
37a									1							3							4
37b																3	1						4
46										1	2			1					1		1		6
47a						1	1			3													5
47b						1	2	3		3						1							10
47c									1	2											1		4
48												2											2
53		1				1	1			2						1					1		7
60									3	1													4
62a									5				2	1									8
62b								1	4					1	1						1		8
64a													3										3
64b													1	2									3
65														2									2
96	1																						1
122a																	3		1				4
122b																	1						1
152a																				2			2
152b																		3	1				4
163a																	5		2				7
163b									2								8		1				11
168								1		1	1						1		1		1		6
234	1																					4	5
Total	3	1	5	3	1	3	4	5	17	15	3	2	6	7	1	11	18	3	7	2	6	4	127

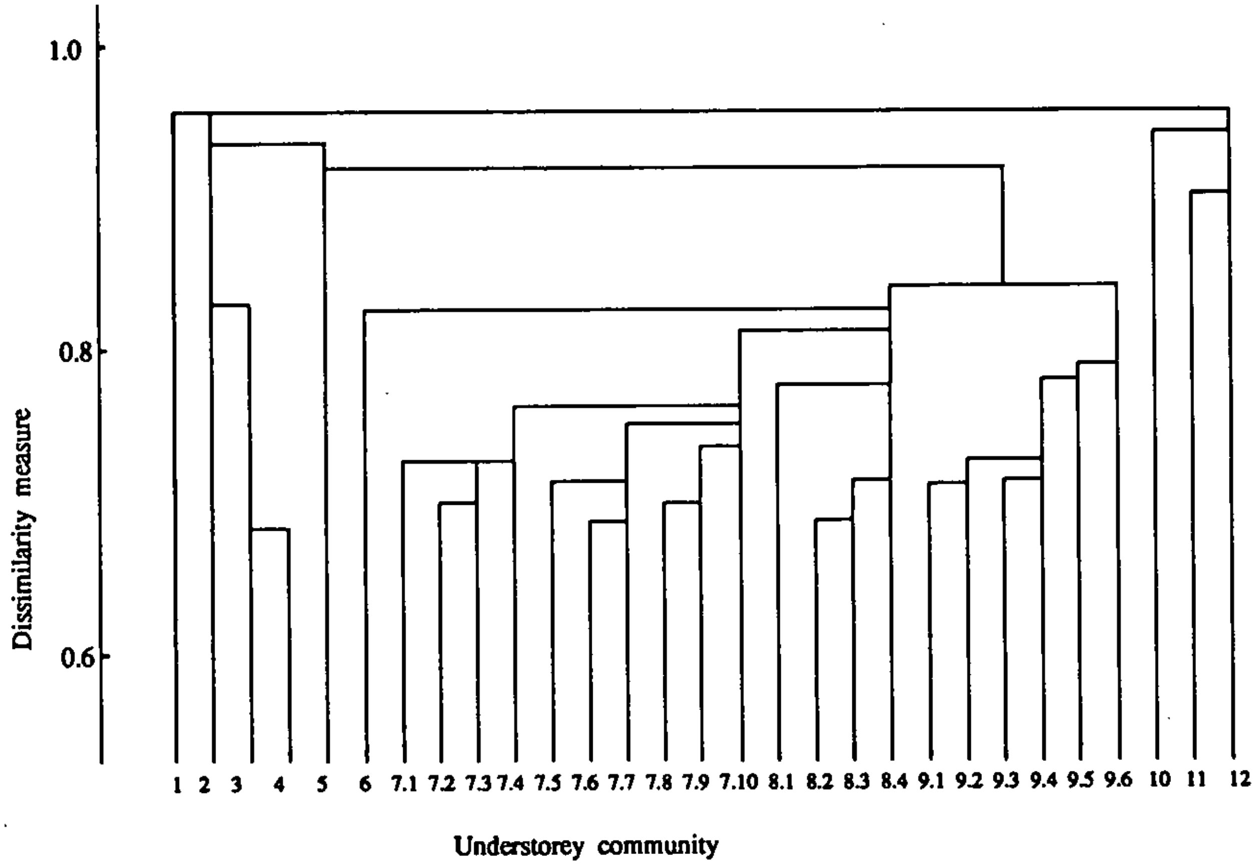


Figure 3. Dendrogram from floristic classification of percentage foliage cover of all species, excluding eucalypts, truncated at the 29 class (community) level.

Table 3. Summary of distribution of the 127 flora survey plots in Wingham Mangement Area among overstorey (WINov) and understorey communities, as described in the text. T= transitional or unplaced plot. NA = overstorey basal area not measured (mostly non-forest).

WINov	Understorey community: 1	2	3	4	5	6	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10	8.1	8.2	8.3	8.4	9.1	9.2	9.3	9.4	9.5	9.6	10	11	12	13	Total
1	3																														3
2.1			1																												1
2.2				5																											5
3				2	1																										3
4				1																											1
5.1							2	1																							3
5.2				1				1			1												1								4
6.1									1		1									1				1			1				5
6.2											1						1				4	1	3	7							17
7.1		1		2			1	1		1	2		1					1			1		1	3							15
7.2								1	1					1																	3
8											1										1										2
9.1																							2	3		1					6
9.2																							1	5		1					7
10																							1								1
11											1	2	3									1	3	1							11
12.1						1			1			2	1			1			1				3	5	3						18
12.2												3																			3
12.3								1				2			1								1	2							7
13				1								1																			2
T				1				1	1		1													2							6
NA																												2	1	1	4
Total	3	1	1	13	1	1	3	6	4	1	8	10	5	1	1	1	1	1	1	1	6	2	16	29	3	2	1	2	1	1	127

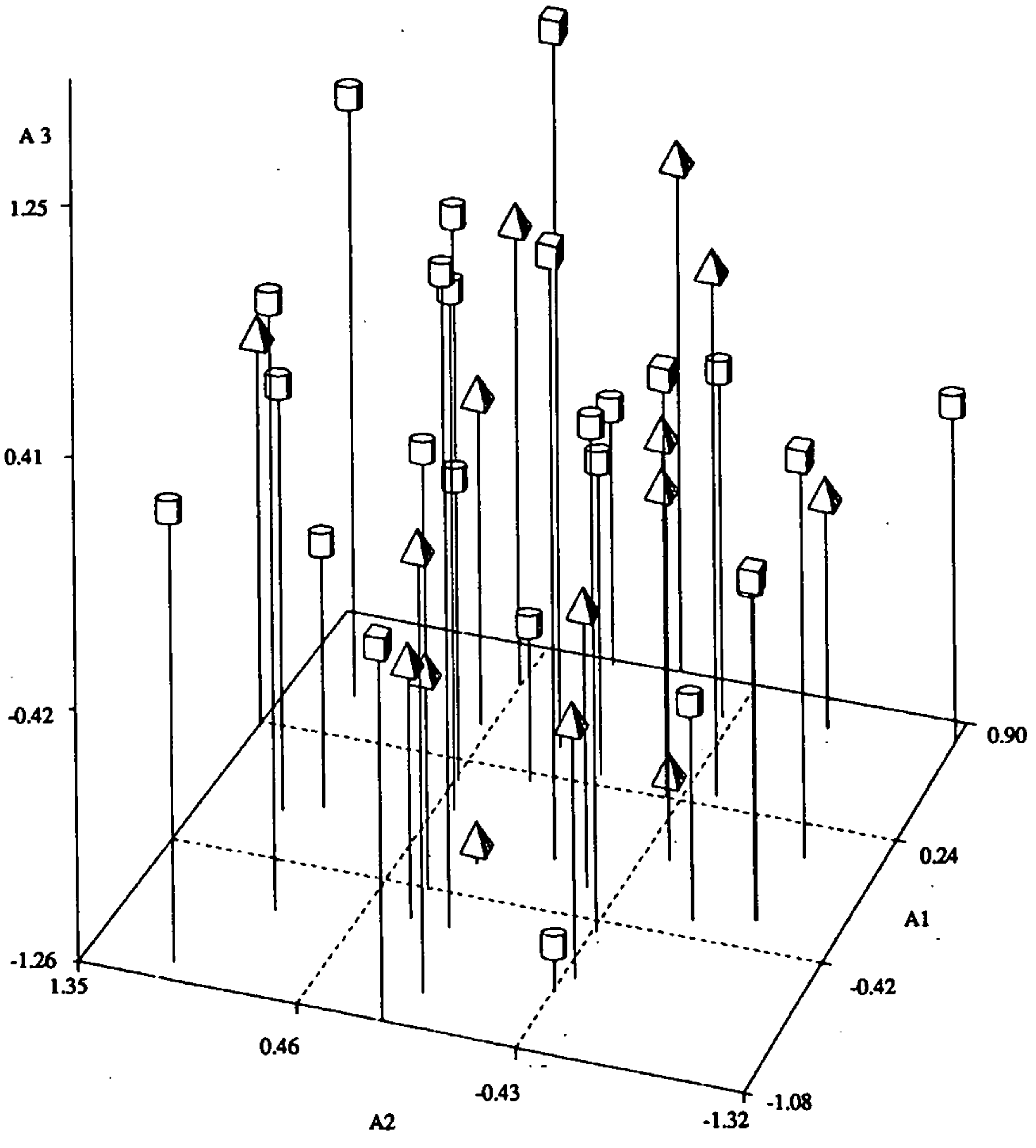
5. *Logging Impact*

Appendix 1 gives an indication of logging impact on individual species, although this can only be interpreted broadly because of the range of other site factors which determine distribution of species among the plots sampled. Plots which are apparently undisturbed but which occur in a generally logged area as part of the mosaic of varying logging intensity have been classified as unlogged but loggable, unless they were physically inaccessible to logging. Many, perhaps most, of these were previously avoided during logging due to low commercial timber volume. Their inclusion exaggerates logging impact if the areas are actually not commercially viable. Of the species which occurred in both the unlogged but loggable category and either logged category, none was significantly more frequent in unlogged but loggable plots (using chi-squared test, $p>0.05$) compared to logged plots. For many species, overall frequency was too low for a reasonable assessment. Nineteen species were recorded only from unlogged but loggable plots. These were all of low overall frequency (three or less).

Relationships among plots resulting from the community classification and ordinations give an indication of impact on plant community composition. If logging impact on floristic composition was major relative to spatial variation, logged plots would be expected to be grouped together at a high level of dissimilarity compared to unlogged plots. This is not the case. Logged plots are generally distributed among each of the three major floristic groups in proportions similar to unlogged plots. For group WINus 4 there are six logged and eight unlogged plots, for group WINus 7, 21 logged and 19 unlogged and for group WIN 9, 27 logged and 31 unlogged. These three groups combined account for 112 of the 127 plots. Of the remaining 15 plots, eight are unlogged plots which represent unusual communities (shrublands and dry rainforest) with little or no floristic similarity to other sampled vegetation in the area. These occur in areas which are both physically inaccessible to logging and of no commercial value and for which assessment of logging impact is irrelevant. The other seven include six logged plots and one unlogged plot which are sufficiently floristically disparate to be excluded from all of the three major groups. However, all are intermediate in the sense that each is more similar to one of the groups than the groups are to each other. The relative floristic disparity of at least some, and possibly all of the logged plots could be due to site factors unrelated to management. This especially applies to the five which are grouped with at least one unlogged plot at the level chosen to represent community groups. The composition of the sole remaining plot, MLL5, may largely represent a logging impact.

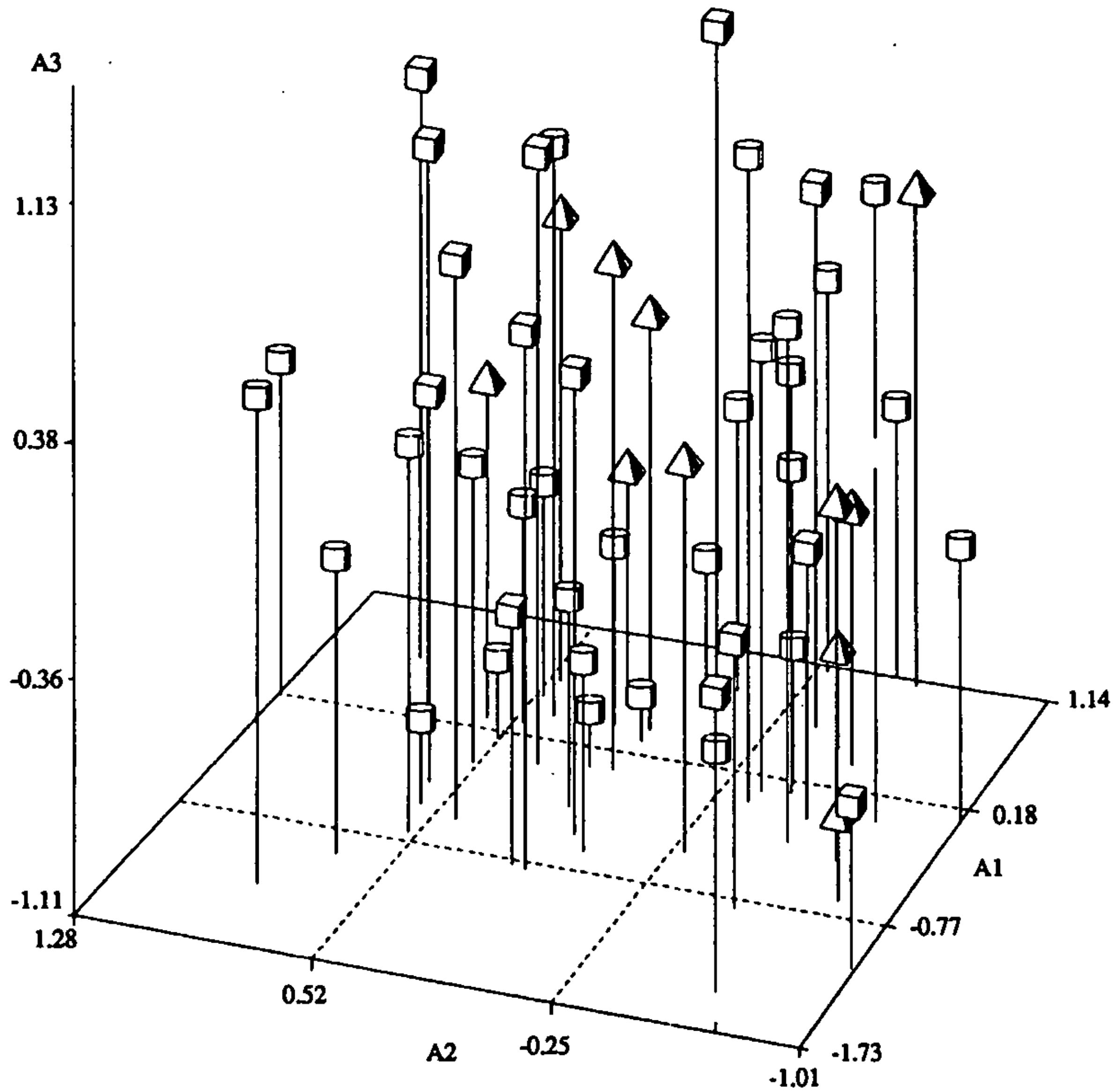
To examine more subtle variations in floristic composition within groups, scatterplots derived from separate ordination of each of the three major plot groups are shown in Figures 4, 5 and 6. For all three plot groups logged plots are generally dispersed through the "cluster" of unlogged plots on all three axes, suggesting that within groups there is no demonstrable logging impact relative to floristic variation resulting from other factors (spatial variation). This includes several plots which were intensively silviculturally treated between 1955 and 1965.

Logged plots have a floristic richness which is higher than or not significantly different from unlogged plots, overall. Median richness for unlogged plots is 42 species per 0.1 ha plot for unloggable areas ($n=16$) and 34 for loggable areas ($n=52$). The higher value for the former could be a result of the inclusion of several floristically rich creek plots. For recently (7-15yr) logged plots it is 40 ($n=30$) and for plots logged 25-35 yr it is 39 ($n=29$).



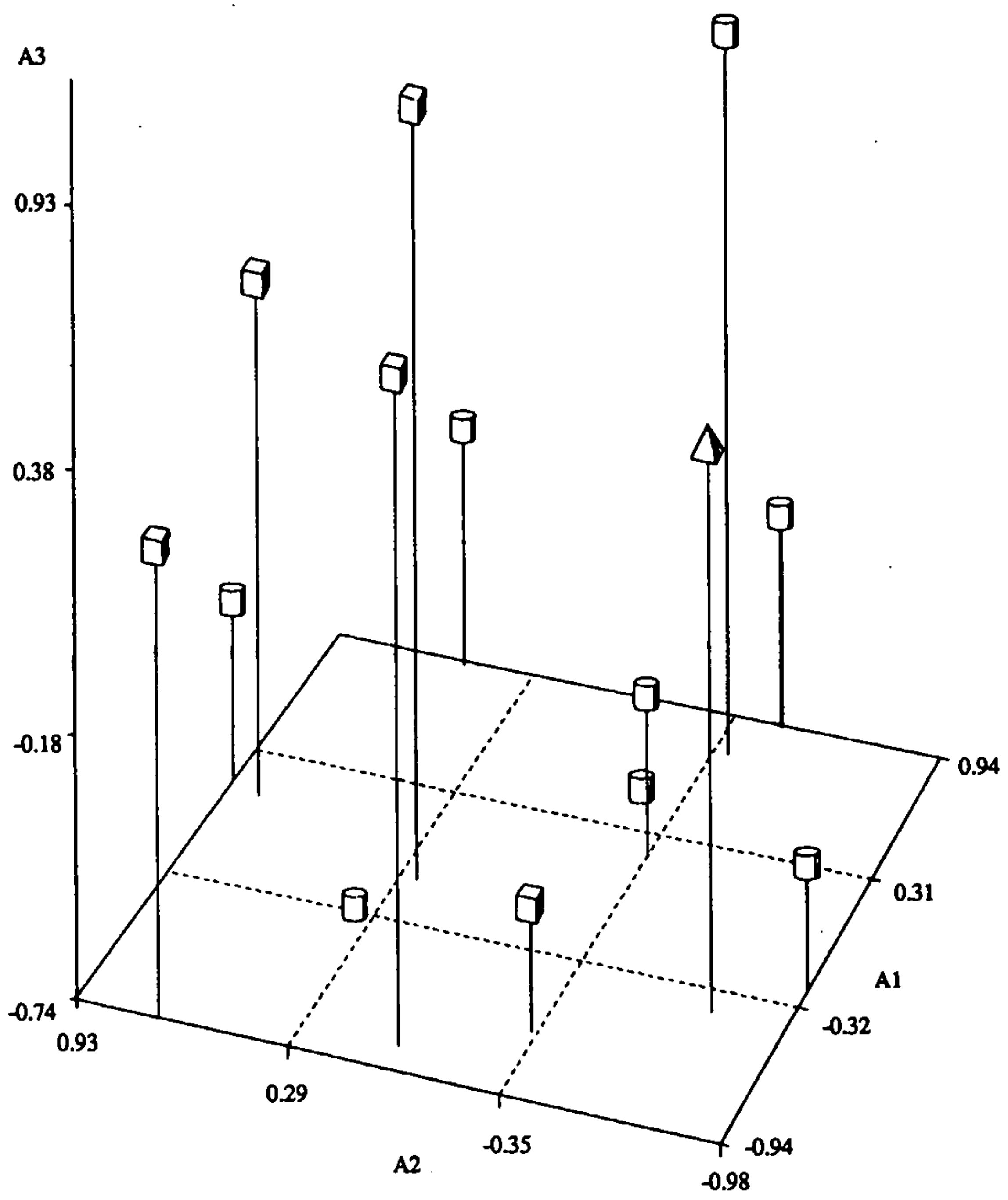
Cylinder = unlogged plots; Pyramid = logged plots, < 10years; Cube = logged plots, > 10 years

Figure 4. Scatter plot of MDS co-ordinates, group 7, logging history superimposed.



Cylinder =unlogged plots; Pyramid = logged plots, < 10 years; Cube = logged plots, > 10 years

Figure 5. Scatter plot of MDS co-ordinates, group 9, logging history superimposed.



Cylinder = unlogged plots; Pyramid = logged plots, < 10 years; Cube = logged plots, > 10 years

Figure 6. Scatter plot of MDS co-ordinates, group 4, logging history superimposed.

DISCUSSION

1. Significant Plant Species

The national conservation significance of plant species is assessed using Briggs and Leigh (1988) as a basic standard. Other measures of conservation significance are taken from other published records and data from specimens held at the New South Wales National Herbarium, Sydney. Species currently considered or likely to be of conservation significance at a regional or national level are listed below. Where appropriate, risk codes are assigned using the criteria of Briggs and Leigh (1988) and shown in parentheses. Except where another source is cited, codes given are those assigned by Briggs and Leigh (1988). Unless otherwise indicated, all records are from the present survey.

Beyeria lasiocarpa Not nationally significant, but is uncommon on the north coast. Locally common in parts of Bobin Creek gorge, but has not been recorded elsewhere in the Management Area.

Dodonaea megazyga (3RCa) Locally abundant at several sites in the area, although not recorded at any survey plot. A small population was recorded in unlogged open forest, but all other populations occurred in heavily logged wet sclerophyll forest and the species appears to regenerate prolifically along road edges. This species is much more widespread and abundant than its risk code indicates and probably should not be regarded as rare.

Gahnia insignis (3RCa) Widely distributed fron central Queensland to northern New South Wales, often locally abundant but occurring in small, isolated populations. A small population occurs at "The Bluff", on the escarpment of Bobin Creek gorge. This is the only record from the Management Area and is close to the southern limit of distribution for this species (a slightly more southerly population occurs in Landsdowne State Forest).

Goodenia grandiflora Not nationally threatened, but generally uncommon and usually occurring as scattered small populations and may be of conservation significance. Only a few individuals have been recorded in the Management Area, all growing in small crevices in otherwise mostly unvegetated rock outcrops.

Goodenia sp. nov. ("fordiana" Carolin ined.) Not listed as nationally threatened, but known from very few specimens over a limited area of the New South Wales north coast. Casual observations suggest it is fairly common in the Hastings and Manning River catchments, occurs in disturbed sites and it may have been previously overlooked. Its conservation status requires further investigation. In Wingham Management Area it is reserved in Rowleys Rock Flora Reserve.

Leucopogon sp. nov. ("cicatricatus" Powell ined.) This species is widespread on the New South Wales northern tablelands and escarpment and in southern Queensland, but occurs in small, isolated populations and probably should be regarded as nationally rare. Only a single population has been recorded from the Management Area, in shrubland on quartzite, along Rowleys Rock summit ridge down to 900 m altitude. This is an unusually low altitude for this species and represents the most southerly known occurrence.

Ozothamnus adnatus Not nationally significant, but uncommon and known from very few collections outside the Sydney-Blue Mountains area. A single small population on a rock outcrop near "The Bluff", Bobin Creek, is the only known record for the Management Area and Port Macquarie Region generally.

Papillilabium beckleri (3RC-) This inconspicuous twig epiphyte is widespread in the Management Area and much more abundant than its frequency in survey plots indicates. It occurs in rainforest and wet sclerophyll forest, especially along creeks. This species is in general much more abundant than its risk code suggests and probably should not be regarded as rare.

Prostanthera rotundifolia Not nationally significant, but apparently rare regionally. The small population around the summit of Rowleys Rock is the only known occurrence in the Management Area.

Schistotylus purpuratus (3RCi) An inconspicuous twig epiphyte, similar in general appearance to *Papillilabium beckleri*, with which it easily confused when not in flower, but apparently less common and occurring only above 600 m altitude. The Management Area is the southern distribution limit for this species. So far, all known records are from Doyles River catchment in the north of the Management Area, although it probably also occurs in the catchments of creeks draining into the Manning River. Most records from the Management Area are from rainforest understorey in Forest Types 47a and 53, but it almost certainly is widespread in rainforest where it is much more difficult to detect. It is currently regarded as inadequately conserved in National Parks, although its true populations are likely to have been considerably underestimated. This species is discussed further below, under Section 3.

2. *Conservation Status of Plant Communities*

It is difficult to assess the conservation status of plant communities because of the ultimately subjective nature of community definition and its dependence on scale. Attempts to assess conservation status at a national scale are too broad for adequate consideration of regional conservation requirements. Benson (1989) has made an attempt to describe conservation status of plant associations in New South Wales. This provides a preliminary basis for conservation assessment, although it considers only the tallest vegetation stratum and there are sometimes difficulties in relating observed stands to Benson's associations. Assessment of conservation status is also severely restricted by the lack of adequate site-specific data for the existing reserve system state-wide. Any current assessment is likely to be conservative.

In this report, assessment of conservation status is made as follows. Eucalypt forest overstorey communities are assessed by comparing plot data and communities resulting from floristic classification with those defined by Benson (1989), taking recent taxonomic and nomenclatural changes into account. Rainforest communities derived from the floristic classification are related to suballiances described by Floyd (1990), and conservation status is taken from Benson (1989). There is no adequate basis for assessing conservation status of the non-eucalypt ("understorey") component of eucalypt forests, which would be difficult in any case because of the short term dynamics of understorey composition. The emphasis is placed on conservation status of communities which are floristically very disparate and of restricted distribution in the Management Area.

Table 3 compares forest communities and indicates conservation status according to Benson (1989). Most communities are regarded as not threatened, although several, especially those at low to mid altitudes (WINov 6.2, 8, 9.1, 9.2, 10 and 11) are considered inadequately conserved. Two communities may be considered vulnerable and inadequately conserved: WINov 12.2 and 13, both dominated by *E. obliqua* and of fairly restricted distribution in the Management Area, associated with soils derived from or influenced by basalt. Community WINov 5.1 is widespread within and outside the Management Area but is difficult to relate to any of Benson's associations. Community WINov 2.1 is not readily related to any previously described community and may be of restricted extent and of conservation significance.

Table 4. Comparison of eucalypt forest types on the basis of overstorey composition.
WINov floristic community is derived from numerical classification of survey data as described in the text. Forest Commission Forest Type is the nearest equivalent type as described in Forestry Commission of New South Wales, (1989). Benson Association is the nearest equivalent association as defined by Benson (1989). Reservation status codes (Res.) are as follows (from Benson 1989): E = endangered; V = vulnerable; N = not threatened; 1 = not or very poorly conserved; 2 = inadequately conserved; 3 = adequately conserved.

WINov Floristic Community		F.C. Forest Type		Map units	Benson Association	Res.
1	Backhousia sciadophora -Drypetes australasica	23.	Myrtle	23/26,96,234	B. sciadophora-Dendrocnide excelsa	N2
2.1	Lophostemon confertus-Tristaniopsis laurina -Ceratopetalum apetalum	13.	Water Gum-Coachwood /53.Brush Box	53	-	-
2.2	Sloanea woollsii-C. apetalum -Doryphora sassafras	2.	Yellow Carrabeen /12.Coachwood-Sassafras	1/3,12c	C. apetalum-S. woollsii- (A. actinophyllum-S. ovata)	N3
3	Argyrodendron actinophyllum	1.	Booyong	1,1/3,23/26	Argyrodendron actinophyllum	N3
4	Backhousia myrtifolia -Tristaniopsis laurina	?23.	Myrtle	23	?B. myrtifolia-L. confertus -T. laurina	N2
5.1	Lophostemon confertus	53.	Brush Box	47a,47b,53	-	-
6.1	E. microcorys-E. saligna	47.	Tallowwood-Blue Gum	47b,62b,168	E. saligna-E. microcorys	N3
6.2	E. acmenoides	60.	Narrowleaf White Mahogany	36,37a,47c,60,62a,62b,163b	E. acmenoides-E. propinqua	N2
7.1	E. saligna	46.	Blue Gum	1/3,46,47a,47b,47c,53,60,168	E. saligna	N3
7.2	E. laevopinea-E. saligna	168.	Silvertop Stringybark-Gum	46,168	E. laevopinea	N2
8	E. grandis	48.	Flooded Gum	48	E. grandis	N2
9.1	E. propinqua	62.	Grey Gum-White Mahogany	62a,64a,64b	?E. propinqua-E. siderophloia	N2
9.2	E. tereticornis	65.	Forest Red Gum-Grey Gum -Roughbarked Apple	46,62a,62b,64b,65	?E. tereticornis	N2
10	E. resinifera	68.	Red Mahogany	62b	?E. resinifera-E. acmenoides	N2
11	E. pilularis	36/37.	Blackbutt	36,37a,37b,47b,53	E. pilularis	N2
12.1	E. campanulata	163.	New England Blackbutt	37b,122a,122b,163a,163b,168	E. campanulata	N3
12.2	E. obliqua -E. cameronii	?152.	Messmate-Gum	152b	?E. obliqua-E. campanulata or E. obliqua-E. cameronii	N2 V1
12.3	E. laevopinea-E. campanulata	167.	Silvertop Stringybark	46,122a,152b,163a,163b,168	E. campanulata	N3
13	E. obliqua	?152.	Messmate-Gum	152a	?E. obliqua-E. viminalis	V2

3. *Impact of Logging*

The majority of significant species occur in steep and/or rocky sites which are unlikely to be directly affected by logging, or in rainforest from which further logging is excluded. An exception is *Schistotylus purpuratus*, which appears to occur most commonly in the commercially highly productive Forest Types 47a and 53 and is currently considered inadequately conserved (Briggs and Leigh 1988). This species has been recorded from areas cleared or heavily logged at least 10 years previously and is apparently capable of colonizing such sites over a period of several decades. Current assessment of conservation status is likely to be highly conservative, in the sense that reserved populations are probably much larger than estimated. However, until more information is available it is best to regard this species as being of possible concern. Although it is highly unlikely that the species will suffer serious population declines as a result of logging, local populations may be reduced, particularly in the short term. Further investigation of the habitat requirements of this species and monitoring of logging impact should be a high priority.

Although both logged and unlogged stands were sampled, it is difficult to assess logging impact more generally, for the following reasons:

i) There are no detailed pre-logging data available, and substantial differences exist between major environmental features of previously logged and unlogged areas. Present differences in vegetation may be related more to site factors other than logging history.

ii) Previously logged areas were often logged repeatedly or using different prescriptions to that planned for future operations. It is thus difficult to relate impact of past logging to that of planned logging. In many cases, past logging has been much more intensive than that planned for the future.

Logging of any one patch of vegetation will cause local changes in relative abundance of species, and local impact (at scales of one hectare or less) may be substantial, at least temporarily. However, the classification results and ordination diagrams of Figures 3-5 suggest that these changes will usually be minor in the context of overall spatial variation in floristic composition, due to factors other than logging history. A very few heavily logged wet sclerophyll areas appear to be floristically disparate due to the post-logging proliferation of one or a few aggressive colonising species. The circumstances under which this occurs are not clear. Although very intense disturbance seems to be necessary, only a small proportion of heavily disturbed sites responds in this manner.

4. *Impact of Fire*

There is a tendency for the grassy understorey communities to be those which have been more recently burnt than the wet sclerophyll understorey communities, as would be expected. The former would be expected to be more frequently burnt, but this is difficult to assess independent of evidence from existing vegetation, because the record of past low intensity fires is not sufficiently detailed or complete to allow a particular plot to be assigned a fire history.

Most of the plots which had been very recently burnt (less than 6 months prior to assessment) by low intensity fire appeared floristically disparate in the classification at the community level, but not at the community group level. This suggests that either fire impact is not major, or that the recently burnt plots were in frequently burnt areas in which the floristic composition of the vegetation had stabilized under the influence of a long-established regime of regular low intensity fire. The latter seems the much more likely alternative. The differences were mostly due to generally low foliage cover of all species rather than major changes in floristic composition, and these plots would be expected to be more closely similar to less recently burnt plots if the assessment had been done after a further six or 12 months.

5. *Weeds*

Weed species (naturalized exotics) form a very small proportion of the overall flora of the area and are a very minor component of the vegetation generally. Significant concentrations of weeds occur only in localised areas that are heavily disturbed (such as log dumps) and only persist where disturbance is regular (such as roadsides and regularly maintained or heavily used recreational areas).

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Appendix 1. Occurrence of vascular plant species by Forest Type group and logging history. The frequency of occurrence of each species in each group is shown as a proportion of the total number of plots for each group (shown in brackets beneath the group heading). There is an overall total of 127 plots. Taxonomy and nomenclature follow Jacobs and Pickard (1981), Jacobs and Lapinpuro (1986) and Harden (1990,1991,1992) except where more recent revisions are available. Groups are derived from overstorey communities described in the text, grouped according to Broad Forest Types described by Forestry Commission of New South Wales (1990).

. species not recorded in that group or category.
+ species recorded from the M.A. but not in a survey plot.
* naturalized alien

Broad Forest Type:
RF=all rainforest communities (WINov 1-4)
MCH=Mixed moist hardwood forest (WINov 6.1,7.1,7.2,8)
BBX=Brush Box forest (WINov 5)
NEH=New England hardwood (WINov 12,13)
BBT=Blackbutt forest (WINov 11)
SM="Semi-moist" hardwood (WINov 6.2)
DCH=Dry Coastal hardwood (WINov 9)
SHR=Shrub communities on rock outcrops (WINus 10-12)

Logging history categories:
UL1=unlogged,unloggable (reserved or very steep and rocky)
L1=logged 5-15yr
UL2=unlogged,loggable
L2=logged 25-35yr

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Abutilon oxycarpum var. oxycarpum	1	.	.	.	.	.	0.06	.	.	.	0.02	.	.
Acacia binervata	10	.	.	0.03	0.06	.	.	0.27	.	.	0.10	0.07	0.10
Acacia elata	2	.	.	.	.	.	.	0.07	.	.	.	0.07	.
Acacia falciformis	4	.	.	.	.	.	.	0.13	.	.	0.02	0.07	0.03
Acacia implexa	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Acacia irrorata	7	.	.	0.03	0.06	.	0.19	0.07	.	.	0.10	0.03	0.03
Acacia maidenii	14	.	0.09	0.10	0.24	.	0.25	0.07	.	.	0.17	0.07	0.10
Acacia melanoxylon	50	0.07	0.64	0.60	0.53	0.60	0.19	0.30	.	0.06	0.37	0.47	0.55
Acacia obtusifolia	3	.	.	.	.	.	.	.	0.75	0.19	.	.	.
Acacia ulicifolia	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Acaena novae-zelandiae	3	.	.	0.07	.	.	.	0.03	.	.	0.04	0.03	.
Acianthus fornicatus	1	.	.	.	0.06	.	.	.	.	.	0.02	.	.
Acmena smithii	42	0.79	0.18	0.43	0.06	1.00	.	0.33	.	0.50	0.27	0.33	0.34
Acradenia euodiiformis	9	0.36	.	0.10	.	.	.	0.03	.	0.19	0.04	0.07	0.07
Acronychia oblongifolia	4	.	.	0.10	.	.	.	0.03	.	.	0.04	0.07	.
Acrotriche aggregata	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Adiantum aethiopicum	4	.	.	0.03	0.18	.	.	.	.	.	0.04	0.03	0.03
Adiantum formosum	16	0.14	0.09	0.37	0.12	.	.	.	.	0.06	0.10	0.17	0.17
Adiantum hispidulum	2	0.07	.	0.03	.	.	.	.	.	0.06	0.02	.	.
Adiantum silvaticum	3	0.07	.	0.03	.	0.20	.	.	.	0.06	.	.	0.07
Alangium villosum ssp. polyosmoides	2	0.14	.	.	.	.	.	.	.	0.06	.	0.03	.
Alchornea ilicifolia	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Alectryon subcinereus	13	0.29	.	0.20	0.12	0.20	.	.	.	0.31	0.06	0.03	0.14
Alectryon subdentatus	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Allocasuarina littoralis	8	0.07	.	.	0.06	.	0.25	.	0.50	0.19	0.04	0.07	0.03
Allocasuarina torulosa	56	0.07	0.82	0.37	0.71	.	0.81	0.33	.	0.06	0.50	0.33	0.66
Alphitonia excelsa	1	.	.	.	.	.	0.06	.	.	.	.	.	0.03
Alpinia caerulea var. caerulea	1	.	.	.	0.06	.	.	.	.	.	.	0.03	.
Alyxia ruscifolia	17	0.36	0.18	0.10	.	0.20	.	0.17	0.25	0.50	0.04	0.10	0.14
Amperea xiphoclada	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Amylotheca dictyophleba	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Aneilema acuminatum	2	0.14	.	.	.	.	.	.	.	0.06	.	0.03	.
Angophora floribunda	24	0.07	0.27	0.17	0.18	.	0.63	0.07	.	0.13	0.35	0.10	0.03
Aphanopetalum resinosum	2	.	.	0.07	.	.	.	.	.	.	.	0.03	0.03
Archirhodomyrtus beckleri	27	0.07	0.45	0.30	0.12	0.40	.	0.27	.	0.13	0.15	0.27	0.31
Argyrodendron actinophyllum	17	0.64	.	0.17	.	0.60	.	.	.	0.44	0.06	0.10	0.14
Aristida vagans	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Aristotelia australasica	1	.	.	.	.	.	.	0.03	.	.	0.02	.	.
Arthropteris beckleri	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Arthropteris tenella	10	0.50	.	0.03	.	0.40	.	.	.	0.38	0.02	0.03	0.07
Arytera divaricata	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Asplenium attenuatum	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Asplenium australasicum	20	0.71	.	0.13	.	0.80	.	0.07	.	0.56	0.08	0.10	0.14
Asplenium flabellifolium	4	.	.	0.03	0.06	0.20	.	.	0.25	0.13	0.02	.	0.03
Asplenium flaccidum spp. flaccidum	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Asplenium polyodon	4	0.29	.	.	.	.	.	.	.	0.06	.	0.03	0.07
Austrosteenisia blackii	3	0.14	.	0.03	.	.	.	.	.	0.13	.	.	0.03
Backhousia myrtifolia	4	0.14	.	.	.	.	.	.	0.50	0.25	.	.	.
Backhousia myrtifolia (small leaf)	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Backhousia sciadophora	3	0.21	.	.	.	.	.	.	.	0.19	.	.	.
Baeckea virgata	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Baloghia inophylla	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Banksia integrifolia	13	0.07	.	0.10	.	.	.	0.30	.	0.06	0.15	0.13	.
Berberidopsis beckleri	4	.	.	0.07	.	0.20	.	0.03	.	0.06	0.04	0.03	.
Beyeria lasiocarpa	2	0.07	.	.	.	.	.	.	0.25	0.13	.	.	.
*Bidens pilosa	1	.	.	.	0.06	.	.	.	.	.	.	0.03	.
Billardiera scandens	17	.	0.36	0.10	.	.	0.06	0.30	.	.	0.13	0.20	0.14
Blechnum cartilagineum	47	0.29	0.73	0.50	0.12	1.00	0.06	0.40	.	0.38	0.29	0.40	0.48
Blechnum minus	+	.	.	.	.	.	.	.	+	+	.	.	.
Blechnum patersonii	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Blechnum wattsii	2	0.14	.	.	.	.	.	.	.	0.06	0.02	.	.
Brachychiton acerifolius	6	0.14	.	0.03	0.06	0.20	.	0.03	.	0.06	0.04	0.07	0.03
Brachychiton discolor	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Breynia oblongifolia	37	0.14	0.45	0.40	0.71	.	0.38	.	.	0.13	0.35	0.17	0.41
Bulbophyllum elisae	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Bulbophyllum exiguum	8	0.21	.	.	.	0.40	.	0.07	0.25	0.38	.	0.07	.
Bulbophyllum schillerianum	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Bulbophyllum shepherdii	3	0.21	.	.	.	.	.	.	.	0.19	.	.	.
Bursaria spinosa	7	.	.	.	.	.	0.06	0.20	.	.	0.10	0.07	.
Calanthe triplicata	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Caldcluvia paniculosa	40	0.57	0.27	0.50	0.06	0.80	.	0.30	.	0.31	0.31	0.37	0.28
Callicoma serratifolia	11	0.07	0.18	0.17	.	0.20	.	0.07	.	.	0.04	0.20	0.10
Callistemon salignus	1	.	.	.	0.06	.	.	.	.	.	0.02	.	.
Callitris macleayana	2	.	.	0.03	.	.	.	0.03	.	.	.	0.03	0.03
Callitris rhomboidea	+	.	.	.	.	.	.	.	+	+	.	.	.
Calochlaena dubia	30	0.14	0.45	0.23	0.24	0.20	0.19	0.27	.	0.19	0.17	0.33	0.28
Canthium coprosmoides	2	.	.	0.03	.	0.20	.	.	.	.	0.02	0.03	.
Canthium odoratum	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Capparis arborea	4	0.29	.	.	.	.	.	.	.	0.25	.	.	.
Carex appressa	6	.	.	0.10	0.12	.	0.06	.	.	.	0.08	0.03	0.03
Carex hattoriana	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Carex spp.	2	0.07	.	.	.	.	.	0.03	.	.	0.02	0.03	.
Cassine australis	3	0.14	.	0.03	.	.	.	.	.	0.13	0.02	.	.
Cassinia leptocephala	7	.	0.09	.	0.06	.	0.13	0.10	.	.	0.02	0.10	0.10
Cassytha pubescens	2	.	.	.	.	.	.	.	0.50	0.13	.	.	.
Cayratia clematidea	9	.	.	0.07	0.24	.	0.19	.	.	.	0.10	0.07	0.07
Cayratia eurynema	1	0.07	.	.	.	.	.	.	.	.	.	.	0.03
Celastrus australis	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Celastrus subspicatus	7	0.14	0.09	0.07	0.12	.	.	.	.	0.06	0.04	0.03	0.10
Cephalaralia cephalobotrys	29	0.29	0.27	0.30	.	1.00	.	0.27	.	0.25	0.21	0.27	0.21
Ceratopetalum apetalum	22	0.64	.	0.20	.	0.60	.	0.13	.	0.38	0.15	0.10	0.17
Cheilanthes sieberi	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Cinnamomum virens	11	0.14	0.09	0.17	.	0.40	.	0.03	.	0.06	0.13	0.07	0.03
*Cirsium vulgare	3	.	.	.	.	.	0.13	0.03	.	.	0.04	0.03	.
Cissus antarctica	38	0.57	0.18	0.50	0.35	0.40	0.19	0.07	.	0.31	0.21	0.30	0.45
Cissus hypoglauca	61	0.36	0.82	0.63	0.35	0.40	0.25	0.53	.	0.38	0.37	0.70	0.52
Cissus opaca	6	0.14	.	.	0.18	.	0.06	.	.	0.13	0.06	0.03	.
Citriobatus pauciflorus	44	0.86	.	0.57	0.24	0.80	0.13	0.17	.	0.56	0.25	0.33	0.41
Citronella moorei	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Claoxylon australe	7	0.21	.	0.03	0.12	0.20	.	.	.	0.13	.	0.13	0.03
Clematis aristata	36	.	0.45	0.23	0.47	0.40	0.31	0.30	.	.	0.29	0.37	0.34
Clerodendrum tomentosum	8	0.14	0.09	0.10	0.06	.	0.06	.	.	0.06	0.04	0.03	0.14
Clerodendrum sp.	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
*Conyza albida	2	.	.	0.03	.	.	0.06	.	.	.	0.04	.	.
Codonocarpus attenuatus	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Cordyline sp. nov. (aff. C. stricta)	13	0.29	0.27	0.10	.	0.40	.	0.03	.	0.25	0.02	0.07	0.21
Correa reflexa	+	.	.	.	.	.	.	.	.	.	.	.	.
Croton insularis	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Croton verreauxii	2	.	.	0.07	.	.	.	.	.	.	0.02	0.03	.
Cryptocarya foveolata	1	0.07	.	.	.	.	.	.	.	.	.	.	0.03
Cryptocarya glaucescens	15	0.14	.	0.27	0.12	0.60	.	.	.	0.06	0.08	0.20	0.14
Cryptocarya meissneriana	17	0.57	.	0.20	.	0.40	.	0.03	.	0.25	0.15	0.03	0.14
Cryptocarya microneura	16	0.07	0.09	0.37	0.06	0.20	0.06	.	.	0.06	0.13	0.13	0.14
Cryptocarya obovata	1	0.07	.	.	.	.	.	.	.	.	.	.	0.03
Cryptocarya rigida	38	0.07	0.82	0.50	0.29	0.40	0.06	0.17	.	0.13	0.19	0.37	0.52
Cupaniopsis foveolata	4	.	.	0.10	.	0.20	.	.	.	.	0.06	.	0.03
Cyathea australis	39	0.29	0.36	0.43	.	0.80	0.06	0.43	.	0.19	0.33	0.43	0.21
Cyathea leichhardtiana	11	0.50	.	0.07	.	0.40	.	.	.	0.25	0.04	0.07	0.10
Cymbidium suave	21	.	0.27	0.20	0.12	.	0.38	0.10	0.25	0.06	0.17	0.13	0.24
Cymbopogon refractus	4	0.07	.	.	0.06	.	0.06	.	0.25	0.13	0.02	.	0.03
Cynoglossum latifolium	6	.	.	0.10	0.06	.	0.06	0.03	.	.	0.08	0.03	0.03
Cyperus disjunctus	5	0.21	.	0.03	.	.	.	0.03	.	0.31	.	.	.
Cyperus enervis	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Cyperus tetraphyllus	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Cyperus spp.	5	.	0.09	0.13	.	.	.	.	.	.	0.08	.	0.03
Danthonia longifolia	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Daphnandra sp. A	15	0.29	.	0.37	.	.	.	.	.	0.13	0.13	0.13	0.07
Davallia pyxidata	7	0.21	.	0.07	0.06	.	.	.	0.25	0.19	.	.	0.14
Daviesia arborea	2	.	.	.	0.06	.	.	0.03	.	.	.	0.07	.
Dendrobium aemulum	10	.	.	0.23	.	0.40	.	0.03	.	0.13	0.06	0.03	0.14
Dendrobium fairfaxii	17	0.36	0.09	0.17	.	0.20	.	0.10	0.50	0.44	0.10	0.10	0.07
Dendrobium gracilicaule	6	0.29	.	0.07	.	.	.	.	.	0.31	0.02	.	.

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Dendrobium kingianum	4	.	.	.	.	.	.	0.03	0.75	0.25	.	.	.
Dendrobium linguiforme	+	.	.	.	.	.	.	.	+	+	.	.	.
Dendrobium mortii	1	.	.	.	.	0.20	.	.	.	0.06	.	.	.
Dendrobium pugioniforme	14	0.50	0.09	0.13	.	0.40	.	.	.	0.31	0.10	0.07	0.07
Dendrobium schoeninum	4	0.29	.	.	.	.	.	.	.	0.25	.	.	.
Dendrobium tarberi	9	0.36	.	0.07	0.06	.	.	.	0.25	0.25	0.02	0.03	0.10
Dendrocnide excelsa	6	0.43	.	.	.	.	.	.	.	0.13	0.02	0.03	0.07
Dendrocnide photinophylla	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Denhamia celastroides	1	.	0.09	.	.	.	.	.	.	.	.	.	0.03
Dennstaedtia davallioides	1	.	.	0.03	.	.	.	.	.	0.06	.	.	.
Desmodium nemorosum	7	.	.	0.07	0.12	.	0.19	.	.	.	0.10	0.07	.
Desmodium rhytidophyllum	11	.	.	0.03	0.24	.	0.25	0.07	.	.	0.13	0.07	0.07
Desmodium varians	38	.	0.45	0.13	0.65	.	0.63	0.27	.	.	0.38	0.43	0.17
Dianella caerulea	93	0.29	0.91	0.70	0.82	0.60	0.81	0.87	0.50	0.44	0.79	0.83	0.69
Dichondra repens	14	.	.	0.07	0.41	.	0.19	0.07	.	.	0.13	0.13	0.10
Dicksonia antarctica	2	0.07	.	.	.	.	.	0.03	.	.	0.02	.	0.03
Dictymia brownii	11	0.57	.	0.03	.	0.20	.	0.03	.	0.50	.	0.07	0.03
Dioscorea transversa	15	0.14	0.09	0.40	.	.	.	.	.	0.19	0.08	0.13	0.14
Diospyros australis	17	0.43	0.09	0.20	0.12	0.20	0.06	.	.	0.25	0.13	0.07	0.14
Diospyros pentamera	4	0.14	.	0.03	.	0.20	.	.	.	0.13	0.02	.	0.03
Diploglottis australis	11	0.43	.	0.03	.	0.40	0.13	.	.	0.13	0.08	0.07	0.10
Dodonaea megazyga	+	.	.	+	.	.	.	.	.	.	.	+	.
Doodia aspera	39	0.29	0.36	0.37	0.76	.	0.13	0.17	.	0.19	0.31	0.30	0.38
Doryphora sassafras	18	0.64	.	0.13	.	0.60	.	0.07	.	0.31	0.13	0.03	0.17
Drymophila moorei	23	0.21	0.09	0.23	.	0.40	.	0.33	.	0.19	0.27	0.20	.
Drypetes australasica	6	0.29	.	0.03	0.06	.	.	.	.	0.25	.	.	0.07
Duboisia myoporoides	3	.	0.09	0.07	.	.	.	.	.	.	0.06	.	.
Dysoxylum fraserianum	7	0.29	.	0.10	.	.	.	.	.	0.13	0.04	0.07	0.03
Echinopogon caespitosus	1	.	.	.	.	.	0.06	.	.	.	.	0.03	.
Ehretia acuminata var. acuminata	2	0.07	.	.	0.06	.	.	.	.	.	0.02	0.03	.
Elaeocarpus kirtonii	+	.	.	.	.	.	.	.	.	.	.	.	.
Elaeocarpus obovatus	5	0.07	.	0.07	0.12	.	.	.	.	0.06	0.04	0.03	0.03
Elaeocarpus reticulatus	46	0.07	0.64	0.40	0.18	0.40	0.06	0.63	0.25	0.25	0.31	0.43	0.45
Elatostemma reticulatum	3	0.07	.	0.03	.	0.20	.	.	.	0.13	.	.	0.03
Elatostemma stipitatum	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Elattostachys nervosa	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Embelia australiana	8	0.21	.	0.10	.	0.20	.	0.03	.	0.13	0.04	0.03	0.10
Endiandra crassiflora	2	.	.	0.03	.	0.20	.	.	.	.	0.02	.	0.03
Endiandra muelleri ssp. muelleri	8	0.14	.	0.10	.	0.60	.	.	.	0.19	0.04	.	0.10
Endiandra sieberi	21	0.14	0.36	0.20	.	0.40	.	0.23	.	0.25	0.13	0.17	0.17
Entolasia marginata	10	.	0.09	0.07	0.06	.	0.31	0.03	.	.	0.10	0.07	0.10
Entolasia stricta	4	.	.	.	.	.	0.06	.	0.75	0.19	0.02	.	.
Entolasia spp.	2	.	0.09	.	.	.	.	0.03	.	.	.	0.07	.
Epacris calvertiana	2	.	.	.	.	.	.	.	0.50	0.13	.	.	.
Eucalyptus acmenoides	26	.	0.18	0.13	0.88	.	0.19	0.07	.	.	0.23	0.20	0.28
Eucalyptus biturbinata	1	.	.	.	0.06	.	.	.	.	.	0.02	.	.
Eucalyptus brunnea	2	.	0.09	.	0.06	.	.	.	.	.	0.04	.	.
Eucalyptus cameronii	14	.	.	0.07	.	.	0.06	0.37	.	.	0.17	0.17	0.03
Eucalyptus campanulata	43	0.07	0.45	0.10	.	.	0.31	0.90	0.50	0.31	0.29	0.50	0.28
Eucalyptus globoidea	11	.	0.09	.	0.12	.	0.38	.	0.50	0.13	0.12	0.07	0.03
Eucalyptus grandis	2	.	.	0.07	.	.	.	.	.	.	.	0.03	0.03

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Eucalyptus intermedia	30	.	0.09	0.13	0.65	.	0.75	0.03	0.25	0.06	0.21	0.27	0.34
Eucalyptus laevopinea	14	.	.	0.13	0.06	.	.	0.30	.	.	0.10	0.30	.
Eucalyptus microcorys	68	0.07	0.91	0.63	0.88	0.40	0.63	0.37	.	.	0.50	0.67	0.76
Eucalyptus nobilis	1	.	.	.	.	.	.	0.03	.	.	0.02	.	.
Eucalyptus obliqua	7	.	.	.	.	.	.	0.23	.	.	0.08	0.10	.
Eucalyptus pilularis	15	.	1.00	.	0.18	.	0.06	.	.	.	0.12	0.07	0.24
Eucalyptus propinqua	21	.	0.09	0.13	0.41	.	0.56	.	.	.	0.17	0.20	0.21
Eucalyptus resinifera	1	.	.	.	.	.	0.06	.	.	.	.	0.03	.
Eucalyptus saligna	61	0.21	0.64	0.87	0.65	0.20	0.38	0.20	0.25	0.31	0.48	0.47	0.59
Eucalyptus tereticornis	16	.	.	.	0.24	.	0.63	0.03	0.25	0.06	0.21	0.10	0.03
Eupomatia laurina	22	0.21	0.09	0.43	0.12	0.60	.	.	.	0.19	0.17	0.13	0.21
Euroschinus falcata var. falcata	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Eustrephus latifolius	27	.	0.36	0.20	0.29	0.20	0.25	0.23	.	.	0.23	0.23	0.28
Exocarpos cupressiformis	16	.	.	0.07	0.12	.	0.50	0.13	.	.	0.15	0.10	0.17
Ficus coronata	4	0.14	.	0.03	.	0.20	.	.	.	0.06	.	.	0.10
Ficus rubiginosa	3	0.07	.	.	0.06	.	0.06	.	.	0.06	.	.	0.07
Gahnia aspera	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Gahnia insignis	+	.	.	.	.	.	.	.	+	+	.	.	.
Gahnia melanocarpa	24	0.07	0.09	0.37	0.18	.	0.06	0.23	.	.	0.21	0.33	0.10
Gahnia sieberiana	1	.	.	.	.	.	.	0.03	.	.	0.02	.	.
Galium spp.	13	.	0.18	0.10	0.18	.	0.19	0.07	.	.	0.17	0.07	0.07
Geitonoplesium cymosum	69	0.36	0.36	0.63	0.82	0.60	0.69	0.43	.	0.50	0.60	0.57	0.45
Geranium spp.	20	.	0.27	0.17	0.29	.	.	0.23	.	.	0.21	0.23	0.07
Glochidion ferdinandi	3	0.07	0.09	0.03	.	.	.	.	.	0.06	0.04	.	.
Glycine clandestina	47	.	0.55	0.20	0.71	.	0.69	0.40	.	.	0.48	0.50	0.24
Glycine tabacina	1	.	.	.	.	.	0.06	.	.	.	0.02	.	.
Gmelina leichhardtii	3	0.14	.	0.03	.	.	.	.	.	0.06	.	0.03	0.03
Gnaphalium spp.	3	.	.	.	0.06	.	0.06	0.03	.	.	0.02	0.07	.
Gomphocarpus sp.	1	.	.	.	.	.	0.06	.	.	.	.	0.03	.
Gonocarpus oreophilus	8	.	.	.	0.06	.	0.06	0.13	0.50	0.19	0.06	0.07	.
Gonocarpus teucrioides	9	.	0.09	.	.	.	0.13	0.20	.	.	0.08	0.10	0.07
Goodenia grandiflora ssp. grandiflora	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Goodenia hederacea ssp. hederacea	2	.	.	.	0.06	.	.	0.03	.	.	.	0.03	0.03
Goodenia sp. nov. ('fordiana' ms)	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Guilfoylia monostylis	1	0.07	.	.	.	.	.	.	.	.	.	.	0.03
Guioa semiglauca	14	0.07	0.09	0.17	0.18	0.40	0.06	0.03	.	0.13	0.06	0.10	0.21
Gymnema dunnii	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Gymnostachys anceps	45	0.57	0.27	0.43	0.47	0.40	.	0.37	.	0.38	0.31	0.43	0.34
Hakea eriantha	2	.	.	.	.	.	.	0.07	.	.	0.02	.	0.03
Hakea salicifolia	3	.	.	.	.	.	.	0.10	.	.	0.04	0.03	.
Hardenbergia violacea	33	.	0.27	0.07	0.35	.	0.63	0.37	0.25	0.06	0.33	0.27	0.24
Hedycarya angustifolia	7	0.07	.	0.10	.	.	.	0.10	.	.	0.06	0.10	0.03
Helichrysum elatum	2	.	.	.	.	.	.	0.03	0.25	0.06	0.02	.	.
Hibbertia dentata	39	0.07	0.82	0.23	0.18	.	0.06	0.60	.	0.13	0.29	0.37	0.38
Hibbertia linearis	+	.	.	.	.	.	+	.	.	+	.	.	.
Hibbertia scandens	69	.	0.55	0.50	0.65	0.20	0.75	0.80	.	0.06	0.63	0.67	0.52
Hibiscus heterophyllus	2	0.07	.	.	0.06	.	.	.	.	0.06	.	0.03	.
Hibiscus splendens	1	.	.	0.03	.	.	.	.	.	.	.	0.03	.
Histiopteris incisa	9	0.14	.	0.17	.	0.20	.	0.03	.	0.13	0.04	0.10	0.07
Hydrocotyle acutiloba	8	0.07	.	.	0.06	.	0.25	0.07	.	.	0.08	0.10	0.03
Hydrocotyle geraniifolia	4	.	0.18	0.03	0.06	.	.	.	.	.	0.06	.	0.03

Appendix 1. (cont).

	Tot. freq. (n=127)	RF (14)	BBT (11)	MCH (30)	SM (17)	BBX (5)	DCH (16)	NEH (30)	SHR (4)	UL1 (16)	UL2 (52)	L1 (30)	L2 (29)
		Broad forest type								Logging category			
Hydrocotyle peduncularis	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Hydrocotyle spp.	2	.	.	.	0.12	.	.	.	.	.	0.02	.	0.03
Hymenophyllum cupressiforme	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Hymenosporum flavum	4	0.07	.	0.07	.	0.20	.	.	.	0.06	.	0.07	0.03
Imperata cylindrica var. major	44	.	0.36	0.23	0.65	.	0.81	0.30	.	.	0.46	0.33	0.34
Indigofera australis	20	.	0.36	0.07	0.35	.	0.19	0.17	.	.	0.23	0.17	0.10
Jacksonia scoparia	7	.	.	.	.	.	0.31	.	0.50	0.13	0.06	0.03	0.03
Jasminum volubile	3	0.21	.	.	.	.	.	.	.	0.19	.	.	.
Kennedia rubicunda	10	.	0.27	.	0.06	.	0.06	0.17	.	.	0.06	0.13	0.10
*Lantana camara	2	0.07	.	.	.	.	0.06	.	.	0.06	0.02	.	.
Lastreopsis acuminata	2	0.14	.	.	.	.	.	.	.	0.06	.	0.03	.
Lastreopsis decomposita	26	0.71	0.09	0.30	0.06	0.80	.	0.03	.	0.50	0.12	0.10	0.31
Lastreopsis microsora	2	0.14	.	.	.	.	.	.	.	0.06	.	.	0.03
Lastreopsis munita	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Legnephora moorei	1	.	.	0.03	.	.	.	.	.	.	.	0.03	.
Lepidosperma elatius	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Lepidosperma laterale	33	.	0.55	0.20	0.35	0.20	0.38	0.20	0.50	0.13	0.23	0.30	0.34
Lepidosperma urophorum	3	.	.	.	.	.	.	.	0.75	0.19	.	.	.
Lepidozamia peroffskyana	12	0.07	.	0.10	0.41	.	.	0.03	.	.	0.02	0.17	0.21
Leptospermum variabile	3	.	.	.	.	.	.	0.03	0.50	0.19	.	.	.
Leucopogon biflorus	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Leucopogon juniperinus	2	.	.	.	.	.	0.13	.	.	.	0.02	.	0.03
Leucopogon lanceolatus var. lanceolatus	35	.	0.27	0.07	0.06	.	0.25	0.77	0.50	0.19	0.27	0.47	0.14
Leucopogon sp. nov. ('cicatricatus' ms)	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Libertia paniculata	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Lindsaea microphylla	2	.	0.09	.	.	.	.	0.03	.	.	.	.	0.07
Linospadix monostachya	6	0.43	.	.	.	.	.	.	.	0.06	0.04	0.03	0.07
Liparis coelogynoides	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Liparis reflexa	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Litsea reticulata	2	.	.	0.07	.	.	.	.	.	.	.	0.03	0.03
Logania albiflora	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Lomandra filiformis	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Lomandra glauca ssp. glauca	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Lomandra hystrix	+	+	.	.	.	.	.	.	.	+	.	.	.
Lomandra longifolia	98	0.07	0.91	0.70	0.94	0.20	1.00	1.00	0.75	0.31	0.85	0.90	0.76
Lomandra multiflora	2	.	.	.	.	.	0.13	.	.	.	0.02	0.03	.
Lomandra spicata	24	0.79	0.18	0.20	.	0.80	.	0.03	.	0.50	0.17	0.03	0.21
Lomatia arborescens	6	.	.	0.03	.	.	.	0.17	.	0.06	0.06	0.07	.
Lophostemon confertus	36	0.07	0.45	0.50	0.29	1.00	0.13	0.10	.	0.25	0.23	0.27	0.41
Maclura cochinchinensis	2	0.07	.	.	.	.	0.06	.	.	0.06	.	.	0.03
Macrozamia communis	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Malaisia scandens	3	0.21	.	.	.	.	.	.	.	0.06	.	0.03	0.03
Mallotus philippensis	2	0.07	.	0.03	.	.	.	.	.	0.06	.	0.03	.
Marsdenia flavescens	3	0.21	.	.	.	.	.	.	.	0.19	.	.	.
Marsdenia rostrata	7	0.14	.	0.10	.	.	.	0.07	.	0.13	0.02	0.07	0.07
Marsdenia suberosa	4	0.14	.	.	0.12	.	.	.	.	0.13	0.02	0.03	.
Maytenus silvestris	20	.	0.27	0.13	0.35	.	0.38	0.03	.	.	0.17	0.17	0.21
Melicope micrococca	2	.	.	0.07	.	.	.	.	.	.	.	0.03	0.03
Melodinus australis	4	0.14	.	.	.	0.40	.	.	.	.	0.02	.	0.10
Microsorum scandens	16	0.64	.	0.10	.	0.40	.	0.07	.	0.31	0.08	0.10	0.14
Mischocarpus australis	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Monotoca scoparia	14	.	0.36	0.03	0.06	.	0.06	0.23	.	.	0.08	0.17	0.17
Morinda acutifolia	3	0.21	.	.	.	.	.	.	.	0.19	.	.	.
Morinda jasminoides	20	0.71	0.09	0.17	.	0.80	.	.	.	0.44	0.04	0.13	0.24
Muellerina celastroides	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Myoporum insulare	2	.	.	.	0.06	.	0.06	.	.	.	0.02	.	0.03
Neolitsea australiensis	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Neolitsea dealbata	8	0.07	.	0.10	0.12	0.40	.	.	.	0.06	0.06	.	0.14
Notelaea longifolia	13	0.21	0.18	0.13	0.12	.	0.06	0.03	.	0.19	0.08	0.07	0.14
Notelaea venosa	6	0.07	.	0.03	.	.	.	0.13	.	0.06	0.08	0.03	.
Olea paniculata	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Olearia cydoniifolia	1	.	.	.	.	.	.	0.03	.	.	.	0.03	.
Olearia viscidula	2	.	.	.	0.03	.	.	0.06	.	.	.	0.04	.
Omalanthus populifolius	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Opercularia aspera	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Oplismenus imbecillus	20	0.14	0.09	0.17	0.24	.	0.38	0.07	.	0.13	0.25	0.03	0.14
Orites excelsa	24	0.64	.	0.13	.	0.80	.	0.23	.	0.31	0.13	0.20	0.21
Oxalis corniculata spp. agg.	25	.	0.18	0.20	0.59	.	0.19	0.13	.	.	0.25	0.20	0.21
Oxylobium ilicifolium	28	.	0.27	0.03	.	.	0.19	0.70	.	.	0.21	0.30	0.28
Ozothamnus adnatus	+	.	.	.	.	.	.	.	+	+	.	.	.
Ozothamnus bidwillii	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Ozothamnus diosmifolius	10	.	0.09	0.03	.	.	0.31	0.10	.	.	0.06	0.17	0.07
Ozothamnus rufescens	16	0.07	0.27	0.17	0.06	0.20	0.13	0.10	.	0.06	0.04	0.23	0.21
Palmeria scandens	29	0.71	0.09	0.37	.	0.80	.	0.10	.	0.38	0.19	0.23	0.21
Pandorea pandorana	31	0.64	0.09	0.40	.	0.20	0.13	0.20	.	0.50	0.21	0.17	0.24
Papillilabium beckleri	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Parsonsia brownii	4	.	.	0.13	.	.	.	.	.	.	0.02	0.03	0.07
Parsonsia rotata	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Parsonsia species A	4	0.21	.	.	.	.	.	0.03	.	0.19	0.02	.	.
Parsonsia straminea	21	0.50	.	0.27	0.06	0.60	.	0.07	.	0.38	0.17	0.03	0.17
Parsonsia velutina	5	0.21	.	0.03	0.06	.	.	.	.	0.13	0.04	0.03	.
Passiflora herbertiana	1	.	.	0.03	.	.	.	.	.	.	.	.	0.03
* Passiflora subpeltata	1	.	.	0.03	.	.	.	.	.	.	.	.	0.03
Patersonia glabrata	2	.	0.09	.	.	.	.	.	0.25	0.06	.	.	0.03
Pellaea falcata var. falcata	30	0.29	0.09	0.33	0.65	0.20	0.19	.	.	0.25	0.29	0.13	0.24
Pellaea falcata var. nana	4	0.29	.	.	.	.	.	.	.	0.19	.	0.03	.
Pellaea paradoxa	4	0.29	.	.	.	.	.	.	.	0.25	.	.	.
Pennantia cunninghamii	11	0.50	.	0.13	.	.	.	.	.	0.25	0.04	0.03	0.14
Peperomia leptostachya	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Peperomia tetraphylla	4	0.29	.	.	.	.	.	.	.	0.19	.	0.03	.
Persoonia linearis	31	.	0.55	.	0.18	.	0.19	0.57	0.50	0.13	0.21	0.30	0.31
Persoonia media	62	.	0.91	0.27	0.65	0.40	0.50	0.77	.	0.06	0.58	0.60	0.45
Phebalium elatius ssp. beckleri	3	.	.	.	.	.	.	.	0.75	0.19	.	.	.
Phyllanthus gasstroemii	3	.	.	0.03	0.12	.	.	.	.	.	.	0.07	0.03
Pimelea ligustrina	1	.	.	0.03	.	.	.	.	.	.	.	0.03	.
Pimelea linifolia	4	.	.	.	.	.	0.06	0.03	0.50	0.13	0.02	.	0.03
Pimelea neo-anglica	2	.	.	0.03	.	.	0.06	.	.	.	0.04	.	.
Piper novae-hollandiae	3	0.14	.	.	.	0.20	.	.	.	0.06	0.02	.	0.03
Piptocalyx moorei	8	0.07	.	0.17	.	0.20	.	0.03	.	.	0.02	0.10	0.14
Pittosporum revolutum	23	0.21	0.09	0.33	0.12	0.40	.	0.17	.	0.13	0.23	0.20	0.10
Pittosporum undulatum	20	0.36	0.27	0.23	0.06	0.20	0.06	0.07	.	0.44	0.06	0.13	0.21
Planchonella australis	3	0.21	.	.	.	.	.	.	.	0.13	.	.	0.03

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Platycerium bifurcatum	33	0.43	0.18	0.40	0.35	0.60	0.06	0.07	0.25	0.50	0.15	0.23	0.34
Platycerium superbum	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Plectorhiza tridentata	3	0.14	.	0.03	.	.	.	.	.	0.13	.	.	0.03
Plectranthus graveolens	6	0.14	.	0.03	0.12	.	.	.	0.25	0.19	0.04	.	0.03
Plectranthus parviflorus	14	0.14	0.09	0.13	0.29	.	0.06	.	0.25	0.25	0.12	0.07	0.07
Poa queenslandica	4	.	.	0.03	0.06	.	0.06	0.03	.	.	0.06	0.03	.
Poa sieberiana var. sieberiana	71	0.07	0.73	0.33	0.76	.	1.00	0.77	.	0.06	0.71	0.63	0.48
Poa sp.	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Pollia crispata	6	0.29	.	0.03	.	0.20	.	.	.	0.06	.	0.03	0.14
Polyosma cunninghamii	16	0.64	.	0.10	.	0.80	.	.	.	0.31	0.12	0.07	0.10
Polyscias elegans	2	.	.	0.03	0.06	.	.	.	.	.	.	0.07	.
Polyscias murrayi	9	0.29	.	0.07	.	0.20	0.06	0.03	.	.	0.06	0.13	0.07
Polyscias sambucifolia	28	.	0.64	0.07	0.18	0.20	0.19	0.40	.	.	0.12	0.40	0.34
Polystichum ?fallax	1	.	.	0.03	.	.	.	.	.	.	0.02	.	.
Pomaderris lanigera	3	.	0.09	.	.	.	.	0.07	.	.	.	.	0.10
Pomax umbellata	4	.	0.09	.	.	.	.	.	0.75	0.19	.	.	0.03
Pratia purpurascens	27	.	0.18	0.07	0.82	.	0.31	0.13	.	.	0.23	0.23	0.28
Prostanthera rotundifolia	3	.	.	.	.	.	.	0.03	0.50	0.19	.	.	.
Prostanthera incisa	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Pseuderanthemum variabile	19	0.07	0.09	0.27	0.35	.	0.13	0.03	.	0.06	0.19	.	0.28
Psychotria loniceroides	65	0.43	0.64	0.73	0.53	0.60	0.25	0.47	.	0.38	0.44	0.53	0.69
Pteridium esculentum	61	.	0.64	0.37	0.76	.	0.44	0.77	.	.	0.60	0.57	0.45
Pteris tremula	12	0.07	0.18	0.20	0.06	.	0.13	.	.	0.06	0.12	0.07	0.10
Pteris umbrosa	3	0.07	.	0.03	.	0.20	.	.	.	0.06	.	.	0.07
Pterostylis sp.	1	.	.	.	0.06	.	.	.	.	.	0.02	.	.
Pultenaea villosa	1	.	.	.	.	.	.	0.03	.	.	.	0.03	.
Pyrrosia confluens	17	0.36	.	0.27	0.06	0.20	0.06	0.03	.	0.31	0.12	0.13	0.07
Pyrrosia rupestris	14	0.14	0.09	0.13	0.06	0.20	.	0.10	0.50	0.38	0.10	0.07	0.03
Pyrrosia spp.	8	0.14	0.09	0.07	0.06	0.40	.	.	.	.	0.06	0.03	0.14
Quintinia verdonii	17	0.43	.	0.20	.	0.40	.	0.10	.	0.25	0.10	0.13	0.14
Ranunculus sp.	3	.	.	0.03	.	.	0.06	0.03	.	.	0.06	.	.
Rapanea howittiana	14	0.07	0.18	0.20	0.06	0.40	.	0.07	.	0.06	0.10	0.17	0.10
Rapanea variabilis	25	0.21	0.36	0.20	0.41	.	0.13	0.10	.	0.19	0.15	0.23	0.24
Rhinerrhiza divitiflora	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Rhodamnia rubescens	16	0.07	0.09	0.40	.	0.20	0.06	.	.	.	0.15	0.13	0.14
Rhodomyrtus psidioides	1	.	.	0.03	.	.	.	.	.	.	.	.	0.03
Rhysotoechia bifoliolata	4	0.29	.	.	.	.	.	.	.	0.25	.	.	.
Ripogonum discolor	21	0.71	.	0.23	.	0.60	.	0.03	.	0.38	0.13	0.10	0.17
Rubus hillii	26	0.14	0.27	0.37	0.24	0.20	0.13	0.10	.	0.13	0.12	0.40	0.21
Rubus parvifolius	27	.	0.18	0.17	0.65	.	0.38	0.10	.	.	0.21	0.27	0.28
Rubus rosifolius	29	0.21	0.27	0.43	0.29	0.20	0.06	0.10	.	0.06	0.25	0.30	0.21
Rubus sp. aff. moorei	15	0.29	0.09	0.20	.	0.40	.	0.07	.	0.13	0.10	0.17	0.10
Sarcochilus falcatus	16	0.36	.	0.13	.	0.20	0.06	0.13	0.25	0.50	0.10	0.03	0.07
Sarcochilus hillii	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Sarcochilus olivaceus	2	0.07	.	.	.	.	.	0.03	.	0.13	.	.	.
Sarcomelicope simplicifolia	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Sarcopetalum harveyanum	9	.	0.09	0.10	0.18	0.20	0.06	.	.	0.06	0.06	0.03	0.14
Sarcopteryx stipitata	19	0.50	0.18	0.20	0.06	0.40	.	0.03	.	0.25	0.12	0.13	0.17
Sarcostemma australe	2	0.07	.	.	.	.	.	.	0.25	0.13	.	.	.
Schistotylus purpuratus	+	+	.	+	.	.	.	.	.	+	+	.	+
Schizomeria ovata	39	0.36	0.36	0.43	0.18	1.00	0.06	0.27	.	0.38	0.27	0.30	0.34

Appendix 1. (cont).

	Tot. freq.	Broad forest type								Logging category			
		RF	BBT	MCH	SM	BBX	DCH	NEH	SHR	UL1	UL2	L1	L2
	(n=127)	(14)	(11)	(30)	(17)	(5)	(16)	(30)	(4)	(16)	(52)	(30)	(29)
Scolopia braunii	2	0.07	.	0.03	.	.	.	.	.	0.06	.	0.03	.
Senecio amygdalifolius	28	0.07	0.18	0.20	0.59	.	.	0.30	.	.	0.31	0.33	0.07
Senecio sp.	1	.	.	.	.	.	.	0.03	.	.	.	0.03	.
Senna odorata	+	.	.	.	.	.	.	.	.	.	.	.	.
*Sigesbeckia orientalis	5	.	0.09	.	0.06	.	0.13	0.03	.	.	0.04	0.07	0.03
Sloanea australis	3	0.14	.	0.03	.	.	.	.	.	.	0.02	.	0.07
Sloanea woollsii	10	0.43	0.09	0.07	.	0.20	.	.	.	0.25	0.04	0.03	0.10
Smilax australis	55	0.36	0.55	0.60	0.41	1.00	0.06	0.43	.	0.25	0.46	0.47	0.45
Smilax glycophylla	17	0.14	0.27	0.23	.	0.40	.	0.10	.	0.13	0.10	0.13	0.21
Solanum aviculare	1	0.07	.	.	.	.	.	.	.	.	.	0.03	.
Solanum brownii	8	.	0.09	0.10	.	0.20	0.06	0.07	.	.	0.08	0.10	0.03
Solanum densevestitum	3	.	.	0.03	.	.	0.13	.	.	.	0.04	0.03	.
Solanum prinophyllum	9	0.07	0.09	0.07	0.12	.	0.19	.	.	.	0.04	0.17	0.07
Solanum stelligerum	12	0.07	.	0.07	0.29	.	0.25	.	.	0.06	0.10	0.10	0.10
Spartothamnella juncea	2	0.14	.	.	.	.	.	.	.	0.13	.	.	.
Stellaria sp.	5	.	.	0.03	0.18	.	.	0.03	.	.	0.06	0.03	0.03
Stenocarpus salignus	4	0.29	.	.	.	.	.	.	.	0.25	.	.	.
Stephania japonica var. discolor	1	.	.	0.03	.	.	.	.	.	.	.	.	0.03
Sticherus lobatus	1	.	.	.	.	.	.	0.03	.	.	0.02	.	.
Sticherus tener	+	.	.	.	.	.	.	.	.	.	.	.	.
Stipa ramosissima	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Streblus brunonianus	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Syncarpia glomulifera	9	.	0.27	0.07	0.24	.	.	.	.	.	0.02	0.03	0.24
Synoum glandulosum	62	0.36	0.64	0.83	0.53	0.60	.	0.43	.	0.25	0.42	0.53	0.69
Syzygium australe	5	0.07	.	0.07	.	0.20	.	0.03	.	0.06	0.02	0.03	0.07
Tasmannia insipida	40	0.71	0.09	0.33	0.06	1.00	.	0.43	.	0.50	0.29	0.30	0.28
Tetrastigma nitens	14	0.43	.	0.10	0.18	.	0.13	.	.	0.31	0.06	0.07	0.14
Thelymitra fragrans	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Themeda australis	19	.	.	0.07	0.18	.	0.63	0.10	0.25	0.06	0.23	0.13	0.07
Todea barbara	1	.	.	0.03	.	.	.	.	.	.	.	0.03	.
Toona australis	1	0.07	.	.	.	.	.	.	.	0.02	.	.	.
Trema aspera	2	.	.	.	0.06	.	0.06	.	.	.	.	.	0.07
Tripladenia cunninghamii	5	.	.	0.07	0.12	.	.	0.03	.	.	.	0.07	0.10
Tristaniopsis collina	12	0.07	0.27	0.10	0.06	0.20	.	0.03	0.50	0.25	0.06	0.07	0.10
Tristaniopsis laurina	1	0.07	.	.	.	.	.	.	.	0.06	.	.	.
Trochocarpa laurina	59	0.14	0.55	0.63	0.35	0.60	0.13	0.70	.	0.38	0.40	0.57	0.52
Tylophora paniculata	3	0.07	.	.	0.06	0.20	.	.	.	0.13	.	0.03	.
Urtica incisa	9	0.07	.	0.03	0.12	.	0.13	0.10	.	.	0.04	0.17	0.07
*Verbena bonariensis	1	.	.	.	.	.	0.06	.	.	.	0.02	.	.
Vernonia cinerea var. cinerea	6	.	.	0.03	0.18	.	0.13	.	.	.	0.04	0.07	0.07
Veronica plebeia	3	.	.	0.07	.	.	.	0.03	.	.	0.06	.	.
Vittadinia tenuissima	+	.	.	.	.	.	.	.	.	.	.	.	.
Viola betonicifolia	12	.	.	0.07	0.24	.	0.13	0.13	.	.	0.15	0.10	0.03
Viola hederacea	20	.	0.27	0.17	0.24	.	0.19	0.17	.	.	0.17	0.17	0.21
Wilkiea huegeliana	12	0.21	0.09	0.13	.	0.80	.	.	.	0.25	0.04	0.07	0.14
Xanthorrhoea malacophylla	2	0.07	0.09	.	.	.	.	.	.	0.06	0.02	.	.
Xanthorrhoea sp.	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Xanthosia pilosa	2	.	.	.	.	.	.	.	0.50	0.13	.	.	.
Zieria ?arborescens	1	.	.	.	.	.	.	0.03	.	0.06	.	.	.
Zieria cytisoides	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Zieria fraseri ssp. B	1	.	.	.	.	.	.	.	0.25	0.06	.	.	.
Zieria smithii	15	.	0.45	0.17	.	0.20	0.06	0.10	.	.	0.08	0.17	0.21

Appendix 2. Descriptions of understorey communities.

Floristic communities are derived from classification at the 29 class level, of all species other than eucalypts. Overstorey communities are superimposed on the classification and the range of overstorey communities associated with each "understorey" community is described. To facilitate comparisons, the communities are considered in four broad categories. The rainforest and shrubland communities are floristically disparate and are grouped for convenience only. Other communities are grouped by floristic similarity (refer to figure 3). Communities are named from the most frequent and abundant species. Habitat and distribution are described from plot data only. Comments on more general habitat and distribution within the Management Area are included under "Comments" where appropriate. In the following descriptions, overstorey communities are prefixed by WINov and floristic communities by WINus. R=floristic richness (median number of species per 0.1 ha plot).

A. Rainforest

WINus 1. *Backhousia sciadophora*

(plots 605, 608, 611; R=53)

Distribution and habitat: Several mostly small but sometimes more extensive patches, on steep to precipitous rocky slopes, often scree, with south to west aspects.

Structure: Low closed forest to closed forest. Canopy sometimes uneven, with vine-filled gaps. Understorey usually sparse to almost non-existent.

Floristics: *Backhousia sciadophora* clearly dominant in the overstorey, with *Drypetes australasica* fairly common but other species infrequent or rare. Small trees *Capparis arborea* and *Pittosporum undulatum*. The vines *Tetrastigma nitens* and *Austrosteenisia blackii* may be locally abundant in the canopy and as vine thickets in canopy gaps. *Morinda acutifolia* is a prominent understorey vine. Frequent ground cover species, none of which is common, include *Pellaea paradoxa, Peperomia leptostachya, Plectranthus graveolens* and *Spartothamnella juncea.*

Comments: This is a very distinct community which usually forms discrete patches, with abrupt boundaries with surrounding or upslope open forest. Boundaries are maintained by fire and topography.

WINus 2. *Callicoma serratifolia-Tristaniopsis collina*

(plot 204; R=13)

Structure: Tall woodland (emergents to 40 m) with dense tall shrub understorey (to 12 m) and virtually non-existent ground cover.

Floristics: Overstorey *E. saligna, E. microcorys* and *Acacia melanoxylon* with *E. microcorys* emergents. Dense shrub layer *Callicoma serratifolia and Tristaniopsis collina.*

Comments: This plot was heavily logged during the late 1950s. It is typical of some heavily logged wet sclerophyll forest in which a few shrub species have become dominant. The conditions which favour this formation are not clear.

Appendix 2. (cont).

WINus 3. *Tristaniopsis laurina-Ceratopetalum apetalum-Adiantum silvaticum*

(plot 610; R=72)

Distribution and habitat: Alluvial flat along Bobin Creek in deeply incised valley.

Structure: Tall open forest (to 50 m) with dense subcanopy (to 30 m) and shrub stratum and moderately dense ground cover.

Floristics: Tall overstorey *Lophostemon confertus* and *Gmelina leichhardtii*. Subcanopy *Tristaniopsis laurina* and *Ceratopetalum apetalum*. Shrubs/small trees *Acradenia euodiiformis* and *Cryptocarya meissneriana*. Common ground cover *Adiantum silvaticum*.

Comments: A distinctive community which was only recorded along Bobin Creek, but may occur elsewhere in the Mangement Area in similarly deeply incised valleys.

WINus 4. *Doryphora sassafras-Ripogonum discolor*

(plots 056, 057, 129, 509, 601 ,603, MLL3, MLL6, RLH1, RLH3, RLH4, RLH5, RLL1; R=40)

Distribution and habitat: Widespread at a range of altitudes (450-1130 m, median 800 m) but mostly on sheltered slopes or in gullies.

Structure: Very variable. Tall woodland or open forest (canopy height 30-50 m, median 40 m) with open to very dense subcanopy. Ground cover varies from almost non-existent to dense.

Floristics: A range of overstorey types. Mostly rainforest, WINov 2.2 *Sloanea woollsii-Ceratopetalum apetalum-Doryphora sassafras* or WINov 3 *Argyrodendron actinophyllum*, but some plots are eucalypt forest (WINov 5.2 *L. confertus-E. microcorys-E. saligna*, WINov 7.2 *E. laevopinea-E. saligna* and WINov 13, *E. obliqua*). Common subcanopy or small tree species include *D. sassafras*, *Acmena smithii*, *Cryptocarya meissneriana*, *Orites excelsa*, *Caldcluvia paniculosa* and *Pennantia cunninghamii*. The vines *Ripogonum discolor*, *Palmeria scandens* and *Cissus antarctica* are frequent and may be locally abundant. The shrubs *Tasmannia insipida* and *Citriobatus pauciflorus* are frequent. Common ground cover species are *Lomandra spicata* and the fern *Lastreopsis decomposita*. The climbing fern *Microsorum scandens* and epiphyte *Asplenium australasicum* are also frequent.

Comments: This is the characteristic understorey of most of the rainforest in the area and also occurs commonly in eucalypt forests at the wetter end of the gradient, including both logged and unlogged areas. Plot 509 is unusual in being at high altitude and being dominated by *E. obliqua*.

WINus 5. *Argyrodendron actinophyllum-Lastreopsis microsora*

(plot 606; R=77)

Distribution and habitat: A single stand in a sheltered minor gully in Knorritt State Forest.

Structure: Tall open forest (40 m) with very dense subcanopy, sparse shrub stratum and moderately dense ground cover.

Floristics: Overstorey almost solely *A. actinophyllum*. Subcanopy *Arytera divaricata*, *Polyosma cunninghamii* and thickets of the vines *Tetrastigma nitens* and *Morinda jasminoides*. Main small shrub *Citriobatus pauciflorus*. *Lastreopsis microsora* dominates the ground cover.

Appendix 2. (cont).

WINus 6. *E. campanulata-Tristaniopsis collina*

(plot 054)

Distribution and habitat: Restricted to a stoney slope immediately below a quartzite outcrop in Rowleys Rock F.R.

Structure: Open forest (25 m) with very dense tall shrub understorey (to 8 m) and sparse ground cover.

Floristics: Overstorey solely *E. campanulata.*. *T. collina* clearly dominates the shrub stratum, with *Prostanthera rotundifolia, Alyxia ruscifolia* and *Trochocarpa laurina* less common. Ground cover *Calochlaena dubia* and *Cyperus disjunctus.*

B. Wet Sclerophyll Forest

WINus 7.1 *Lophostemon confertus-Cryptocarya glaucescens-Lastreopsis decomposita*

(plots 002, MUH2, MUL7; R=44)

Distribution and habitat: Mostly sheltered mid to lower slopes at mid altitudes (500-750 m).

Structure: Tall open forest (30-50 m) with dense mesophytic subcanopy or small tree stratum and sparse to moderately dense ground cover.

Floristics: Abundant subcanopy species *C. glaucescens, C. rigida.* Common vines *Palmeria scandens, Cephalaralia cephalobotrys.* Most common ground cover *L. decomposita, Lomandra spicata* and *Blechnum cartilagineum.*

WINus 7.2 *Caldcluvia paniculosa-Blechnum cartilagineum*

(plots 027, 116, 142, 328, 604, MUH7; R=47)

Distribution and habitat: Widespread at mid-altitudes (650-870 m, median 765 m) on sheltered slopes.

Structure: Tall woodland (logged plots) to tall open forest (30-50 m canopy height, median 45 m) with moderately dense to dense subcanopy/tall shrub stratum and sparse to dense ground cover. Floristics: Eucalypt overstorey, comprising several communities but usually various mixtures of the species *Lophostemon confertus, E. microcorys* and *E. saligna. E. laevopinea* and *E. campanulata* may be present and some stands dominated by one or both of these species have this understorey type. Frequent and often abundant subcanopy/tall shrub species include *Caldcluvia paniculosa, Schizomeria ovata, Trochocarpa laurina, Quintinia verdonii, Acmena smithii* and *Elaeocarpus reticulatus. Ceratopetalum apetalum* is less frequent but may be locally abundant. The vines *Cissus hypoglauca, Palmeria scandens* and *Piptocalyx moorei* occur frequently and often form dense thickets. Common ground cover species are *Blechnum cartilagineum* and *Drymophila moorei.*

Comments: This represents the most widespread of the moister end of the wet sclerophyll forest understorey gradient in the area, being common in both logged and unlogged areas.

Appendix 2. (cont).

WINus 7.3 *Trochocarpa laurina-Elaeocarpus reticulatus*

(plots 117, 120, 501, 602; R=44)

Distribution and habitat: Fairly widespread in broadly similar habitats to WINus 7.2, but tending to occur on more exposed slopes.

Structure: Tall woodland (logged plots) to tall open forest (canopy 30-50 m, median 45 m), usually with dense subcanopy/tall shrub stratum and sparse low shrub and ground cover.

Floristics: Eucalypt overstorey as for WINus 7.2. Subcanopy/tall shrubs *Trochocarpa laurina, Elaeocarpus reticulatus, Acmena smithii* and *Schizomeria ovata. Banksia integrifolia* is often locally common at higher altitudes. The vine *Cissus hypoglauca* is frequent and sometimes abundant. Common small shrubs *Citriobatus pauciflorus* and *Psychotria loniceroides.* Common ground cover *Gymnostachys anceps* and *Lomandra longifolia.* The epiphytes *Pyrrosia confluens, Dendrobium fairfaxii* and *Sarcochilus falcatus* are often common.

Comments: This shares many species with WINus 7.2 but appears to represent a drier phase.

WINus 7.4

(plot 128; R=29)

Structure: Tall open forest (canopy 45 m) with moderately dense subcanopy/tall shrub stratum and sparse shrub and ground cover strata.

Floristics: Overstorey *E. saligna* and *Lophostemon confertus.* Subcanopy/tall shrubs *Ceratopetalum apetalum, Cryptocarya glaucescens, Trochocarpa laurina* and *Archirhodomyrtus beckleri.*

WINus 7.5 *Acacia melanoxylon-Synoum glandulosum-Lomandra longifolia*

(plots 014, 060, 148, 154, 226, 511, MLH5, MUH5; R=45)

Distribution and habitat: Fairly widespread on slopes at low to moderate altitudes (410-780 m, median 625 m).

Structure: Tall woodland (logged plots) to tall open forest (canopy height 30-50 m, median 37 m) with dense shrub stratum and sparse to moderately dense ground cover.

Floristics: Overstorey very variable, comprising a range of communities with no single species having frequency greater than 0.5. The most frequent species are *Eucalyptus saligna, Lophostemon confertus* and *E. microcorys,* but plots dominated by *E. grandis* or *E. pilularis* are included. The most frequent and abundant subcanopy/tall shrub species are *Acacia melanoxylon, Synoum glandulosum* and *Cryptocarya rigida* and the vines *Cissus hypoglauca* and *Smilax australis.* Common small shrubs *Psychotria loniceroides* and *Eupomatia laurina.* Frequent and sometimes abundant ground cover species include *Lomandra longifolia, Dianella caerulea, Gahnia melanocarpa* and *Poa sieberiana.*

Appendix 2. (cont).

WINus 7.6 *Elaeocarpus reticulatus-Poa sieberiana*

(plots 123, 403, 505, 506, 507, 508, 513, DLH6, NLH6, NUH5; R=42)

Distribution and habitat: Widespread at higher altitudes (over 900 m) but occasionally down to 700 m, mainly on sheltered slopes with south-easterly to south-westerly aspects.

Structure: Tall woodland (logged plots) or tall open forest with mostly sparse to moderately dense (occasionally very dense) tall shrub/subcanopy stratum and moderately dense ground cover.

Floristics: Overstorey mainly in the *E. campanulata* community group (WINov 12), although sometimes associated with *E. pilularis*. The most common overstorey species are *E. obliqua*, *E. campanulata* and *E. cameronii*. Tall shrubs/small trees *Elaeocarpus reticulatus*, *Persoonia media* and *Trochocarpa laurina*. Small shrubs/low vines *Oxylobium ilicifolium*, *Hibbertia scandens*, *H. dentata*, *Smilax australis* and *Leucopogon lanceolatus*. Main ground cover *Poa sieberiana*, *Lomandra longifolia*, *Dianella caerulea* and *Pteridium esculentum*.

Comments: This is the widespread drier phase wet sclerophyll type occurring at higher altitudes. It shares some characteristics with dry sclerophyll communities (group WINus 9).

WINus 7.7 *Caldcluvia paniculosa-Blechnum cartilagineum*

(plots 229, 287, 299, MLH3, MLH6; R=40)

Distribution and habitat: Fairly widespread, mainly on sheltered slopes at mid altitudes (580-810 m, median 730 m).

Structure: Tall woodland or open woodland (logged plots) or open forest (canopy 35-50 m, median 45 m), mostly with dense subcanopy or shrub stratum and sparse, or occasionally dense, ground cover.

Floristics: Overstorey mostly dominated by *E. pilularis* (WINov 11), although other species are usually present and may be occasionally dominant. *E. microcorys* and *L. confertus* are present in 4 of the 5 sample plots but are prominent in only one. Frequent and common small trees or tall shrubs include *Caldcluvia paniculosa*, *Synoum glandulosum*, *Archirhodomyrtus beckleri*, *Tristaniopsis collina*, *Cryptocarya rigida* and *Trochocarpa laurina*. The most common ground cover species are *Hibbertia dentata*, *Lomandra longifolia*, *Blechnum cartilagineum* and *Dianella caerulea*.

WINus 7.8 *Psychotria loniceroides-Rhodamnia rubescens*

(plot 365; R=35)

Structure: Open forest to 45 m with moderately dense shrub and ground cover strata.

Floristics: Overstorey *E. saligna* and *E. laevopinea*. Tall shrubs *Acacia maidenii* and *Cryptocarya microneura*. The most abundant smaller shrubs are *P. loniceroides* and *R. rubescens*. There is no clearly abundant ground cover species, which include *Lomandra longifolia*, *Adiantum formosum* and *Doodia aspera*.

Appendix 2. (cont).

WINus 7.9 *Cassinia leptocephala-Blechnum cartilagineum*

(plot 510; R=30)

Structure: Tall woodland, to 45 m, with sparse shrub stratum and moderately dense ground cover.

Floristics: Overstorey *E. saligna, E. campanulata* and *E. laevopinea.* Main shrubs *Cassinia leptocephala* and *Acacia maidenii.* The ground cover is clearly dominated by the ferns *Blechnum cartilagineum* and *Calochlaena dubia.*

WINus 7.10 *Acacia elata-Blechnum cartilagineum*

(plot 377; R=38)

Structure: Tall open woodland (40 m) with dense subcanopy/tall shrub stratum and moderately dense ground cover.

Floristics: Residual overstorey of *E. campanulata.* Subcanopy almost entirely of *Acacia elata* with occasional regenerating *E. microcorys* saplings. Common ground cover species *Blechnum cartilagineum, Calochlaena dubia, Lomandra longifolia* and *Palmeria scandens.*

Comments: This community is a result of post-logging dominance of a site by *Acacia elata.* Similar communities may occur naturally after wildfire.

WINus 8.1 *Syncarpia glomulifera-Culcita dubia*

(plot 093; R=39)

Structure: Tall woodland (to 45 m) with moderately dense subcanopy, scattered shrubs and sparse ground cover.

Floristics: Overstorey *E. pilularis, E. microcorys, E. intermedia* and *E. saligna.* Subcanopy dominated by *Syncarpia glomulifera* with *L. confertus* and *Acacia melanoxylon.* Shrubs *Synoum glandulosum, Trochocarpa laurina* and *Cryptocarya glaucescens.* Ground cover *Calochlaena dubia.*

WINus 8.2 *Acacia melanoxylon-Synoum glandulosum*

(plot MLH4; R=31)

Structure: Open forest (canopy 30 m) with dense subcanopy and tall shrub stratum and very sparse ground cover.

Floristics: Overstorey *E. saligna.* Subcanopy *Acacia melanoxylon, E. saligna* and *Callicoma serratifolia.* Shrubs *Synoum glandulosum* and *Trochocarpa laurina.*

Appendix 2. (cont).

WINus 8.3 *Acacia melanoxylon-Daviesia arborea*

(plot NLH4; R=18)

Structure: Open forest to 30 m with moderately dense tall shrub stratum and virtually non-existent ground cover.

Floristics: Overstorey *E. campanulata* and *E. saligna*. Subcanopy/shrub stratum dominated by *A. melanoxylon* and *D. arborea*, with *Allocasuarina torulosa, Lepidozamia peroffskyana* and *Psychotria loniceroides* less common.

Comments: This plot was burnt less than 12 months prior to survey.

WINus 8.4 *Allocasuarina torulosa-Trochocarpa laurina*

(plot MUL2; R=19)

Structure: Open woodland to 35 m with occasional taller emergents. Scattered small tree/tall shrub understorey and very sparse ground cover.

Floristics: Overstorey *E. microcorys, E. acmenoides, E. saligna* and *L. confertus*. Small trees/tall shrubs *Allocasuarina torulosa, Acacia irrorata, Trochocarpa laurina* and *Cryptocarya rigida*. Ground cover *Doodia aspera, Blechnum cartilagineum* and *Calochlaena dubia*.

Comments: This plot was burnt less than 12 months prior to survey.

C. Dry Sclerophyll and Grassy Forests

WINus 9.1 *Lepidozamia peroffskyana-Lomandra longifolia*

(plots 007, 043, 111, 605, DLH5, DLL1; R=41)

Distribution and habitat: Widespread in the southern one third of the Mangement Area, at low to moderate altitudes (350-700 m, median 475 m), often on north to north-easterly slopes.

Structure: Open woodland (logged plots) to open forest, to 35 m canopy height (median 28 m). Very sparse to non-existent tall shrub stratum and mostly dense low shrub/ground cover.

Floristics: Overstorey mostly dominated by *E. acmenoides* (WINov6.2) but plot 605 is *E. grandis* and plot 111 is *E. saligna*. *Allocasuarina torulosa* is common in the subcanopy. The cycad *Lepidozamia peroffskyana* is usually clearly the most abundant understorey species and is a characteristic feature of this community, but is absent from plot 111. Other frequent, but less common species include *Lomandra longifolia, Imperata cylindrica, Dianella caerulea* and *Pteridium esculentum*. *Poa sieberiana* is abundant in some plots.

Appendix 2. (cont).

WINus 9.2 *Allocasuarina torulosa-Lomandra longifolia-Imperata cylindrica*

(plots 221, DLL4; R=25)

Structure: Woodland to tall open forest (to 45 m) with sparse to moderately dense subcanopy, very sparse shrub layer and very sparse ground cover.

Floristics: Two different overstorey communities. Plot 221 is *E. pilularis* and plot DLL4 is *E. acmenoides*. Subcanopy *Allocasuarina torulosa*. Ground cover mainly *Lomandra longifolia* and *Imperata cylindrica*.

Comments: Both plots were burnt less than 12 months prior to survey.

WINus 9.3 *Allocasuarina torulosa-Lomandra longifolia-Dianella caerulea*

(plots 008, 023, 078, 086, 504, 547, 577, 600, DLH3, DLL3, DUH1, DUL1, MLL1, MUL3, MUL5, NLH3; R=39)

Distribution and habitat: A very widespread community occurring at low to mid altitudes (270-940 m but mostly below 700 m) on mid to upper slopes with a range of aspects.

Structure: Mostly woodland to tall woodland (canopy 18-50 m, median 35 m) with moderately dense subcanopy, sparse to moderately dense shrub stratum and mostly dense to very dense or closed ground cover.

Floristics: This community occurs through most of the eucalypt overstorey communities and is not clearly associated with any particular one or few. It is least often associated with communities characterized by *E. saligna*, *E. microcorys*, *L. confertus* and/or *E. laevopinea*. Subcanopy of *A. torulosa* is usually prominent. Frequent but usually not abundant shrubs *Persoonia media*, *Psychotria loniceroides* and *Synoum glandulosum*. Frequent and abundant ground cover species are *Lomandra longifolia*, *Dianella caerulea*, *Hibbertia scandens* and *Poa sieberiana*.

WINus 9.4 *Lomandra longifolia-Imperata cylindrica*

(plots 021, 094, 098, 099, 113, 133, 247, 272, 281, 376, 503, 512, DLH4, DUH4, DUH5, DUL3, DUL5, DUL6, DUL7, MUH1, NLH2, NUH1, NUH2, NUH6; R=16)

Distribution and habitat: A very widespread community occurring over a range of altitudes (250-950 m, median 650 m) and in a range of habitats, but mainly on mid to upper slopes or crests.

Structure: Open woodland (logged plots) to tall open forest (canopy height 25-50 m, median 35 m), with sparse to moderately dense subcanopy, sparse to non-existent shrub stratum and very sparse to closed (mostly dense to very dense) ground cover.

Floristics: Occurs in a very wide range of eucalypt overstorey types, but most prominent in WINov 6.2 *E. acmenoides* and especially WINov 9.2 *E. tereticornis* (5 out of the total 7 plots in this overstorey community). There is usually a subcanopy of *Allocasuarina torulosa* and less frequently, *Angophora floribunda*. The most common shrub is *Persoonia media*. Frequent and abundant ground cover species include *Lomandra longifolia*, *Poa sieberiana*, *Imperata cylindrica*, *Dianella caerulea*, *Glycine clandestina* and *Desmodium varians*. *Themeda australis* is sometimes locally abundant.

Comments: This is the single most extensive understorey community in the Mangement Area and typifies large areas of dry forest.

Appendix 2. (cont).

WINus 9.5 *Acacia binervata-Lomandra longifolia*

(plots 152, 335, 502; R=40)

Distribution and habitat: Exposed upper slopes at altitudes of 740-930 m.

Structure: Tall open forest (40 m) with moderately dense shrub and ground cover strata.

Floristics: Sampled plots were all in overstorey community WINov 12.1 *E. campanulata*. *Acacia binervata* is the characteristic and by far the most common shrub/small tree. Other, less common shrubs are *Leucopogon lanceolatus*, *Oxylobium ilicifolium*, *Persoonia media* and *P. linearis*. Common ground cover species *Lomandra longifolia*, *Poa sieberiana* and *Dianella caerulea*.

WINus 9.6 *Allocasuarina littoralis-Lomandra longifolia*

(plots 071, 290; R=16)

Structure: Open woodland to open forest (canopy 25-28 m) with sparse subcanopy, sparse shrub layer and sparse ground cover.

Floristics: Overstorey *E. tereticornis* and *E. propinqua*. A subcanopy of *Allocasuarina littoralis* and *Angophora floribunda* is characteristic. Shrubs *Acacia maidenii*, *Exocarpos cupressiformis* and *Jacksonia scoparia*. Common ground cover species *Lomandra longifolia*, *Poa sieberiana* and *Themeda australis*.

D. Shrubland

WINus 10. *Leptospermum variabile-Phebalium elatius*

(plots 053, 054; R=28)

Distribution and habitat: Quartzite outcrop on narrow ridge in Rowley's Rock Flora Reserve at 800-1000 m altitude.

Structure: A mosaic of shrub thickets or isolated shrubs, mostly below 3 m height, and bare rock, with occasional eucalypt emergents to 10 m.

Floristics: Emergent *E. campanulata*. Dominant shrubs *Leptospermum variabile* and *Phebalium elatius* with localized patches of *Acacia obtusifolia*. Other common shrubs *Prostanthera rotundifolia* and *Epacris calvertiana*. The significant species *Leucopogon* sp. nov. occurs only in this community in the Mangement Area. The lithophyte *Dendrobium kingianum* is locally abundant in suitable microsites.

Comments: This is a very restricted community which occurs over an area of several hectares on and near the summit of Rowleys Rock. A broadly similar community was noted over a small area of similar habitat on Dingo Peak in the south of the Mangement Area, and other small patches occur on rock outcrops outside the Mangement Area.

Appendix 2. (cont).

WINus 11. *Leptospermum petersonii-Themeda australis*

(plot 607; R=20)

Distribution and habitat: Small area forming a narrow band on a steep to precipitous rock outcrop immediately above a cliff.

Structure: Open shrubland and shrub thicket mosaic to 2 m tall, with rare taller emergents.

Floristics: Emergent *Allocasuarina littoralis* and *Eucalyptus globoidea*. Dominant shrubs *L. petersonii*, *Acacia ulicifolia* and *Baeckea virgata*. Ground cover *Themeda australis* and *Aristida vagans*.

WINus 12. *E. campanulata-Acacia obtusifolia-Phebalium elatius* ssp. *beckleri*

(plot 609; R=21)

Distribution and habitat: Restricted to a rocky slope immediately above a cliff on Coolpi Creek.

Structure: Low open forest (10-15 m tall) with dense shrub understorey (to 3 m) and very sparse ground cover.

Floristics: Tallest stratum dominated by *E. campanulata*. *Acacia obtusifolia* is clearly the most abundant shrub, with *P. elatius* ssp. *beckleri*, *Prostanthera ?incisa*, *Jacksonia scoparia* and *Persoonia linearis* less common. Common ground cover species *Lepidosperma urophorum*, *Lomandra glauca*, *Patersonia glabrata* and *Dendrobium kingianum*.

Comments: This community is known only from the locality sampled. It is clearly similar to WINus 11 but appears to represent a variant on a slightly less extreme site.

Appendix 3. Descriptions of Forest Type map units. Definitions and general descriptions are given by Forestry Commission of New South Wales (1989).

1, 1/3, 2/3
These are not clearly distinguishable in the field and past logging has undoubtedly had some influence on present canopy composition. Generally subtropical rainforest, although with a strong warm temperate influence at higher altitudes. Common canopy species are *Argyrodendron actinophyllum, Sloanea woollsii.*

12c
This appears to be a well-defined map unit with composition matching the definition, although *Sloanea woollsii* is prominent in all sampled stands and may be generally widespread.

23
Usually *Backhousia myrtifolia*, sometimes with eucalypt emergents.

23/26
This composite unit includes two separate communities. On steep slopes it is a closed forest of *Backhousia sciadophora*, sometimes with subtropical elements (thus fitting the broad type 23). Elsewhere it is structurally poorly developed subtropical rainforest (type 26) on marginal or heavily disturbed sites.

36, 37a, 37b Blackbutt
Mostly dominated by *E. pilularis*, as defined, although sometimes *E. acmenoides-E. punctata.* One plot was *E. campanulata.*

46 Sydney Blue Gum (*E. saligna*)
A very variable map unit. Although *E. saligna* occurs in most plots, it is not consistently dominant.

47a, 47b, 47c Tallowwood (*E. microcorys*)-Sydney Blue Gum
Includes various mixtures of *E. microcorys, E. saligna* and *Lophostemon confertus. E. saligna* is often locally dominant. One sample plot was community WINov 11, *E. pilularis.*

48 Flooded Gum (*E. grandis*)
A well defined unit of limited extent at low altitudes which clearly matches its defined composition.

53 Brush Box (*Lophostemon confertus*)
Although usually including *L. confertus*, sampled stands varied in composition, being broadly similar to type 47, with other species often dominant.

60 Narrowleaved White Mahogany (*E. acmenoides*)
A fairly well defined unit in which most stands are dominated by *E. acmenoides.*

62a, 62b Grey Gum-Grey Ironbark-White Mahogany
Most areas of this map unit were community 6.2, *E. acmenoides* and thus not distinguishable from unit 60. Other communities included in this unit are 9.1 *E. propinqua*, 9.2 *E. tereticornis* and 10 *E. resinifera.*

64a
Sampled areas were mostly dominated by *E. propinqua.*

64b
Includes areas of *E. tereticornis* and some areas of *E. propinqua.* In most cases probably not distinct from map unit 65.

Appendix 3. (cont).

65 Forest Red Gum-Grey Gum-Roughbarked Apple

A fairly well-defined unit in which *E. tereticornis* is usually dominant.

96 Undefined

This appears to be a minor typographical error. The one patch mapped as this unit was a well defined stand of *Backhousia sciadophora.*

122a, 122b New England Stringybark (*E. cameronii*)

E. campanulata and *E. cameronii* were codominant in most sampled stands, and this unit is probably not distinguishable from 163.

152a Messmate (*E. obliqua*)-Gum

The two sampled stands were dominated by *E. obliqua*, as defined.

152b Messmate (*E. obliqua*)-Gum

E. obliqua co-dominant with *E. campanulata* and/or *E. cameronii.* This represents a variant of typical 152, on drier or less fertile sites, where gum species are absent.

163a, 163b New England Blackbutt (*E. campanulata*)

This extensive type mostly accurately matches its defined composition, with *E. campanulata* usually clearly dominant, although sometimes co-dominant with *E. laevopinea.* Occasional stands at lower altitudes have only a minor component of *E. campanulata* and were classified with *E. acmenoides.*

168 Silvertop Stringybark (*E. laevopinea*)-Gum

A variable unit which includes a range of communities. Typically, it includes *E. laevopinea* and *E. saligna* in various proportions, although either may be locally dominant. On drier sites at high altitudes *E. campanulata* becomes more prominent and this unit grades into 163. At the other extreme on moister and/or more fertile sites, *E. microcorys* or *Lophostemon confertus* are more common and there is a gradation to types 47 or 53. *E. laevopinea* may be absent in either of these situations.

234 Rock

Although defined as largely unvegetated, areas mapped as this type include a range from dense shrub communities to a mosaic of bare rock and shrub thickets to an extreme, on cliffs and near vertical rock outcrops, of bare rock with isolated herbs or shrubs. Extensive areas mapped as this unit in Bobin Creek gorge support low closed forest or closed shrubland of *Backhousia sciadophora* and/or *B. myrtifolia.*

DORRIGO MANAGEMENT AREA

Plant List

Key to Codes

Origin

* Introduced species

Herbarium Coffs Harbour

H Present in Coffs Harbour herbarium

Habitat

RF	Rainforest
STF	Subtropical Rainforest
WTRF	Warm Temperate Rainforest
CTRF	Cool Temperate Rainforest
DRF	Dry Rainforest
WSF	Wet Sclerophyll Forest
DSF	Dry Sclerophyll Forest
HTH	Heath
RCK	Rock
RIV	Riverine
CLT	Cultivated

Occurrence

State Forest

111	Clouds Creek
318	Marengo
488	Wild Cattle Creek
489	Moonpar
490	Bielsdown
659	Hyland
831	Ellis
849	Killungoondie (now mostly Dorrigo National Park)
996	Chaelundi

Other

NP	National park	
PP	Private Property	
	DA	Dangar Falls
	DE	Deervale
	DO	Dorrigo
	E	Ebor-Tyringham
	ED	East Dorrigo
	H	Hernani
	L	Little Murray River
	MO	Moonpar

DORRIGO MANAGEMENT AREA

Conservation Status

As listed by Leigh *et al* in "Rare or Threatened Australian Plants," Australian National Parks and Wildlife, Special Publication 7, 1981 are shown according to the code used in that publication

1	Species known only from type collection. Taxonomic status and present distribution may be uncertain
2	Very restricted distribution (less than 100 km)
3	Range over 100 km but occurs only in small populations, mainly restricted to highly specific habitat
V	Not presently endangered but at risk over a longer period
R	Rare, but not considered currently endangered or vulnerable
K	Poorly known species, limited knowledge of distribution
C	Known to be represented within a National Park or other Proclaimed Reserve
+	Distribution extends outside Australia

State Forest Reservation

BR	Blicks River Flora Reserve
BB	Black Bull Flora Reserve
DWG	Dorrigo White Gum Forest preserve
EP	Edwards Plain Flora Reserve
M	Mobong Creek Flora Reserve
MC	Middle Creek Forest Preserve
MR	Moses Rock Flora Reserve
NJ	Norman Jolly Memorial Grove (F.R.)
RC	Red Cedar Flora Reserve
TT	Teak Tree Flora Reserve

National Park Reservation

D	Dorrigo N.P.
G	Guy Fawkes River N.P.
MH	Mt. Hyland Nature Reserve
N	New England N.P.
PP	Private Property

Source of Data

The primary source of information for this plant list is the Commission's Coffs Harbour herbarium, supplemented by field observations by local officers, and recordings from National Parks in the environs of the Area.

Dorrigo Management Area

A. FERNS		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK
ADIANTACEAE									
Adiantum aethiopicum	Common Maidenhair Fern		RF	Herb	996,488			MR	G,D
A. formosum	Giant Maidenhair Fern		RF/WSF	Herb	996,831, 318,488			MC,RC	G,MH,D
A. hispidulum	Rough Maidenhair Fern	H	RF/WSF	Herb	659,996, 318			BR,MC	
A. silvaticum	Maidenhair Fern	H	RF/WSF	Herb	996,488			BB	
ASPIDIACEAE									
Arachnoides aristata	Shield Fern		RF	Herb	318			MC	
Lastreopsis acuminata (shepherdii)	Shiny Shield Fern	H	RF	Herb	318,996, 488			RC	MH,D
L. decomposita	Trim Shield Fern	H	RF	Herb	488,996, 318,489			MC	MH,D
L. microsora	Creeping Shield Fern		RF	Herb	831,996				MH
L. munita	Naked Shield Fern				996				
Polystichum formosum	Broad Shield Fern		RF	Herb		NP			G
P. proliferum	Mother Shield Fern								G,MH
ASPLENIACEAE									
Asplenium attenuatum	Simple Spleenwort		RF	Litho-phyte	996				D
A. australasicum (nidus)	Birds-nest Fern		RF/WSF	Epi-phyte	Common			BB,BR, MC,NJ, RC	G,MH,D
A. bulbiferum	Mother Spleenwort	H	RF	Herb	318			MC	
A. flabellifolium	Necklace Fern	H	RF	Litho-phyte	996				G,D
A. flaccidum		H	RF		318,659			MC	MH,GD
A. polyodon	Sickle Spleenwort			Epi-phyte	996,318			MC	G,MH
ATHYRIACEAE									
Athyrium australe	Austral Lady Fern	H	RF	Herb	318,996			MC	MH,D
A. dilatatum (Diplazium maximum)	Giant Lady Fern	H	RF	Herb	488			EP	D
BLECHNACEAE									
Blechnum cartilagineum	Gristle Fern	H	WSF	Herb	489,111, 996,488 318,849			BB,BR, MV	D
B. minus	Soft Water Fern				659			BR	
B. nudum	Fishbone Water Fern	H	RF,WSF	Herb	659,488			BB,BR	G,D
B. patersonii	Strap Water Fern	H	RF	Herb	488,318, 966			BB,MC	MH,D
B. wattsii (procerum)	Hard Water Fern	H	WTRF	Herb	318,488			BB,BR	MH,G,D
Doodia aspera	Rasp Fern	H	RF/WSF	Herb	488,831, 996,659, 318			BR,MC	D
D. caudata var. laminosa	Small Rasp Fern		RF	Herb	996				
D. caudata var. media	Small Rasp Fern	H	RF	Herb		NP			D
CYATHEACEAE									
Cyathea australis	Rough Tree Fern	H	RF,WSF	Shrub	488,996, 659,318, 849,996 318,489			BB,BR, EP	MH,C,D, MC,RC

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
CYATHEACEAE (cont.)									
Cyathea cooperi	Straw Tree Fern	H	RF/WSF	Shrub	996,318, 489			MC	
C. leichhardtiana	Prickly Tree Fern	H	RF/WSF	Shrub	488,318, 996,489			BB,MC, NJ	MH,D
DAVALLIACAE									
Davallia pyxidata	Hare's-foot Fern	H	RF	Epi-phyte	996,318, 488			BB,BR, MC,RC	D
DENNSTAEDTIACEAE									
Histiopteris incisa	Bats' wing Fern		RF	Herb	318			MC	G,MH,D
Hypolepis muelleri	Harsh Ground Fern	H		Herb	996,318			MC	
H. punctata	Downy Ground Fern	H		Herb	488				
H. rugulosa	Ruddy Ground Fern			Herb	488			BB	
Pteridium esculentum	Bracken Fern		WSF/DSF	Herb	659,96, 318,849			BR,MC	D
DICKSONIACEAE									
Culcita dubia	False Bracken	H	RF/WSF	Herb	996,488, 659			BB,BR, EP	D
Dicksonia antarctica	Soft Tree Fern		WSF/DSF	Shrub	996,318, 849,489			BR,MC, NJ	MH,G,D
GLEICHENIACEAE									
Gleichenia microphylla	Scrambling Coral Fern				996				
Stricherus flabellatus	Shiny Fan Fern	H	RF,WSF	Herb	488			BB	D
S. lobatus	Spreading Fan Fern	H	RF,WSF	Herb	996,318			MC	MH,G
GRAMMITIDACEAE									
Grammitis billardieris	Finger Fern		RF	Epi-, Litho-phyte		NP			G,D,
Grammitis meridioralis		H				NP			D
HYMENOPHYLLACEAE									
Macroglena caudata	Jungle Bristle Fern	H	RF	Epi-phyte		NP			D
Macroglena cupressiforme	Common Filmy Fern	H	CTRF	Epi-phyte		NP			D
Hymenophyllum flabellatum	Shiny Filmy Fern					NP			G
Polyphlebium venosum	Veined Bristle Fern		RF	Epi-phyte		NP			MH
LYCOPODIACEAE									
Lycopodium cernuum	Small-cone Mountain Moss				849				D
L. deuterodensum	Mountain Moss		WSF/DSF	Herb	996				N,D
MARSILEACEAE									
Marsilia varium		H				NP			G
NEPEROLEPIDACEAE									
Arthropteris beckleri	Hairy Climbing Fish-bone Fern	H	RF	Epi-phyte	318,996			MC	MH,D
A. tenella	Climbing Fish-bone Fern	H	RF	Epi-phyte	996,318			MC	MH,D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
INDACEAE									
ea barbara	King Fern		DSF	Shrub	849,659			BR	MH,G,D
YPODIACEAE									
ymia brownii	Strap Fern	H	RF	Epi-phyte	996,318, 488			BB,MC, RC	G,MH,D
rosorium diversifolium	Kangaroo Fern		RF	Epi-phyte	318			MC	G,MH
scandens	Fragrant Fern	H	RF	Epi-phyte	318,488			MC,RC	MH,G,D
tycerium bifurcatum	Elk Horn Fern		RF,WSF	Epi-phyte	996,318, 488,489			BB,MC,MR, NJ,RC	G,D
superbum (grande)	Stag Horn Fern		RF,WSF	Epi-phyte	996,318		3VC		D
rosia confluens	Horse-shoe Felt Fern		RF,WSF	Epi-phyte	488,318, 659			BR,MC, RC	G,MH,D
rupestris	Rock Felt Fern		RF,WSF	Epi-Litho-phyte	996,318, 488			BB,MC	MH,G,D
LOTACEAE									
lotum nudum	Skeleton Fork Fern		RCK	Herb	996				
RIDACEAE									
ridium - See Dennstaedиaceae									
ris comans	Hairy Bracken	H			318				
ris tremula	Tender Bracken		RF	Herb	996,318			MC	D
ris umbrosa	Jungle Bracken	H	RF	Herb	318,489, 831,996			MC,RC	MH,D
IOPTERIDACEAE									
ilanthes tenuifolia	Rock Fern								
laea falcata var. falcata	Sickle Fern		RF/WSF/ DSF	Herb	996,318, 488			EP,MC	G,MH
laea falcata var. nana	Small Sickle Fern	H	RF	Herb	996				G,MH,D
laea paradoxa		H	RF	Herb	996				G,D
LYPTERIDACEAE									
istella dentata (Cyclosorus nymphalia)	Binung		RF	Herb	996				
TARIACEAE									
taria elongata	Ribbon Fern	H	RF	Epi-phyte	849				D
GYMNOSPERMS									
UCARIACEAE									
ucaria cunninghamii	Hoop Pine		DRF, WTRF, WSF	Tree	488,996, 489			NJ,RC, TT	D
PRESSACEAE									
llitris endlicheri	Black Cypress Pine			Tree	489			DWG	G
macleayana	Brush Cypress Pine		RF,WSF	Tree	488,489			NJ	D
oblonga	Tasmanian Cypress Pine			Tree	318		3RC		
rhomboidea	Port Jackson Cypress Pine		DSF	Tree	996,849				D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
PODOCARPACEAE									
Podocarpus elatus	Brown Pine			Tree					
ZAMIACEAE									
Lepidozamia peroffskyana	Sessile Burrawang		RF,WSF	Shrub					D
Macrozamia moorei	Pineapple Palm	H	DSF,WSF	Shrub	996	NP			
C. MONOCOTYLEDONS - excluding vines									
AGAVACEAE									
Cordyline stricta	Erect Palm Lily	H	RF,WSF	Shrub	488,996			BB,EP, MR	MH,G,D, N
C. fruiticosa	Broad Palm Lily	H	RF	Shrub	996,489, 488			BB,NJ, RC,TT	MH
ARACEAE									
Alocasia macrorrhizos	Cunjevoi		RF	Herb	488,996			EP,RC	D
Gymnostachys anceps	Settler's Flax		RF,WSF	Herb	996,318			BB,MC, RC	MH,D
ARECACEAE									
Archontopheonix cunninghamiana	Bangalow Palm		RF	Tree	448,489			NJ	D
Linospadix monostachya	Walking Stick Palm	H	RF	Shrub	318,488, 996,489			MC,NJ, RC	MH,D,N
COMMELINACEAE									
Aneilema acuminatum	Slug Herb		WSF,DRF, RF	Herb	996				D
A. biflorum	Twin-flowered Wandering Jew		WSF,DRF RF	Herb	996				D
Commelina cyanea	Blue Wandering Jew		RF,WSF	Herb	996,489			DWG	D
Pollia crispata	Pollia		RF	Herb	996,318				D
CYPERACEAE									
Carex appressa	Tall Sedge		RF	Herb	996,659			BR	D,G
C. gaudichaudiana	Tufted Sedge		RF	Herb	659			BR	D,N
C. lobolepis	Sedge					NP			N
C. neurochlamys	-	H			488				
Cyperus brevifolius					849				D,N
C. disjunctus	Jungle Flat Sedge	H	RF	Herb	659				MH,D,N
C. filipes	Slender Flat Sedge	H	RF	Herb	488				D
C. lucidus	Leafy Flat Sedge	H			659			BR	
C. tetraphyllus	Flour-leaved Flat Sedge				996				
Exocarya scleroides	-	H							
Gahnia aspera	Short Saw Sedge		WSF,HTH	Herb		NP			D
G. melanocarpa	Black-bruit Saw Sedge	H			996				
G. sieberana	Red-fruit Saw Sedge	H			996,488, 318,489			MC	N,G
G. sp.	-				659			BR	
Isolepis sp.	-		WSF,DSF	Herb		NP		D	
Lepidosperma elatius	Tall Sword Sedge		WSF	Herb	488,318			MR	D
L. urophorum	-				996				

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT.
CYPERACEAE (cont.)									
Schoenus maschalinus	Leafy Bog Rush	H			488				
S. melanostachys	Black Bog Rush					NP			N
IRIDACEAE									
Libertia paniculata	Branching Grass Flag				318				
Patersonia fragilis	Short Purple Flag		WSF,DSF	Herb	849,488	NP		MR	D,N
JUNCACEAE									
Juncus dichotomus	-					NP			G
J. pauciflorus			DSF		659			BR	
J. prismatocarpus	Branching Rush	H							
J. usitatus	Common Rush								
J. vaginatus	-					NP			G
LILIACEAE									
Corynotheca lateriflora						NP			G
Dianella caerulea	Rough Flax Lily	H	WSF,DSF, Rock	Herb	996,488, 318,489	NP		NJ	MH,D
D. laevis	Smooth Flax Lily	H	RF	Herb	849				D
Drymophila moorei	Orange-berry Drymophila		RF,WSF	Herb	488,318, 489			BB,NJ	G,MH, D,N
Kreysigia multiflora	Kreysigia	H	RF,WSF	Herb	996,488q			RC	D
ORCHIDACEAE									
Acianthus exsertus	Mosquito Orchid				996				
Bulbophyllum aurantiacum	Summer Bulbophyllum		RF	Epi-phyte	488				D
B. crassulifolium	Stonecrop Orchid		RF	Epi-phyte	318,488			MC	D
B. elisae	Mountain Bulb Orchid	H	RF	Epi-phyte	488,996			RC	G,D
B. exiguum	Autumn Bulbophyllum	H	RF	Epi-phyte	488				G,D
B. weinthalii	Hoop Pine Orchid		RF	Epi-phyte	488				C
Caladenia carnea	Pink Fingers	H			659,996			BR	
Calanthe triplicata	Christmas Orchid		RF,WSF	Herb	659,488				C,D
Chiloglottis reflexa	Autumn Bird Orchid				996				
Corybas aconitiflorus	Spurred Helmet Orchid		WSF	Herb	996				
Cymbidium canaliculatum	Arrowroot Orchid				996				
C. madidum	Banded Cymbidium				488			RC	
C. suave	Snake Orchid		RF,WSF, DSF	Epi-phyte	488			BB	G,D
Dendrobium aemulum	Box Orchid		RF,WSF, DSF	Epi-phyte	488,996			BB	D
D. beckleri	Pencil Orchid		RF	Epi-phyte	996,488			RC	D
D. falcorostrum	Beech Orchid				849		3RC		D,N
D. gracilicaule	Spotted Orchid		RF	Epi-phyte	996,488				D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. P
ORCHIDACEAE (cont.)									
Dendrobium kingianum	Pink Rock Orchid		WSF,DSF, RF	Litho-phyte	488,996			RC	D
D. linguiforme	Thumb-nail Orchid		WSF,DFS, RF	Epi-Litho-phyte	996,488				C,D
D. pugioniforme	Dagger Orchid	H	RF	Litho-phyte	659,318, 488,996			BR,MC, RC	G,MH,D
D. speciosum var. speciosum	Rock Lily		WSF,DSF, RF	Epi-phyte	996,318, 488			MC,RC	G,MH,D
D. speciosum var. hilli	Slender Rock Lily		WSF,DSF, RF	Epi-phyte	996,488				D
D. tenuissimum	Slender Pencil Orchid		RF	Epi-phyte	488,996		3RC		D
D. teretifolium	Bridal Veil Orchid		RF	Epi-phyte	996,318, 659,488			BR,MC	MH,D
D. tetragonum	Tree Spider Orchid	H	RF	Epi-phyte	4891			BB,RC	D
Dipodium punctatum	Hyacinth Orchid		WSF/WSF	Sapr. (Herb)	488,996			MR	D,N
Diuris abbreviata	Short-tailed Doubletails		WSF	Herb		NP			N
Liparis coelogynoides	Fairy Tree Orchid		RF	Epi-phyte	488,996				D
L. reflexa	Yellow Rock Orchid		RF	Litho-phyte	488				D
Plectorrhiza tridentata	Tangle Orchid		RF	Epi-phyte	996,488			BB,RC	D
Prasophyllum brevilabre	Short-lip leep Orchid					NP, PP-H			N
Pterostylis curta	Blunt Greenhood					PP-DO			
P. grandiflora	Greenhood	H	WSF/DSF	Herb	659				
P. longifolia	Tall Greenhood				996				
P. obtusa	Blunt-tongue Greenhood	H				NP			N
Rhinerrhiza divitiflora	Raspy-root Orchid		RF	Epi-phyte	996,488				D
Sarcochilus ceciliae	Fairy Bells		WSF,DSF	Litho-phyte	996				G,D
S. falcatus	Orange Blossom Orchid	H	RF,WSF	Epi-phyte	659,318, 488,996			BB,RCQ	MH,D,N
S. hillii	Pink Tangle Orchid	H	RF		488				D
S. olivaceus	Lawyer Orchid	H	RF		996,488				D
Spiranthes sinensis	Austral Ladies Tresses		WSF/DSF	Herb	849,996				D,N
POACEAE									
* Axonopus affinis	Narrow-leaf Carpet Grass		DSF	Herb	996				D
* A. compressus	Broad-leaf Carpet Grass		DSF/CLT	Herb	489			DWG	
Capillipedium parviflorum	Small-flowered Scented-top Grass				849				D
Danthonia longifolia	Long-leaf Wallaby Grass	H							
Dichelachne micrantha (sciurea)	Short-haired Plume Grass				849				D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
POACEAE (cont.)									
Entolasia stricta	Wiry Panic Grass		DSF,WSF	Herb	659,111 488,996			BR	N
Imperata cylindrica var. major	Blady Grass		DSF,WSF	Herb	831,849, 111,996, 318,489,			BB,BR, DWG	D
Oplismenus imbecillis	Creeping Beard Grass		RF,WSF	Herb	996				D
* Paspalum dilatatum	Paspalum		CLT	Herb	849,489				D
P. alopecuroides	Swamp Foxtail				659				
* Pennisetum clandestinum	Kikuyi Grass	H	CLT	Herb	489			DWG	D
* Poa sp.	-		DSF	Herb	659,318			BRMC	
Stipa ramosissima	Bamboo Spear Grass			Herb	996,489			RC,DWG	
Themeda australis	Kangaroo Grass		DSF,WSF	Herb	111,996 849,659, 489			BR,DWG	D
RESTIONACEAE									
Restio australis					488			MR	
XANTHORRHOEACEAE									
Lomandra elongata	Round Mat Rush								G
L. longifolia ssp. longifolia	Spiny-headed Mat Rush		WSF/DSF	Herb	996,659, 488	NP		BB,BR, EP	D,N
L. multiflora	Many-flowered Mat Rush				488				
L. spicata	Jungle Mat Rush	H	RF	Herb	318,996				MH,G,D, N
Xanthorrhoea australis ssp.	Giant Grass Tree		WSF/DSF	Shrub	318			MC	D
ZINGIBERACEAE									
Alpinia caerulea	Wild Ginger		RF/WSF/ DSF	Herb	488,996				D
D. MONOCOTYLEDON VINES									
ARACEAE									
Pothos longipes	Pothos		RF	Vine	318			MC	D
ARECACEAE									
Calamus muelleri	Lawyer Cane		RF	Vine	488,489			M,NJ	D
DIOSCOREACEAE									
Dioscorea transversa	Yam		RF	Vine	996,488			BB	D
LILIACEAE									
* Asparagus setaceus	Asparagus Fern								
PETERMANNIACEAE									
Petermannia cirrosa	Tendril Yam	H	RF,WSF	Vine	488,318, 489			BB,NJ	D,MH,N
PHILESIACEAE									
Eustrephus latifolius	Orange Vine	H	WSF/DSF	Vine	996,659, 488,111			BB,BR, MR	G,D,N
Geitonoplesium cymosum	Scrambling Lily	H	RF,WSF	Vine	488,996, 318,489			MC,MR, NJ	D
SMILACACEAE									
Ripogonum album	White Supple-jack		RF	Vine	996				G,D

Dorrigo Management Area

					OCCURRENCE			CONSERVATION	
		H	HABITAT	HABIT	S.F.	OTHER	STATUS	S.F. RES.	NAT. PK.
SMILACACEAE (cont.)									
Ripogonum discolor	Two-tone Supple-jack	H	RF	Vine	318,488, 996,489			BB,MC, M,NJ, RC,TT	MH,G,D
R. elseyanum		H	RF/WSF	Vine		NP			D
R. fawcettianum	Small Heart-leaved Supple-jack	H	RF,WSF	Vine	996				D
Smilax australis	Prickly Supple-jack		RF,WSF	Vine	996,659, 489,488, 318			BB,BR, NJ,RC	D,N
S. glyciphylla	Sarsaparilla	H	RF,WSF	Vine	488,849, 489			BB,M, MR,NJ	D
E. DICOTYLEDONS - excluding vines									
ACANTHACEAE									
Hypoestes floribunda	-								
Pseuderanthemum variabile	Pastel Flower		RF,WSF	Herb	996				D
Rostellularia pogonanthera	-	H	DSF		488				G
AKANIACEAE									
Akania lucens	Turnipwood	H	RF	Shrub/ Tree	318,488, 996,489			MC,M, NJ,RC TT	MH,D
ALANGIACEAE									
Alangium villosum	Brown Muskheart		RF	Tree	996,318			MC	MH,D
AMARANTHACEAE									
Deeringia amaranthoides	Deeringia	H	RF	Herb	996				G,D
Nyssanthes diffusa	Barb-wire Weed				111,996, 488			EP	G
ANACARDIACEAE									
Euroschinus falcata	Pink Poplar		RF	Tree	996,488			MR,TT	
Rhodosphaera rhodanthema	Deep Yellow-wood					NP			G
APIACEAE									
Gingidia montana	Angelica					PP-E	2RC+		
Hydrocotyle sp. A (aff. tripartita)	Broad-leaf Pennywort				996				
H. pedicellosa	Scrub Pennywort		RF	Herb	488,318				MH,D
H. tripartita	Slender Pennywort		RF,WSF	Herb	996				D
Platysace lanceolata	Shrubby Platysace	H	DSF	Shrub		NP			G
Trachymene incisa	Native Candytuft		WSF,DSF	Herb	996				
Xanthosia pilosa	Woolly Xanthosia	H		Shrub		NP			G
APOCYNACEAE									
Alyxia ruscifolia	Broom Box	H	RF	Shrub	318,996, 488			RC	G,MH,D, N
Ervatamia angustisepala	Banana Bush		RF	Shrub	996,488			M	D
ARALIACEAE									
Astrotricha floccosa	Sneeze Bush				488				
Astrotricha longifolia	Long-leaved Sneeze Bush		WSF	Shrub	659			BR	D,N

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.P.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
RALIACEAE (cont.)									
olyscias elegans	Silver Basswood		RF	Tree	996,488, 318,489			EP,MC,M, NJ,RC,TT	G,MH,D
. murrayi	White Basswood		RF	Tree	996,318, 488,489			MC,M,NJ, RC	D
. sambucifolia	Ornamental Ash		RF,WSF	Shrub/ Tree	996,488, 849,489			BB,BR, MR,NJ	MH,D,N
STERACEAE									
Ageratina riparia	Small Crofton Weed			Herb	996				
idens pilosa	Pitch Forks		WSF,DSF	Herb	996				D
assinia compacta	Crowded Cassinia	H	WSF	Shrub	659			BR	
. quinquefaria	Wild Rosemary				659			BR	
. trinerva	Three-veined Cassinia	H	RF,WSF	Shrub		NP			D,MH,N
Cirsium vulgare (lanceolatum)	Spear Thistle			Herb	659			BR	
onyza canadensis	Canadian Fleabane								
Helichrysum apiculatum	Yellow Buttons	H	WSF	Herb	659			BR	
H. bidwillii	Bidwill's Everlasting				996				G
H. bracteatum	Golden Everlasting	H	WSF	Herb	996,849				D
H. diosmifolium	Sago Bush		RF,WSF	Shrub	996,488, 489			BB,BR,EP, MR,NJ	D,N
H. elatum	White Paper Daisy	H	RF,WSF	Herb	659,318			BR,MC	MH,D,N
H. rufescens	White Everlasting		RF	Shrub		PP-DE			D
H. rutidolepis	Pale Everlasting				849				D,N
H. scorpioides	Curling Everlasting	H				NP			N
H. semipapposum	Clustered Everlasting	H			849				D
Helipterum anthemoides	Camomile Sun-ray	H			659			BR	N
Olearia canescens	Grey Daisy-bush					PP-L			N
O. cydoniifolia	Quince-leaf Daisy-bush					NP			N,G
O. spp.					488,659				
* Onopordium acanthium	Scotch Thistle				996,489			DWG	
* Picris hieracioides	Hawk Weed	H							
Podolepis jaceoides	Showy Podolepis	H			831				
Senecio bipinnatisectus	Common Fire Weed					PP-DE			
S. lautus ssp. lanceolatus	Variable Groundsel					PP-L			
S. minimus var. minimus					831				
S. vagus ssp. eglandulosus	Saw Groundsel				489			DWG	G,N
Sigesbeckia orientalis	Indian Weed				659			BR	
*Tagetes minuta	Stinking Roger				996				
* Taraxacum officinale	Dandelion				996				
ATHEROSPERMATACEAE									
Daphnandra micrantha (apetala)	Socketwood		RF	Tree	996,659, 488,318			MC,RC, TT,EP	MH,G,D, N
D. tenuipes	Red-flowered Socketwood	H			318			MC	

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. P
ATHEROSPERMATACEAE (cont.)									
Doryphora sassafras	Sassafras	H	RF	Tree	996,659, 849 318,			BB,BR, MC	MH,G,D
D. sassafras var. microphyla	-					PP-L			
BORAGINACEAE									
Cynoglossum australe	Austral Hound's Tongue					NP		G	N,G
C. latifolium	Forest Hound's Tongue		RF	Herb	996				D,N
Ehretia acuminata	Silky Ash,		RF	Tree	488,996, 318,489			EP,MC, NJ,TT	G
BRASSICACEAE									
Cardamine sp. x	Native Cress				996				N
CANNABIACEAE									
* Cannabis sativa	Indian hemp, Marihuana		CLT	Sm Shrub					
CAPPARIDACEAE									
Capparis arborea	Native Pomegranate		RF	Tree	996,318, 488			TT	G,D
CAPRIFOLIACEAE									
Sambucus australasica	Yellow Elderberry	H	RF	Shrub	318,488			EP,RC	D
CASUARINACEAE									
Allocasuarina littoralis (suberosa)	Black She-oak	H	DSF	Tree	996,659, 488,849			BR	D
A. rigida	Mountain She-oak	H	DSF	Tree		NP			N
A. torulosa	Forest Oak		DSF,WSF	Tree	111,318, 831,996 488,659, 489h			BB,BR, NJ,EP, MC,MR	D
Casuarina cunninghamiana	River Oak		Riverine	Tree	488,489, 996				D
CELASTRACEAE									
Denhamia pittosporoides	Orange Boxwood		RF	Tree	488,996, 489,318, 849			BB,MC, M,NJ, RC,TT	MH,D
D. sp. (nov.)		H	WTRF	Shrub	659				MH
Elaeodendron australe var angustifolium	Red Olive Berry		RF	Tree	488,996			EP,RC, TT	G
Maytenus bilocularis	Orangebark				996,488			TT	
M. sp. nov.					849				D
M. silvestris	Narrow-leaved Orangebark		RF/WSF	Shrub	659			BR	G,MH,N
M. silvestis x bilocularis	-	H			489				
CHENOPODIACEAE									
Rhagodia nutans	Nodding Saltbush			Herb	996.				
Spartothamnella juncea	Slender Broom	H	DRF	Shrub		NP			G
CONVOLVULACEAE									
Dichondra repens	Kidney Weed				996				N

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
CUNONIACEAE									
Caldcluvia paniculosa	Corkwood	H	RF/WSF	Tree	Common			BB,MC,M, NJ,RC	MH,D,N
C. mollis	Hairy Corkwood	H	RF	Tree		PP-DE			D
Callicoma serratifolia	Callicoma		RF	Tree/ Shrub	488,489, 318,849			BB,MC,M, NJ,DWG	MH,G,D, N
Ceratopetalum apetalum	Coachwood	H	WTRF	Tree	Common			BB,MC, M,NJ	MH,G,D, N
Geissois benthamiana	Red Carabeen	H	WT&STRF	Tree	996,488, 318			BB,MC,M NJ	MH,D
Schizomeria ovata	Crab Apple	H	WTRF/WSF	Tree	996,488, 849,489, 318			BB,EP,MC, TT,M,NJ, RC	MH,G,D, N
Vesselowskya rubifolia	Mararie	H	CTRF	Tree	318			MC	MH,N
DILLENIACEAE									
Hibbertia aspera	Trailing Guinea-flower	H			318				
H. obtusifolia	Blunt-leaved Guinea-flower	H	WSF/DSF	Shrub	488				
H. riparia	Erect Guinea-flower	H	DSF	Shrub		NP			G
EBENACEAE									
Diospyros australis	Yellow Persimmon	H	RF	Shrub/ Tree	996,318, 488,489			MC,TT, DWG	G,MH,D
D. pentamera	Grey Persimmon		RF	Tree	488,996 318,489			MC,M,NJ, RC,TT	G,D
ELAEOCARPACEAE									
Aristotelia australasica	Wine Berry	H	WS,RF	Shrub	489,996, 831,318, 613,659			MC	D,N,MH, G
Elaeocarpus grandis	Silver Quandong		RF	Tree		NP			D
Elaeocarpus holopetalus	Mountain Quandong		CTRF	Sm. Tree	318				N,G,MH
E. kirtonii	White Quandong	H	RF	Tree	488,318				D
E. obovatus	Blueberry Ash		RF	Tree	488,996, 489			TT,DWG	G
E. reticulatus	Lily-of-the-Valley Tree		WSF	Tree/ Shrub	996,488, 849			BB,M, MR,NJ	D
Sloanea australis	Maiden's Blush		RF	Tree	488			M	D
S. woollsii	Yellow Carabeen	H	STRF	Tree	488,318, 996,489			MC,M, NJ	D,MH
EPACRIDACEAE									
Acrotriche aggregata	Red Cluster Heath	H	RF,WSF, DSF,HTH	Shrub	488,318, 849				MH,G, D,N
Brachyloma daphnoides	Daphne Heath	H			318				
Epacris longiflora	Fuchsia Heath	H	DSF,HTH	Shrub		NP PP-L			D,N
E. microphylla	Coral heath	H	River-ine, HTH	Shrub	488				N
E. pulchella	Heart-leaved Heath	H	DSF	Shrub	488				N
Leucopogon attenuatus	Grey Beard Heath	H			488				

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.P.	OCCURRENCE OTHER	STATUS	CONSERVATION S.P. RES.	CONSERVATION NAT. PK.
EPACRIDACEAE (cont.									
Leucopogon lanceolatus	Lance Beard Heath	H	WSF/ DSF	Shrub	111,849, 489,488, 659,996			DWG,BB, BR,MC, MR,NJ	N,D,N
Leucopogon neo-anglicus	New England Beard Heath	H		Shrub	996,318				N
L. sp. B	-	H							N
Lissanthe strigosa	Peach Heath	H				PP-DA			
Monotoca elliptica	Tree Broom Heath				849				D
M. scoparia	Prickly Broom Heath	H			488			MR	TR72978, N
Trochocarpa laurina	Tree Heath	H	RF/WSF	Shrub/ Tree	489,318, 996,488, 849			BB,EP, MC,M,MR, MR,NJ	G,MH,D
T. sp. nov. aff. laurina	Mountain Tree Heath	H			659,318				MH,N
ESCALLONIACEAE									
Anopterus macleayanus	Tasmanian Laurel		WSF/ DSF	Shrub	488,489			BB,NJ	MH,D,N
Cuttsia viburnea	Elderberry	H	RF	Tree/ Shrub	488,489			BB	D,N
Polyosma cunninghamii	Featherwood	H	RF	Tree	488,318, 996,489			MC,M, NJ	MH,D,N
Quintinia sieberi	Brown Possum Wood	H	RF	Tree	318,488, 489			MC	D,MH,G, N
Q. verdonii	Grey Possum Wood		RF	Tree	489,488, 849,318			BB,MC, M,NJ	MH,D,N
EUPHORBIACEAE									
Adriana glabrata	-	H	DRF	Shrub	996				G
Amperea xiphoclada	Broom Spurge	H	HTH	Herb	488			MR	
Austrobuxus swainii	Pink Cherry	H	WTRF	Tree	488,489		3RC	BB,NJ	D
Baloghia lucida	Scrub Bloodwood		RF	Tree	488,318, 996			TT	G,MH,D
Beyeria viscosa	Pinkwood				996,488			EP	G
Breynia oblongifolia	Dwarf's Apples		WSF, DSF	Shrub	996,488, 489			BB,MR,NJ, TT,DWG	G,D
Bridelia exaltata	Scrub Ironbark				488			TT	
Claoxylon australe	Brittlewood		RF	Shrub/ Tree	488,996, 318,489			MC,NJ, RC,TT	G,D
Cleistanthus cunninghamii	Omega		RF	Shrub	996				
Coelobogyne ilicifolia	Native Holly		RF	Shrub	488,996			TT	G
Croton insularis	Queensland Cascarilla Bark	H			659			BR	G
C. stigmatosus	Broad Silvery Native Cascarilla		DRF	Sm. Tree	996		2RC		G
C. verreauxii	Green Native Cascarilla		RF	Shrub	996,488			TT	D
Drypetes australasica	Yellow Tulipwood		RF	Tree	996,488			EP,TT	G
Mallotus discolor	Yellow Kamala				488			TT	
M. philippensis	Orange Kamala		RF	Tree/ Shrub	996,489			DWG	G,D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.P.	OTHER	STATUS	CONSERVATION S.P. RES.	NAT. PK
EUPHORBIACEAE (cont.)									
Omalanthus populifolius	Native Poplar		RF, WSF	Shrub	996,488, 489			NJ,RC	G,D
Phyllanthus gasstroemii	Forest Phyllanthus		RF, WSF	Shrub	489			DWG	D
Ricinocarpus speciosus	Brush Wedding Bush	H			488				
EUPOMATIACEAE									
Eupomatia bennettii	Small Bolwarra		RF,WSF	Shrub					D
E. laurina	Bolwarra		RF,WSF	Tree/ Shrub	489,996, 318,488			BB,MC,MR NJ,TT	MH,D
FABACEAE									
SUB-FAMILY: CAESALPINIOIDEAE									
* Cassia floribunda	Coffs Senna		RF	Shrub				RC	D
C. odorata	Southern Cassia	H	DRF	Shrub		NP			G
C. barclayana var.	Pepper-leaf Senna							EP	
SUB-FAMILY: FABOIDAE									
Bossiaea buxifolia	Matted Bossea	H			996				G
Crotalaria mitchellii	Long-leaf Bird-flower				996				
Daviesia acicularis	Needle-leaved Bitter Pea	H			488			MR	
D. ulicifolia	Gorse Bitter Pea		DSF	Shrub	488			MR	
Desmodium rhytidophyllum	Hairy Trefoil	H			488			MR	
D. varians	Slender Tic Trefoil			Herb	996,659			BR	N
Dillwynia juniperina	Prickly Parrot Pea	H	River-ine,	Shrub	488				
D. retorta	Twisted Parrot Pea		NTHQ HTH	Shrub		NP PP-E			N
Gompholobium latifolium	Giant Wedge Pea	H	DSF	Shrub	488			MR	
Hovea lanceolata	Tall Hovea	H				NP		BR	G
H. longifolia	Rusty Pods					PP-Ed			
H. purpurea	Narrow-leaf Hovea	H			488				
Indigofera australis var.	Australian Indigo		DSF,WSF	Shrub	488,996				N
Oxylobium aciculiferum	Prickly Shaggy Pea	H	DSF	Shrub		NP			D
O. arborescens	Tall Shaggy Pea	H	DSF	Shrub		NP			G
O. ilicifolium	Holly Shaggy Pea	H	DSF	Shrub	996,659			BR	D,N
Pultenaea flexilis	Willow Bush Pea	H				NP			G
Pultenaea myrtoides	Silvery Bush Pea	H				NP			N
P. petiolaris	Stalked Bush Pea	H			488				
P. retusa	Blunt Bush Pea	H	DSF	Shrub	488			MR	G
P. sp. A.	-	H	WSF	Shrub	318,488			MR	
Sphaerolobium vimineum	Leafless Globe Pea	H				NP			N
* Trifolium repens	White Clover				659			BR	
Zornia dictyocarpa	Two-leaved Chainpod	H	DRF	Herb		NP			G

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.P.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. I
SUB-FAMILY MIMOSOIDEAE									
Abarema grandiflora	Pink Laceflower	H	RF,WSF	Shrub	488,489			NJ,RC, TT	D
A. sapindoides	Snow-wood		RF	Tree	488,996			BB,M	D
Acacia baileyana	Cootamundra Wattle	H				PP-DO			
A. binervata	Two-veined Hickory		WSF	Tree	996,488, 318,489			BB,MC, NJ	
A. dealbata	Silver Wattle	H	WSF/DSF	Shrub		PP-MO			
Acacia decurrens	Green Wattle			Shrub	488,489			NJ	
A. diphylla	Wollomombi Wattle			Shrub					G
A. falciformis	Downy Hickory Wattle		WSF/DSF	Shrub	659,831, 318,488			BR,MC, MR	
A. filicifolia	Fern-leaf Wattle	H	WSF/DSF	Shrub		PP-E			
A. fimbriata	Fringed Wattle				996				
A. floribunda	Sally Wattle		WSF/DSF	Shrub	659,488, 489			BR,EP, MR,DWG	
A. irrorata ssp. velutinella	Green Wattle				488,318, 489,			EP,OWG	
A. irrorata spp.	-				996				
A. longifolia var. sophorae	Coast Golden Wattle				318				
A. maidenii	Maiden's Wattle		WSF	Tree	488,996, 489			BB,MR, NJ,RC, TT	D
A. mearnsii	Black Wattle	H			659			BR	
A. melanoxylon	Blackwood		WSF/DSF	Tree	489,849, 659,488, 318			BR,EP, MC,DWG, M,NJ, TT	G,D,N
A. myrtifolia	Myrtle Wattle		WSF/DSF	Shrub	996,488			MR	
A. obtusifolia	Blunt-leaf Mountain Wattle		DSF	Shrub	318				N
A. orites	Mountain Wattle				996,318, 659			BR,MC	
A. ulicifolia	Prickly Moses		DSF	Shrub	659				G,N
FAGACEAE									
Nothofagus moorei	Negrohead Beech	H	CTRF	Tree	659,488, 849		3RC	R	D,N
FLACOURTIACEAE									
Scolopia braunii (brownii)	Flintwood		RF	Tree	488,996			T	D
GERANIACEAE									
Geranium solanderi var. solanderi	Austral Crane's-bill	H	DSF	Herb	831,659			BR	D
GOODENIACEAE									
Dampiera purpurea	Mountain Dampiera		WSF	Shrub	488			MR	
Goodenia grandiflora	Large-flowered Goodenia	H		Shrub		NP			G
G. ovata	Hop Goodenia	H	WSF	Shrub	488				
GYROSTEMONACEAE									
Codonifolius attenuatus	Bell-fruit Tree		RF	Tree/ Shrub		NP			D,G

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
HALORAGACEAE									
Gonocarpus oreophilus	Mountain Raspwort	H	WSF	Shrub		NP			D
G. tetragynus	Common Raspwort		WSF	Shrub	996				
G. teucrioides	Germander Raspwort				659			BR	
Haloragis sp.	-		WSF,DSF	Herb		NP			G,D
ICACINACEAE									
Citronella moorei	Silky Beech	H	RF	Tree	318,831, 488,996			MC,NJ, RC	D
Pennantia cunninghamii	Brown Beech	H	RF	Tree	996,318			MC	MH,D
LAMIACEAE									
Ajuga australis	Austral Bugle	H	DSF	Herb		NP PP-E			D,N
* Marrubium vulgare	White Horehound	H			489				
Plectranthus graveolens	Sticky Cockspur Flower	H	RCK	Herb		NP			G
P. parviflorus	Cockspur Flower	H	RCK	Herb	996,489			DWG	G,D
P. parviflorus x P. argentatus		H	DSF	Herb	489				
Prostanthera spp. aff. incana	-	H	Rocky	Shrub	318				
P. lasianthos	Victorian Christmas Bush		RF	Shrub/ Tree	849				G,MH, D,N
P. ovalifolia	Oval Mint-bush	H	DSF	Shrub	488			MR	D,MH
Teucrium corymbosum	Forest Germander	H		Herb	831				
Westringia amabilis	Tall Westringia	H	DSF	Shrub	488				
LAURACEAE									
Beilschmiedia elliptica	Grey Walnut	H	RF	Tree	488,489			M,NJ, RC	
B. obtusifolia	Blush Walnut	H	RF	Tree	659,488, 489			NJ,TT	D
* Cinnamomum camphora	Camphor Laurel		RF,CLT	Tree		NP			D
C. oliveri	Camphorwood	H	RF,WSF	Tree	488,318, 489			XX,MC, NJ	D
C. virens	Red-bark Camphorwood	H	RF	Tree	488,318, 489			MC,M, N,J,TT	MH,D
Cryptocarya bidwillii	Yellow Laurel	H							
C. erythroxylon	Pigeonberry Ash	H	RF	Tree	318,996				D
C. sp. nov. (Dome Mountain)	Dorrigo Laurel	H			488,849				D
C. foveolata	Mountain Walnut	H	RF	Tree	318,659, 996,849			MC	MH,G, D,N
C. glaucescens	Silver Sycamore	H	RF	Tree	488,318, 849,489			EP,MC,M, NJ,RC	D
C. floydii	Gorge Laurel	H			318		1K		G
C. meisnerana	Thick-leaved Laurel	H	RF	Shrub/ Tree	488,849, 489			BB,M, NJ	D
C. microneura	Murrogun		RF	Tree	488,489			BB,EP, NJ,TT	D
C. sp. nov. (New England N.P.)	Mountain Laurel	H	RF	Tree	488			TT	N,G, MH,D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
LAURACEAE (cont.)									
Cryptocarya obovata	Pepperberry		RF	Tree	488,489			M,NJ, RC,TT	G,D
C. rigida	Rose Maple	H	RF,WSF	Tree	488,996, 318,489			BB,MC, NJ	MH,D
Endiandra crassiflora	Dorrigo Maple	H	RF	Shrub/ Tree	488,849, 489			BB,M, NJ	D,MH
E. discolor	Domatia Tree,		RF	Tree	488			RC	D
E. introrsa	Red Plum		RF	Tree	488,489			NJ	D
E. muelleri	Green-leaved Rose Walnut	H	RF	Tree/ Shrub	488,996, 489			PB,M, NJ,RC,TT	MH,D
E. sieberi	Pink Walnut	H	RF,WSF	Tree/ Shrub	831,488, 489,318, 996			BB,NJ	MH,D
E. virens	White Apple	H	RF	Tree/ Shrub		NP			D
Litsea leefeana	Brown Bolly Gum	H	RF	Tree	488				D
Litsea reticulata	Bolly Gum	H	RF,WSF	Tree	488,318, 489			BB,MC, NJ,RC	MH,D
Neolitsea australiensis	Smooth-barked Bolly Gum	H	RF	Tree	318,849, 996				G,D, MH,N
Neolitsea dealbata	White Bolly Gum	H	RF,WSF	Tree	996,488, 489			BB,EP,M, NJ,DWG, RC,TT	D,N
LOBELIACEAE									
Isotoma fluviatilis	Swamp Isotoma	H	SHTH	Herb	318				
Lobelia trigonocaulis	Brush Lobelia	H	RF	Herb	996,849, 318			MC	D
Pratia purpurascens	Purplish Pratia		Heath	Herb	488,659			BB,BR	
LOGANIACEAE									
Logania albiflora (floribunda)	Narrow-leaf Logania		DSF	Shrub	996				
LORANTHACEAE									
Amyema bifurcatum	Rusty-flowered Mistletoe								
A. cambagei	Needle Mistletoe								
A. congener ssp. congener	Erect Mistletoe								
A. congener ssp. rotundifolium	Round-leaved Mistletoe								
A. conspicuum ssp. conspicuum	Wolly-flowered Mistletoe								
A. gaudichaudii	Paperbark Mistletoe								
A. miquelii	Box Mistletoe								
A. pendulum ssp. longifolium	Drooping Mistletoe								
A. pendulum ssp. pendulum	Drooping Mistletoe					PP-E			
A. quandang var. quandang	Grey Mistletoe								
Amylotheca dictyophleba	Brush Mistletoe								
Benthamina alyxifolia	Box-leaved Mistletoe					PP-D			

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
LORANTHACEAE (cont.)									
Dendrophthoe vitellina	Long-flower Mistletoe								
Muellerina celastroides	Coast Mistletoe								
M. myrtifolia	Myrtle-leaf Mistletoe								
LYTHRACEAE									
Lythrum salicaria	Purple Loosestrife	H	Woodland		659				
MALVACEAE									
Abutilon acutatum	Hairy Chinese Lantern					NP			G
A. oxycarpum	Narrow-leaf Chinese Latern		DRF	Shrub		NP			C
Hibiscus heterophyllus	Native Rosella		RF,WSF	Shrub/ Tree	996				D,G
Howittia trilocularis	Blue Howittia	H			488				
* Sida rhombifolia	Paddy's Lucerne				489			DWG	
MELIACEAE									
Dysoxylum fraseranum	Rosewood	H	RF	Tree	659,318, 996,488, 489			EP,MC,NJ RC,TT	MH,G,D
Dysoxylum rufum	Hairy Rosewood		RF,WSF	Tree	996,489			NJ	D
Melia azedarach var.	White Cedar		RF	Tree	996				D,G
Synoum glandulosum	Scentless Rosewood	H	RF,	Shrub/ Tree	996,488, 489			BB,MC, N	D
Toona australis	Red Cedar		RF	Tree	488,996, 489			EP,M,NJ, RC,TT	D
MONIMIACEAE									
Hedycarya angustifolia	Australian Mulberry	H	RF	Tree	659,488			RC	D,N
Wilkiea huegeliana	Wilkiea	H	RF	Tree/ Shrub	488,996, 318,489			BB,MC, NJ,DWG	D
MORACEAE									
Ficus coronata	Creek Sandpaper Fig		RF,WSF	Tree	488,996, 318,489			MC,NJ, RC,TT	D
F. macrophylla	Moreton Bay Fig		RF	Tree	996				G,D
F. obliqua (eugenioides)	Small-leaved Fig		RF	Tree		NP			D
F. rubiginosa	Rusty Fig	H	RF,WSF	Tree	996,488			EP	G
F. superba var. henneana	Deciduous Fig	H				NP			D,G
F. virens var. sublanceolata	White Fig								
F. watkinsiana	Green-leaved Moreton Bay Fig	H	RF	Tree	613,996				D,G
Maclura cochinchinensis	Cockspur								
Streblus brunonianus	Whalebone Tree	H	RF	Tree	488,996, 489			RC,TT, DWG	D,G
MYOPORACEAE									
Myoporum acuminatum	Pointed Boobialla	H	RF	Shrub	318			MC	
MYRSINACEAE									
Rapanea howittiana	Howitt's Muttonwood	H	WSF,RF	Tree	489,831, 659,318, 488			BB,EP, NJ	MH,G, D,N
R. variabilis	Variable Muttonwood	H	WSF,RF	Tree	488,996			MR,TT	G,D

Dorrigo Management Area

						OCCURRENCE			CONSERVATION	
			H	HABITAT	HABIT	S.F.	OTHER	STATUS	S.F. RES.	NAT. PK.
MYRTACEAE										
Acmena hemilampra	Broad-leaved Lilly Pilly					489			NJ	
A. smithii	Lilly Pilly			RF,WSF	Tree	318, 996, 488			MC,M, RC	MH,G, D,N
Angophora floribunda	Rough-barked Apple	AAAAB	H	DSF	Tree	318				
A. subvelutina	Broad-leaved Apple	AAABA		DSF	Tree	996				
Archirhedomyrtus beckleri	Rose Myrtle			RF,WSF	Tree/ Shrub	996,318, 488,489			BB,NJ	MH,D
Austromyrtus acmenoides	Scrub Ironwood			RF	Tree	488			RC,TT	
A. bidwillii	Lignum-vitae			RF	Tree	996,488			TT	G
A. hillii	Scaly Myrtle					488,489			NJ	
A. lasioclada	Velvet Myrtle					489			DWG	
Backhousia myrtifolia	Grey Myrtle			RF,WSF	Tree/ Shrub	996,489			NJ,DWG	G,MH,D
B. sciadophora	Shatterwood			RF	Tree	996				D
Baeckea utilis	Alpine Baeckia		H	RCK	Shrub		NP			D,N
Callistemon pallidus	Lemon Bottlebrush		H				NP			G
C. paludosus	River Bottlebrush					659			BR	
C. salignus	Pink Tip			WSF	Tree	488,489			EP,RC, DWG	D
Calytrix tetragona	Common Fringe Myrtle					488				
Decaspermum paniculatum	Silky Myrtle			RF	Tree	488			M	D
Eucalyptus acaciiformis	Wattle-leaved Peppermint	SPECC		DSF	Tree	659,318		3V	BR	
E. acmenoides	Narrow-leaved White Mahogany	MAG:C	H	WSF,DSF	Tree	831,488, 489			EP,MR	D,N
E. amplifolia	Cabbage Gum	SNEEA	H		Tree	318				
E. andrewsii ssp. campanulata	New England Blackbutt	MATHDB	H	DSF	Tree	Common			BB,BR,MC, MR,DWG	D
E. approximans ssp.	Barren Mountain Mallee	MAKIK	H	DSF	Tree		NP	3RC		N
E. banksii	Tenterfield Woollybutt	SPIFA	H	DSF	Tree		NP			G
E. benthamii	Dorrigo White Gum	SPIKQ	H	DSF	Tree	489,849		3RC	DWG	D
E. bosistoana	Coast Grey Box	SUNCA			Tree					
E. bridgesiana ssp bridgesiana	Apple Box	SPIDCA	H		Tree		NP			G
E. caliginosa	Broad-leaved Stringybark	MAHED	H		Tree	318,996				
E. cameronii	Diehard Stringybark	MAHEH	H		Tree	488,111, 996,318, 659,831			EP,MR	
E. crebra	Narrow-leaved Ironbark	SUP:S		DSF	Tree	996				
E. cypellocarpa	Mountain Grey Gum	SPIFE	H		Tree		NP			G
E. sp. aff. cypellocarpa	-				Tree		NP			G
E. dalrympleana ssp. heptantha	Broad-leaved Mountain Gum,	SPINCC	H	DSF	Tree	659			BR	N

Dorrigo Management Area

						OCCURRENCE			CONSERVATION	
			H	HABITAT	HABIT	S.F.	OTHER	STATUS	S.F. RES.	NAT
MYRTACEAE (cont.)										
Eucalyptus deanei	Round-leaved Gum	SECAA	H	DSF	Tree	659,831 996			BR	
E. eugenioides	Thin-leaved Stringybark	MAHEA	H	DSF	Tree	318,488 996				
E. fastigata	Brown Barrel	MAKCB	H	WSF,DSF	Tree	659			BR	N
E. globoidea	White Stringybark	MAHEF	H	DSF	Tree					
E. grandis	Flooded Gum	SECAB	H	WSF	Tree	488,849				D
E. gummifera	Red Bloodwood	CAFUF	H	WSF,DSF	Tree	996,488, 489,831				D
E. laevopinea	Silver-top Stringybark	MARAB	H	WSF,DSF	Tree	Common			BR,MC	
E. ligustrina	Privet-leaved Stringybark	MAHEQ	H	DSF	Tree		NP			G
E. maculata	Spotted Gum	CCC:B	H	DSF	Tree	993,318,				
E. maculata var. grayii	Narrow-leaved Spotted Gum			DSF	Tree	996,488				
E. melliodora	Yellow Box	SUX:A	H	DSF	Tree		NP			G
E. michaeliana	Northern Brittle Gum	SNI:A	H	DSF	Tree		NP	3VC		G
E. microcorys	Tallowwood	SWA:A	H	WSF,DSF	Tree	Common			DWG,BB, EP,MC, NJ,RC	D
E. moluccana	Grey Box	SUL:B	H	WSF,DSF	Tree	318,996				
E. nicholii	Small-leaved Pepperment	SPECE	H	DSF	Tree			3V		
E. nova-anglica	New England Pepperment	SPINS		DSF	Tree	659			BR	
E. obliqua	Messmate	MAKAA	H	WSF,DSF	Tree	996,318			BR	N
E. paniculata	Grey Ironbark	SUV:D	H	DSF	Tree					
E. pauciflora	Snow Gum	MAKHAA	H	DSF	Tree	659			BR	N
E. pilularis	Blackbutt	MAIAA	H	WSF,DSF	Tree	831,996, 488,489, 111			BB,EP, MR,NJ	D
E. propinqua	Small-fruited Grey Gum	SECEA	H	WSF,DSF	Tree	488,318			MC,MR	D
E. punctata var. punctata	Grey Gum	SECEDA	H	WSF,DSF	Tree	488				
E. punctata var. punctata	Northern Grey Gum	SECEDD	H	DSF	Tree	996				
E. pyrocarpa	Large-fruited Blackbutt	MAIAB		DSF		488			MR	
E. quadrangulata	White-topped Box	SPIHA	H	WSF,DSF	Tree	966				D
E. radiata ssp radiata	Narrow-leaved Peppermint	MATELA	H	DSF	Tree	318,659			BR	N
E. resinifera	Red Mahogany	SECCC	H	WSF,DSF	Tree	318,996				
E. rubida	Candlebark Gum	SPINF		DSF	Tree	659				
E. saligna	Sydney Blue Gum	SECAC	H	WSF,DSF	Tree	Common			NJ,RC, DWG,BB, BR,EP, MC,MR	D
E. siderophloia	Pale Grey Ironbark	SUP:I	H	DSF	Tree		NP			D

Dorrigo Management Area

			H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. PK.
MYRTACEAE (cont.)										
Eucalyptus signata	Scribbly Gum	MATKD	H	DSF	Tree	318,996, 831				
E. stellulata	Black Sallee	MAKMA	H	DSF	Tree	659			BR	
E. tereticornis	Forest Red Gum	SNEEB	H	DSF	Tree	318,996, 489			DWG	
E. tindaliae	Tindale's Stringybark	MAHCI		DSF		996				
E. umbra ssp.	Broad-leaved White Mahogany	MAG:AB	H	DSF	Tree	996,488				
E. umbra ssp. umbra	Bastard Mahogany	MAG:AA	H	DSF	Tree	831,996				
E. viminalis	Manna Gum	SPIKKA	H	WSF,DSF	Tree	996,659, 849			BR	D,N
Kunzea bracteolata	Stiff Kunzea			Heath	Shrub	318		3RC		
Leptospermum brachyandrum	Thin-fruit Tea-tree		H		Shrub	488				
L. flavescens	Common Tea-tree			WSF,DSF, HTH	Shrub	659,488, 318,489			BR,MR	MH,D,N
L. sp. nov. aff. flavescens			H		Shrub	613			D	
L. sp. nov				DSF,HTH	Shrub	318				MH
L. microcarpum	Small-fruited Tea-tree					996				
L. myrtifolium	Myrtle Tea-tree			HTH	Shrub	659			BR	N
L. petersonii	Lemon-scented Tea-tree		H	DSF,HTH	Shrub	488,489				D
L. phylicoides	Burgan		H	DSF,HTH	Shrub	488,489			DWG	D
Lophostemon confertus	Brush Box			RF,WSF	Tree	Common			BB,MC,NJ	D
Rhodamnia argentea	Malletwood			RF	Tree	488,489			EP,M,NJ RC,TT	D
R. rubescens	Brush Turpentine			RF,WSF	Tree/ Shrub	996,318, 488,489			BB,MC, NJ,TT	MH,D
Rhodomyrtus psidioides	Native Guava			RF	Shrub	488,489			NJ,TT,D	D
Syncarpia glomulifera	Turpentine			WSF	Tree	488,489			BB,EP,M NJ	D
Syzygium coolminianum	Blue Cherry			RF	Tree	488,318, 489			BB,MC,N	D
S. corynanthum	Sour Cherry			RF	Tree	996				D
S. crebrinerve	Purple Cherry			RF	Tree	488,318			MC	D
S. paniculatum	Brush Cherry			RF,WSF	Tree	996,489, 488			NJ,RC,T	MH,D
Tristaniopsis collina	Water Gum			RF,WSF	Tree	659,488, 849,489			BR,NJ,RC	D,N
OLEACEAE										
Jasminum suavissimum	Erect Jasmine		H		Herb		NP			G
* Ligustrum sinense	Small-leaved Privet			RF,WSF	Shrub	489			DWG	D
Notelaea longifolia var. longifolia	Large Mock Olive			WSF,DSF	Tree	488,996, 489			NJ,TT	G,D
N. microcarpa var. velutina	Gorge Mock Olive					996				G
N. microcarpa var. velutina x N. longifolia	Hybrid Mock Olive		H			489			DWG	G

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Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. PK.
EACEAE (cont.)									
venosa	Veined Mock Olive		RF, WSF, DSF	Shrub/ Tree	996, 318, 489			MC, DWG	MH, D
venosa var 'A'	-				318, 659			MC	N
lea paniculata	Native Olive	H	RF	Tree	996				G
XALIDACEAE									
xalis corniculata	Yellow Wood Sorrel		WSF, DSF	Herb	996				D
EPEROMIACEAE									
eperomia leptostachya	Slender Pepper Plant		RF, WSF	Herb, Litho.	996				G, D
. tetraphylla	Four-leaved Pepper Plant		RF	Epi-, Litho.	996, 318			MC	D
HYTOLACCACEAE									
Phytolacca americana	Stalked Ink Weed				996				
ITTOSPORACEAE									
Bursaria spinosa	Sweet Bursaria	H	WSF, DSF	Shrub	996, 318, 488, 489			MC, NJ	MH, D
Citriobatus pauciflorus	Orange Thorn	H	RF, WSF	Shrub	996, 318			EP, TT, MC, NJ, BB, M, RC	G, MH, D, N
Hymenosporum flavum	Native Frangipani		RF, WSF	Tree	488, 996, 318				G, MH, D
Pittosporum revolutum	Yellow Pittosporum	H	WSF	Shrub	996, 488, 489			BB, MR, NJ, RC, TT	G, D
P. undulatum	Sweet Pittosporum	H	RF, WSF	Shrub	318, 488, 996, 489			MC, NJ	G, MH, D
PLANTAGINACEAE									
Plantago varia	Variable Plantain	H				NP			C
POLYGALACEAE									
Comesperma ericinum	Match Heads	H	DSF	Shrub	996				G
POLYGONACEAE									
Polygonum convolvulus	Black Bindweed	H				NP			D
P. decipiens	Slender Knotweed	H				NP			D
P. orientale	Princes Feathers	H							
P. strigosum	Spotted Knotweed	H	DSF	Herb		NP			D
PROTEACEAE									
Banksia integrifolia	White Banksia	H	RF, DSF	Tree	996, 849, 488, 659			BR, EP, MC	MH, G, D, N
B. marginata	Silver Banksia				488			MR	
B. spinulosa	Golden Candlesticks	H	WSF/DSF	Shrub	996				G
Grevillea robusta	Silky Oak	H			996				G
G. sp.	-	H				NP			G
Hakea eriantha	Tree Hakea	H	WSF/DSF	Tree	996				
H. macraeana	Pine-leaved Hakea	H	RF, WSF	Shrub	488, 489		3RC	DWG	D
H. microcarpa	Small-fruited Hakea	H			318				
H. sericea	Silky Needle Bush		WSF/DSF	Shrub	849				D

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.P.	OCCURRENCE OTHER	STATUS	CONSERVATION S.P. RES.	CONSERVATION NAT. PK.
PROTEACEAE (cont.)									
Helicia glabriflora	Pale Oak		RF	Tree	488,659				D
Hicksbeachia pinnatifolia	Monkey Nut		RF	Tree, Shrub		NP			F
Isopogon anemonifolius	Tall Drumsticks			Shrub	488			MR	
Lomatia fraseri	Silky Lomatia	H			996,659				MH,N
L. silaifolia	Wild Parsley	H	WSF/DSF	Shrub	318,659, 488,489			BR,MR, DWG	N
Oreocallis pinnata	Dorrigo Oak	H	WT,RF	Tree	488,849, 489			NJ	D
Orites excelsa	Prickly Ash	H	RF	Tree	996,489, 488,318, 849			BB,MC, M,NJ	MH,G,D, N
Persoonia attenuata (P. media)	Scrub Geebung	H	WSF,RF	Shrub	659,488, 849,489			BB,MR, NJ,DWG	MH,D,N
P. cornifolia	Round-leaved Geebung	H	WSF/DSF	Shrub	996,659			BR	
P. levis	Paper-bark Geebung		WSF,DSF	Shrub	318			MC	
P. prostrata	Prostrate Geebung				996				
Petrophile canescens	Prickly Cone Sticks	H			448,996				
Stenocarpus salignus	Red Silky Oak	H	RF.	Tree	448,996, 489			EP,M,NJ, RC,DWG	MH,D,N
S. sinuatus	Wheel of Fire Tree		RF	Tree		NP			D
Triunia youngiana	Native Honeysuckle	H	RF	Shrub	488,489			M,NJ	D
RANUNCULACEAE									
Ranunculus lappaceus var. lappaceus	Common Buttercup				659			BR	N
R. plebeius	Hairy Buttercup		DSF	Herb	849				D
* R. repens	Creeping Buttercup				659			BR	
RHAMNACEAE									
Alphitonia excelsa	Red Ash	H	RF	Tree	488,996, 489,			EP,M,NJ, DWG,RC,TT	D
Cryptandra amara	Bitter Cryptandra	H	Woodland	Shrub	659			BR	
C. lanosiflora	Woolly-flowered Cryptandra	H				NP			N
Emmenosperma alphitonioides	Yellow Ash		RF	Tree	488,318, 489			MC,NJ, TT	D
Pomaderris betulina	-				659			BR	
P. ferruginea	Rusty Pomaderris	H	DSF	Shrub	659,318, 489			DWG	MH
P. nitidula	Mountain Pomaderris	H	HTH	Shrub					D,N
RUBIACEAE									
Canthium odoratum	Native Coffee		RF	Shrub	996				G
C. vacciniifolium	Small-leaved Coffee				996				
Coprosma quadrifida	Prickly Currant Bush	H	RF	Shrub	318,659, 489			BR,MC, DWG	G,MH,N
Galium spp. A			WSF,DSF	Herb	996				D,N
Hodgkinsonia ovatiflora	Golden Ash		RF	Tree	996,488			TT	

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. PK.
RUBIACEAE (cont.)									
Pomax umbellata	Pomax	H	WSF,DSF, HTH	Herb		NP			G
Psychotria loniceroides	Hairy Psychotria	H	RF,WSF	Shrub	831,996, 488,489			BB,MC, NJ,TT	D
Randia benthamiana	Native Gardenia		RF	Shrub	488,489			BB,M,NJ	D
RUTACEAE									
Acradenia euodiiformis	Bonewood	H	RF	Tree	488,849				D
Acronychia laevis	Northern White Lilly-Pilly		RF	Tree	488,489			NJ,RC,TT	
A. oblongifolia	White Lilly-Pilly	H	RF	Tree	659,996, 318,488			BB,EP	G,MH,D, N
A. pubescens	Hairy Acronychia	H	RF	Tree	488,318, 489			BB,M, NJ,TT	MH,D
Asterolasia correifolia	Brown Star-bush	H	WSF		111				
Bauerella simplicifolia	Yellow Acronychia	H	RF	Tree	488,996, 489			M,NJ, RC,TT	G,MH,D
Boronia anethifolia	Narrow-leaved Boronia	H			318				
B. ledifolia	Showy Boronia	H		Shrub	488				
Bosistoa floydii	Five-leaved Bonewood					NP	2RC		D
Correa lawrenciana	Mountain Correa	H	WSF	Shrub		NP			D,N
C. reflexa	Common Correa	H	WSF/DSF	Shrub		NP			G
Euodia micrococca	White Euodia		RF	Tree	488,996, 318,489			EP,NJ,RC, TT,DWG	G,D
E. sp. A.	Smooth-leaved Doughwood,		WTRF	Tree, Shrub	488			TT	D
Flindersia australis	Crow's Ash,		RF	Tree	488			TT	D
Flindersia schottiana	Silver Ash	H	STRF, WSF	Tree		NP			D
Geijera latifolia	Scrub Wilga	H	RF	Tree	659,996, 488			EP,TT	G
G. salicifolia	Narrow-leaved Scrub Wilga	H				NP			G
Melicope octandra	Doughwood				318				
Phebalium elatius ssp. beckleri	Tall Phebalium	H	DSF	Shrub	659,488, 849				MH,D
P. squameum	Satinwood	H	WSF,HTH	Shrub					
P. squamulosum ssp. squamulosum	Scaly Phebalium	H	WSF,DSF	Shrub	488			EP	
P. squamulosum ssp. verrucosum						NP			
Zieria arborescens	Tall Zieria		RF,WSF	Shrub	996,488				D
Z. smithii	Sandfly Zieria		RF	Shrub	488			EP	
Z. spp						NP			G
SANTALACEAE									
Exocarpos cupressiformis	Native Cherry		WSF/WSF Woodland	Shrub	488			MR	N
E. strictus	Pale-fruited Cherry	H		Shrub	659,996, 489			BR,DWG	N

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK
SAPINDACEAE									
Alectryon forsythii	Ravine Birds-eye	H	DRF	Sm.Tree		NP			G
A. subcinereus	Wild Quince	H	RF,WSF, DSF	Tree	996,318, 488			MC,RC, TT	G
A. subdentatus	Holly-leaved Birds-eye	H	RF	Tree	488,318, 489			RC,DWG	G
Arytera divaricata	Gap Axe	H	RF	Tree		NP			D
Cupaniopsis foveolata	Toothed Tuckeroo		RF	Tree	318,488, 489			EP,MC,NJ	D
C. parvifolia	Small-leaved Tuckeroo					NP			C
C. serrata	Rusty Tuckeroo				488			RC	
Diploglottis australis	Tamarind		RF	Tree	996,488, 318,489			MC,NJ,RC, TT,M	MH,D
Dodonaea megazyga	Winged Hop-bush	H	RF	Shrub	996,318, 831		3RC	MC	
D. triquetra	Large-leaf Hop-bush		WSF,DSF	Shrub	488				
D. viscosa	Sticky Hop-bush				996,488			TT	G
Elattostachys nervosa	Beetroot		RF	Tree	488			EP,RC,TT	D
Guioa semiglauca	Guioa	H	WSF/DSF/ RF	Tree	489,488, 996			EP,NJ,RC, TT,DWG	G,D
Harpullia hillii	Oblong-leaved Tulip					NP			C
H. pendula	Tulipwood	H							
Jagera pseudorhus	Foambark		RF	Tree	488			TT	
Mischocarpus pyriformis	Brush Apple	H	RF	Tree	488,489			DWG	
Rhysotoechia bifoliolata	Two-leaved Tuckeroo		RF	Shrub/ Tree	996,488			TT	D
Sarcopteryx stipitata	Corduroy	H	RF	Tree	488,489, 996,318, 849			BB,EP,MC, M,NJ,RC	MH,D
SAPOTACEAE									
Planchonella australis	Black Apple	H	RF	Tree	488,489			M,NJ,RC	D
SCROPHULARIACEAE									
Parahebe derwentiana	Derwent Speedwell	H		Herb		PP-E			N
Veronica notabilis	Forest Speedwell	H		Herb		NP			G
SIMAROUBACEAE									
Guilfoylia monostylis	Native Plum	H	RF	Tree, Shrub	488,318, 996				MH,D
SOLANACEAE									
Duboisia myoporoides	Duboisia	H	RF	Shrub	488,489, 318,849			EP,NJ	D
Nicotiana debneyi	Sticky Tobacco					NP			C
Physalis minima	Wild Gooseberry				489			DWG	
Solanum aviculare	Kangaroo Apple	H	WSF/DSF	Shrub	488,996, 489			NJ	D
S. brownii	Violet Nightshade	H		Shrub	489,488			RC	
* S. chenopodioides	-	H			488				

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
SOLANACEAE (cont.)									
Solanum densevestitum	Hairy Nightshade	H	WSF/DSF	Shrub	831,488, 996,489			BB,DWG	
S. inaequilaterum	Few-thorned Nightshad	H		Shrub	996,318, 488			EP,MC	MH
Solanum laciniatum	-		RF	Shrub	488			RC	D
S. mauritianum	Wild Tobacco			Shrub	488,996, 489			M,DWG, NJ	D
S. prinophyllum	Gin's Whiskers	H	DSF	Shrub	996,318			MC	D
* S. pseudocapsicum	Madeira Winter Cherry	H			488			EP,RC	
S. stelligerum	Star-hair Nightshade				996				N
S. Sp.			WTRF,WSF	Shrub		NP			D
STACKHOUSIACEAE									
Stackhousia viminea	Slender Stackhousia	H				PP-E			N
STERCULIACEAE									
Brachychiton acerifolius	Flame Tree		RF	Tree	318,488, 489			MC,M, NJ	MH,D,N
B. discolor	Brush Kurrajong		RF	Tree	996				D,C
B. populneus	Kurrajong		WSF,DSF	Tree	996,489				D,G
Commersonia bartramia	Brown Kurrajong		WSF	Shrub		NP			D
C. fraseri	Brush Kurrajong	H	RF,WSF	Tree, Shrub	488				D
Heritiera actinophylla	Booyong	H	STRF	Tree	996,488, 318,489			MC,M,NJ, RC,TT	MH,D,N
H. trifoliolata	White Booyong		RF	Tre	996				D
Rulingia pannosa	Kerrawang	H	DSF-WSF	Shrub	488				
Seringia arborescens	Seringia			Tree	488			BB	
STYLIDIACEAE									
Stylidium graminifolium	Grass Trigger-plant	H	Heath	Herb	488			MR	N
S. laricifolium	Giant Trigger-plant	H	DSF	Herb	996				G,N
SYMPLOCACEAE									
Symplocos thwaitesii	Buff Hazelwood		RF	Tree/ Shrub	488			TT	
THYMELAEACEAE									
Pimelea latifolia ssp. hirsuta	Hairy Riceflower		WSF	Shrub	996				
P. ligustrina ssp. hypericina	Hipericum-leaved Riceflower		WSF	Shrub	488			RC	N
P. ligustrina ssp. ligustrina	Tall Riceflower				996,488, 659,489			BR,EP, DWG	MH
P. linifolia ssp.	Slender Riceflower	H	DSF,HTH	Shrub	849				D,G,N
P. pauciflora	Poison Riceflower	H			488			EP	G
Wikstroemia indica	Red-fruited Riceflower				488				
TREMANDRACEAE									
Tetratheca thymifolia	Black-eyed Susan	H	WSF,DSF, HTH	Herb	996			MR	

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
ULMACEAE									
Aphananthe philippinensis	Grey Handlewood				996				
Trema aspera	Poison Peach	H	RF	Tree	996,488, 489			NJ,DWG	
URTICACEAE									
Dendrocnide excelsa	Giant Stinging Tree	H	RF	Tree	488,318, 996			MC,RC	MH,G,D, N
Dendrocnide photinophylla	Shining-leaved Stinging Tree		RF	Tree	996				D
Elatostema reticulatum	Smooth Nettle		RF	Herb	488,318			BB,MC	MH,D,N
E. stipitatum	Small Smooth Nettle		RF	Herb		NP			D
Urtica incisa	Scrub Nettle	H	RF,WSF, DSF	Herb	996				G,D,N
* U. urens	Small Nettle			X	489			DWG	
VERBENACEAE									
Clerodendrum floribundum	Smooth Clerodendron		RF,WSF	Shrub	488				D
C. tomentosum	Hairy Clerodendron		RF,WSF	Tree/ Shrub	996,488			BB,TT	G,D
Gmelina leichhardtii	White Beech	H	RF	Tree	488,489			NJ	D
* Lantana camara	Lantana		WSF/DSF/ RF	Shrub	488				D
* Verbena bonariensis	Purple-top		DSF	Herb	489			DWG	D
V. officinalis	Common Verbena		DSF	Herb		NP			G,D
VIOLACEAE									
Hybanthus enneaspermus	Orange Ladies Slipper		WSF,DSF	Herb		NP			D
Hymenanthera dentata	Tree Violet	H							
Viola betonicifolia	Mountain Violet		WSF/DSF	Herb	488,659			BB,BR	
V. hederacea	Native Violet				659			BR	
WINTERACEAE									
Tasmannia insipida	Tasteless Pepper Bush	H	RF/WSF/ DSF	Shrub	659,996, 488,318, 849			BB,BR, MC,M	MH,G, D,N
T. stipitata	Mountain Pepper Bush	H	RF	Shrub	318,659		3RC	MC	H
ZYGOPHYLLACEAE									
Zygophyllum apiculatum	Pointed Twinleaf	H	DRF	Herb		NP			G
F. DICOTYLEDON VINES									
AMARANTHACEAE									
Deeringia arborescens	Climbing Deeringia		RF	Vine	996				D
ANNONACEAE									
Rauwenhoffia leichhardtii	Zig-Zag Vine	H	RF	Vine	996,488			TT	D
APOCYNACEAE									
Melodinus australis	Rubber Vine	H	WTRF	Vine	996,318, 489			NJ	MA,D
Parsonsia brownii	Mountain Silkpod	H	CTRF/ WTRF	Vine	Common				N,G,MH
Parsonsia fulva	Rusty Silkpod		RV	V	489			NJ	

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OTHER	STATUS	CONSERVATION S.F. RES.	NAT. PK.
APOCYNACEAE (cont.)									
Parsonsia induplicata	Thin-leaved Silkpod	H	WTRF/ CTRF	Vine		NP PP-DE			MH,D,N
P. latifolia	Broad-leaved Silkpod	H	DRF	Vine	996				MH,D
P. straminea	Ivy Silkpod	H	RF,WSF	Vine	Common			BB,EP, MC,NJ,RC	D,N
P. tenuis	Slender Silkpod	H	DRF	Vine	996,318		2RC		C
P. velutina	Velvet Silkpod		RF	Vine	996				MH,D
P. ventricosa	Mountain Silkpod	H	DRF- STRF	Vine		NP			G
P. sp. A	Black Silkpod	H	WTRFSF	Vine	318				D,MH,N
P. sp. B	Milky Silkpod		RF,WSF	Vine	318,488			BB	MH,G,D, N
ARALIACEAE									
Cephalaralia cephalobotrys	Climbing Panax		RF	Vine	318,488			BB	MH,G,D, N
ASCLEPIADACEAE									
Gymnema sp. A	Large-flowered Milk Vine	H	DRF	Vine	996				C
Marsdenia flavescens	Yellow Doubah	H	RF	Vine	488,996, 489			EP,NJ, TT	G,D
M. latifolia	-			Vine	996				
M. rostrata	Stalked Doubah	H	RF	Vine		PP-DE			D
M. suberosa	Corky Milk Vine	H	RF/WSF	Vine	996				
Secamone elliptica	Small-leaved Corky Milk Vine			Vine					G
Tylophora grandiflora	Single Purple Milk Vine	H	DRF	Vine	996				C
BIGNONIACEAE									
Pandorea jasminoides	Bower-of-Beauty			Vine	996				
P. pandorana	Wonga Wonga Vine		WSF	Vine	996,488, 489			MR,NJ	G,D,N
CELASTRACEAE									
Celastrus australis	Small Staff Climber	H	RF	Vine	996				G,D
C. subspicatus	Large Staff Climber		RF	Vine	996				D
CUCURBITACEAE									
Diplocylos palmatus	Native Bryony					NP			C
Sicyos australis	Star Cucumber				996,488			RC,TT	
* Zehneria cunninghamii	Wild Cucumber	H	RF	Vine	488,996			RC	D
CUNONIACEAE									
Aphanopetalum resinosum	Gum Vine	H	RF	Vine	488,996, 318,489			NJ	G,D,N
DILLENIACEAE									
Hibbertia dentata	Twining Guinea-flower		WSF	Vine	996,488, 659,318			BR,MC	N
H. scandens (volubile)	Snake Vine		WSF,DSF	Vine	111,489, 996,488, 318,849			BB,BR,MC, MR,NJ	MH,G,D, N

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK
FABACEAE									
SUB-FAMILY CAESALPINIOIDEAE									
Caesalpinia subtropica	Corky Vine								C
SUB-FAMILY FABOIDEAE									
Derris involuta	Derris Vine		RF	Vine	488			EP	D
Glycine clandestina	Twining Clycine	H	RF,DSF	Vine	996,659, 488			BR,MC, MR	G,D,N
Hardenbergia violacea	False Sarsaparilla	H	DSF,WSF	Vine	996,659, 318			BR,M	N
Kennedia rubicunda	Soldier Vine		DSF,WSF	Vine	996,488, 318			BB,MC	D
Lonchocarpus sp. A	Blood Vine		RF,WSF	Vine					C
Millettia megasperma	Native Wistaria				488			M	
FLACOURTIACEAE									
Streptothamnus beckleri	Montane Tape Vine	H	RF	Vine	318,488, 489			MC,M, NJ	G,MH,D N
S. moorei	Thick Roundleaf Vine	H			488				
GESNERIACEAE									
Fieldia australis	Fieldia				318				MH,G,N
MENISPERMACEAE									
Legnephora moorei	Grey Roundleaf Vine	H	RF	Vine	996				D,G
Sarcopetalum harveyanum	Big-leaf Vine	H	RF	Vine	996,488			BB	G,D
Stephania japonica var. discolor	Tape Vine		RF,WSF	Vine	996,318				G,D
MONIMIACEAE									
Palmeria scandens	Anchor Vine	H	RF	Vine	996,488,			BB,MC,M,	MH,D,N
MORACEAE									
Maclura cochinchinensis	Cockspur Thorn		RF	Vine	488,996			EP,RC,TT	G,D
Malaisia scandens	Burny Vine				318,488			M	MH
MYRSINACEAE									
Embelia australiana	Embelia	H	RF	Vine	488,996, 318,489			BB,MC, NJ,TT	MH,D
OLEACEAE									
Jasminum singuliflorum	Solitary Jasmine	H	RF	Vine		NP			G,D
J. volubile	Single-leaved Jasmine	H	RF	Vine		NP			G
PASSIFLORACEAE									
Passiflora aurantia	-			Vine	488				
P. herbertiana	Orange Passionfruit		WSF	Vine	996				D,G
* P. subpeltata	White Passionfruit				489,488			DWG,RC	D
PIPERACEAE									
Piper novae-hollandiae	Pepper Vine		RF	Vine	318			MC	D
PITTOSPORACEAE									
Billardiera scandens	Common Apple-berry		WSF	Vine	996,488, 659,489			BB,BR, NJ	N

Dorrigo Management Area

		H	HABITAT	HABIT	OCCURRENCE S.F.	OCCURRENCE OTHER	STATUS	CONSERVATION S.F. RES.	CONSERVATION NAT. PK.
RANUNCULACEAE									
Clematis aristata	Traveller's Joy		RF,WSF	Vine	996,488			BB,EP	N
C. glycinoides	Erect Clematis	H	RF	Vine	996,659			BR	G,D,N
ROSACEAE									
Acaena novae-zelandiae	-				659			BR	
Rubus hillii	Queensland Bramble		WSF,RF	Vine	831,996, 488,318, 659,489			BB,BR, EP,M,MR, RC,NJ	G,D,N
R. moorei	Greenleaf Bramble								
R. parvifolius	Native Raspberry			Vine	996,659			BR	N
R. rosifolius	Roseleaf Bramble		RF	Vine	996,488, 489			BB,MC, NJ,RC	MH,D,N
* R. discolor (procerus)	Blackberry			Vine	996,659			BR	
RUBIACEAE									
Morinda acutifolia	Clustered Morinda		RF	Vine					C
M. jasminoides	Jasmine Morinda		RF	Vine	488,996, 318,489			BB,MC, M,NJ	D
TRIMENIACEAE									
Piptocalyx moorei	Bitter Vine			Vine	488,996, 489			BB,MC, M,NJ	
VITACEAE									
Cayratia clematidea	Slender Grape		WSF,RF	Vine	996,488			EP,TT	G,D
C. eurynema	Smooth Tender Grape		RF	Vine	996				D
Cissus antarctica	Simple Water Vine	H	RF	Vine	996,488, 318			EP,MC, TT	G,MH,D
C. hypoglauca	White-leaved Water Vine	H	WSF,RF	Vine	488,996, 831,318, 489			BB,EP, MC,M, MR,TT	G,MH,D
C. sterculiifolia	Kurrajong-leaved Grape	H	STRF	Vine					D
Tetrastigma nitens	Shiny-leaved Grape	H	DRF,WSF	Vine	996				G,D

DORRIGO MANAGEMENT AREA

Plant List

Summary of Rare or Threatened Plants

Botanical Name	Common Name	Cons. Status	Occurrence S.F.	Occurrence Flora Reserve	Occurrence NP
Austrobuxus swainii	Pink Cherry	3RC	488,489,	BB, NJ	D
Bosistoa floydii	Five-leaved Bonewood	2RC			D
Caesalpinia subtropica	Corky Vine	3RC			C
Callitris oblonga	Tasmanian Cypress Pine	3RC	318		
Croton stigmatosus	Broad Silvery Native Cascarilla	2RC	996		G G
Cryptocarya floydii	Gorge Laurel	1K	318		D,N
Dendrobium falcorostrum	Beech Orchid	3RC	849		D
Dendrobium tenuissimum	Slender Pencil Orchid	3RC	488,996		
Dodonaea megazyga	Winged Hopbush	3RC	996,318,831	MC	
Eucalyptus acaciiformis	Wattle-leaved Peppermint	3V	659,318	BR	
E. approximans	Barren Mountain Mallee	3RC			N
E. benthamii	Dorrigo White Gum	3RC	489,849	DWG	D
E. michaeliana	Northern Brittle Gum	3VC			G
E. nicholii	Small-leaved Peppermint	3V	318,996,659		
Gingida montana	Angelica	2RC+	Pte. Prop. on Ebor-Tyringham Rd.		
Hakea macreana	Pine-leaved Hakea	3RC	488,489	DWG	D
Kunzea bracteolata	Stiff Kunzea	3RC	318		
Morinda acutifolia	Clustered Morinda	3V			C
Nothofagus moorei	Negrohead Beech	3RC	659,488,849	BR	D,N
Parsonsia tenuis	Slender Silkpod	2RC	996,318		C
Platycerium superbum	Staghorn Fern	3VC	996,318		D
Tasmannia stipitata	Mountain Pepper Bush	3RC	318,659	MC	H

MONASH UNIVERSITY

DEPARTMENT OF
GEOGRAPHY AND ENVIRONMENTAL SCIENCE
CENTRE FOR
PALYNOLOGY AND PALAEOECOLOGY

AUSTRALIA

Dear

I attach my draft affidavit regarding the action Corkill & NEFA vs Forestry Commission of NSW (Dorrigo Management Area EIS's). This affidavit is necessarily very general as I cannot claim to be familiar with the particular areas under dispute and due to a lack of time for detailed analysis. However, I hope it will be of some value to you.

I am not concerned about fees but some small amount for costs incurred would be useful if the action is successful.

I can be contacted either at home (usually mornings or evenings) on 03 561 3886 or at work directly on 03 565 2927 or through the office 03 565 2929. FAX 03 565 2948.

I will be available if required during most of June/July except for July 7-18 when I will be overseas.

All the best

Peter Kershaw

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CORKILL V. FORESTRY COMMISSION OF NEW SOUTH WALES AND OTHERS

Memorandum of Advice

1. The Mount Royal State Forest lies 45 kilometres north of Singleton. It adjoins the Barrington Tops National Park, part of which was carved out of the Forest in 1984 so that the Forest is now in two non-contiguous sections. This case concerns the small Davis Creek section of the Forest which buffers the south western edge of the Park from cleared private land to the west and forested but grazed private land to the south.

2. The section has an area of 999 hectares, of which 250 hectares have a slope exceeding 30 degrees. The geology of the forest is a mixture of olivine basalt and clastic and volcanic sediments. The soils are predominantly rich basaltic, although there are less stable yellow, red and grey clays throughout the section. Davis and Cross Creeks rise in the steeply sloped Mount Royal Range and drain through the Forest to the Hunter River. The Forest contains a mixture of timbers, occurring in wet and dry conditions, as well

as closed canopy rainforest. Much of the wet sclerophyll has rainforest understory, and some of it can be classified ecologically as rainforest.

3. The rainforest proper occurs in clusters throughout the Forest. It has been divided into compartments 200 to 204 inclusive and each compartment contains rainforest and rainforest elements. Some of the rainforest is extremely rare being Antarctic beech occurring at the southernmost point of its distribution in eastern Australia, and at heights apparently below other cool temperate beech rainforest: see **New South Wales Rainforests, The Nomination for The World Heritage List**, Dr Paul Adam, NPWS, 1987, pp 8-9, 75-78. Unusually, the Forest is old-growth, that is, it has not previously been logged with the exception of a small segment of compartment 201. The logging work was illegal so no records of it are held by the Forestry Commission.

4. As it is an old-growth forest, there is remarkable species diversity in both flora and fauna. I have conferred with Dr Christopher Dickman, of the School of Biological Sciences at the University of Sydney who has recently conducted a major fauna survey with a view to advising the National Parks and Wildlife Service on its endangered species programme. Dr Dickman has advised

me that the forest contains a number of rare and endangered species, including the Hastings River mouse which he identified in the course of fauna surveys which are summarized in **A Survey of The Mammals of Mount Royal and Barrington Tops New South Wales,** Dickman and McKechnie, Aust. Zool. 21(6) 1985 at pp. 531-543. Other rare and endangered species expected to occur in the forest include the parma wallaby and the long-nosed potoroo. Other species of conservation significance have been found including the spotted-tailed quoll, koalas, the peregrine falcon, the glossy black cockatoo, the masked owl, the spine-tailed swift, the scaly (ground) thrush, the crested shrike-tit, the rufous fantail and the spotted quail-thrush. The Forestry Commission has recognized in its **Management Plan for Mount Royal Management Area** (1988) that most of these species are likely to be found within the Forest: see Appendix 7, **Management Plan.** I have also conferred with Roger Lembit, an agricultural scientist and environmental consultant specializing in vegetation and soil surveys. Mr Lembit surveyed the Mount Royal State Forest in 1982 as part of a contribution to the peak conservation groups' submission to the New South Wales Government on proposed additions to the Barrington Tops National Park. That submission recommended the addition of this section of the Mount Royal State Forest to the Park but when the boundaries were drawn in 1984, most of the section was excluded. Mr Lembit has described the forest to me as pristine, having significant conservation and catchment values which could be compromised by roading and logging especially on the steeper slopes. He is of the opinion that both the roading and logging works which have taken place or are proposed are likely to significantly affect the environment of the forest.

5. On or about 22 December 1989, servants and/or contractors of the Forestry Commission commenced roading works in the Davis Creek section of the Mount Royal State Forest. Those works proceeded through Cross Creek. On January 3 1990 the applicant commenced these proceedings to restrain the logging and roading activities until the preparation of environmental impact statement in accordance with the provisions of Part V of the Environmental Planning and Assessment Act 1979. Despite the service on that day of the application for interlocutory and final relief, roading proceeded until it was finally restrained on 9 January 1990 by the giving of undertakings on the part of the Forestry Commission to the Land and Environment Court in lieu of interlocutory orders. The road is now within 100 metres of Davis Creek.

6. On 16 January 1990, the proceedings were mentioned

again before Cripps CJ. Counsel for the Forestry Commission admitted that his client was in breach of Part V of the Act, in that it had failed to prepare and exhibit an environmental impact statement in relation to the proposed roading and logging activities. On that day, two logging companies, R A Sweetman and Son Pty. Ltd. and Upper Hunter Timbers Pty. Ltd., were joined as parties respondent in the proceedings. Cripps CJ made interlocutory orders against the logging companies in the same terms as the undertakings given by the Forestry Commission. He felt able to do so by reason of the admission of breach, from which it followed that any approvals or licences issued by the Commission were also nugatory. The companies are restrained from roading and logging in the Forest until 13 March 1990. On 6 February 1990, a further directions hearing was held before Cripps CJ. Counsel for the Forestry Commission withdrew the admission of breach and advised the Court that an environmental impact statement was being prepared by the Commission, but not under the provisions of Part V of the Act. In other words, the Commission was preparing a non-statutory EIS. Counsel for the Commission further informed the Court that the Commission was prepared to undertake not to log compartments 202-204 until its completion of the EIS, but would seek orders from the Court permitting it to log part of compartments 200 and

201 delineated on a map filed in Court, even though no EIS would have been completed preparatory to such work.

7. I have been advised by Counsel for both the Forestry Commission and the logging companies that they propose to ask the Court on 13 March 1990 to discharge the undertakings and injunctions. Mr Corkill must therefore be in a position to proceed on that day or an adjourned date for the interlocutory orders sought in the application. I am asked to advise upon the prospects for success of the application.

8. Part V of the Environmental Planning and Assessment Act contains two obligations which must be complied with by all public authorities and others whose activities do not require development consent: in considering any such proposed development, the authority must examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment (s.111) and it must not carry out the development without obtaining, examining and considering an EIS where the development is likely to significantly affect the environment (s.112).

9. The Forestry Commission, whose activities in this case do not require development consent under Part IV of the Act, has comprehensively failed to comply with these

obligations. Its consideration of environmental matters is restricted to an Environmental Review in 1983 and a codicil to that review in 1988 together with the **Management Plan**.. Both the Review and its codicil express ignorance of both flora and fauna in the area. Some very general forestry types are given but only in relation to millable timber. The Environmental Review disarmingly admits that the forest will be

> "transformed from an unlogged forest to a vigorous regenerating forest....the ecosystems of the locality will be disrupted during the duration of road construction and harvesting....the forest will generally lose its unlogged, semi-wilderness appeal"

and concludes that the new forest will have a different appeal "showing the inescapable presence of man in the form of roads, snig tracks and stumps". The **Management Plan** admits that there has been no comprehensive flora survey (p.4). Again, there is only a broad description of forest types of utilitarian assistance to foresters but having no use for ecological assessment of significance. The Plan states that no fauna surveys have been done in the area (p.6) although it ignores work performed by Dickman referred to above. It does however mention the Hastings River mouse, describing its occurrence as "unusual". It omits to state that it is near extinction. No areas have been reserved in the Davis Creek section to protect flora and/or fauna and the preferred management priority classification, which can afford limited protection to some forests, is "multiple use general". This means what it says and ensures that none but the most basic protective measures will be taken by the Commission in working the land. The Plan also admits that there are no current research projects in relation to the forest (p.10). Surprisingly, it concedes that the forest has "considerable nature conservation value" (p.20) and that it is "locally significant". It seeks to diminish that significance by suggesting that regionally it is less significant. The Plan defines region to include most mid north coast forests including the Barrington Tops National Park. The Act requires, however, that in considering the duties under Part V, the relevant environment is the land on which the proposed activities are to take place together with any other land upon which those activities will have a direct or indirect impact: Jarasius v. Forestry Commission (unreported, 14 March 1988) at 25-27; Bailey v. Forestry Commission(1989) 67LGRA200 at 212-213P "it was not open to the Forestry Commission to determine that the relevant environment for the purposes of s.112 in this matter is the whole forest". In this case, the relevant environment upon which the significance of the impacts of logging and roading is to be assessed is the Davis Creek section. It is a discrete water catchment area draining to different streams than the remainder of the State Forest and it is geographically separated from both the National Park and the State Forest by a ridge system. The Forestry Commission has accepted in the **Management Plan** that these activities will have a significant impact upon that local environment.

10. It may be that this is all the evidence that is necessary for the Court to find that there has been a breach of s.112. Not even the Forestry Commission can resile from its own assessment of the impact of its activities upon the Forest. This view is assisted by the following passages from **Jarasius** concerning old growth forests:

> In my opinion, by its very nature the integrated logging activity, whether on a local or regional viewpoint, has inevitably a significant effect of converting the environment from that of an old forest to that of a different and regenerated forest. The forest must be fragmented and flora is likely to be reduced in species and diversity. The full extent of the likely impact on flora in this environment is difficult to assess because there has been no comprehensive survey or research on impacts on non-commercial species. The process of removal of the old forest and regeneration has, in my opinion, immediate short and long term effects on the environment and notwithstanding (and sometimes as a consequence) of management procedures of the first respondent, such effects are likely to be significant.
>
> I am satisfied that as a consequence of the nature of the activity it is likely that many species of fauna will be adversely affected by the current logging operations and this effect is likely to be compounded by fire. I am also satisfied that if the current logging operations continue for a long term it is likely that arboreal populations could

significantly change, particularly if regrowth forests fail to provide adequate habitats for birds and mammals. Whilst it is apparent that tree dwelling birds and mammals are not evenly distributed in the region, I am satisfied that existing management procedures and prescriptions do not guarantee the maintenance of composition and distribution.
Erosion and increased turbidity in the stream system is likely, at least in the short term, but I am not satisfied that logging is likely to cause changes in streams in excess of naturally occurring fluctuations. The construction of roads with associated works of drainage, timber clearing, cutting and filling, excavation and retaining walls has an effect on this environment and that effect is significant, particularly if located in or near rainforests, creeks or swamps. The opening of such roads and quarries in the forest is also likely to have a significant effect as a consequence of increased human activity, machinery and vehicles, visual change, fire risk and danger to fauna.
Control burning both pre and past logging is carried out by the first respondent to reduce the impact of wildfire and to facilitate regeneration. However it is conceded that repeated burning associated with logging, as distinct from wildfire, is likely to cause sheet and gully erosion before regeneration. I am also satisfied that regular burning as distinct form wildfire is likely to affect the diversity of plant and animal communities and their habitat to a significant extent, particularly in the long term. I make no similar finding as to broad area rather than periodic burning proceedings. I have no hesitation in finding that the said activities of the first respondents and those of the other respondents in areas "A" and "B" are likely to significantly affect the environment within the meaning of of s.112, and that it was not reasonably open to them to conclude otherwise. I make the same finding with respect to the subject approvals and associated works, whether such environment is limited to areas "A" and "B" separately or together, or even the agreement area as a whole." (pp 25-27)

If it is necessary, the applicant in these proceedings has the substantial scientific support referred to in paragraph 4 above for the conclusion that the impact of the activities will be significant for this forest. I should deal with one argument foreshadowed by Counsel for the Commission in relation to significance. As large areas of forest are conserved in the Barrington Tops National Park, including part of the Mount Royal State Forest, the Commission will contend that the natural systems in the Mount Royal Forest are replicated within the area so conserved and therefore have no unique qualities which are deserving of protection and presumably study. One answer is to draw attention to the relevant environment, which necessarily excludes comparison with these other areas. Another answer is that those other areas have been recognised as having world heritage significance by the inscription of the National Park on the World Heritage List. It may well be, as the Forestry Commission will argue, that the Mount Royal Forest shares similar natural values with the Barrington Tops National Park: if this is so, then those values are by definition of international significance. The Commission's argument is in fact a powerful reason for attributing significance to any impact which transforms this natural habitat.

11. Nor can the Commission hide behind its familiar

technique of failing to conduct any surveys of the area preparatory to its decision to conduct logging and roading so that it can describe various natural values of the forest as "none known". This disgraceful abuse of the law was first exposed in Kivi v. Forestry Commission (1982) 47LGRA 38 Cripps CJ said that:

> "The expressed lack of knowledge of what was likely to be encountered in the locality together with an expressed hope that the effect of what ever was encountered would be protected by general conditions and the implementation of the Commission's policies, does not satisfy me that the conclusions reached by [the district forester] are sustainable". (at p.44)

Apart from the circularity of this argument, there is another more powerful reason for denying to the Forestry Commission the benefit of its own ignorance. Section 111 of the Act obliges the Commission to examine all matters affecting or likely to affect the environment by reason of the roading, logging and burning proposed for the Forest. Quite clearly this is an express obligation on the Commission to conduct the flora and fauna surveys that would better inform it of the nature of the existing environment. It must do so whether or not the activities will have a significant effect upon the environment. On this construction, s.111 fits easily into the scheme of Part V, as it is in part intended to make meaningful the prohibition upon carrying out significantly harmful activities in the absence of a properly prepared and exhibited EIS.

12. A succession of Judges in the Land and Environment Court have decided that the appropriate test for determining a breach of s.112 is whether the decision to proceed with the activity in the absence of an EIS was not reasonably open to the determining authority. In reaching my conclusion that the Commission is in breach of ss.111 and 112, I have applied this test, even though the propounding of it expresses an egregious legal error. The correct test is to treat the facts required to exist before the obligation to prepare an EIS arises as jurisdictional or collateral, that is, as conditions precedent so that the Court in judicial review proceedings determines the existence of those facts rather than investigating whether the authority's opinion that the activities were not likely to significantly affect the environment was so unreasonable that no reasonable authority could have reached it. The line of authority for this error includes Leichhardt Municipal Council v. Maritime Services Board (1985) 57LGRA169 at 177 per Cripps CJ; Drummoyne Municipal Council v. RTA (1989) 67LGRA155 per Stein J; Bailey v. Forestry Commission (1989) 67LGRA200 per Hemmings J and Rundle v.Tweed Shire Council (1989) 68LGRA308 per Bignold J. One consequence of this error is that an EIS need not be prepared even if the activities which it should have described and assessed

do have a significant impact upon the environment, provided the decisionmaker has remained within the bounds of rationality. A clever statutory authority desiring to avoid the environmental assessment provisions of the Act and to cloak its activities in secrecy should have no difficulty in complying with this standard. It is bad law simply because the factual conditions precedent to the exercise of power in s.112 are cast objectively. If the legislature intended the provision to be read subjectively, it would have adopted the expedient of an "in the opinion of" clause. Even these clauses are not immune from attack for jurisdictional error, but I know of no case where an objective condition precedent to the exercise of a power has been held to be unreviewable otherwise than for legal irrationality. There are quite fundamental constitutional reasons for constraining administrative decisionmakers to act within power: a Government subject to law is one whose actions may be judicially scrutinized. To exclude or confine such scrutiny as the Land and Environment Court has done here is to permit the executive to ignore the law. The proposition may be demonstrated by the power to deport an illegal entrant. The deportation power may be exercised by the Minister without judicial scrutiny as to its merits, provided the grounds for his decision stay within the bounds of rationality. But the power can only be exercised if the deportee is in fact an illegal entrant. The existence of that fact cannot be conclusively decided by the Minister, and if appealed the Court will determine it, and not merely the reasonableness of the Minister's decision.

The principle is described by Sir William Wade QC in the sixth edition of **Administrative Law**:

> "The principle of objectivity authorises the Court to define that area of freedom. It is only one of the many weapons in their armoury, but it is of primary importance. Without it they would be powerless to prevent serious usurpations. A public authority might then, by making some mistake as to the extent of its powers, do something which the statute never intended to permit. The object of the courts is to prevent this at all costs by standing guard over the frontiers of free discretion. In other words, the minister or other body must not be allowed to be the judge of the extent of his own powers (at 280).
> ....if the court fails to stand guard over facts and requirements expressed objectively in [the law], it surrenders the rule of law to the rule of executive discretion. It is essential, therefore, that "where the exercise of executive power depends upon the precedent establishment of an objective fact, the courts will decide whether the requirement has been satisfied" (Khawaja's case [1984] AC74 at 110)" (at 285).

This is a legal commonplace in Australia: Australian Communist Party v. Commonwealth (1951) 83CLR1.

13. As I have already observed, this case may not be the occasion for removing this blight upon the jurisprudence of the Land and Environment Court. There

is ample evidence that the decision of the Forestry Commission not to conduct an EIS was so unreasonable that no reasonable public authority could have so decided. This was no doubt what prompted its Counsel to make the concession (later withdrawn) of breach of s.112. It appears that the tactic of the Forestry Commission may be but weakly to resist an order compelling the preparation of an EIS in the hope that the Court will suspend the operation of any final orders preventing logging and roading until the EIS has been prepared. In both Jarasius and Bailey, the Court was persuaded to temper the impact of the injunctions awarded in those cases by exercising its discretion to restrict them to certain compartments. In the absence of specific evidence of environmental damage to other parts of the forests, the Court was prepared to permit the continuation of logging.

14. This exercise of judicial discretion has the potential to undermine Part V. It appears to have been employed without advertence to the onus of proof which must always lie on the party seeking to invoke the discretion (Warringah Shire Council v. Sedevcic [1987] 63 LGRA360). Nonetheless, the applicant in these proceedings should be cautious not to leave himself exposed by failing to call evidence of site specific surveys undertaken by experts in flora, fauna,

avifauna, erosion and general forest ecology. The area here is considerably smaller than the large forests in Jarasius and Bailey. The task of surveying these compartments to resist any such discretionary order should not be difficult.

15. Finally, it is frequently argued in such cases that the impact upon employment and wealth in local communities should prevent the grant of an interlocutory injunction on the balance of convenience. Fortunately, this argument is not available to the second and third respondents, as the area has not been logged since 1984 and as the Management Plan states, "there are no industries currently depending upon the Area for supplies of timber". This is not a case where the survival of a business enterprise or of a local community depends upon the continuation of an unlawful activity.

16. Mr Corkill enjoys excellent prospects of success in obtaining both interlocutory and final relief against the Forestry Commission. The case against the other respondents is contingent upon success against the Commission. I am particularly impressed with the force of the advice of Dr Dickman and the obvious significance of this forest, which I have inspected, having regard to its similarity with the World Heritage

area of the Barrington Tops National Park. It would be difficult to find a more blatant case of a public authority acting in contumacious disregard of the law.

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CORKILL V. FORESTRY COMMISSION OF NEW SOUTH WALES

NORTH WASHPOOL

Memorandum of Advice

1. The Forestry Commission of New South Wales threatens to road, log and burn within an area of State Forest on the northern border of the Washpool National Park. The area forms part of the Washpool and Billilimbra State Forests comprising 6,053 hectares. The topography rises steeply to the Gilbraltar Range from the two main water courses, Malara Creek on the western border of the area and Desert Creek which falls from west to east until it joins Washpool Creek at the south eastern boundary of the area. It is largely unroaded and with an exception to be noticed shortly, unlogged. Not only is it old growth forest in the sense explained in Jarasius v. Forestry Commission (1988, unreported, Hemmings J.), it is also predominantly warm temperate and sub-tropical rainforest and wet sclerophyll eucalypt forest with well developed rainforest understoreys. The rainforest is a complex mixture of associations but it is outstanding for the prevalence of coachwood. Geographically and ecologically, it is a natural continuation of the Washpool National Park which is one of the rainforest/wet sclerophyll areas of

New South Wales listed as world heritage property. This inscription recognised that the National Park preserved the largest stand of coachwood forest in the world and a diversity of plant communities and a mosaic distribution of wet sclerophyll and rainforest communities unsurpassed in New South Wales (**New South Wales Rainforests: The Nomination for the World** Heritage List, Paul Adam, NPWS, 1987, pp 57-61). It is an area of like quality which the Forestry Commission now proposes to log.

2. In two previous cases this year, I have advised Mr Corkill concerning threats by the Forestry Commission to log wet sclerophyll forest at Mount Royal in the Barrington Tops and Chaelundi adjacent to the Guy Fawkes River National Park. In both cases the proposal envisaged damaging the forests and dependant fauna without first fulfilling the statutory requirements under the Environmental Planning and Assessment Act 1979 ("the Act") to prepare, assess and consider an Environmental Impact Statement ("EIS") and to examine the impact on the environment of the proposed activities. In this case, the Forestry Commission has purportedly fulfilled the first obligation, that is, to prepare, assess and consider an EIS for the proposed activities and would no doubt claim that in doing so it discharged the second obligation.

3. In 1980 it exhibited an EIS for a proposal to log part of an area of 43,283 hectares to supply both rainforest and hardwood timbers to six timber mills over 30 years. After its exhibition, the Department of the Environment and Planning decided to call in and assess the EIS pursuant to Section 113 (5) of the Act. In May 1982, it published an environmental impact assessment Proposed Forest Operations in the Washpool Area ("DEP") which recommended that "the Washpool area should not be logged as proposed in the EIS but that the majority of the area be managed for conservation purposes with the remainder managed for timber production" (p.134). In October 1982, the State Government decided to reserve the larger part of the area studied in the EIS as National Park. On 14 December 1982, the Forestry Commission issued a formal determination under the Act as follows :

> "(a) Roading and logging operations for rainforest and hardwood timbers shall be carried out only in that part of the Washpool area as described in the Environmental Impact Statement, which is not to be reserved as National Park in accordance with the Government's decision;
>
> (b) The boundaries shown by broken red lines on the map shall be accurately defined in consultation with the National Parks and Wildlife Service, and having regard to any other requirements of the Government.
>
> (c) The harvesting in rainforest stands shall be

to maximum economic utilisation of quota logs, subject to the provisions of individual harvesting plans; and the log volume from such harvesting shall be available to Big River Timbers Pty Ltd.

(d) The strategies and prescriptions in hardwood and rainforest harvesting and the measures to reduce the environmental impact of forest operations as outlined in the environmental impact statement, shall be implemented.

(e) The views of the National Parks and Wildlife Service shall be sought and taken into consideration in respect of :-

(i) measures to reduce any possible impact of the forest operations on populations of Aepyprymnus rufescens (rufous rat kangaroo) and Potorous tridactylus (long nosed potoroo); and

(ii) any necessary roading proposed in close proximity to the areas which are to be reserved as National park.

(f) The Commission's Management Plans for the Casino West and Grafton Management Areas shall be amended to accommodate this determination."

Three matters should be noticed. First of all, it was then proposed to harvest rainforest to maximum economic utilisation which necessarily requires canopy removal. Second, no accurate definition of the boundaries of the National Park had then taken place. Third, the prescriptions stated in the EIS for reducing the environmental impact of the proposal were to be implemented, presumably without alteration.

4. What is the present proposal? With some difficulty, I have undertaken a comparison of the maps annexed to the EIS with the later maps produced by the Forestry Commission indicating the compartments which are or may be logged. From this study, it appears that compartments 679, 686 and 687 were not within the EIS study area but will now be logged. These compartments comprise 862 hectares of forest. Of the compartments within the present proposal two have been partially logged. Compartment 679 was apparently logged in 1989 to extract 3,150 cubic metres of rainforest timber and compartment 694 was logged in 1989 and 1990 to extract 3,069 cubic metres of rainforest timbers. The former compartment was outside the EIS study area. About 20% of the area of the Malara Creek catchment (3,163 hectares) comprises rainforest and brushbox whereas about 46% of the Desert creek catchment (2,890 hectares) is rainforest or brushbox. As 90% of the rainforest area is on slopes less than 30 degrees it is reasonable to assume that most of the rainforest will be logged. The only measure (other than the usual management prescriptions) proposed by the Commission recently to reduce the impact of logging on the rainforest areas is the reservation of an area of archaeological significance in the Desert Creek catchment comprising 1,130 hectares. The District

Forester has proposed by letter of 23 April 1990 to a member of the Baryugil Aboriginal Community to reserve this area from logging. I have no instructions whether this has been endorsed by the Forestry Commission. Assuming that it is excluded from the logging proposal, the Commission therefore intends to log 4,923 hectares, of which at least 30% comprises rainforest/brushbox, and much of the remainder is associated with a closed canopy rainforest understorey.

5. No harvesting plans are available for the current proposal. It is therefore necessary to assume that roading, logging and burning will take place in the forest area in accordance with the 1982 determination of the Commission and the Casino West Management Plan published by the Forestry Commission in 1979 but amended in 1980, 1982, 1983 and 1987. Upon analysis, however, the determination and the management plan conflict with each other and the management plan contains ambiguous, inconsistent and conflicting prescriptions for the logging proposal. The Management Plan states that logging shall be excluded from a management "buffer area" along the eastern boundary of Billilimbra State Forest adjoining the proposed National Park (p. 52). In Appendix 13 (a), the Management Plan notes an agreement with the National Parks and Wildlife Service that :

> "There would be general recognition of the need for sympathetic management of the forest adjoining the National Park, and specifically that there would be a significant buffer area of State Forest which would not be subject to any forest operations."

This buffer is suspiciously like the so called archaeological area proposed by the District Forester to be reserved from logging. Further enquiry may disclose that the two are identical. For present purposes, I observe that the area does not in fact buffer the National Park from the proposed forestry operations; it merely preserves a small catchment area which borders the National Park for about 1,000 metres. The southern boundary of the forest to the National Park stretches for over 14 kms and the Commission proposes to log all but one kilometre of it.

6. But the Management Plan is most obscure in its treatment of rainforest logging. Before setting out its provisions the Commission's definition of rainforest should be explored. The Commission does not include as rainforest areas of forest with tall eucalypts, even though there is an extensive understorey closed canopy of rainforest. It is not clear whether the Commission counts as rainforest myrtle, myrtle/viney scrub and viney scrub flora associations (forest types 23, 23/26 and 26). These difficulties make the management prescriptions of

uncertain application. In any event the Management Plan states that logging shall be excluded from :

> "Within rainforest stands in the area of Billilimbra State Forest south-west of Main Creek and the area included in the Desert Creek catchment of Washpool State Forest, ie within the Washpool EIS area." (p 42)

The area described in this prescription is the area of the present proposal. At this point, it seems clear that there shall be no rainforest (to whatever forest types that description extends) logging permitted. On the following page, however, under the heading "Rainforest" the following further prescriptions are stated as applying "specifically to the Desert Creek catchment and south-west of Main Creek in the Forests :

> "(10) Large-crowned trees of minimal log value, the felling of which would cause excessive damage to the residual stand to be retained after logging, shall not be harvested.
>
> (11) Subject to retention of at least 50% canopy cover so as to maintain a viable rainforest structure of the pre-existing species range, harvesting otherwise shall be directed to maximum economic utilisation only of those logs included in the allocation to Big River Timbers (Veneer) Pty Ltd." (p 43)

Far from encouraging regeneration of rainforests, the Management Plan stipulates silvicultural activities by planting eucalypt species such as silvertop stringybark in log loading areas, snig tracks and abandoned roads as well as under canopy openings .1 hectare or more in extent "following rainforest logging" in the proposal area (p. 44(a)).

7. The matter is put beyond doubt, however, by two events. First of all, the Commission permitted rainforest logging within these catchments in 1989 and 1990 (see paragraph 4 above). More significantly, the Commission released a press statement which I received on 10 August 1990. It announced the resumption of logging and roading in the Billilimbra and Washpool State Forests in pursuance of the Government's "commitment to make available hardwood and brushwood resources within the North Washpool area". "Brushwood" is a synonym for rainforest timber.

8. In extent alone the 1980 proposal differs markedly from the 1990 proposal, but does the greater include the lesser such that it can be said that the study of the greater proposal has discharged the legal obligation to study the lesser? In my opinion, it has not for a very simple reason. An EIS is required to include certain matters which are set out in Regulation 57 (2) to the Act. The proposed activity must be described in full (R. 57(2)(a)) as must the existing environment likely to be affected by the proposed activity. The EIS does not describe the proposed activity. The volume of timber to be removed is different as is the

intensity of logging. The area to be logged is dramatically reduced and the percentage of area which is capable of being logged has been increased. The sequence of logging, the percentage of forest types and the amount of particular forest types left undisturbed are different. So too is the justification for the proposal and the market demand. The impact on the socio-economic environment of the area will change. The profitability of the proposal, which forms part of any justification for environmental impacts from the use of public land, is radically reduced by the present proposal. I have undertaken an analysis of the returns to the Forestry Commission from the activities described in the Casino West Management Reports issued annually by the District Forester. The Ewingar Working Circle, which includes Washpool and Billilimbra State Forests, recorded losses in 1986, 1987 and 1988 to such an extent that the District Forester stated in his 1988 Annual Report that :

> "Under present accounting guidelines there appears to be little change (sic) in the foreseeable future of the commercial accounts for Ewingar getting back onto the right side of the ledger."

The proposed activity will include many kilometres of roading, the cost of which will further aggravate the existing losses from timber production. How can the justification for a proposal such as this be assessed without examining its profitability? Each of these matters demonstrates that the effluxion of time and the alteration of the proposal have removed any continuing efficacy of the 1980 EIS in fulfilling the obligation contained in section 112 of the Act.

9. There are two further fundamental problems with the 1980 EIS. It did not study North Washpool. What it did study, it did so inadequately.

10. The most important functions of an EIS are to describe the existing environment and to predict the impacts on it of the proposed activity. In describing the forest environment it is usual to examine the physical environment (geology, topography, soils, rainfall, hydrology, climate and water quality), the biological resources of the forest (flora, fauna) and the socio-cultural environment (archaeological and anthropological significance, historical sites, existing and proposed land uses, employment generation). To some extent, the biological resources of a forest depend upon its physical environment so that changes in the physical environment of the forest (for example the nutrient status of its soils) will affect the diversity and type of biological resources dependent upon it. There is also an interdependence of biological resources, in the sense that fauna is often flora specific and, of course, some flora will depend

upon the presence or absence of some fauna to introduce or eliminate growth-effecting organisms. Rarely will a description of the forest environment be complete without examining its environmental domains, a method of analysis described by Mackey et al (Assessing the representativeness of the wet tropics of Queensland as World Heritage property, Biol. Conserv. (1989) 50: 279-303) to assess the physical environment. The EIS does not attempt environmental domain analysis, assuming that there is sufficient information available to do so. It is then necessary to characterise the flora:

> "Before any assessment can be made of the nature of vegetation in a given area, it is necessary to describe it, that is to know what species are present, how they are distributed and what is their relative abundance. Basic to the description of vegetation is the knowledge of floristics, life form and structure. Floristics involves the identification and listing of the species present. Life form or growth form in its simplest manifestation indicates the kinds of plants present, e.g. trees, shrubs, forbs, herbs, mosses, and so on.
>
> Structure is defined in terms of the following attributes:
>
> . Stratification, or the vertical arrangements of the life forms present;
>
> . Spatial distribution, or the horizontal arrangement of species;
>
> . Species abundance.
>
> Abundance is expressed in a number of ways. It may be assessed subjectively, in relative terms such as abundant, frequent, occasional or rare; or preferably by one or more of the following quantitative measures:

- Density or number of individuals per unit area;
- Cover, or the proportion of ground surface occupied by a vertical projection of the foliage of the species being considered.
- Frequency, or the probability of the species being present in a randomly selected quadrat (sample of plot);
- Biomass, or the amount of vegetable matter per unit area."

Richards et al, Biological Conservation of the South-East Forests, Report of the Joint Scientific Committee to Commonwealth Minister for Resources and NSW Minister for Natural Resources, July 1990.

Surveys of fauna abundance and distribution are necessary to characterise the fauna of the area, to ascertain the conservation value of the area in relation to fuana and to determine whether particular species or their preferred habitats are present in the survey area. The use of survey evidence from other areas may be useful to assess conservation value but it is not informative of the abundance and distribution of fauna within the area proposed to be logged. The fauna which should be surveyed are mammals, birds, reptiles, amphibians, aquatic fauna and invertebrates. The 1980 EIS did not survey North Washpool (or any other place in the Washpool area) for fauna.

11. The physical environment of the area is not described at all. Rather, the EIS describes the regional climate, rainfall, wind and temperature using data from points up to 150 kilometres away from the area. No assessment is made of water quality of the catchment areas and the rainfall data is limited and apt to mislead (EIS p. 70-74 and Appendix 9). Particularly disturbing is the absence of any data for cyclonic winds (EIS p. 74). Cyclonic winds cause windthrows and blowdowns in rainforest where the canopy has been opened by roading or logging (Pugh, **North Washpool, EIS Deficiencies and Logging Impact**, 1989, unpublished). The rainfall data provided in the EIS may underestimate the likely rainfall of the Washpool area (DEP, p. 22) and a statistically invalid method was used to plot rainfall isohytes based on a regression equation (NPWS, **Proposed Forest Operations in the Washpool Area**, 1981, Appendix 1). Although referred to in the EIS (p. 74, Appendix 9), no rainfall intensity-duration curve or probability curve is reproduced. The absence of reliable hydrological data in the EIS was one of the matters which prompted the National Parks and Wildlife Service to conclude that the EIS did not comply with the Act (NPWS, 1981, p.32):

> "The base line climatological data is sparse and ... includes statistically invalid assumptions and a number of omissions. While a runoff coefficient of 0.46 has been calculated, reworking of the raw data provided in Tables 2 and 4 (Appendix 9),

> enables 95% confidence limits of 0.26-0.60 to be calculated. Thus, there is a reasonable probability that,during periods of intense precipitation, the yearly average runoff coefficient could be as high as 0.60. The Environmental Impact Statement acknowledges (Appendix 9, page (vi)) that the three monthly wet period coefficient can reach 0.86. These figures are of critical importance in evaluating the impact of logging operations upon runoff quantity and quality".
> (NPWS, 1981, p. 36-37)

The Forestry Commission later admitted that this analysis was correct, except that the probability of the coefficient reaching 0.60 should be described as "small" (DEP, p. 219).

12. As rainfall, temperature and wind speed and direction are usually measured over decades, the Forestry Commission may be excused for failing to obtain site specific data (although it is not difficult to calibrate remote wind data by taking site specific measurements). There is no such excuse for its failure to carry out a site specific examination of the geology, soil types and soil fertility of the area. The Commission used a geological survey of limited accuracy (EIS, p. 68) and it failed to carry out soil mapping (EIS, p. 69). Some of the soils in the area are deep and highly erodable (such as the granites - granodiorites). An understanding of soils and soil fertility is critical to appreciating the extent of any

possible erosion from roading, logging or burning activities. In Bailey v Forestry Commission (1989) 67 LGRA 200, Hemmings J decided that the Standard Erosion Mitigation Conditions which the Commission proposes to enforce in this area were unsuitable for controlling erosion on slopes over 25 degrees where the surface soil is removed and the subsoil is highly erodable. It is proposed to log in North Washpool on slopes up to 30 degrees. The DEP concluded, after discussion with statutory authorities, that:

> "Research work had not been undertaken to establish the probable runoff characteristics and soil types with respect to erosion and water quality. It is considered that, without provision of data on soils of the Washpool area and without evidence of the efficiency of the Standard Erosion Mitigation Conditions or application thereof, there is considerable doubt that the soil and water resources of the area will be adequately protected....A characteristic of the proposed mitigation measures is that there is generally non-specification of the criteria for application of the measures....it is evident that the proposed mitigation measures are non-specific and open to considerable interpretation as to whether or not they need to be implemented".
>
> (DEP, 1982, p. 62-63).

Again, the Forestry Commission has admitted the criticism:

> "There is some justification of submissions stating that there is insufficient hydrological data and data on soil type and their erodibility".
>
> (DEP, 1982, p. 160).

This is a valuable admission of inadequacy which is admissible in any proceedings to challenge the EIS. Interestingly, Floyd notes that his investigations in the South Washpool area established that the geological source data for the EIS contained major errors (**Rainforest of Gilbraltar Range National Park and Southern Section Washpool State Forest**, 1980, NPWS unpublished, p.2). Dr. Fox also noted this, but more importantly her report on the vegetation of the Washpool area explains the significance of analysing soil chemistry. Dr. Fox found a correlation between high calcium concentrations in soil and logged rainforest sites, and between the soil from logged rainforest sites and the soil from the wet sclerophyll forest sites (**A Vegetation Survey of the Washpool Area, Northern NSW, National Herbarium of NSW**, DEP, 1983, p.96). The EIS contains no discussion of nutrient loss or chemical change in soil types subjected to stress from logging or roading activities, except to record the further admission that "detailed investigations of the soils have not been made" (EIS, p.121).

13. The only discussion of water quality in the EIS is in relation to some off-site data collected for Washpool creek (EIS, pp.70-71, 120 -121, 122). This is a significant omission. Even the EIS recognises that the Washpool area has been nominated as wilderness (EIS, p.1;Helman et al, **Wilderness in Australia - Eastern NSW**

and South-Eastern Queensland, 1976, University of New England). In 1980, the NPWS commissioned Hughes to report on the significance of Washpool creek and other wild rivers in the Washpool area. Hughes found that:

> "The logging operations proposed by the Forestry Commission of NSW for the Washpool Area would totally negate the wild river values of the Washpool wild river system.... the impacts of logging on wild river values are both direct and indirect and can be substantial even when disturbance is some distance from the immediate stream corridor. The more pristine the stream the greater the impact of any given disturbance. Particular impacts of logging in the Washpool area on wild river values include massive visual disturbance, the intrusion of unnatural noise, reduced water quality, changes to fire regimes with consequences for the distribution of forest types, and finally the risk of introduction of exotic flora and fauna".
>
> Wild rivers in North-Eastern NSW with particular reference to the streams of the Washpool area and the effects of foresty operations thereon, 1981, NPWS, 75.

Any visual degradation of water quality must reduce the wilderness values of the forest. Changes in water quality will also affect the health of aquatic plant and animal life. Remarkably, there is a complete absence of any discussion in the EIS of what plant and animal life is dependent on streams in the area. This was an unforgivable omission as logging would take place as close as twenty metres from streams and road crossings of watercourses were proposed, quite apart from the potential for catchment erosion. The State

Pollution Control Commission assessed the proposal as having a significant impact on suspended sediment, turbidity, dissolved loads, nutrients, oxygen concentrations and stream temperatures. The Commission attacked the EIS for failing to recognise that water quality is dependent on snigging and other operations as well as controlling erosion from roadworks (DEP, 1982, p.52). The NSW State Fisheries noted that the Eastern sub-species of Murray Cod which is particularly sensitive to siltation and suspended solids was unique, probably present in the Washpool area and should be afforded protection. It also expected the spiny crayfish to occur in the area. This crayfish is also very sensitive in changes in water quality (DEP, 1982, p.44).

14. The EIS does discuss flora and fauna. Its description of flora is by refernce to forest types developed to assist in forestry management and not ecological investigations (Forest Types in NSW, Research Note number 17, Forestry Commission, 1989). The forest was typed by aerial survey and there is no evidence of field validation in North Washpool. Floyd found several types (all floral associations) which were not recorded as forest types at Washpool and the NPWS concluded that the forest type maps exaggerated significantly the area of sub-tropical rainforest and

commensurately underestimated the area of warm temperate rainforest (NPWS, 1981,p.38). As typing is an overstorey description, it generally ignores well-developed rainforest understoreys in wet sclerophyll forests. Indeed, the NPWS suggested that some such types could be interpreted as rainforest with hardwood emergents (NPWS, 1981,p.37). The EIS does, however, use data from sample sites: misleadingly and without proper assessment according to Dr. Fox (**A Vegetation Survey of the Washpool Area**, 1983, pp. 134-135). Remarkably, none of the sample sites were within the North Washpool area, although some bordered it (see Fox, 1983, p.34). The EIS confesses ignorance of the mechanisms for the distribution of vegetation associations (p.89) and proceeds to describe the dominant rainforest as integrated or mixed and it cannot ascribe any "any clear reason for this apparently random variation" (EIS, pp 90-91). It then reports several significant associations and asserts that no rare or endangered plant species have been noted in the area. On the other hand, Floyd had no difficulty in defining the mixed rainforest as three associations with six seral stages for Coachwood-Crabapple-Corkwood (DEP, 1982, pp 25-27). The absence of site-specific data and the international significance of the rainforests at Washpool prompted the DEP to commission Dr. Fox of the National Herbarium to produce a more substantial report on the area. Dr. Fox was scathing in her criticism of the vegetation sections of the EIS (See Fox, 1983, pp 134-136). The treatment of data in the EIS was cavalier. The assessment of the impact on vegetation from logging did not describe the sites used to compare impact from previous logging operations and failed to describe the methodology used to assess the incidence of dieback and canopy change, thereby precluding assessment and evaluation of its conclusions.

15. Disturbingly, Dr. Fox reached almost diametrically opposed conclusions to those in the EIS concerning the impact of logging and the significance of the Washpool area. It was the mixture or gradations of forest which Dr. Fox considered an outstanding feature:

> "The area is also exceptional for the richness of gradations between different rainforest types and mixed stands with eucalypt canopy over rainforest understorey. This rich mosaic is the result of complex combinations of soil type, topography, shelter and precipitation, refined by the absence or frequency of fire and by cyclone or storm damage. Taking the entire area with its mosaic of rainforests and moist eucalypt forests, this is the largest remaining virtually undisturbed moist forest unit in northern NSW."
> (p. 7)

Dr. Fox sampled 35 sites including 14 that had been logged in order to describe and understand the vegetation of the area. She found 70 species which were of special botanical interest because they were rare or restricted or because they were at their furthest known extent of geographical or topographical distribution. Computer analysis of the data collected by her clearly distinguished the logged rainforest sites from the undisturbed rainforest and she concluded that:

> "Logged rainforests are qualitatively different from unlogged stands, regardless of the time since logging. Studies that attempt to quantify the changes caused by logging, and to put a timescale on the process of regeneration ignore this concept. There is a fundamental and qualitative change when pristine vegetation is modified in any way. Logging alters the floristic composition, physical structure, life form composition, several site attributes and soil chemistry of a rainforest stand. All changes degrade the stand so that it more closely resembles a relatively depauperate association such as a moist eucalypt stand with rainforest understorey (p. 9).
>
> "There is also an insidious threat to the continued existence of rainforest if logging occurs in or adjacent to them. This comes from a high probability of the establishment of eucalypts in areas that have had their canopy opened by logging. In some cases it is the practice of forestry authorities to establish eucalypts as a "nurse crop" for regenerating rainforest areas. Once such a crop is established, there then arises a likelihood of either logging to remove the merchantable eucalypts or reclassification of the stand as mixed forest because of the presence of the eucalypts. Either outcome could lead to the continued logging and potential long-term deterioration of the rainforest (p.103)".

Dr. Fox was prescient in that the Management Plan for the area anticipates such silvicultural activity after loss of rainforest canopy (see para 6 above).

16. The analysis of vegetation impacts in the EIS was unscientific and unsatisfactory. No site-specific vegetation was sampled and there is no warrant for the predictions of recovery from rainforest logging.

17. It is probably enough to defer to the DEP for an assessment of the inadequacies of the EIS in describing fauna:

> "...the mammals were not surveyed, the avifauna is described on the basis of suspected occurrence generally from standard references, expected occurrences for reptile and amphibians are appended, the invertabrates have not been surveyed and the aquatic fauna is not considered. The description on fauna in the EIS is based on the assumption (not supported) that the area and its fauna are currently in equilibrium with no long-term decline of either forest types or faunal species." (p.30)"

The EIS fails to assess the impact of logging, roading and burning upon fauna. No ecological research had then been undertaken in forests comparable to those in the Washpool area to assess the impact of logging on faunal species or communities (NPWS,1981, p.40). Although subsequent to the publication of the EIS fauna surveys have been conducted (Osborne, **Vertebrate Faunal Studies in the Washpool-Gilbralter Range Region**, 1982, Total Environment Centre; Holmes, **Avifauna Of The Big Scrub Region**, 1987, NPWS; Barker, **Reptiles and Amphibians of the Gilbraltar Range**, 1981, NPWS; Clancy, **Report on the Fauna of the Desert and Malara Creeks**, Billilimbra and Washpool State Forest, 1989, Wilderness Society), only Clancy addresses North Washpool specifically and he carried out a limited field survey in the Desert Creek catchment during August 1989, when poor conditions would have discouraged fauna. On my advice, Mr. Corkill retained a leading wildlife ecologist, Sandy Gilmore, to assess the impact of the proposed roading and logging operations in the forest on fauna and the adequacy of the EIS. Gilmore concludes that the EIS is grossly inadequate. It failed to include specific faunal information based on surveys and research within the area it purported to describe. It concentrated on short-term impacts and did not quantify those impacts associated with changes in the age, size and density of trees, in order to predict loss or gain of habitat using a dynamic habitat simulation model. A geographic information system should have been used to generate patterns of distribution of rare, threatened and forest dependent vertebrate species through space under different harvesting alternatives. The consequences of reducing population to smaller and more isolated fragments should have been specifically researched. The impact of roading in encouraging predatory species should have been studied. The EIS does not study faunal interactions with adjoining lands and in particular it does not describe which species are migratory and which land use categories and vegetation could be influenced through an impact on the densities of migratory faunal species in the North Washpool area. Gilmore found that the North Washpool area probably sustains 28 species of fauna listed as endangered on Schedule 12 of the National Parks and Wildlife Act 1974.

18. It has now been demonstrated that the archaeological work undertaken for the EIS was deficient. The EIS reported recommendations by the archaeologist retained by the Forestry Commission that three areas be further studied. Significant aboriginal sites have now been discovered in the forest, but not in any of the three areas proposed for future study. The EIS only surveyed a very small part of the area to be logged (less than 10%) and apparently no surveys were carried out in North Washpool (EIS, Appendix 15). The NPWS also inspected the area and concluded that "there is insufficient data, at present, to decide where the proposed logging in the Washpool State Forest will conflict with the legitimate demands of local aborigines for the protection of sacred/significant areas" (EIS, Appendix 14, p.v). Although archaeological and anthropological investigations of rainforest areas are difficult because of the amount of leaf litter, there is evidence that Aborigines occupied and exploited rainforests, contrary to earlier

perceptions of forest usage (see especially Bowdler, Aboriginal Sites on the Crown-timber lands of NSW, 1983 Forestry Commission of NSW). The NPWS, which is the consent authority for the destruction of aboriginal sites, was unable to make an assessment of the importance of any areas in the forest to aborigines "until after the completion of the detailed survey" (NPWS, 1981, p. 42). Whilst it may be reasonable to sample indicative areas of a large forest, some of which will be disturbed by forestry operations, the failure to survey the North Washpool area at all is not. In any event, the present proposal is to log a much smaller forest with more limited areas of possible aboriginal activity. Failure to survey such areas is a material deficiency in the EIS.

19. The environmental impacts upon the forest of the proposed activities have not been properly assessed. Some of them have not been noticed at all whilst others, as I have described above, are inadequately or misleadingly discussed. Pugh (1989) discusses in exceptional detail the likely impacts. I gratefully adopt his analysis and conclusions, which will be important in the likely event that the Court is asked to exercise its discretionary power to exclude some compartments from any injunction.

20. The inadequacies of the EIS are manifest. Both the DEP and the NPWS reached that conclusion when assessing it early last decade. It has not improved with age. I do not think it necessary to canvass the various tests proposed for determining the validity of an environmental impact statement. This EIS fails all of them. The prevailing test is whether the EIS is adequate (**Guthega Development Pty. Ltd. v. Minister** (1986) 7 NSWLR 353). The Washpool EIS was an inadequate document to assess the impact of the logging and other operations proposed in the Washpool area in 1980. Now that those logging operations have been restricted to a much smaller but still significant area in North Washpool, the EIS is even more inadequate as it contains virtually no site-specific data concerning the existing environment, it studies a different proposal at a different time with different social and economic consequences and the absence of physical and biological data relating to the area has prevented any intelligible assessment of environmental impacts.

21. I am therefore of the opinion that proceedings in the Land and Environment Court to restrain forestry activities in the North Washpool area pending the completion of an EIS within the meaning of the Act will succeed. As there is a serious case to be tried, I am of the opinion that the Court would award an

interlocutory injunction on the balance of convenience. The following evidence will be necessary to secure this relief:

(a) An affidavit from Mr. Gilmore to the effect of his statement;

(b) An affidavit from a flora specialist, preferably Dr. Fox or someone familar with the rainforest and wet sclerophyll vegetation;

(c) An affidavit from a soil scientist who can assess the erodability of soils and the impact of logging, roading and fire activities upon them. Dr. McGarity is the obvious choice, having given evidence in Bailey's case and being familar with the North-East region;

(d) An affidavit from an hydrologist, who can comment on the accuracy and relevance of the data used in the EIS and who can recalculate runoff coefficients and make assessments of the impact of vegetation removal upon velocity and volume of runoff. Dr. Christopher Joy of Water Studies Pty. Ltd. is a highly regarded expert in this area, although he has little forest-specific experience. Such experience is probably unneccessary, even if it was available within Australia.

(e) An affidavit from a fresh water biologist who can describe the stream ecology of the catchment areas in the forest, including reporting the sensitivity of flora and fauna to levels of suspended sediment and other pollutants calculated by the hydrologist and soil scientist to enter the stream system during erosion events;

(f) A forest ecologist, with practical experience in managing forestry operations who can give evidence of the impact of logging and ancillary operations upon the forest environment. I recommend Assistant Professor Recher;

(g) An affidavit from an archaeologist concerning the inadequacies of the EIS. I recommend Ms. Mary Dallas or Dr. Scott Cane.

(h) An affidavit from Dr. Paul Adam, who wrote the nomination of the New South Wales rainforests for the world heritage list. Dr. Adam is ideally placed to assess the conservation significance of the North Washpool area.

22. If proceedings are commenced, I would expect the Land and Environment Court to order that they continue on the pleadings. The next task for any experts retained by Mr. Corkill should be to list the defects of the EIS (so far as it concerns their area of expertise) to assist me in settling points of claim. A great deal of information has already been amassed at my suggestion to assist me in preparing this advice. That information will be necessary for the purposes of these proceedings and it should so far as relevant be made available to our witnesses. As well, each witness should be supplied with a copy of Mr. Pugh's paper. If the Forestry Commission contests the interlocutory application, a Notice to Produce should be served on it requiring production for the purposes of evidence of all documents referred to or used in the compilation of the EIS, together with any data, environmental reviews, surveys, harvesting plans, roading maps, timber licenses or correspondence relating to North Washpool. A subpoena should issue to the Department of Planning to obtain the correspondence between the Foresty Commission and the Department during the preparation by the Department of its environmental impact assessment report. I understand that such correspondence may

contain assertions concerning the adequacy of the EIS and requests by the DEP for further information which were not met by the Forestry Commision. A subpoena should also issue to the NPWS for their data on North Washpool and any discussion, negotiations or correspondence between the Service and the Forestry Commission relating to buffer zones between the Washpool National Park and Washpool and Billilimbra State Forests. I have spoken to the Deputy Director of the National Parks and Wildlife Service with a view to securing evidence from expert officers in the Service who have studied the Washpool area in the course of assessing the EIS. It is Service policy not to "voluntarily" co-operate but I understand that Service officers will be amenable to receiving a subpoena to give evidence.

23. The Wilderness Society nominated North Washpool as part of a wilderness area under the Wilderness Act 1987 in December 1988. I am advised that the Service will complete its report on the nomination within two weeks, and that Cabinet will consider the matter within a month. Whether or not North Washpool is included as a formal wilderness area, it has wilderness values which forestry activities will compromise. No doubt Service experts have prepared an assessment which will be useful for the proceedings, and it too should be sought

under subpoena.

Tim Robertson

Frederick Jordan Chambers

15 August 1990.

CORKILL v. FORESTRY COMMISSION

CHAELUNDI STATE FOREST

MEMORANDUM OF ADVICE

1. The Chaelundi State Forest covers an area of 36,700 hectares and lies about 60 km north west of Dorrigo. Beyond its western border is the Guy Fawkes River National Park, a "wilderness" park whose only access point is through the Forest. The Forest is part of a system of forests in the Dorrigo Management Area comprising about 100,000 hectares. Two decades of logging resource remain within the system and significant resources for logging occur in other forest management areas in the Coffs Harbour-Grafton region. The Dorrigo Management Area comprises old-growth, re-growth and plantation forests, and logging contractors are licensed to extract timber from the whole management area rather than particular compartments in individual forests. Generally speaking, the three major logging contractors who operated in the Dorrigo area will take timber to fill their annual quotas from all the forests.

2. By reason of its inaccessibility, the Chaelundi State Forest is the least logged and best preserved of the forest ecosystem. The Management Plan for Dorrigo

Management Area 1985 records in appendix 8 that most of the forest is unlogged, old-growth but by early 1990 a significant portion of the forest east of Chaelundi Road had been logged. The area which these proceedings concern is west of Chaelundi Road in what is known locally as the Pine Creek catchment area and immediately continuous with the National Park.

3. On 13 March 1990 proceedings were commenced in the land and Environment Court by Mr Corkill for a declaration that the Forestry Commission was in breach of section 111 of the Environmental Planning and Assessment Act 1979 ("the Act") in that the Commission had failed to examine and take into account to the fullest extend possible all matters affecting or likely to affect the environment by reason of the proposed logging, roading and burning activities in the forest. He also sought a declaration that these activities were likely to significantly affect the environment, thereby laying the basis for a permanent injunction restraining the Forestry Commission and others in privity with it from carrying out the activities until it had complied with sections 111 and 112 of the Act. Section 112 of course requires an environmental impact statement to be prepared and exhibited if activities which do not otherwise require planning consent are likely to significantly affect the environment. An interlocutory

order was sought restraining the Commission from carrying out any logging, roading or burning activities in compartments 180, 193, 197-204 inclusive, 207, 209-219 inclusive, 221-224 inclusive and 302-306 inclusive.

36 cpts

4. On that date, the proceedings for the interlocutory injunction were heard ex parte by Mr Justice Stein, who granted the injunction in terms and made other procedural orders. His Honour did so on the basis of affidavit evidence containing expert opinion to which I shall presently turn. The proceedings were called over before His Honour on 23 March 1990, at which an unsuccessful application was made by Senior Counsel for the Forestry Commission for expedition of the proceedings. The Court was informed, contrary to earlier indications, that the Commission did not propose to ask the Court to discharge the interlocutory injunction but rather would contest the proceedings at trial on a final basis. Having regard to the strength of the affidavit evidence, this change in attitude is not surprising. The proceedings were adjourned for a week to enable the Forestry Commission to file and serve a motion and affidavit for expedition. That course too has now been abandoned by the Forestry Commission (although not before considerable preparation by us to contest the foreshadowed motion), and it is expected that the proceedings will follow the

usual course. Procedural directions have been given for the filing of points of claim and defence.

5. I am asked to advise on prospects for success in obtaining the final order sought in the application. Fortunately, I need not discuss the relevant law as I have recently canvassed it at paras. 8 - 14 of my Memorandum of Advice of February 1990 in Corkill v. Forestry Commission of New South Wales (Mount Royal State Forest). From that review of the authorities the following principles may be stated:

a) Before the Forestry Commission can embark upon logging, roading or burning activities, it must examine the environment and the impact of its proposed activities upon that environment;

b) It must be taken into account to the fullest extent possible the results of that examination;

c) The activities may not be carried out without obtaining, examining and considering an environmental impact statement where these activities are likely to significantly affect the environment.

d) The logging, roading or burning or old growth forests may be said to be or have a significant impact on the environment whether the environment is defined as local or regional;

e) As a matter of law, the relevant environment is the area of land upon which the activities will directly impact and any other land which may suffer indirect impacts from the logging, burning and roading activities;

f) The obligation to examine a forest environment necessarily involves site-specific surveys for fauna, rare and endangered flora, archaeological and cultural sites, visual impacts, (not only on the forest but on surrounding lands) erosion and stream disturbance.

. . .

The obligation to examine the forest environment is quite separate and distinct from the obligation to produce an EIS where activities having a significant impact upon the environment are proposed.

6. In this case, the Forestry Commission has commenced roading into the old growth section of the Forest north-west of the junction of Chaelundi Road and the Liberation Fire Trail. A plan has been made available to me by the Forestry Commission, pursuant to a notice to produce, which sets out the proposed roading works and snig tracks together with the system of filter strips in which the logging will be discouraged. It is apparent from that plan that all but minor corridors of timber along stream beds and possibly on ridges will be logged for hardwood sawlogs. As well, it is proposed to selectively log rainforest areas for mature, over mature and damaged trees "as necessary to fulfill community demand for speciality purpose timbers which cannot reasonably be satisfied by purchase elsewhere or from timber made available under the other harvesting prescriptions" (Environmental Review, Part Chaelundi State Forest, 13 April 1988, p.8). In fact, rainforest

areas have already been logged. When viewing the Forest on 31 March 1990 I saw mature coachwood logs lying by the side of the new road, and the remnants of rainforest understorey which had been logged in the compartments 177, 178 and 179.

7. The Environmental Review asserts that the Forestry Commission is committed to supplying 40,000 cubic metres net of sawlogs from the Dorrigo Management Area to Allen Taylor & Co. Ltd, Duncan's Holdings Limited and G. L. Briggs & Sons Pty Ltd. The Commission has assessed the resource in this part of the Forest at 250,000 cubic metres gross, which is said to be sufficient to meet the commitments of the Commission for between 4 and 5 years. The Environmental Review discloses that some timber will be taken from other forests to supply these commitments. It is clear from the Management Plan and the Annual Reports of the Regional Forester that there are adequate supplies of timber available elsewhere in the region to satisfy these so called commitments for the foreseeable future. If it matters, the period during which the Forestry Commission may be compelled to comply with the statutory requirements in relation to environmental assessment need not result in any loss of employment as the resource base of the area is otherwise available to sustain logging and processing activities at the

planned rates.

8. The evidence that these planned activities will have a significant impact upon the Forest environment is compelling. The Forest supports fauna that is classified as endangered by Schedule 12 and 12 A of the National Parks and Wildlife Act 1974 ranging from fauna of special concern to fauna in imminent danger of extinction. I have annexed to this advice a table classifying the fauna identified by the Management Plan. Since the Plan was published, there have been further fauna surveys which have found other rare and endangered species such as the rare Beech Skink Leiolopisma zia and the Long-nosed Potoroo and the Palma Wallaby. The Rufous Scrub-bird and the almost extinct Hastings River Mouse have also been found in the Forest. In his affidavit affirmed on 13 March 1990, Harry Hines, a wildlife consultant, deposed that he had never encountered a higher density of gliders than in the Forest (para. 4). Dr Tony Norton of the Centre for Resource and Environmental Studies, The Australian National University, who is a specialist in Eucalypt forest wildlife and particularly arboreal marsupials, has conducted biological surveys throughout the region of which the Chaelundi State Forest is part, with an emphasis on Chaelundi. His affidavit affirmed 13 March 1990 deposes to the very high species

diversity of arboreal marsupials and owls in the Forest and the high conservation value of the Forest in a national context. He identifies rare and endangered species present within the Forest and asserts that "this population density is the highest known for any forest in eastern Australia" with one irrelevant exception in northern Queensland. He concludes that this old-growth eucalypt forest has significance not only because it supports such a wide diversity and depth of animal life but also because it is significant scientifically as there is limited knowledge about the biology of the species in their interaction in the Forest environment. He suggests that it will be impossible to evaluate the impact of logging on the fauna of the forest without further broadscale biological surveys of areas which will be either directly or indirectly affected by forestry activities.

9. Dr Harry Recher has also inspected the Forest for the applicant. Dr Recher is well known as one of the leading forest scientists in Australia, and his evidence concerning the impacts of logging on old-growth forests has been accepted in other cases by the Land and Environment Court. In his statement, Dr Recher refers to the management prescriptions recommended by the Forestry Commission to minimise the environmental impact of forestry activities. Dr Recher

asserts that such prescriptions will only partially mitigate the long term effects of logging on fauna. In particular, he asserts that species such as the Sooty Owl require extensive stands of old-growth forests for their long term survival. After discussing the impacts of logging upon the canopy cover and the foraging and nest sites of such animals, he directs his evidence to the Environmental Review:

> "The Environmental Review fails to account for the likely effects of logging and associated pre- and /or post-logging fires on the mature forest ecosystem and dependent wildlife. The Review acknowledges the high population density of arboreal marsupials along Liberation Trail (p.36) and the presence of forest owls dependent on these marsupial populations (p. 9) along with other rare and endangered fauna (p. 41). However, the only wildlife management prescriptions referred to in the Review are the retention of some mature trees as wildlife habitat trees (p. 41, 65), reservation of some areas of flora and fauna protection (p. 64), and standard erosion mitigation and road construction procedures (p. 63, 64). These prescriptions are inadequate for fauna conservation and management. For example, the retention of mature and over mature trees at a

rate of 1/ha, preferably in clumps of 5, does not appear to be based on any assessment of pre-logging abundances of either fauna or of habitat trees. The prescription recommended is inadequate and will contribute to the long-term reduction in the abundances of hole-nesting birds and arboreal marsupials."

Of course, the Environmental Review recommends that no environmental impact statement be prepared. This erroneous conclusion is exposed by Dr. Recher. It is perhaps ironic that the exceptional nature of the Forest is best demonstrated by the information provided to the author of the Environmental Review by Dr. L. W. Braithwaite of CSIRO. The density of arboreal mammals in the Forest was 40 times the density recorded by his research unit in the south-east forests of New South Wales (p. 46).

10. The floral systems of the Forest are not preserved in the adjacent National Park. The Wilderness Working Group reported to the then Minister for Planning and Environment in May 1986 that "the dry sclerophyll forests within the National Park contrast markedly with the wetter, thickly wooded diverse forest structure in Chaelundi State Forest in the east that is being progressively subjected to heavy logging and roading on the ridges" (p.41).

There are numerous rare or threatened plants occurring in the Forest and these are set out at pages 38 - 40 of the Environmental Review. Many of the Review's assertions about the distribution and occurrence of these plants, like its assertions concerning the fauna of the area, are incorrect. For example, during my view of the Forest, I was informed by an officer of the National Parks and Wildlife Service that the Small-leaved peppermint (Eucalyptus Nicholii) had been found in the Forest, despite the Review's prediction that "it is unlikely to occur in the area under review" (p. 38).

11: The Forest also has significant wilderness value. It was identified by the Helman Report (Wilderness in Australia, Helman, Jones, Pigram and Smith, 1976, Department of Geography, University of New England). That report recommended that most of the present area of Chaelundi be managed as wilderness but by 1986 the Minister's Wilderness Working Group could only say of this area that less than a quarter of it had been protected in the Guy Fawkes River National Park. Some weeks ago, the Armidale Branch of the Wilderness Society nominated an area including this part of the Forest under Section 7 of the Wilderness Act 1987 for identification and declaration as Wilderness. The Director of the National Parks and Wildlife Service must now examine that nomination with a view to determining whether it ought to be dealt with by the Minister under the Act. The Land and Environment Court has recognised in previous cases the significance of such proposals in the recognition of areas as having special conservation value. Especially has this been so where Government authorities or committees have adopted the work of voluntary conservation groups. There is no doubt that Chaelundi is significant for its wilderness value alone. Roading seriously compromises wilderness, not to speak of logging and burning.

12. The Forest has scientific values as discussed by Dr. Norton. As well, it is probable that there are aboriginal archaeological and cultural sites in the area. Some 6 kms below this area adjacent to Chaelundi Mountain there is an aboriginal stone formation. The Environmental Review blandly states that no archaeological survey has been undertaken (p. 44) and no such survey will be undertaken before logging commences. However, we are promised by the Forestry Commission that if aboriginal areas are discovered in the course of logging, they will be preserved. Presumably, the Forestry Commission will ensure that the logging companies employ persons with degrees in aboriginal archaeology or anthropology. The suggestion in the Environmental Review that the steps proposed are

sufficient to protect such significant values is ludicrous.

12. The area is part of the catchment for Pine Creek which flows into the Boyd River and then to the Nymboida River and then to the Clarence River. A very rare cod species is expected to occur in the Boyd River and platypuses are present in Pine Creek. I have seen logging in compartments 177 and 178 on steeply sloped land running directly into the headwaters of Pine Creek. The potential for erosion of these areas was obvious and even the Environmental Review recognises that despite mitigation measures erosion will pollute the Creek waters after rain (pp. 43, 61). Naturally, no study has been made of the Creek system to determine the extent of impact.

13. It is apparent from this review of the evidence that the forestry activities proposed will have a significant impact on the environment. The evidence that no examination has taken place as required by Section 111 is indisputable. Of all State Forests, Chaelundi is probably the strongest example of a place which requires detailed site specific examination of the environment for each of the values discussed above.

14. Prospects for success in these proceedings are

excellent. I cannot leave the subject without referring to the Forestry Commission's Annual Reports for 1988 and 1989. Both Reports clearly disclose the Forestry Commission's belief that it is legally obliged to prepare Environmental Impact Statements in circumstances such as these: Annual Report 1988 pp. 17, 25; Annual Report 1989, pp 12 - 13, 22, 33. Unmistakably, the Forestry Commission has renounced its legal obligations under the Environmental Planning and Assessment Act 1979. It has become a lawless, rogue public authority and ultimately its misconduct will be punished by the Court, whether by mulcting the Commission in costs or otherwise.

TIM ROBERTSON

FREDERICK JORDAN CHAMBERS

11 April 1990

ENDANGERED FAUNA - SCH. 12 & 12A NATIONAL PARKS AND WILDLIFE ACT. 1974

Summary from Management Plan for Dorrigo Management Area 1985 - Appendix 7.

	Total	Pt 1	Pt 2	Pt 3	Pt 4	Sch 12A
Mammals	7	4	1	1	1	
Reptiles	6	2	2	2	-	
Birds	18	12	5	1	-	
Amphibians	4	-	-	-	-	4
TOTAL	35	18	8	4	1	4

Part 1 : Fauna of special concern
2 : Vulnerable and rare fauna
3 : Threatened fauna
4 : Fauna in imminent danger of extinction

Sch 12 A : Protected amphibians

CORKILL v. FORESTRY COMMISSION

CHAELUNDI STATE FOREST

Further Memorandum of Advice

1. On 11 April 1990 I advised that there were excellent prospects for success in restraining the Forestry Commission from logging, roading and burning old growth timber in the Chaelundi State Forest. Shortly thereafter, the Forestry Commission agreed to prepare an Environmental Impact Statement (EIS) but now seeks discretionary orders from the Court which would suspend the operation of the interlocutory injunction in relation to three compartments of the Forest, compartment nos. 180, 198 and 200. The Commission desires these compartments to be logged by licensees whilst preparing and exhibiting the EIS. About 600 hectares of Forest are involved.

2. I have inspected one of these compartments. On 26 May 1990 I conferred with Dr Harry Recher and Dr Tony Norton, two of our expert witnesses referred to in my earlier advice. They advised that these compartments contain or support some of the richest and most diverse arboreal fauna to be found in Australia. The unusual

and highly significant occurrence of such fauna is discussed at length in my earlier advice. Dr Recher advises that the management prescriptions proposed by the Commission for logging will not modify significantly the impact of logging upon the fauna populations. Dr Recher's opinion was expressed with the reservation that he had not physically inspected each compartment but nevertheless he felt able to say from his general knowledge and examination of work done in the United States in relation to old growth forests (which work is yet to be repeated in Australia) that the logging of these compartments will have a significant adverse effect upon the Forest ecosystem. Dr Norton is very familiar with the area, having conducted surveys and tests there in previous years.

3. I advise that significant environmental harm is likely to occur if the existing injunction is suspended to permit logging and roading in these compartments. The purpose of a Part 5 EIS ~~to~~ is to inform decision makers of the environmental impact likely to arise from proposals, so that these proposals may be modified or abandoned if the impact is adverse and significant. To destroy the environmental values of a forest before the data is collected and, pursuant to sections 112 and 113, exposed to public and bureaucratic scrutiny so that well-informed judgements can be made by the

decision makers is to undermine the Act.

4. From time to time the Land and Environment Court has exercised its undoubted power to suspend the operation of an injunction or to refuse an injunction altogether when it has found a continuing breach of the Environmental Planning and Assessment Act which would otherwise justify the grant of an injunction. The approach taken by the Court in such matters is set out by Kirby P. in Warringah Shire Council v. Sedevcic 10NSWLR 335 at 339-341. This issue arose in the context of a logging operation in Bailey v. Forestry Commission (1989) 67 LGRA 200 at 216, where Hemmings J. found that the Commission was in breach of Section 111 and 112 of the Act in relation to a proposal to log 22 compartments of a forest. His Honour granted an injunction only to prevent logging on slopes in excess of 25 degrees. Bailey's case was unusual because the forest concerned had been selectively logged for many years. It was not an old growth forest and the principal environmental impact of logging was erosion of the steeper slopes of the forest. The Court found that other claims of impact were exaggerated or technical or the subject of legitimate dispute by the Forestry Commission. It stressed that :

"It is highly likely, after compliance with those

> obligations that it would be open to the Forestry Commission properly to determine that similar logging operations could and should be approved in suitable locations and under appropriate conditions." (at 217)

In contrast, there are numerous grounds for environmental objection to the logging of Chaelundi and no reasonable decisionmaker could dismiss any possibility of a post EIS decision not to log the Forest. On the contrary, and again unlike Bailey's case, there have been proposals for some years to transfer this part of Chaelundi State Forest to the adjacent National Park or to declare it a wilderness area under the Wilderness Act 1987. Hemmings J. concluded from his review of the authorities that :

> "It is clear that the discretion conferred upon the Court should not be used to set aside the new regime imposed by the E P & A Act to make the decisions of a determining authority environmentally sensitive." (at 216)

Having regard to the matters canvassed in this and my earlier advice, the conclusion is inevitable that the logging of these compartments is environmentally insensitive, at the very least in the absence of proper impact assessment. Indeed, it is probable that the very values which distinguish this part of the Forest from others in the Dorrigo Management Area are threatened with extinction by the proposal for discretionary logging.

5. I have advised in conference that further affidavits should be obtained from Dr Norton, Mr Hines and Dr Recher following their site specific examinations of these three compartments. I also advised that a vegetation survey was necessary because of the opinion expressed to me by a local officer from the National Parks and Wildlife Service that a colony of rare eucalypts occurs in this area and that other rare or endangered vegetation may be distributed in the predominantly rainforest understorey of the compartments. I have also suggested that an archaeological report be prepared for the area having regard to the known archaeology and assumed aboriginal use of the Forest. As well, advice should be obtained from a soil scientist if there is any potential for erosion (Dr John McGarrity would be appropriate). If soils are washed into any of the creeks in the area, and particularly Pine Creek, an assessment should be made by an aquatic biologist of the possible impact of sediment on the streamlife. Finally, our opponents will probably argue that unemployment and business

disruption would occur if the injunction is continued. For reasons that I have canvassed in my earlier advice, this argument is unlikely to prevail, even if it could in itself constitute a reason for relaxing the injunction. It will be necessary, however, for us to obtain expert accounting or economic evidence on the availability of alternative resources in the Dorrigo and adjacent Management Areas and the costs of their exploitation.

Per

TIM ROBERTSON

FREDERICK JORDAN CHAMBERS

1 June 1990

HILLMAN
&WOOLF
SOLICITORS

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BRUCE WOOLF
BA LLB Dip URP

BRIAN HILLMAN
LLB. Dip B Admin.
Dip S de Fr des Aff
Accredited Migration
Consultant

OUR REF BSW 2382/90

YOUR REF

DATE 6 June 1990

Mr J. Corkill
3 Albert Street
FOREST LODGE NSW 2037

Dear John

CORKILL v FORESTRY COMMISSION OF NSW - CHAELUNDI STATE FOREST

I enclose copy of Further Memorandum of Advice dated 1 June, 1990 which we have received from Tim Robertson of Counsel.

Yours sincerely

Bruce Stephen Woolf

Encl.

Table 5 : Expenditure for Conservation Management 1990-1991

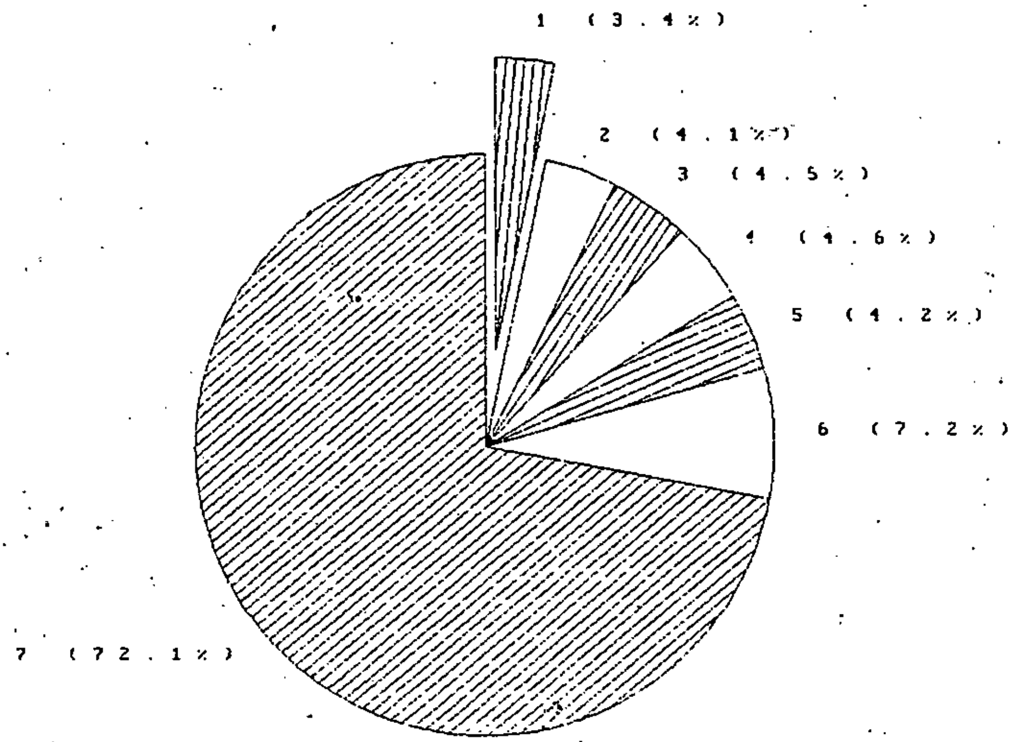
Agency	Net Expenditure All Reserves ($ millions)	Per Capita[a] Expenditure ($)
New South Wales National Parks & Wildlife Service	74.0	12.50
Victoria Dept Conservation & Environment National Parks, Flora & Fauna programs	67.5[b]	15.25
Queensland Dept Environment & Heritage National Parks & Wildlife Service	49.3	16.59
South Australia Dept Environment & Planning Park Management Program	17.1[c]	16.96
Western Australia Dept Conservation & Land Management Wildlife, Recreation Management	26.3	15.79
Tasmania Dept Parks, Wildlife & Heritage Land Management & Heritage, World Heritage Area programs	12.4	26.93
Northern Territory Conservation Commission plus ANPWS	42.6[d]	268.26
Australian Capital Territory Dept Environment, Land & Planning	na	na

a Based upon ABS Pocket Yearbook New South Wales 1992 projected populations 1991.
b Pers.comm Dept Information (18 September 1992) based upon the figures in RAC Forest and Timber Inquiry Final Report 1992 Table 8.2, p.220; the figures for administration/corporate services are now added into the amount.
c 1990-1991 Annual Report administration/corporate services now added into the amount.
d Includes management of Kakadu and Uluru National Parks managed by ANPWS.
na not available.

Source:
- RAC Report 1992, Table 8.2, p.220
- ABS Pocket Yearbook New South Wales 1992
- Department Annual Reports

Note: The accuracy of the figures is reliant upon the accuracy of the Departmental accounting procedures and the RAC Report Table.

Graph: Expenditure for Conservation Management 1990-1991



Legend

		Per Capita Expenditure
1	New South Wales	12.50
2	Victoria	15.25
3	Queensland	16.59
4	South Australia	16.96
5	Western Australia	15.79
6	Tasmania	26.93
7	Northern Territory	268.26
	Australian Capital Territory	not applicable

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

APPLICATION
CLASS 4

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

Full name of Applicant: JOHN CORKILL

Address: 3 Albert Street, FOREST LODGE NSW 2037

Occupation: Environmentalist

The Applicant seeks the following relief:

1. A declaration that the First Respondent acted unlawfully in refusing to consider the exercise of his power under Section 136(1) of the Heritage Act 1977 to make an order to cease work in Compartments 180, 198 and 200 of Chaelundi State Forest ("the said order").

2. A declaration that the purported decision of the Second Respondent on or about 26 July 1991 refusing to make the said order was unlawful.

3. A declaration that the adoption of the following policies by the First, Second and Third Respondents placed a fetter upon the exercise of the powers, functions and duties of the Respondents under the Heritage Act and amounted to an abdication of those powers, functions and duties contrary to law:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

(b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

(c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

where matters would otherwise require action under the Heritage Act.

4. A declaration that it was not reasonably open to the Respondents to decide that the said Compartments of Chaelundi State Forest are not items of State environmental heritage.

5. An order requiring the First Respondent to consider the request by the Applicant on 23 July 1991 to make the said order according to law.

6. An order requiring the Third Respondent to consider the request by the Applicant on 23 July 1991 to recommend to the Second Respondent that he make such Interim Conservation Order under the Heritage Act 1977 in relation to the area of land comprised in the said Compartments of Chaelundi State Forest according to law.

7. Further or other orders.

8. Costs.

Date: Signed: ....

To the First Respondent:

The Hon. ROBERT MARSDEN HOPE, QC
Chairman
Heritage Council of New South Wales
175 Liverpool Street
SYDNEY NSW 2000

To the Second Respondent:

The Hon. ROBERT WEBSTER, MLC
Minister for Planning and Energy
Level 12, Westfield Tower
100 William Street
DARLINGHURST NSW 2010

To the Third Respondents:

Mr NIGEL ASHTON
221 GREENWICH ROAD
GREENWICH NSW 2065

Mr STEPHEN DAVIES
c/-National Trust Centre
Observatory Hill
SYDNEY NSW 2000

Dr KEN CABLE
10/92 St. Pauls Street
RANDWICK NSW 2031

Mr PETER PHILLIPS
Suite 401,
541 George Street
SYDNEY NSW 2000

Ald. SHEILA SWAINE
38 Baron's Crescent
HUNTERS HILL NSW 2110

Mr WILLIAM WOOLDRIDGE
2 Deed Place
NORTHMEAD NSW 2152

Mr JOHN FERRIS
14 Viret Street
HUNTERS HILL NSW 2110

Mr LYNDSAY SHADDOCK
c/- Trinity Properties
18th Floor, St. James Building
111 Elizabeth Street
SYDNEY NSW 2000

Mr LINDSAY KELLY
Government Architect
26th Floor, State Office Block
Phillip Street
SYDNEY NSW 2000

Mr BILL GILLOOLY
Director
National Parks & Wildlife Service
54 Bridge Street
HURSTVILLE NSW 2220

Ms G. KIBBLE
Director
Department of Planning
Remington Centre
SYDNEY NSW 2000

A Callover will take place before the registrar at the time and place specified below OR

The hearing of (or the applicant's claim for interlocutory relief in) these proceedings will take place before the Court at the time and place specified below.

If there is no attendance before the Court or the Registrar, as the case may be, by you or your counsel or solicitor, or agent authorised by you in writing, the hearing or Callover may take place and orders may be made in your absence.

Time: am on the day of 19

Place: The Land and Environment Court of New South Wales
Level 6, American Express Tower
388 George Street (cnr King Street)
SYDNEY NSW 2001

....
Registrar

IN THE LAND AND ENVIRONMENT COURT
OF NEW SOUTH WALES

LAND AND ENVIRONMENT
COURT OF NEW SOUTH WALES

No 40157 of 1991

JOHN ROBERT CORKILL

Applicant

Robert Marsden Hope, Q.C.;
CHAIRMAN OF
THE HERITAGE COUNCIL OF N.S.W.

First Respondent

Robert James Webster
THE MINISTER FOR PLANNING

Second Respondent

Mr Nigel Ashton
Mr Stephen Davies
Dr Ken Cable
Mr Peter Phillips
Ald Sheila Swaine
Mr William Wooldridge
Mr John Ferris
Mr Lyndsay Shaddock
Mr Lindsay Kelly
Mr Bill Gillooly
Ms Gabrielle Kibble

Third Respondents
as members of
THE HERITAGE COUNCIL OF N.S.W.

POINTS OF DEFENCE

CHRISTINE CRAIG HANSON
PRINCIPAL LEGAL ADVISER
DEPARTMENT OF PLANNING
LEGAL BRANCH
175 LIVERPOOL STREET
SYDNEY 2000

DX 15

(MR C BROWN)

FILE NO.:

TELEPHONE: 391 2155

1. The Respondents admit the allegations contained in paragraphs 1, 2 and 3 of the Points of Claim.

2. In answer to paragraph 4 of the Points of Claim, the Respondents admit that the Applicant wrote a letter dated 23 July 1991 to the First Respondent and crave leave to refer to the said letter when produced at the hearing as if the same were fully set forth herein.

Save as aforesaid, the Respondents do not know and cannot admit the allegations contained in paragraph 4 of the Points of Claim.

3. In answer to paragraph 5 of the Points of Claim, the First Respondent says that he dealt with the request of the Applicant contained in the said letter of 23 July 1991 upon the basis of the matters set out in the letter of 29 July 1991 from the First Respondent to the Solicitor for the Applicant.

The First Respondent craves leave to refer to the said letter dated 29 July 1991 when produced as if the same were fully set forth herein.

Save as aforesaid, the First Respondent does not know and cannot admit the allegations contained in paragraph 5 of the Points of Claim.

4. In answer to paragraph 5 of the Points of Claim, the Second and Third Respondents do not know and cannot admit the allegations contained therein.

5. In answer to paragraph 6 of the Points of Claim, the First Respondent denies that he acted unlawfully and denies that he refused to consider the exercise of his power under s136(1) of the Heritage Act 1977 as alleged.

6. In answer to paragraph 6 of the Points of Claim, the Second and Third Respondents do not know and cannot admit the allegations contained therein.

7. In answer to paragraph 8 of the Points of Claim, the Respondents do not know and cannot admit the allegations therein.

8. In answer to paragraph 9 of the Points of Claim, the Respondents do not know and cannot admit the allegations contained therein.

9. In answer to paragraph 10 of the Points of Claim, the First and Third Respondents repeat the allegations contained in paragraph 3 above.

Save as aforesaid, the First and Third Respondents do not know and cannot admit the allegations of fact contained in paragraph 10 of the Points of Claim.

10. In answer to paragraph 10 of the Points of Claim, the Second Respondent says that he rejected the Applicant's request in the said letter of 23 July 1991 upon the basis of the matters set out in the report to the Minister dated 26 July 1991.

The Second Respondent craves leave to refer to the said report when produced as if the same were fully set forth herein.

11. In answer to paragraph 12 of the Points of Claim, the Second Respondent denies the allegations contained therein.

12. In answer to paragraph 12 of the Points of Claim, the First and Third Respondents do not know and cannot admit the allegations contained therein.

13. In answer to paragraph 13 of the Points of Claim, the Respondents say that this is a question of law and crave leave to refer to the Heritage Act on the hearing of the proceedings.

14. In answer to paragraph 14 of the Points of Claim, the Respondents repeat the allegations contained in paragraphs 3 and 10 herein.

Save as aforesaid, the Respondents deny the allegations contained in paragraph 14 of the Points of Claim.

15. In answer to paragraph 16 of the Points of Claim, the Respondents say that if the information referred to is that contained in the said letter of 23 July 1991, the allegations contained in paragraph 16 are admitted.

16. In answer to paragraph 17 of the Points of Claim, the Respondents repeat the allegations contained in paragraphs 3 and 10 above.

Save as aforesaid, the Respondents deny the allegations contained in paragraph 17 of the Points of Claim.

17. In answer to paragraph 18 of the Points of Claim, the Second Respondent repeats the allegations contained in paragraph 10 above.

18. In answer to paragraph 18 of the Points of Claim, the First and Third Respondents do not know and cannot admit the allegations contained therein.

19. In answer to the whole of the Points of Claim, the Respondents deny that the Applicant is entitled to any of the relief sought.

Dated the 23 day of August 1991.

CHanson

Christine Hanson
Solicitor for the First,
Second and Third Respondents

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

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LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

AFFIDAVIT
Deponent: BRUCE STEPHEN WOOLF

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 3103/1

On the 30 day of August, 1991, I, BRUCE STEPHEN WOOLF, of 40 Liverpool Street, Rose Bay in the State of New South Wales make oath and say as follows:-

1. I am the solicitor for the Applicant in these proceedings.

2. The Respondents and the Department of Planning, among others, have answered Subpoenas to Produce in these proceedings which were returnable on 14 August, 1991.

3. In the afternoon of Friday, 23 August, 1991 the Respondents served on the Applicant Points of Defence and an Affidavit of Mr R. Power sworn 23 August, 1991.

4. The Applicant requested the issue of further Subpoenas to Produce addressed to the Director of the Department of Planning and to the Department of Planning returnable for 29 August, 1991.

5. The issue of the further Subpoenas was necessary largely

because of failure to fully and properly answer earlier Subpoenas.

6. On the morning of 28 August, 1991 I discussed with the Respondent solicitor, Mr Najem, to produce formally or informally further material so that we would be in a position to inform the Court on 29 August, 1991 of the situation. Although no files were produced on 28 August, 1991 I expected the further Subpoenas would be complied with on 29 August, 1991.

7. From my inspection of the material produced to date I believe that as at the date of swearing this Affidavit the Subpoenas have not been fully and properly answered.

8. On 29 August, 1991 the Respondent solicitor forwarded to me for the first time at approximately 4.40pm a list of further files held by the Department of Planning in relation to item 1 in Subpoenas returnable on 14 August, 1991 addressed to the Department of Planning, and the Second and Third Respondents. Annexed hereto and marked "A" is a true copy of the said list. At approximately 5.00pm the said solicitor informed me that he would commence inquiring about these files in the morning of 30 August, 1991.

9. Annexed hereto and marked "B" is a true copy of a letter dated 30 August, 1991 from Woolf Associates, solicitors, to Legal Branch, Department of Planning.

10. Having regard to the above matters, I believe the preparation of the Applicant's case in these proceedings has been and is severely prejudiced by the failure to fully and properly answer the Subpoenas issued in these proceedings.

SWORN by the Deponent)
)
at Sydney on the 30th)
)
day of August, 1991)
)
Before me:)

....

....
BRUCE STEPHEN WOOLF

THIS IS THE ANNEXURE MARKED " A " REFERRED TO IN THE AFFIDAVIT OF BRUCE STEPHEN WOOLF SWORN AT SYDNEY ON THE 30th DAY OF August 1991.
BEFORE ME:

NATURAL AREAS CONSIDERED UNDER THE HERITAGE ACT 1977

1ST JANUARY 1988 TO 29 AUGUST 1991

ACTION TAKEN

Natural area adjoining Long Neck Lagoon, Pitt Town, Hawkesbury:- ICO - 11.3.88. Expired.

Eastern Headland natural area, Malabar, Randwick:- ICO - 12.2.88. Expired.

Natural area - Chatham Road, Eastwood, Ryde (vegetation on road reserve) - ICO - 26.2.88. Expired.

Barranjoey Headland and Ithsmus, Palm Beach, Warringah - ICO - 22.1.88. Expired.

Red Cedar Trees, Cedar Creek, Lockinvar, Greater Cessnock:- s130 Order - 12.2.88. Expired.

Pattimores Lagoon, Lake Conjola, Shoalhaven:- s130 Order - 8.1.88. Expired.

Barragal Lagoon, Camden Park Estate, Wollondilly:- s130 Order - 25.1.88.

Mt Jerrabomberra, Queanbeyan - s136 Order - 8.4.88. Expired.

Natural Area, Rajah Road, Ocean Shores, Murwillimbah - ICO revoked - 13.5.88.

Mt Wilson Precinct, Blue Mountains - ICO - 21.10.88.

Mt Wilson Precinct, Blue Mountains - ICO - 3.11.89.

Eastern Headland, Malabar, Randwick - ICO - 23.3.89.

Koala Colony, Avalon Parade, Avalon, Warringah - ICO - 17.3.89 Expired.

Natural area south west of Agnes Banks, Penrith - PCO - 10.3.89.

Barragal Lagoon, Camden Park Estate, Wollondilly - s130 Order 1.2.89 - Revoked 21.4.89.

Mt Wilson Precinct, Blue Mountains - ICO - 16.11.90.

Sorensons Nursery, Leura, Blue Mountains - s130 Order - 9.11.90.

NO ACTION

David Berry Hospital Natural Environment, Tannery Road, Berry.

Natural Area, Muriel Street, Falcon Bridge, Blue Mountains.

Devils Creek Catchment Area, Tantawangalo, Bega.

WOOLF
ASSOCIATES
SOLICITORS
10th Fl, 82 ELIZABETH STREET
SYDNEY NSW 2000
TELEPHONE (02) 221 8522
FACSIMILE (02) 223 3530
DX 1556 SYDNEY
BRUCE WOOLF
BA LLB Dip URP
ASSOCIATES:
BRIAN HILLMAN
LLB. Dip B Admin.
Dip S de Fr. des Aff
EDWARD L. MURA
B Ec. LLB.

THIS AND THE FOLLOWING PAGE IS THE ANNEXURE MARKED "B" REFERRED TO IN THE AFFIDAVIT OF BRUCE STEPHEN WOOLF SWORN AT SYDNEY ON THE 30th DAY OF AUGUST 1991
BEFORE ME:

OUR REF BSW 3103/1

YOUR REF

DATE 30 August 1991

Mr C. Brown
Legal Department
Department of Planning

BY FACSIMILE: 391 2337

Dear Sir

CORKILL v HERITAGE COUNCIL OF NSW - CHAELUNDI STATE FOREST NO. 40157 OF 1991

We refer to previous correspondence.

In relation to the files and documents produced on 29 August, 1991:

1. File HC88 refers to file RML1024 on the same subject matter yet that file has not been produced. Please produce the further file.

2. File 79/1951(2)3 has a copy of a document titled "Draft Criteria: NSW Heritage Council - Natural Significance". The original has not been produced and we call for the original of that document in the file in which it occurs. This ought to have been produced under other items of the Subpoenas.

3. The originals of the letter of 18 August, 1988 and 16 November 1989 have not been produced. In accordance with the Subpoenas issued we call for these original letters in the file in which they occur.

4. No delegations have been produced. Are there none? If so, please advise in writing by return. If there are current delegations, please produce these.

5. You advised on the morning of 29 August, 1991 that in relation to the Subpoena to the Department, item 3(c) was being obtained and inquiries were being made in relation to item 3(a). Yet neither of these documents have yet been produced.

6. Our inspection of the files produced on 29 August, 1991 revealed that only those files specifically named by us were produced, yet you now advise of a considerable number of further files which answer the Subpoenas. There accordingly appears to have been a real and substantial

.../2

failure to produce the documents as required by the Subpoenas. As advised to you we believe that this failure has seriously prejudiced our client's preparation of his case.

We note the Court's direction that any further Affidavit upon which you seek to rely be served by 5.00pm on 29 August, 1991. As we have received no further Affidavit we now assume that the Respondents do not seek to rely on any further Affidavits.

Yours faithfully

IN THE LAND AND ENVIRONMENT COURT OF NEW SOUTH WALES

No. of 1991

BETWEEN:

JOHN CORKILL
APPLICANT

AND

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of NSW
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning and Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G.KIBBLE
as Members of the Heritage Council for NSW
THIRD RESPONDENTS

AFFIDAVIT OF BRUCE STEPHEN WOOLF

Applicant's address for service:

WOOLF ASSOCIATES
Solicitors
10 Floor
82 Elizabeth Street
SYDNEY NSW 2000
Dx: 1556 Sydney
Tel: (02) 221 8522
Fax: (02) 223 3530
Ref: BSW 3103/1

On 27 August 1991, I BRUCE STEPHEN WOOLF of 40 Liverpool Street, Rose Bay, New South Wales, solicitor say on oath:

1. I am the solicitor for the Applicant in these proceedings.

2. On 23 August 1991, the Respondents served on the Applicant in Affidavit of Mr R Power sworn 23 August 1991 and Points of Defence.

3. The Respondents have answered subpoenas to produce in these proceedings but I believe from my inspection of documents produced that the subpoenas have not been fully answered.

4. As a result of matters arising out of the material referred to in paragraphs 2 and 3 above, I believe it is necessary in preparation of the Applicant's case to request issue of further subpoenas addressed to the Respondents.

5. The proceedings have been granted expedition and the hearing is to commence on 2 September 1991.

6. I have informed the solicitor for the Respondents of the Applicant's intention to request the issue of further subpoenas.

7. In the circumstances I request leave for short service of the subpoenas on Respondents be granted by this Honourable Court.

SWORN)
by the Deponent at)
Sydney in the State of New)
South Wales this 27th)
day of August 1991.)

B. Woolf

....

Before me...

Solicitor
Sydney

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: The Secretary
Department of Planning
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 29th day of August 1991 at 9.30 am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

TIME FOR SERVICE
ABRIDGED TO 11.00am 27/8/91
ORDER
M. J. CONNELL
REGISTRAR.

SCHEDULE

---

1. All documents and files relating to the advice by the "Minister" referred to in paragraph 4 of the information report dated 23 May 1989 by Charles Hill entitled "Procedures for dealing with natural areas nominated under the Heritage Act, 1979".

2. All documents and files relating to any policy or practice of:

   a) Minister for Planning
   b) Department of Planning
   c) Heritage Council of NSW
   d) Minister for the Environment

   relating to the use of the Heritage Act for the protection of the natural environment from 1 1988 July to date.

3. Originals and copies of:

   a) Correspondence between Minister for Local Government and Planning, David Hay to Minister for Environment, Mr Moore of 6 October 1988 relating to Horton's Creek Rainforest

   b) Letter dated 18 August 1988 from Minister for Local Government and Planning, Mr Hay to Minister for Environment, Mr Moore relating to the Koala colony at Wedderburn.

   c) Letter from Minister for Environment, Mr Moore to Minister for Local Government and Planning, Mr Hay dated 4 November 1988 re Horton's Creek Rainforest and the National Parks and Wildlife Act.

   d) Letter from Minister for Environment, Mr Moore to Minister for Local Government and Planning, Mr Hay dated 16 November 1989 relating to Horton's Creek Rainforest.

   e) All further correspondence, briefing notes, reports, memoranda and other records relating to the consideration of the matters discussed in the letters a) to d) above including and any further correspondence relating to the said letters from 1 January 1988 to date.

4. All documents and files relating to request for and the consideration for protection of the Wedderburn Koala colony.

5. All documents, notes, correspondence, memoranda and advices relating to the Agenda, business papers and the minutes of the meeting of the Heritage Council dated 1 August 1991.

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

DATED: 27.8/91

BY THE COURT REGISTRAR

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: 27/8/91.
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: Ms G Kibble
Director
Department of Planning
175 Liverpool Street
Sydney NSW, 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 29th day of August 1991 at 9.30am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

TIME FOR SERVICE
ABRIDGED TO 11.00am 27/8/91
ORDER
M. J. CONNELL
REGISTRAR.

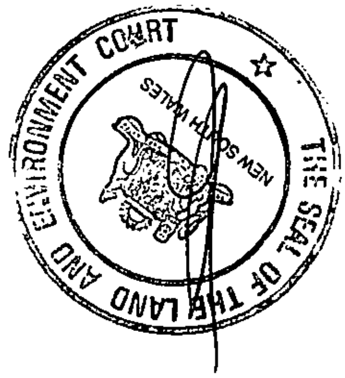
<u>SCHEDULE</u>

Any proposal or consideration of any proposal to protect any part of Chaelundi State Forest or make any advice in respect thereof under the Heritage Act:

1. All notes taken by you to the Heritage Council meeting of 1 August 1991;

2. All documents referred to by you during the said Heritage Council meeting;

3. Briefing notes, memoranda or other documents relating to the use of the Heritage Act for natural areas from 1 January 1988 to date.



DATED: 27.8.91

BY THE COURT REGISTRAR

Last day for service: 27.8.91
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT COURT
OF NEW SOUTH WALES

LAND AND ENVIRONMENT
COURT OF NEW SOUTH WALES

No 40157 of 1991

JOHN ROBERT CORKILL

Applicant

Robert Marsden Hope, Q.C.;
CHAIRMAN OF
THE HERITAGE COUNCIL OF N.S.W.

First Respondent

Robert James Webster
THE MINISTER FOR PLANNING

Second Respondent

Mr Nigel Ashton
Mr Stephen Davies
Dr Ken Cable
Mr Peter Phillips
Ald Sheila Swaine
Mr William Wooldridge
Mr John Ferris
Mr Lyndsay Shaddock
Mr Lindsay Kelly
Mr Bill Gillooly
Ms Gabrielle Kibble

Third Respondents
as members of
THE HERITAGE COUNCIL OF N.S.W.

AFFIDAVIT

Deponent: Robert Alwyn Power

Sworn: 23 August, 1991

CHRISTINE CRAIG HANSON
PRINCIPAL LEGAL ADVISER
DEPARTMENT OF PLANNING
LEGAL BRANCH
175 LIVERPOOL STREET
SYDNEY 2000

DX 15

(MR C BROWN)

FILE NO.:

TELEPHONE: 391 2155

I, ROBERT ALWYN POWER, of the Department of Planning, 175 Liverpool Street, Sydney, say on oath:-

1. I am the Manager of the Heritage Branch in the Department of Planning. In that position, I am responsible to the Director of Planning for the day to day operations of the Branch in its provision of technical and administrative assistance to the Director, the Heritage Council and, through them the Second Respondent, the Minister for Planning, on heritage matters.

2. Sometime late in the afternoon on 23 July 1991, I received a fax from the First Respondent, the Chairman of the Heritage Council, forwarding to me a copy of a letter he had received from Woolf Associates. I made two copies of this fax, and gave the original to Mr Neil Urwin, Leader of the Natural Resources Unit, in the Department, gave one of the copies to Ms Sue Holliday, the Assistant Director in the Department, who is responsible for heritage matters and I retained the other copy.

C Brown

Robert A Power

3. At about mid-day on 24 July 1991, the Director informed me that the matters in the letter had been discussed with the Second Respondent and that the Second Respondent had indicated that he would take the decision. The Director also informed me that Mr N Urwin was to prepare a report for the Second Respondent and requested me to assist him in its preparation.

4. When I returned to my office, I telephoned the First Respondent and informed him that the Second Respondent had indicated that he would take the decision in the matter.

The First Respondent said words to the effect:

"All right then."

I said words to the effect:

"A report will be prepared for the Minister by Neil Urwin and myself and I will send you a copy."

5. Later that day, I saw Mr N Urwin and said to him words to the effect:

"I understand that you are preparing a report for the Minister on the Chaelundi State Forest matter and I am to assist you. Let me know when you are ready."

Mr N Urwin said that he knew about the proposed activity by the Forestry Commission as his branch had done an assessment of the EIS.

6. On 25 July 1991 a report was prepared and signed by Mr N Urwin, myself and the Director and then referred to the Second Respondent for his consideration.

7. On 26 July 1991, the report was amended. The amended report was signed by Mr N Urwin, myself and the Director and then referred to the Second Respondent for his consideration. Prior to the finalisation of the amendments, I had a telephone discussion with the First Respondent, in which he informed me that the report as proposed to be amended would be satisfactory to him. I later made a notation on the amended report to this effect.

8. The recommendation contained in the amended report was later approved by the Second Respondent and a copy of the said report bearing the signature of the Second Respondent is annexed hereto and marked "A".

9. Later that day I informed the Applicant by telephone of the Second Respondent's decision and that the First Respondent would be sending him a letter on Monday. I then read to the Applicant

GBrown

Robert H[illegible]

over the telephone the contents of the letter from the First Respondent to the Applicant dated 29 July, 1991. I was not aware during my telephone conversation with the Applicant that his phone had been switched to loudspeaker.

SWORN by Robert Alwyn Power)
this 23 day of August 1991)
before me)

Robert A Power
....

G Brown
....
Solicitor
Sydney.

110.

RECOMMENDATION

It is recommended that the Minister decline to use s.136 of the Heritage Act for the protection of Compartments 180, 198 and 200, Chaelundi State Forest for the following reasons:

i) a full and proper EIS has been prepared and exhibited. Submissions on the EIS have been considered in the Forestry Commission's determination and the proposed activity altered accordingly;

ii) Protection under the Heritage Act would not lead to appropriate long term conservation management of the area.

iii) Interim protection under the NPW Act and ultimate acquisition is considered the most viable approach if the area is seen by Government to have those conservation attributes which warrant their retention without logging.

N Urwin

N URWIN
Leader
Natural Resources Unit

Rob Power

R POWER
Manager
Heritage Branch
26/7/91

The Chairman of the Heritage Council, Mr. Justice Hope, has seen this Briefing Note and endorses its content and recommendations. He will be writing to the Solicitors for Mr. Corkhill. Rob Power

Gabrielle Kibble
26/7/91.

GABRIELLE KIBBLE
Director of Planning

APPROVED:

Robert Webster
26/7/91

MINISTER

This page and the succeeding 3 pages are the Annexure Marked "A"
referred to in the affidavit of ROBERT ALWYN POWER
sworn at Sydney this 23 day of AUGUST 1991.
before me:
C Brown
Solicitor / ~~Justice of the Peace~~

THE NOMINATION FOR ACTION UNDER THE HERITAGE ACT

The submission in support of the nomination makes a number of technical points in refutation of information and assessments in the EIS and subsequent determination documents.

That the subject area is rich and diverse in animal species and, moreover, the habitat of a list of rare and endangered species is not in dispute. There is some argument over the presence or absence of individual species and the detailed habitat requirements of others but essentially all parties agree that the area is highly significant for these values. The disagreement centres upon the view by the Forestry Commission that its management can minimise the impact on these values allowing a level of harvesting to proceed; and the opposing view that it cannot.

This latter view, argued inside (NPWS) and outside government is that the only appropriate course is for pure conservation management, possibly augmented by the inclusion of the area in the proposed Guy Fawkes wilderness area.

THE APPROPRIATENESS OF THE USE OF THE HERITAGE ACT

Over and above the difficulties outlined above in technically assessing the nomination, the question of the appropriateness of the use of the Heritage Act is a serious consideration.

In recent years, for both the built and natural environment, administrators of the Heritage Act have been looking beyond the statutes for protection and considering the best long term management options for items once protected. This is especially relevent to the natural environment and in many cases where there is an overriding need for long term and continuing management of an area, use of the interim protection provisions of the National Parks and Wildlife Service which tie into permanent conservation management have been preferred over use of the Heritage Act in isolation.

Applied to the subject area this consideration poses the question "what is the end product for which interim protection is being applied"? The answer in this case is far from clear. No draft planning instrument is in existence to offer long term conservation land use. No provision or resources exist in either the Heritage Council or the Department of Planning for the Management of a remote natural area, should a permanent conservation order be the end result.
Clearly, for the area's continued conservation management the area would need to be brought into the estate of the National Parks and Wildlife Service. Provision exists within that agency's legislation for interim protection while such acquisition is being negotiated. This provision was enacted to provide, inter alia, an interim protection mechanism more appropriate to the circumstances and to avoid invalid use of the Heritage Act.

It is appropriate that both the Government and community have an expectation that a Government agency will comply with legislation. Thus avoiding the need for another agency in the form of the Heritage Council to impose yet another layer of statutory controls over a site.

-e/s

This included a submission by the National Parks and Wildlife Service which also asked for a delay of the implementation of the proposal until the Service had finished a wilderness assessment involving the subject compartments and the completion by the Commission of the EIS for the Dorrigo Management Area (which includes Chaelundi State Forest).

The Department also suggested that the Commission's decision would be subject to close scrutiny and that it might be appropriate to amend the scale and pattern of activities in response to submissions.

The Forestry Commission determined the proposed logging of compartments 180, 198 and 200 of Chaelundi State Forest on 21 March, 1990. The Determination report provides a summary and examination of the EIS and addresses the written representations that were received during the period of exhibition.

Based upon its examination of the EIS and the received submissions, the Forestry Commission has approved an alternative described in the EIS rather than the preferred proposal. This option was chosen as it was considered by the Forestry Commission to best preserve the abundance of arboreal marsupial populations. Trees which yield ex-quota or salvage logs (trees containing hollows) will therefore be retained for denning and nesting to maintain the populations of arboreal mammals and hollow dependent birds at pre-existing levels.

It is the Department's view that the procedures under the EPA Act have been properly carried out. The EIS contained sufficient information on the proposed activity, environment and impact interactions for a rigorous public debate to occur. Submissions to the EIS were constructive and the main points raised were commended to the Forestry Commission by the Department.

The Forestry Commission's consideration of these matters is recorded in its determination report published in February, 1991. The determination indicates that the Forestry Commission took into account many of the matters raised and modified its proposed activity to accord with them.

That this result is not considered acceptable or satisfactory to opponents of the logging activities is evidenced by the recent activity in the media. Experience in these matters to date would indicate that a challenge to the determination in the Land and Environment Court would be the next step for those unhappy with the determination. However, previous judgements in the Court where the Forestry Commission has failed to furnish an EIS for an activity have included an indication that the Forestry Commission is considered to be the appropriate and responsible land manager of State Forest needing only to face up to its responsibilities under the EPA Act which, if properly discharged, more than adequately deal with matters which might be expected to be dealt with under the Heritage Act.

For this reason opponents to the logging may now perceive this to be a less sure approach and may be looking to the Heritage Act as an alternative vehicle for their concerns.

GB

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DEPARTMENT OF PLANNING

Ministers Memo No:

Briefing Note No:

Dept File No:

Branch: Natural Resources Unit
Co-ordination Branch &
Heritage Branch

CHAELUNDI STATE FOREST

ISSUE:

NOMINATION FOR ACTION UNDER THE HERITAGE ACT

BACKGROUND:

The Chairman of the Heritage Council has been approached by solicitors representing Mr John Corkhill with a request that a S.136 order under the Heritage Act be placed over an area in Chaelundi State Forest and that the Heritage Council consider the making of an Interim Conservation Order over the same area. A copy of the request is attached for the Minister's information.

The subject area comprises three compartments of the State Forest for which the Forestry Commission has recently completed a determination under Part V of the Environmental Planning and Assessment Act.

The three compartments total 560 hectares and occur within a much larger (unsurveyed) area of old growth forest in both Chaelundi State Forest and the bordering Guy Fawkes National Park.

ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES UNDER THE EPA ACT

The Department issued Director's requirements on 31 July, 1990 for an EIS for proposed logging of compartments 180, 198 and 200 of Chaelundi State Forest. The EIS was exhibited from 2 October, 1990 to 1 November, 1990.

The Department advised on 4 December, 1990 that it was appropriate for the Commission to determine its proposal without an inquiry or examination under the EPA Act. Attention was drawn to strong concerns about the nature and extent of likely impacts, the values of the area and the adequacy of the assessment in various submissions to the EIS.

26/7/91 Richard Hammond
For B/N. Registered
Shalo [illegible]

IN THE LAND AND ENVIRONMENT COURT OF NEW SOUTH WALES

No.40157 of 1991

BETWEEN:

JOHN CORKILL
APPLICANT

AND

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of NSW
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning and Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G.KIBBLE
as Members of the Heritage Council for NSW
THIRD RESPONDENTS

POINTS OF CLAIM

Applicant's address for service:

WOOLF ASSOCIATES
Solicitors
10 Floor
82 Elizabeth Street
SYDNEY NSW 2000
Dx: 1556 Sydney
Tel: (02) 221 8522
Fax: (02) 223 3530
Ref: BSW 3103/1

1. The First Respondent is the Chairman of the Heritage Council of NSW appointed under Section 8(2)(a) of the Heritage Act, 1977 ("the Act").

2. The Second Respondent is the Minister responsible for the administration of the said Act.

3. The Third Respondents are the members of the Heritage Council of NSW constituted pursuant to and appointed under the said Act.

4. On 23 July 1991, the Applicant applied to the First Respondent to exercise his powers under Section 136(1) of the Act to make an order ("the said Order") to prevent work in Compartments 180, 198 and 200 of Chaelundi State Forest ("the said Compartments") and incorporated a request that the Third Respondent consider recommending to the Second Respondent that he make an interim conservation order under the Act in relation to the said Compartments.

5. The First Respondent declined to consider exercising his powers under section 136(1) of the said Act for the following stated reasons:

(a) the policy that the Heritage Act is never to be used in relation to developments by Government agencies if those agencies are required to comply with Part 5 of the Environmental Planning and Assessment Act 1979;

(b) the policy that the First Respondent never considers exercising this power if the Second Respondent is available to do so;

and for the following unstated reason:

(c) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage.

6. In the premises the First Respondent acted unlawfully in refusing to consider the exercise of his power under Section 136(1) of the Heritage Act 1977 to make the said Order:

(a) by applying an inflexible policy without regard to the merits of the case;

(b) by abdicating the said power to another person;

(c) by taking irrelevant considerations into account in considering whether to exercise the said power;

(d) by acting unreasonably;

as set out in paragraph 5 above.

7. The Applicant claims the relief sought in paragraphs 1 and 5 of the Application.

8. The said Compartments comprise an area of land of scientific and natural significance for the State.

PARTICULARS

(a) the said Compartments contain the highest density of arboreal marsupials ever recorded anywhere in Australia.

(b) the said Compartments contain the greatest number of rare and endangered species of fauna ever recorded or expected to occur in any forested area of like size anywhere in New South Wales;

(c) the said Compartments contain pristine high quality old growth habitat for rare and endangered species of fauna of exceptional conservation value.

9. By reason of the matters set out in paragraph 7 above, it was not reasonably open for the Respondents or any of them to decide that the said Compartments were not items of the environmental heritage.

10. Despite the Applicant's request referred to in paragraph 4 above and the matters set out in paragraphs 7 and 8 above, the Respondents have rejected or will reject the said request by reason of their adoption of and adherence to the policies set out in paragraph 5 above.

11. The Applicant claims the relief sought in paragraphs 3, 4 and 5 of the Application.

12. The Second Respondent has adopted the policy of never using the Heritage Act 1977 to protect the natural environment.

13. The duties of the Third Respondent under the Heritage Act include recommending measures to the Second Respondent for or with respect to the conservation of items of environmental heritage.

14. The Third Respondent has unlawfully refused to make a recommendation under the Heritage Act which would be contrary to the said policy of the Second Respondent and the Second Respondent has unlawfully refused to exercise his powers under the Heritage Act in relation to the natural environment and will continue to do so.

15. The Applicant claims the relief sought in paragraphs 2 and 6 of the Points of Claim.

16. The Applicant notified the First Respondent on 23 July 1991 that he had information from leading scientists relating to his application. At no material time did any of the Respondents request the Applicant to provide the said information, despite his readiness to do so.

17. On 26 July 1991, the Heritage Branch of the Department of Planning purported to refuse the Applicant's application for the said Order.

18. The Second Respondent gave no consideration to the said application because he did not deal with it or alternatively he gave no real consideration to the said application because he failed to obtain the information in support of the said application which any reasonable decision maker would have obtained.

19. The Applicant claims the relief sought in paragraph 2 of the Application.

IN THE LAND AND ENVIRONMENT COURT OF NEW SOUTH WALES

No. 40157 of 1991

BETWEEN:

JOHN CORKILL
APPLICANT

AND

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of NSW
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning and Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G.KIBBLE
as Members of the Heritage Council for NSW
THIRD RESPONDENTS

POINTS OF CLAIM

Applicant's address for service:

WOOLF ASSOCIATES
Solicitors
10 Floor
82 Elizabeth Street
SYDNEY NSW 2000
Dx: 1556 Sydney
Tel: (02) 221 8522
Fax: (02) 223 3530
Ref: BSW 3103/1

1. The First Respondent is the Chairman of the Heritage Council of NSW appointed under Section 8(2)(a) of the Heritage Act, 1977 ("the Act").

2. The Second Respondent is the Minister responsible for the administration of the said Act.

3. The Third Respondents are the members of the Heritage Council of NSW constituted pursuant to and appointed under the said Act.

4. On 23 July 1991, the Applicant applied to the First Respondent to exercise his powers under Section 136(1) of the Act to make an order ("the said Order") to prevent work in Compartments 180, 198 and 200 of Chaelundi State Forest ("the said Compartments") and incorporated a request that the Third Respondent consider recommending to the Second Respondent that he make an interim conservation order under the Act in relation to the said Compartments.

5. The First Respondent declined to consider exercising his powers under section 136(1) of the said Act for the following stated reasons:

(a) the policy that the Heritage Act is never to be used in relation to

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developments by Government agencies if those agencies are required to comply with Part 5 of the Environmental Planning and Assessment Act 1979;

(b) the policy that the First Respondent never considers exercising this power if the Second Respondent is available to do so;

and for the following unstated reason:

(c) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage.

6. In the premises the First Respondent acted unlawfully in refusing to consider the exercise of his power under Section 136(1) of the Heritage Act 1977 to make the said Order:

(a) by applying an inflexible policy without regard to the merits of the case;

(b) by abdicating the said power to another person;

(c) by taking irrelevant considerations into account in considering whether to exercise the said power;

(d) by acting unreasonably;

as set out in paragraph 5 above.

7. The Applicant claims the relief sought in paragraphs 1 and 5 of the Application.

8. The said Compartments comprise an area of land of scientific and natural significance for the State.

PARTICULARS

(a) the said Compartments contain the highest density of arboreal marsupials ever recorded anywhere in Australia.

(b) the said Compartments contain the greatest number of rare and endangered species of fauna ever recorded or expected to occur in any forested area of like size anywhere in New South Wales;

(c) the said Compartments contain pristine high quality old growth habitat for rare and endangered species of fauna of exceptional conservation value.

9. By reason of the matters set out in paragraph 7 above, it was not reasonably open for the Respondents or any of them to decide that the said Compartments were not items of the environmental heritage.

10. Despite the Applicant's request referred to in paragraph 4 above and the matters set out in paragraphs 7 and 8 above, the Respondents have rejected or will reject the said request by reason of their adoption of and adherence to the policies set out in paragraph 5 above.

11. The Applicant claims the relief sought in paragraphs 3, 4 and 5 of the Application.

12. The Second Respondent has adopted the policy of never using the Heritage Act 1977 to protect the natural environment.

13. The duties of the Third Respondent under the Heritage Act include recommending measures to the Second Respondent for or with respect to the conservation of items of environmental heritage.

14. The Third Respondent has unlawfully refused to make a recommendation under the Heritage Act which would be contrary to the said policy of the Second Respondent and the Second Respondent has unlawfully refused to exercise his powers under the Heritage Act in relation to the natural environment and will continue to do so.

15. The Applicant claims the relief sought in paragraphs 2 and 6 of the Points of Claim.

16. The Applicant notified the First Respondent on 23 July 1991 that he had information from leading scientists relating to his application. At no material time did any of the Respondents request the Applicant to provide the said information, despite his readiness to do so.

17. On 26 July 1991, the Heritage Branch of the Department of Planning purported to refuse the Applicant's application for the said Order.

18. The Second Respondent gave no consideration to the said application because he did not deal with it or alternatively he gave no real consideration to the said application because he failed to obtain the information in support of the said application which any reasonable decision maker would have obtained.

19. The Applicant claims the relief sought in paragraph 2 of the Application.

LAND AND ENVIRONMENT
COURT OF NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT
COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL
Applicant

ROBERT MARSDEN HOPE
as Chairman of the
Heritage Council of NSW
First Respondent

ROBERT WEBSTER
Minister for Planning
and Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LYNDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the
Heritage Council of NSW

WILLIAM JOHN GILLOOLY will at 9.30 a.m. on 15th August, 1991 at Level 6, American Express Tower, 388 George Street, Sydney move the Court for orders -

1. That the Subpoenae for Production issued in matter no. 40157 of 1991 to Bill Gillooly, National Parks and Wildlife Service returnable on 14th August, 1991 be set aside.

2. Costs.

The time before which this notice of motion is to be served has been abridged by the Court to 12 noon on 13 August, 1991.

Date:

Solicitor for the
National Parks and
Wildlife Service

NOTICE OF MOTION

V. K. Ingram,
Solicitor for the National
Parks and Wildlife Service,
Level 4,
Otis House,
43 Bridge Street,
HURSTVILLE. NSW. 2000

To: John Corkill,
c/- Woolf & Associates,
10th Floor,
82 Elizabeth Street,
SYDNEY. NSW. 2000

Reference: Ms. J. Pearce
Telephone: (02) 585-6319

First and second respondents to be notified.

TIME FOR SERVICE
ABRIDGED TO 12 noon on 13/8/91
ORDER
M. J. CONNELL
REGISTRAR. per: 13/8/91

LAND AND ENVIRONMENT
COURT OF NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT COURT
OF NEW SOUTH WALES

No 40157 of 1991

JOHN ROBERT CORKILL

Applicant

Robert Marsden Hope, Q.C.;
CHAIRMAN OF
THE HERITAGE COUNCIL OF N.S.W.

First Respondent

Robert James Webster
THE MINISTER FOR PLANNING

Second Respondent

Mr Nigel Ashton
Mr Stephen Davies
Dr Ken Cable
Mr Peter Phillips
Ald Sheila Swaine
Mr William Wooldridge
Mr John Ferris
Mr Lyndsay Shaddock
Mr Lindsay Kelly
Mr Bill Gillooly
Ms Gabrielle Kibble

Third Respondents
as members of
THE HERITAGE COUNCIL OF N.S.W.

NOTICE OF APPEARANCE

ROBERT MARSDEN HOPE,
Chairman of the Heritage
Council of N.S.W.,
ROBERT WEBSTER,
Minister for Planning and
Energy,
HERITAGE COUNCIL OF N.S.W.
appear.

Solicitor: Christine Hanson
Legal Branch
Department of
Planning
175 Liverpool St
SYDNEY NSW 2000

Address for Service:

c/- Christine Hanson
Legal Branch
Department of Planning
Level 7
175 Liverpool Street
SYDNEY NSW 2000

Christine Hanson

Solicitor for the
First, Second and
Third Respondents

CHRISTINE CRAIG HANSON
PRINCIPAL LEGAL ADVISER
DEPARTMENT OF PLANNING
LEGAL BRANCH
175 LIVERPOOL STREET
SYDNEY 2000

DX 15

(MR C BROWN)

FILE NO.: G90/00157/Z01

TELEPHONE: 391 2155

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **DOMINIC HERSCHEL**
c/ Level 2
151 Macquarie Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per: [signature]

SCHEDULE

1. All diaries, reports, minutes, notes, files, memoranda, draft press releases, correspondence, telephone log books, telephone message pads, communication records and documents, final press releases relating to the application by John Corkill for an order under Section 136 of the Heritage Act 1977 and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order in relation to Compartments 180, 198 and 200 of Chaelundi State Forest from 23 July 1991 to date.

DATED: August 2, 1991

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning & Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per

TO: **Mr GARRY WEST**
Minister for Conservation and Land Management
Level 2, 153 Macquarie Street
SYDNEY NSW 2000

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

SCHEDULE

1. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) members and alternate members of the Heritage Council of New South Wales;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   (f) officers of the Department of Conservation and Land Management.

   from 23 July 1991 to date relating to the said application.

3. All draft and final original and copies of the press statement issued by you dated 26 July 1991 relating to Chaelundi State Forest.

DATED: August 2, 1991

BY THE COURT REGISTRAR

SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

THE SEAL OF THE LAND AND ENVIRONMENT COURT

NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: The Hon. ROBERT MARSDEN HOPE, QC
Chairman
Heritage Council of New South Wales
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per [signature]

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

SCHEDULE

1. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application to you of 23 July 1991 for the making of order under Section 136 of the Heritage Act from 23 July 1991 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) members and alternate members of the Heritage Council of New South Wales;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

4. All records relating to any delegation of your powers, functions or duties under the Heritage Act 1977, current from 1 July 1991 to date.

DATED: August 2, 1991

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning & Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: **Mr ROBERT WEBSTER**
Minister for Planning & Energy
Level 12, Westfield Tower
100 William Street
DARLINGHURST NSW 2010

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per [signature]

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council or the Minister for Planning of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its or your powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council or Chairman of the Heritage Council or Minister for Planning to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and for the Heritage Council to consider recommending to you as Minister for planning the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or persons on your behalf and:

   (a) officers of the Department of Planning;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) the Chairman of the Heritage Council;

   (d) the members of the Heritage Council;

(e) officers of the Forestry Commission of New South Wales;

from 23 July 1991 to date relating to the said application.

6. All original and copy official and personal diaries and telephone message pads between 23 to 29 July 1991 inclusive.

7. All draft and final originals and copies of the press statement issued by you dated 26 July 1991 headed "Forestry Commission to Manage Chaelundi State Forest".

8. All tape recordings of any interviews given by you in relation to the said press release.

DATED: August 2, 1991

BY THE COURT REGISTRAR

SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

Exhibits Clerk
Land & Environment Court of
New South Wales
GPO Box 3365
SYDNEY NSW 2001

in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **The Secretary**
Department of Planning
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning & Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

SUBPOENA FOR PRODUCTION

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per: [signature]

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council or Chairman of the Heritage Council or Minister for Planning to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between officers of the Department of Planning or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) the Chairman of the Heritage Council;

   (d) the members of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED: August 2, 1991

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **The Proper Officer**
HERITAGE COUNCIL OF NEW SOUTH WALES
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

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THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per:

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

DATED: August 2, 1991

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

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   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT COURT
OF NEW SOUTH WALES

No. 40157 of 1991.

JOHN CORKILL
Applicant
ROBERT MARSDEN HOPE AS CHAIRMAN OF THE HERITAGE COUNCIL OF N.S.W.
First Respondent
ROBERT WEBSTER MINISTER FOR PLANNING & ENERGY
Second Respondent
NIGEL ASHTON, STEPHEN DAVIES, KEN CABLE, PETER PHILLIPS, SHEILA SWAINE, WILLIAM WOOLDRIDGE, JOHN FERRIS, LYNDSAY SHADDOCK, LINDSAY KELLY, BILL GILLOOLY, G. KIBBLE, AS MEMBERS OF THE HERITAGE COUNCIL OF N.S.W.
Third Respondents

AFFIDAVIT OF SERVICE

MARCUS OPIT
Deponent
8/08/91
Sworn

FILED BY:
HILLMAN & WOOLF
SOLICITORS
82 ELIZABETH STREET
SYDNEY NSW 2000
DX; 1558 SYDNEY
TEL; 221 8522

On the 8th day of August, 1991, I, MARCUS OPIT, of 15 Castlereagh Street, Sydney, in the State of New South Wales, a Licensed Commercial Sub-Agent, being duly sworn make oath and say:-

1. I am over the age of 18 years.
2. I did on Monday the fifth day of August, 1991, duly serve the within-named witness, BILL GILLOOLY, with a signed and sealed copy of the Subpoena For Production, a copy of which is annexed hereto and marked with the letter "A", by delivering it to a male employee of National Parks & Wildlife Service of New South Wales, a person apparently not less than sixteen years of age, at, 4th Floor, 43 Bridge Street, Hurstville, in the said State, at the hour of 1.00 o'clock in the afternoon.
3. Before such service I asked the person so served, "Are you authorised to accept service on behalf of BILL GILLOOLY?" He replied, "Yes."
4. At the time of such service I tendered the amount of $10.00 Conduct Money for attendance at Court which was accepted.

S W O R N at SYDNEY)
by the Deponent on the)
day first abovementioned)
Before me:)
)
A Justice Of The Peace.)

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **BILL GILLOOLY**
NATIONAL PARKS AND WILDLIFE SERVICE
OF NEW SOUTH WALES
43 Bridge Street
HURSTVILLE NSW 2220

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

SUBPOENA FOR PRODUCTION

MAY BE MADE
RETURNABLE
ON 14/8/91
M. J. CONNELL
REGISTRAR
per: [signature]

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

This is Annexure "A" referred to in the Affidavit of MARCUS OPIT sworn this 8th day of AUGUST, 1991 before me: [signature]
A Justice of the Peace.

SCHEDULE

1. All files, statements, reports, draft and final assessments, records and documents, minutes, memoranda and correspondence relating to the Guy Fawkes River Wilderness Area, Chaelundi State Forest and any recommendation for the making of an Interim Protection Order in relation to a part of the said Forest.

DATED: August 2, 1991

SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

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IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: DOMINIC HERSCHEL
c/ Level 2
151 Macquarie Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

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(a) before the Court

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388 George Street
(cnr King Street)
SYDNEY NSW 2001

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THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE
RETURNABLE
ON 14/8/91
M. J. CONNELL
REGISTRAR.
per:

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All diaries, reports, minutes, notes, files, memoranda, draft press releases, correspondence, telephone log books, telephone message pads, communication records and documents, final press releases relating to the application by John Corkill for an order under Section 136 of the Heritage Act 1977 and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order in relation to Compartments 180, 198 and 200 of Chaelundi State Forest from 23 July 1991 to date.

DATED: August 2, 1991

SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

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   Land & Environment Court of
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   GPO Box 3365
   SYDNEY NSW 2001

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IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **DOMINIC HERSCHEL**
c/ Level 2
151 Macquarie Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

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SOLICITORS
10th Floor
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SYDNEY NSW 2000
DX: 1556 SYDNEY
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REF: BSW 2536/0

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SYDNEY NSW 2001

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THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per: [signature]

SCHEDULE

1. All diaries, reports, minutes, notes, files, memoranda, draft press releases, correspondence, telephone log books, telephone message pads, communication records and documents, final press releases relating to the application by John Corkill for an order under Section 136 of the Heritage Act 1977 and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order in relation to Compartments 180, 198 and 200 of Chaelundi State Forest from 23 July 1991 to date.

DATED: August 2, 1991

SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

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   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

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IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning & Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: Mr ROBERT WEBSTER
Minister for Planning & Energy
Level 12, Westfield Tower
100 William Street
DARLINGHURST NSW 2010

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

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THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per: [signature]

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council or the Minister for Planning of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its or your powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council or Chairman of the Heritage Council or Minister for Planning to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and for the Heritage Council to consider recommending to you as Minister for planning the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or persons on your behalf and:

   (a) officers of the Department of Planning;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) the Chairman of the Heritage Council;

   (d) the members of the Heritage Council;

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

(e) officers of the Forestry Commission of New South Wales;

from 23 July 1991 to date relating to the said application.

6. All original and copy official and personal diaries and telephone message pads between 23 to 29 July 1991 inclusive.

7. All draft and final originals and copies of the press statement issued by you dated 26 July 1991 headed "Forestry Commission to Manage Chaelundi State Forest".

8. All tape recordings of any interviews given by you in relation to the said press release.

DATED: August 2, 1991

BY THE COURT REGISTRAR

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

Exhibits Clerk
Land & Environment Court of
New South Wales
GPO Box 3365
SYDNEY NSW 2001

in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: **Mr GARRY WEST**
Minister for Conservation and
Land Management
Level 2, 153 Macquarie Street
SYDNEY NSW 2000

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE
RETURNABLE
ON 14/8/91
M. J. CONNELL
REGISTRAR.
per:

SCHEDULE

1. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) members and alternate members of the Heritage Council of New South Wales;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   (f) officers of the Department of Conservation and Land Management.

   from 23 July 1991 to date relating to the said application.

3. All draft and final original and copies of the press statement issued by you dated 26 July 1991 relating to Chaelundi State Forest.

DATED: August 2, 1991

BY THE COURT REGISTRAR

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: The Hon. ROBERT MARSDEN HOPE, QC
Chairman
Heritage Council of New South Wales
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 ~~at 9.00 am~~ or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE
RETURNABLE
ON 14/8/91
M. J. CONNELL
REGISTRAR
per: [signature]

SCHEDULE

1. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application to you of 23 July 1991 for the making of order under Section 136 of the Heritage Act from 23 July 1991 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) members and alternate members of the Heritage Council of New South Wales;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

4. All records relating to any delegation of your powers, functions or duties under the Heritage Act 1977, current from 1 July 1991 to date.

DATED: August 2, 1991

BY THE COURT REGISTRAR

LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: The Secretary
Department of Planning
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning & Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

SUBPOENA FOR PRODUCTION

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
PU: [illegible]

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council or Chairman of the Heritage Council or Minister for Planning to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between officers of the Department of Planning or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) the Chairman of the Heritage Council;

   (d) the members of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales

   from 23 July 1991 to date relating to the said application.

DATED: August 2, 1991

BY THE COURT REGISTRAR

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street; Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 41057 of 1991

TO: The Proper Officer
HERITAGE COUNCIL OF NEW SOUTH WALES
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

MAY BE MADE RETURNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.
per

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED: August 2, 1991

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: The Proper Officer
FORESTRY COMMISSION OF NEW
SOUTH WALES
95 Castle Hill Road
WEST PENNANT HILLS NSW 2120

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR PRODUCTION

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

MAY BE MADE
RETURNABLE
ON 14/8/91
M. J. CONNELL
REGISTRAR.
per:

SCHEDULE

1. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application to the Chairman of the Heritage Council of New South Wales of 23 July 1991 for the making of order under Section 136 of the Heritage Act from 23 July 1991 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between officers of the Forestry Commission and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) members and alternate members of the Heritage Council of New South Wales;

   (e) the Chairman of the Heritage Council of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED: August 2, 1991

SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

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5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

TO: **BILL GILLOOLY**
NATIONAL PARKS AND WILDLIFE SERVICE
OF NEW SOUTH WALES
43 Bridge Street
HURSTVILLE NSW 2220

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

THE SEAL OF THE LAND AND ENVIRONMENT COURT
NEW SOUTH WALES

SUBPOENA FOR PRODUCTION

...E MADE ...RNABLE ON 14/8/91
M. J. CONNELL
REGISTRAR.

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on 14th day of August 1991 at 9.00 am or, if notice of a later date is given to you, the later date at 10.00 am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All files, statements, reports, draft and final assessments, records and documents, minutes, memoranda and correspondence relating to the Guy Fawkes River Wilderness Area, Chaelundi State Forest and any recommendation for the making of an Interim Protection Order in relation to a part of the said Forest.

DATED: 2 August, 1991

THE SEAL OF THE LAND AND ENVIRONMENT COURT NEW SOUTH WALES

BY THE COURT REGISTRAR

Last day for service: August 6, 1991
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40157 of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

NOTICE OF MOTION

TIME FOR SERVICE
ABRIDGED TO 12 NOON.
ORDER 2/8/91
M. J. CONNELL
REGISTRAR. [SIGNED]
1/8/91

The Applicant will at 9.30 on 7th day of August 1991 at the Land and Environment Court, 388 George Street, Sydney move the Court for the following orders:

1. That the hearing of the proceedings be expedited.
2. That the Applicant have leave to apply to the Registrar forthwith for the fixing of a date for the hearing of the proceedings.
3. Such further or other order as the Court may deem fit.

FILED:

....
BRUCE STEPHEN WOOLF
Solicitor for the Applicant

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

IN THE LAND AND ENVIRONMENT COURT
OF NEW SOUTH WALES

No. of 1991

JOHN ROBERT CORKILL
Applicant

Robert Marsden Hope, Q.C.;
CHAIRMAN OF
THE HERITAGE COUNCIL OF N.S.W.
First Respondent

Robert James Webster
THE MINISTER FOR PLANNING
Second Respondent

Mr Nigel Ashton;
Mr Stephen Davies;
Dr Ken Cable;
Mr Peter Phillips;
Ald. Sheila Swaine;
Mr William Wooldridge;
Mr John Ferris;
Mr Lyndsay Shaddock;
Mr Lindsay Kelly;
Mr Bill Gillooly;
Ms Gabrielle Kibble;

Third Respondents
as members of
THE HERITAGE COUNCIL OF N.S.W.

AFFIDAVIT

JOHN ROBERT CORKILL
Deponent

Sworn: 1st August, 1991

WOOLF ASSOCIATES
Solicitors, 10th Floor,
82 Elizabeth Street,
SYDNEY. N.S.W. 2000

Phone: 02 221 8522
Facsimile: 02 223 3530
DX: 1558
Ref: Mr BRUCE WOOLF

I, JOHN ROBERT CORKILL, of 3 Albert Street, Forest Lodge, in the state of New South Wales do solemnly, sincerely and truly affirm and declare as follows:

1. I am an environmentalist seeking to protect the natural heritage values of the Chaelundi State Forest, near Dorrigo in the states' north east.

2. Annexed hereto and marked "A" is a true copy of the media release of the Forestry Commission of NSW, dated 19 July, 1991. Annexed hereto and marked "B" is a true copy of the letter which I caused my solicitor, Mr Bruce Woolf, to write to the Chairman of the Heritage Council of NSW dated 23/7/1991. Following the issuing of this letter neither I, nor my solicitor were contacted to acknowledge the receipt of the letter or to request the provision of supporting documents offerred in the letter of application.

3. At approximately 4.30pm on Friday, 26 July, 1991, I recieved from a journalist a copy of a media release issued by the Minister for Conservation and Land Management, Mr Garry West, dated 26 July, 1991. A true copy of this media release is annexed hereto and marked "C". This media release was the only response to Mr Woolf's letter.

4. Following discussion with Mr Woolf and counsel, I caused Mr Woolf to issue a second letter to the Chairman of the Heritage Council on the afternoon of 26 July, 1991. A true copy of this letter is annexed hereto and marked "D".

J R Corkill

5. At 4.58pm, I dialled the phone number of the Department of Planning's Switchboard. I had the following conversation:

The switchboard operator said
"Department of Planning. Can I help you?

I said
"Yes. I want to talk to somebody regarding the Heritage Act but I'm not sure who to speak to.

She said
"OK. Hold the line please.

Phone rang at an extension and a man answers.

I said
"Hello, Its John Corkill calling. I want to make an inquiry about an application I've made under the Heritage Act. Can you help me with my questions?

He said
"I may be able to help you. What was it regarding?

I said
"I'm seeking an emergency order under s.136 of the Heritage Act. My solicitor has written the Chairman seeking an order to protect an are of natural heritage significance.

He said
"Who is your solicitor?

I said
"Mr Bruce Woolf of Woolf Associates. He's in Elizabeth Street, the city.

He said
"Have you spoken to anyone else in the Department regarding this matter?

I said
"No. I haven't even spoken to the Chairman. We wrote to him earlier this week and I've just heard from a journalist that my application's been rejected. Can you tell me what's happened to my application?

He said
"I'm not sure. What were you seeking?

I said
"An emergency order to protect the natural heritage values of the Chaelundi state forest.

J. R. Corkill

He said
"Oh, no. The Heritage Council wouldn't consider that. The Council hasn't applied the Heritage Act to the natural heritage for some years, since there were amendments to other Acts. We don't consider environmental issues.

I said
"But my solicitors advise me that the Council has power to consider these matters. That's why we applied. I know the Heritage Act has been used to protect natural heritage before.

He said
"Yes but not for some years.

I said
"Now listen. We wrote to the Chairman, we haven't recieved a response. Next thing I hear I'm told that my application's refused, and the Minister for Conservation and Land Management Mr West has issued a press statement and is quoting the Department. Ive checked with Mr Woolf. He hasn't even submitted our evidence. We're still waiting to hear where to send it. I want to know what's going on!

He said
"Yes, I see.

I said
"I realise that it's Friday afternoon, but this was an urgent application. Frankly, I'm less than impressed with what I've heard. Can you confirm any of what I've said?

He said
"No. I'm not sure what's going on

I said
"I don't suppose there's anyone else I can talk to who might know what's happened?

He said
"I don't think so. I think everyone else has left for the afternoon.

I said
"I see. Well I suppose that's it then. Someone knows what's happening but it's not you or me. What was your name then?

He said
"Dennis McManus.

I said
"And you're what in the Heritage Branch?

BWdy J.R. Cokill.

He said
"I'm the Secretary.

I said
"OK. Thanks Mr McManus. You can be sure I be right back onto this first thing on Monday morning.

He said
"Right Mr Corkill.

I said
"Good afternoon.

He said
"Good afternoon.

I hung up at around 8 or 9 minutes after five p.m.

6. At about 5.30 p.m. Mr Woolf telephoned me at my office, returning my call. He confirmed to me that, as at then he still had not heard from the Chairman of the Heritage Council and hence had not despatched the bundle of supporting documents. I informed him of my conversations with a journalist and Mr McManus.

7. At 6.30 p.m I was in the company of Mr Robert Mezzatesta, Consultant to the Australian Heritage Commission. We were in the office we share at the NSW Environment Centre. I was telling him of the progress of the Chaelundi campaign for that day.At approx. 6.38 I answered the telephone.

8. I had the following conversation.

I said
"Environment Centre.

A man said
"Hello yes. Is Mr John Corkill there?

I said
"Yes. Speaking.

He said
"Oh good. I'm Rob Power, from Heritage Branch of Department of Planning.

I said
"Oh yes Mr Power. I spoke to Mr McManus earlier and he didn't seem to know what was going on. Perhaps you can tell me what's happened to my application for an emergency order under section 136?

Bwolf J.R. Corkill.

He said
"Well I may be able to.

I said
" Well I certainly hope someone can provide an explanation. I heard from a journalist earlier this evening that the Branch has issued some kind of report, yet when I checked with my solicitor he confirms that we have recieved no response, let alone a report.

He said
"Actually, the reason I've phoned is to see if you where there and if so for how long. You see I've spoken to the Chairman, Mr Justice Hope and we're settling a letter to reply to your application. I tried to call Mr Woolf earlier but there was no answer at his office. Will you be there long? Can I get back to you there in say, fifteen minutes?

I said
"That's peculiar, since I phoned there 3 or 4 times today and his staff were there all day. He called me this after -noon before he left the office. What time did you call?

He said
"A few minutes before I called you earlier this evening.

I said
"Well that explains it. He'd left his office well before then.

He said
"Will you be at this number much longer?

I said
"Alright. I can wait for you. How real is fifteen minutes?

He said
"Oh pretty close. I'll definitely call back very soon.

I said
"OK Mr Power. If it means I know something about what's been happening, I'll wait for your call.

He said
"Right then, I'll call you back soon.

I said
"Alright. I be waiting.

I hung up then.

B Woolf J.R. Corkill

9. At about 7 or 8 minutes to 7 p.m. I answered the phone at the NSW Environment Centre. I had the following conversation.

I said
"Environment Centre

A man said
" Mr Corkill?

I said
" Yes speaking. Mr Power?

He said
"Yes it's Rob Power calling back.

I said
"I hope you can tell what's going on now?

He said
"Well I have a letter here which I want to read to you. It's from Mr Justice Hope.

I said
"I'm not sure I want to hear it read, You can fax it to me here. Our fax number is...

He said
"I can't fax it. None of our typists are here and it isn't typed.

I said
"I don't mind if it's longhand provided its legible.

He said
"It isn't signed. I've settled it with Mr Hope on the phone and I'm proposing to have it typed and sent to you on Monday morning. Do you want to hear it read?

I said
"Yes, but I hardly think this is satisactory so late in the day. Go ahead Mr Power.

At this point in our conversation, I switched the phoneset to 'speaker mode' so that Mr Powers' voice could be heard in the office. Mr Mezzatesta was present while Mr Power proceeded to read to me over the speaker telephone.

Mr Power apparently read me the text of a letter, of which I don't recall the exact words. My recollection is that I was advised that:

* it was Government policy for the Heritage Council not to involve itself in environmental disputes;

B. Woolf J.R. Corkill

* the Forestry Commission had prepared an Environmental Impact Statement for the proposed logging and hence the Heritage Council had no role to play in reviewing a decision to log the forest.

When Mr Power was finished reading, there was a moments silence while I switched the phone back to hand held operation, to permit me to speak.

I had the following conversation with Mr Power.

I said
"So you're rejecting my application...It hasn't even been considered. This is most unsatisfactory. I'm certainly don't consider your advice by telephone at this time of the week as being proper notice of any Heritage Council decision, nor is it a satisfactory response to my solicitors letter. I am most dissatisfied with this.

He said
"I intend to send you this in writing on Monday. I suppose it should go to your solicitor since he wrote the letter to the Chairman.

I said
"Yes. Write to Mr Woolf. But I'm most unhappy about this. I don't propose to argue the toss with you about this but I want to say now how unhappy I am about the processing of my application. I've already instructed my solicitor to write again to the Chairman. That letter's gone as far as I know, so one way or another you'll be hearing about this again next week, as events unfold. I'm certainly not satisfied with being rung up on a Friday night by you to be officially advised of something when we've made a written request to the Chairman.

He said
"No...

I said
"We I'm not going to carry on with this now. As far as I concerned ther has been a political intervention. There is no legal impediment to the Chairman of the Council considering my application. You're not the right person to sound off to now and if you're like me you'd like to leave it at that and finish for the week.

He said
"That's right Mr Corkill.

I said
"Well let's leave it at that then for now. We'll be in touch next week. Thank you for your advice nonetheless.

B Woolf J.R. Corkill

He said
"Yes. Goodnight Mr Corkill.

I said
"Goodnight.

I hung up at 7.12p.m. Friday 26 July, 1991.

10. On Monday morning, 29 July, 1991 I recieved a copy of a media release issued by the Minister for Planning and Minister for Energy, Mr Robert Webster, dated 26 July, 1991. A true copy of this media release is annexed hereto and marked "E".

11. Later on Monday, 29 July, 1991, I recieved a copy of a letter from the Chairman of the Heritage Council of NSW to my solicitor. A true copy of this letter is annexed hereto and marked "F".

12. Exhibited to me at the time of my affirming of this affidavit are the following documents which are referred to in the first letter from Woolf Associates to the Chairman of the Heritage Council:

1. Land and Environment Court Orders, Corkill vs Forestry Commission of NSW No. 40052/90 dated 13 March 1990; JF
2. Forestry Commission Environmental Impact Statement for Compartments 180, 198 and 200 of Chaelundi State Forest;
3. National Parks and Wildlife Service Submission to the FCNSW Chaelundi EIS;
4. North East Forest Alliance Submission to the FCNSW Chaelundi EIS;
5. Mr Harry Hines, Wildlife Ecologist, Submission to the FCNSW Chaelundi EIS;
6. Dr Tony Norton, Wildlife Ecologist, Submission to the FCNSW Chaelundi EIS;
7. Report on the determination of the FCNSW EIS for Chaelundi, ommitting Appendices 1 and 2;
8. Dr Andrew Smith, Wildlife Ecologist, expert report;
9. Mr David Milledge, Wildlife Ecologist, expert report;
10. Mr Alexander Gilmore, Wildlife Ecologist, expert report;
11. Dr Tony Norton, Wildlife Ecologist, dictated statement;

B. Woolf J.R. Corkill

13. I am informed and verily believe that pursuant to its public statements referred to in paragraph 2 hereof, the Forestry Commission of NSW is threatening to carry out roading and logging activities in Compartments 180, 198 and 200 of the Chaelundi State Forest and there is, in accordance with the material referred to above and exhibited to me, an immediate and continuing threat to the environmental heritage values of the said forest.

14. I accordingly request this Honourable Court to grant the relief sought in the application and Notice of Motion filed herein.

Affirmed and declared at)
Sydney in the state of)
New South Wales this 1st)
day of ~~July~~ August 1991.)

J. R. Corkill
....
Deponent

Before me........B Wolf........................
Solicitor
B. S. WOLF

FORESTRY COMMISSION OF NEW SOUTH WALES

Conserving forests for our future

This is the annexure marked
"A" referred to in the
Affidavit of John Corkill
sworn the 1st day of August
1991

Before me :

18 July 1991

Media Release

Chaelundi Roading to Resume Soon

Road construction in preparation for logging in Chaelundi State Forest will commence next week.

This was announced today by Dorrigo District Forester John Murray who said that weather conditions now allowed the resumption of work that had been delayed by rain.

Roading to allow access to three compartments within Chaelundi State Forest is the first operation specified in the Environmental Impact Statement which was determined in March. No date has yet been set for the start of logging.

John Murray said that the completion of an EIS was the principal demand of protesters who disrupted logging last year.

"The EIS has been published, public submissions taken and determined according to the law. Logging plans have been significantly modified to avoid unacceptable environmental impacts, particularly on animals. This is what the EIS process is all about," Mr Murray said.

Mr Murray said that it was disappointing that protesters had been completely unmoved by the fact that their principal objection had been met.

"Their pretext for blocking operations was that logging would be illegal without an EIS. The fact that their attitude is unchanged indicates that legality was never the issue."

"The forest operations which are set out in the EIS are part of the strategy for managing north coast forests which was launched by the Premier in June last year. The strategy provides for the largest program of environmental assessment ever undertaken in Australian forest," Mr Murray said.

Mr Murray said that the strategy provided for a sensible balance between the preservation and wise use of mature State forests. The balance was heavily weighted towards preservation with almost 80% being excluded from logging. If the large areas preserved within National Parks were taken into account, then the permanently preserved share increased to 92%.

For further information, contact Dale McLean (066) 528677
David Newman (02) 9804570

WOOLF
ASSOCIATES
SOLICITORS

10th Fl, 82 ELIZABETH STREET
SYDNEY NSW 2000
TELEPHONE (02) 221 8522
FACSIMILE (02) 223 3530
DX 1556 SYDNEY
BRUCE WOOLF
BA LLB Dip URP
ASSOCIATES:
BRIAN HILLMAN
LLB. Dip B Admin:
Dip S de Fr des Aff
EDWARD L. MURA
B Ec. LLB.

OUR REF

YOUR REF

DATE

This is the annexure marked "B" referred to in the Affidavit of John Corkill sworn the 1st day of August 1991

Before me : [signature]

23 July 1991

Hon RM Hope, QC, AC
Chairman
Heritage Council of New South Wales
Fax 247 1054

URGENT

Dear Mr Hope

RE: CHAELUNDI STATE FOREST

I act for John Corkill, an environmentalist, who instructs me for the reaons set out below, to apply for an order by you under section 136(1) of the Heritage Act 1977 to prevent work being carried out with respect to compartments 180, 198 and 200 of Chaelundi State Forest until the Heritage Council has had an opportunity to make a recommendation to the Minister for Planning for an interim conservation order for these compartments.

I am faxing herewith copies of a press statement last week by Mr Murray, the Regional Forester, and an article by Mr Bailey in yesterday's Sydney Morning Herald which sufficiently demonstrate the urgency of this application and the pendency of work in this part of the Forest.

Chaelundi State Forest covers an area of 36,700 hectares and lies about 60 kilometres northwest of Dorrigo. Beyond its western border is the Guy Fawkes River National Park. The area to which this application relates is west of Chaelundi Road in the catchment of Pine Creek immediately contiguous with the National Park. The three compartments have an area of 561 hectares, less than 2% of the Forest.

These three compartments of Chaelundi State Forest have the greatest density of arboreal mammal fauna of any forested land anywhere in Australia. Densities have been measured by the Forestry Commission, the National Parks and Wildlife Service and independent forest ecologists. Using the data reported by the Forestry Commission of New South Wales alone, estimates of arboreal mammal abundance range from 399 individuals per square kilometre to 2857 individuals per square kilometre (**Proposed Hardwood Operations Compartments 180, 198, 200 Chaelundi State Forest, Environmental Impact Statement Report**, February 1991, p.25). To place these estimates in some context, the richest arboreal habitats in Coolangubra State Forest in the southeast of New South Wales are estimated to carry 84 individuals per square kilometre. Dr Andrew Smith, a leading independent forest ecologist, considers that these estimates of abundance of arboreal fauna are probably the highest ever recorded in Australia. Mr Hines, a forest ecologist employed in the Victorian Department of Conservation and Environment and the person who has surveyed the richest forest habitats in New South Wales believes that these compartments carry the highest ever density of arboreal mammals recorded in New South Wales (**Comments on the EIS on the Proposed Hardwood Operations in Compartments 180, 198 and 200 of Chaelundi State Forest** HB Hines, 31 October 1990, p.5). For this reason alone, these compartments are an item of environmental heritage, being a place of scientific and natural significance for this State.

It is not merely the abundance but the diversity of forest species which marks out these compartments as State environmental heritage. The compartments contain a suite of endangered species rarely encountered elsewhere in Australia's forest estate. The following species are listed in Schedule 12 of the National Parks and Wildlife Act 1974 as endangered fauna which are known or likely to occur within these compartments:

Powerful Owl
Masked Owl
Sooty Owl
Spotted-tailed Quoll
Feathertail Glider
Long-nosed Potoroo
Hastings River Mouse
Parma Wallaby
Fawn-footed Melomys
Brush-tailed Phascogale
Dome-headed Bat
Koala
Eastern Bristlebird
White-throated Needletail
Cicadabird
White's Thrush
Crested Shrike-tit
Glossy Black Cockatoo
Rufous Fantail
Dwarf Crowned Snake
Southern Angle-headed Dragon
Stephen's Banded Snake
Carpet Python
Major Skink

Two additional endangered species were found in these compartments. Fletcher's Frog is a protected amphibian (Schedule 12A) and the rare Beech Skink has only just been described. Its discovery in the wet eucalypt forest of these compartments is the first record of its presence outside rainforest, particularly Antarctic Beech. As well, the Green-thighed Frog and species of the genus Kyarranus, both protected amphibians, are likely to occur (the Forestry Commission did not survey for amphibians, dasyurids, potoroids, small macropodids, bats, rodents and most reptiles).

Independent forest ecologists retained by the North East Forest Alliance have evaluated the evidence that this is a unique habitat of conservation significance to the State and, indeed, the nation. Dr Andrew Smith of the Department of Ecosystem Management, University of New England, reported as follows:

> *"Glider populations of this density have significant cultural and ecological values, including the provision of optimum habitat for top predators such as the Powerful Owl and the Spotted-tailed Quoll.... The number of rare and threatened animal species already known in the EIS area or within close proximity (3km) is amongst the highest that I am aware of, and when species which are likely to occur on the basis of known habitat preference are also included, the EIS area could be unique with respect to its richness of rare and threatened mammals. Certainly the number of rare and threatened mammals already known to occur in Chaelundi is higher than I have recorded during previous surveys of areas of comparable size in north-east New South Wales."*

Dr Tony Norton of the Centre for Resource and Environmental Studies, The Australian National University, used computer modelling to predict the potential optimum habitat for most arboreal marsupials in the Chaelundi State Forest region. He subsequently undertook wildlife surveys and found that:

> *"Overall the forests encompassed by Chaelundi State Forest contain several biological attributes. On the basis of the best available scientific data, some of these appear unique. That is, they occur nowhere else on the Australian continent.*
>
> *Consequently it was concluded that these forests have a very high conservation value... compared to much of the eucalypt forest estate... the forest sampled in this survey contain a very high species diversity of arboreal marsupials and owls. At least nine*

> *species of arboreal marsupials are present...the maintenance of relatively large and intact areas of old growth forest appears essential to conserve the known habitat requirements of the identified species of arboreal marsupials and owls."*

Mr Alexander Gilmour, a consultant to the National Parks and Wildlife Service and an experienced fauna surveyor undertook a wildlife survey of the proposed Guy Fawkes Wilderness Area including these three compartments. He found that the compartments had the highest density of arboreal marsupials of any part of the area surveyed by him including the adjacent Guy Fawkes River National Park. He concluded that:

> *"The very high frequency of greater gliders along the Broadmeadows Road compared with elsewhere in NSW and Australia is of national significance. It implies a particularly dense population and thus optimum habitat... these compartments are of such national significance and are of irreplaceable value as a research resource..."*

Mr Hines, of the Victorian Department of Conservation and Environment, also surveyed the area and reported that the mean density of arboreal mammals was at least four times that found for arboreal mammals anywhere in the Coffs Harbour forest region:

> *"I calculated the density of arboreal mammals to be 1,250 per square kilometre... from the information presented it would appear that the density of arboreal mammals along this transect are the highest ever recorded in NSW.... when all the available data are considered together it is obvious that the EIS compartments not only support large densities of arboreal mammals but also relatively high species richness... and apparently a large population of the recently described rare Beech Skink was located... (this occurrence) is highly significant."*

The State's fauna expert authority, the National Parks and Wildlife Service has concluded that these compartments require protection from unnatural disturbance:

> *"The remaining tall old growth forests of New South Wales are a tiny proportion of the original forest of the State. The present system of conservation reserves does not provide an adequate sample of the forest ecosystems, in particular, old growth forests on high nutrient soils... such as those in the EIS area. Old growth forests are now so restricted and have such high conservation and*

> *research value.... there is a case for their protection from logging, clearing or other detrimental disturbance... the NPWS concludes that the high natural conservation values justify the areas being protected, and would represent, if including the adjoining old growth forest to the north, an important conservation achievement for the protection of:*
>
> * *wilderness*
> * *old growth forests*
> * *critical habitat for densities of Greater Gliders*
> * *protection of rare, endangered and threatened species of regional significance.*
>
> *There is no doubt that the proposed logging would destroy or seriously impair the abovementioned values in the immediate time."*

The Forestry Commission of New South Wales has legal responsibility for the State Forest. My client has serious concerns about its record in wildlife conservation. For example, it is now established that roading and logging authorised by the Commission probably led to the extinction of the Long-footed Potoroo (*Potorous longipes*) in the Sheep Station Creek area of Bondi State Forest. The Forestry Commission's own wildlife specialists have advised it since 1983 that it must retain more habitat and potential habitat trees than existing management prescriptions (southeastern New South Wales - one per three hectares; northeastern New South Wales - one to two per hectare) in order to retain in situ viable populations of some common arboreal mammals immediately after logging: Kavanagh, **Wildlife Management - Eden Region**, Forestry Commission of New South Wales, unpublished report, 24 June 1991; Watts, **Arboreal Mammal Surveys - Summary Chaelundi Group Forests**, Forestry Commission of New South Wales, internal report 9 May 1989. These biologists recommended the retention of hollow-bearing trees at a rate of 10 hollow trees per hectare for rich areas of Chaelundi State Forest (Watts, p.12, assuming a density of Greater Gliders of 227 per square kilometre - an underestimate by an order of magnitude) and 10 habitat trees per hectare for high quality fauna habitat in the Eden region (Kavanagh, p.9, based on data from areas with much lower densities of arboreal fauna than these compartments in Chaelundi State Forest). No data is available for measuring long term impacts on arboreal fauna, including such matters as the disappearance of lower order species or feed trees for herbivores as a result of logging or post-logging burning. Mechanical disturbance of the soil and the burning of terrestrial habitats such as hollow logs directly affect non-arboreal species. The opening up of areas by roading encourages exotic predators such as foxes which are probably directly responsible for the local extinction of the Long-footed Potoroo. Mr David Milledge, a leading forest ecologist, has advised that similar risks may occur in these compartments:

> *"Contrary to the claim in the EIS, the Spotted-tailed Quoll is highly likely to be disadvantaged by the impact of activities. Although widely distributed in eastern Australia, it has suffered substantial fragmentation and contraction of its range since European settlement and has become locally extinct in some areas where it was once common. Its close relative, the Eastern Quoll D.viverrinus, appears to be extinct on mainland Australia. The Spotted-tailed Quoll is considered to suffer from competition with the introduced Fox Vulpes vulpes and feral Cat Felis catus and evidence from scats indicates that it is preyed on by the Fox and also the Dingo/feral Dog Canis familiaris. Disturbance from roading and logging resulting from the proposed operation in these compartments will facilitate invasions by its introduced competitors and predators and could lead to its permanent decline, a situation which has occurred in other NSW north coast forests subject to selective logging. These claims cannot be described as "suppositional" nor is the invasion of exotic predators normally dependent on "increases in food sources" (EIS Report). There is good evidence to implicate the Fox in the decline of medium-sized dasyurids. The EIS quotes the Complete Book of Australian Mammals on the status of the Spotted-tailed Quoll but omits to include the highly pertinent concluding sentence of this text which states:*
>
>> *"If the last forest areas in which it is found are opened up by logging, it may become so thinly distributed that it will be unable to survive".*
>
> *The Spotted-tailed Quoll can be considered likely to be lost from these compartments as a result of the proposed timber harvesting activities.....*
>
> *Contrary to the claim in the EIS Report, the activities associated with timber harvesting are highly likely to impact on the Long-nosed Potoroo. Destruction of its habitat during and after logging through mechanical ground disturbance and disposal and control burning, together with the introduction of exotic predators facilitated by roading, are likely to be detrimental and effects may be permanent."*

Despite advice to the Commission from its own ecologists since about 1983 (and by other independent ecologists since 1975) the Commission has failed to heed their calls and continues to log forests without adequate retention of habitat and potential habitat trees to endeavour to ensure viable populations of common arboreal mammals. None of its prescriptions address the impacts of these activities upon non-arboreal endangered fauna. In this case, the Commission has determined the proposal to log these compartments by modifying its harvesting prescriptions to *"ensure retention of 50% of the existing mature forest canopy cover in areas logged... retention shall favour habitat trees or potential habitat trees. This .... is justified in consideration of the high value of this particular area for arboreal mammals."* (EIS Report, p.32). Kavanagh estimates that 50% canopy retention logging operations probably retain between 7-18 trees per hectare (Kavanagh, p.12). This estimate is obviously referable only to forest types occurring in the Eden region from which it was drawn and it is not known whether similar results could be achieved in the wet montane forests of the Chaelundi region. Assuming its accuracy, however, the Chaelundi EIS reports that in areas adjacent to these compartments where between 22% and 65% of canopy has been removed in New England Blackbutt forest types (Table 33, p.119), about 40 hollow trees per hectare were retained, of which 30 were inhabited by animals (Table 31, p.118). It is clear from this evidence that retention of even 18 habitat trees per hectare will dramatically reduce the populations of common arboreal mammals in this part of the Forest.

Even if 50% canopy retention logging was sufficient to maintain viable populations of some arboreal mammals in the short term (less than two years after logging), which it clearly is not, then there is not the slightest evidence to suggest that these populations will be maintained over time. More importantly, however, none of this material relates to the danger posed by logging, roading and burning to terrestrial animals and arboreal mammals with highly specialised diets (such as Koalas) or the rare owls or birds. Mr Milledge advises that:

> *"The Glossy Black-cockatoo Calyptorhynchus lathami, recorded on a number of occasions in these compartments, required old-growth eucalypt trees with large trunk hollows for nesting, so contrary to the statement in the EIS Report, it would be adversely affected by the logging of eucalypt trees. This species has very specific nest site requirements and it is difficult to see how measures taken to protect hollow-dwelling mammals will be of benefit. The EIS Report infers that extensive removal of understorey vegetation may occur, which will also adversely affect the Glossy Black-cockatoo because it is dependent for a*

> *high proportion of its diet on the seeds of Forest Oak Allocasuarine torulosa, an important understorey tree. This repudiates the statement in the EIS that "feeding areas for Glossy Black-cockatoos should be retained".*

The Forestry Commission has conceded the significance of this area for one only of the rare species of owl known to occur in it by undertaking to instruct staff *"in recognising areas likely to be used for nesting by the Powerful Owl"* and by protecting those areas for a radius of 200 metres from the nest (EIS Report, p.32). Mr Milledge further advises that:

> *"The endangered (Schedule 12) Sooty Owl Tyto tenebricosa is probably more at risk from the proposed operation than the Powerful Owl, due to its sedentary and more specialised habits and smaller home range requirements, yet no specific consideration appears to have been given to mitigating impact on this species.... My research on the Sooty Owl in Victorian Mountain Ash Eucalyptus regnans forest, with a distribution concentrated in and around stands older than 150 years of age. Where it occurred in younger or logged forests it was limited to areas with high densities of stags (standing dead trees) or a few areas along major watercourses. The Sooty Owl appears to closely parallel the North American Spotted Owl Strix occidentalis in population size, home range size, strong association with old-growth forests and other ecological requirements and can be expected to exhibit broadly similar responses to the Spotted Owl with regard to intensive logging. Mathematical predictions based on detailed, long-term studies of the Spotted Owl have shown an overall decline with progressive extinctions of fragmented, isolated populations that appear likely to be similar for the Sooty Owl. Contrary to the claim in the EIS that it takes mainly terrestrial species, a high proportion of the Sooty Owls' prey appears to consist of arboreal mammals and it could be significantly disadvantaged by logging and lost from the area."*

Owl nests are notoriously difficult to find and generally require specialist assistance. Mr Corkill and his advisers have read many thousands of Forestry Commission documents, management plans, harvesting plans, reports and other records relating to its management responsibilities. Never have we seen any evidence that its field staff, who are supposed to supervise ordinary harvesting operations, have been trained in the recognition or surveying of fauna or have the knowledge enabling them to do so. Time and again, surveys of forested areas have been performed by independent researchers which establish the existence of species, often in considerable numbers, of which the Forestry Commission is wholly unaware. The evidence for this proposition is contained in the affidavits read and exhibits tendered in the four Corkill cases in the Land and Environment Court in 1990 and 1991 (Mount Royal State Forest: No.40002 of 1990; Chaelundi State Forest: No.40052 of 1990; Billilimbra and Washpool State Forests: No.40208 of 1990; and, Way Way and Yarrahappini State Forests: No.40059 of 1991). In each of these cases, I was Mr Corkill's solicitor.

No management prescription short of preservation could sustain the innate values of this area.

Inadequate though it is, it is instructive to examine the Policy Statement approved on 24 December 1987 by the Forestry Commission relating to wildlife conservation. Paragraph 3 of the Policy Statement provides:

> *"Suitable habitat conditions will be maintained throughout the native forest estate. Areas of special value will be identified to form the core of a conservation strategy and manage with priority for wildlife values. Critical areas will be reserved free from adverse disturbance."*

Watt assessed arboreal mammal populations throughout the Chaelundi group of forests as of "special value" within the context of this policy (Watts, p.13). This recommendation was based upon data from lower quality areas of fauna habitat in Chaelundi and it assumed a density of Greater Gliders of 227 individuals per square kilometres. Using the same method (drive/transect), Hines estimated an abundance of 1,251 Greater Gliders per square kilometre in these compartments. By any assessment, these compartments contain critical habitat for this species and so require preservation within the terms of the Commission's Wildlife Policy.

Dr Andrew Smith has examined the claims in the EIS and EIS Report that 50% canopy retention can maintain the natural values of this area and he has reported as follows:

> *"The effects of logging, and specifically 50% canopy removal, on vegetation succession, floristics and structure and its implication for fauna succession and habitat change have not been adequately considered. The EIS claims (p.97),*
>
> > *"that the degree of disturbance that could be expected to occur as a result of harvesting these areas would remain within the levels of disturbance which have shaped the*

> *forest in the past, and later that... holding the forest in a section of the natural spectrum of successional progression that could be expected to occur under natural conditions".*

These statements are misleading and incorrect. Logging in moist hardwoods forests differ from natural disturbance in many important ways which are likely to have an adverse effect on the survival of rare and threatened fauna. Logging does not leave large trees standing to decay naturally and input energy into the decomposing chain after they collapse. Logging disturbance occurs at a much greater frequency than natural disturbance and prevents forests reaching their natural climax state. The cumulative effect of such changes could lead to the extinction of species which prefer undisturbed old growth habitats. The effects of 50% canopy retention logging also differ from those of natural disturbance processes. 50% canopy removal is likely to have a significant impact on forest structure and floristics. It will change uniform-age structured forests to multi-age structure forests and could alter tree species composition, depending on which species are selectively harvested. The possible effects of these changes on fauna are not considered. Alteration of forest structure, in particular the regeneration of a dense understorey, could decrease habitat suitability for owls for reducing visibility and for Greater Gliders by reducing the efficiency of gliding. The EIS (p.142) claims "that populations of arboreal mammals and hollow dependent birds would be maintained at pre-existing levels" under a 50% canopy removal logging alternative but no data are presented to substantiate this claim and this conclusion is inconsistent with my research which shows an approximate decline in arboreal mammal numbers in proportion to canopy removal in the short term. The effects of 50% canopy removal on large owls could be significant through reduction of food supplies. The effects of 50% canopy removal on Spotted-tailed Quolls could also be significant through increased competition from dogs, foxes and cats and through reduction in abundance of arboreal mammal prey. The effects of 50% canopy removal on small rare and endangered macropods and potoroids (Long-nosed Potoroo and Rufous Bettong) are unclear, but could be significant if increased roading promotes invasion by foxes...

Procedures proposed for mitigating impacts of 50% canopy retention logging on owls are unlikely to be effective. The EIS Report states that "staff will be instructed in recognising areas likely to be used for nesting by the Powerful Owl. On identifying a nest, areas up to 200 metres from the nest will be completely *protected from logging." This procedure ignores the fact that the main adverse impact on owls is through alterations to the food supply rather than disturbance of nest sites. Nest sites of owls are notoriously difficult to recognise and I have no confidence that this exercise can be carried out effectively by untrained personnel. Similarly, little confidence can be placed in proposals to instructed Forestry Commission of New South Wales personnel how to look out for and identify Rufous Scrub Bird habitat or the habitats of other rare, threatened and special interest species. The identification of rare fauna, rare fauna habitat and keystone resources in forest environments is a specialised task requiring rigorous training and considerable practical experience. The Forestry Commission of New South Wales does not have a wildlife survey team for mandatory examination of old growth forest for special flora and fauna values prior to logging. This situation is in marked contrast to practice in the State of Victoria where all old growth forest blocks in public forests are subject to rigorous flora and fauna survey, rigorous protection of significant wildlife values and public comment on proposed protection and impact mitigation procedures. The Forestry Commission thus violates the New South Wales "Forest Strategy" which states that a comprehensive information base will be used as the basis for assessing the environmental sustainability of logging activity. ...*

Following my examination of the EIS and the EIS Report, with particular reference to assessment of likely significant impacts on fauna as required by the Environmental Planning and Assessment Act 1979, I have concluded that the EIS is deficient in every major facet of wildlife impact assessment and that the overall treatment is superficial and appears to favour a predetermined outcome rather than presenting a full and unbiased assessment of all environmental costs and benefits. The description of fauna diversity and habitats within the region is inadequate. The prediction of likely impacts is inadequate. Procedures recommended for mitigating and identifying impacts are likely to be ineffective, consideration of logging alternatives and the no logging option are inadequate, and the entire impact assessment is built on the false premise that the only significant fauna value of the EIS area is the exceptional abundance of Greater Gliders (EIS p.144), which ignores the exceptionally high and possibly unique association of rare and threatened species in the area and its national, State and regional significance as an example of pristine high quality old growth habitat"

This is an area which pre-eminently qualifies for permanent conservation. Certain correspondence between the Minister for the Environment and the former Minister for Planning and Local Government concerns the role of the Heritage Council in protecting the natural environment. One view of that correspondence is that the Heritage Council has acted upon the dictation of the former Minister for Planning or pursuant to some policy of the Government by abdicating its responsibilities for items of natural environmental heritage. It is certainly the strongly held view within the environment movement that the Heritage Council has abandoned the natural environment ostensibly for the quite spurious reason that the Minister for the Environment has the power to make an interim protection order over land. Of course, interim protection orders only last for 12 months and cannot be reimposed. They are not substitutes for the machinery for the Heritage Act which Parliament intended to protect the State's environmental heritage whether built, cultural, scientific or natural. I draw your attention to the views of the Minister for the Environment, Mr Moore on this matter, which my client endorses:

> *"I very much fear that failure to apply the provisions of the Heritage Act for the protection of the natural environment, especially rare and threatened species is likely to cast doubt on the strength of this Government's commitment to conserving the State's natural heritage. In particular, it will be interpreted in the wider community as a wider lack of commitment towards the protection of rare and threatened species from extinction. At a time when the Federal Government is addressing a proposal to join a world convention (Convention for the Conservation of Biological Diversity) that would confer a national obligation to protect all rare and threatened species, it would be preferable to avoid any appearance in this State of reluctance to take action where necessary."* (letter to Hon David Hay, MP, 16 November 1989 concerning the Horton's Creek Rainforest)

I am informed that a large police presence has now emerged in Chaelundi State Forest with a view to protecting the Forestry Commission's roading teams and logging contractors as they proceed this week to disturb this important site. I ask that you give this matter the highest priority and act with great urgency to protect this area whilst the Heritage Council considers the appropriateness of an interim conservation order.

I have available for your information the documents to which this letter refers. Please let me know where you would wish them to be delivered.

Yours faithfully

BRUCE WOOLF

FORESTRY COMMISSION OF NEW SOUTH WALES
Conserving forests for our future

19 July 1991

Media Release

Chaelundi Roading to Resume Soon

Road construction in preparation for logging in Chaelundi State Forest will commence next week.

This was announced today by Dorrigo District Forester John Murray who said that weather conditions now allowed the resumption of work that had been delayed by rain.

Roading to allow access to three compartments within Chaelundi State Forest is the first operation specified in the Environmental Impact Statement which was determined in March. No date has yet been set for the start of logging.

John Murray said that the completion of an EIS was the principal demand of protesters who disrupted logging last year.

"The EIS has been published, public submissions taken and determined according to the law. Logging plans have been significantly modified to avoid unacceptable environmental impacts, particularly on animals. This is what the EIS process is all about," Mr Murray said.

Mr Murray said that it was disappointing that protesters had been completely unmoved by the fact that their principal objection had been met.

"Their pretext for blocking operations was that logging would be illegal without an EIS. The fact that their attitude is unchanged indicates that legality was never the issue."

"The forest operations which are set out in the EIS are part of the strategy for managing north coast forests which was launched by the Premier in June last year. The strategy provides for the largest program of environmental assessment ever undertaken in Australian forest," Mr Murray said.

Mr Murray said that the strategy provided for a sensible balance between the preservation and wise use of mature State forests. The balance was heavily weighted towards preservation with almost 80% being excluded from logging. If the large areas preserved within National Parks were taken into account, then the permanently preserved share increased to 92%.

For further information, contact Dale McLean (066) 528677
David Newman (02) 9804570

The Sydney Morning Herald

New battle over logging in NSW north

By PAUL BAILEY
Environment Writer

Conservationists and the NSW Forestry Commission are at odds again, this time over preparations for logging in the Chaelundi State Forest, near Dorrigo.

A Dorrigo district forester, Mr John Murray, has released a statement saying road construction will start this week to give access to three logging compartments within the State forest.

Mr Murray said the environmental impact statement (EIS) for the area was finalised in March this year and logging plans had been significantly modified to avoid an unacceptable impact on the environment, particularly on animals.

But the North-East Forest Alliance (NEFA) said yesterday the plan to log the old-growth forests threatened "unique, nationally significant populations" of owls, gliders, quolls, forest birds and other animals.

A NEFA co-ordinator, Mr John Corkill, said the Minister for the Environment, Mr Moore, and the director of the NSW National Parks and Wildlife Service, Mr Bill Gilooly, had a serious legal obligation to protect endangered species.

Mr Corkill said legal advice provided to the alliance was that Mr Moore had the power under the National Parks and Wildlife Act to impose an interim protection order over forests where logging threatened native species.

It is understood the parks service is preparing a recommendation that a protection order be imposed over the disputed areas in Chaelundi.

The park service submission to the EIS on the logging proposals for Chaelundi was critical of the Forestry Commission, saying it had failed to provide an adequate assessment of the disturbances that logging would cause to visual, flora, fauna, Aboriginal and wilderness values of the area.

It said the EIS description of the flora and fauna was inadequate and that the forest types in Chaelundi were not conserved in any NSW national park.

The service also requested that no further logging or road building proceed until its assessment of the wilderness values of the area was completed.

The Wilderness Society nominated part of Chaelundi as a wilderness in March 1990 and the service has a two-year period to complete an assessment of its nature conservation values. That assessment, which must be completed by March next year, then goes to State Cabinet which decides whether to declare the area a wilderness.

NEFA members have erected barriers along the access roads into Chaelundi as part of a protest against the proposed logging in areas they say should be declared a wilderness. They have also set up a permanent protest camp nearby.

Mr Murray said the conservationists' pretext for setting up the blockade was that logging would be illegal without an EIS. He said the fact that their attitude had not changed since the EIS was completed indicated that legality was never the issue.

"The forest operations which are set out in the EIS are part of the strategy for managing NSW coast forests launched by the Premier in June last year," he said.

Mr Moore said last night he had received no recommendation from the parks service that a protection order be placed over parts of Chaelundi, but he said a report would be forwarded to him this week on the matter.

TO BRUCE

NEW SOUTH WALES

MINISTER FOR CONSERVATION
AND LAND MANAGEMENT

This is the annexure marked "C" referred to in the Affidavit of John Corkill sworn the 1st day of August 1991

Before me :

FOR IMMEDIATE RELEASE

26 JULY 1991

The Minister for Conservation and Land Management, Garry West, has welcomed a fresh Governme report on proposed logging operations in the Chaelundi State Forest near Coffs Harbour.

Police and Forestry Commission officers moved into the forest last Tuesday to remove illegal blockad set up by protesters.

Mr West said the Department of Planning has recommended against a request by the protesters to prote the forest through an interim conservation order under the Heritage Act.

"The Planning Department's Heritage Branch report is significant for several reasons", Mr West said.

"Firstly, it confirms that the environmental impact statement authorising the logging operations w properly carried out and contained full information on environmental impacts and how they will mitigated.

"Second, it reveals that the Forestry Commission has scaled down its harvesting plans to safegua habitat for tree dwelling animals.

"And third, the Department of Planning says it would be an abuse of process to invoke the Heritage A on the Chaelundi forest," Mr West said.

In view of the report, Mr West has called on protesters to cease their obstruction of lawful road-buildi activities authorised by the EIS process.

Mr West said access to the Chaelundi forest was vital for the future of timber mills in the Dorrigo a Grafton areas.

"The livelihoods of hundreds and hundreds of people are at stake if logging operations are prevented delayed," Mr West said.

"In Chaelundi we have achieved a proper balance between protecting environmental and social values.

"Research has shown that the light logging planned for the area will have no long-term impact on anin habitat, while the community can still have the wood products we all need.

"This is what ecologically sustainable development is all about."

For further information contact Dominic Herschel on (02) 251 8498.

Level 2, 151 Macquarie Street, Sydney Australia 2000
Telephone: (02) 251 8498 Facsimile: (02) 251 1442

This is the annexure marked "D" referred to in the Affidavit of John Corkill sworn the 1st day of August 1991

Before me : [signature]

WOOLF ASSOCIATES
SOLICITORS

10th Fl, 82 ELIZABETH STREET
SYDNEY NSW 2000
TELEPHONE (02) 221 8522
FACSIMILE (02) 223 3530
DX 1556 SYDNEY

BRUCE WOOLF
BA LLB Dip URP

ASSOCIATES:
BRIAN HILLMAN
LLB. Dip B Admin.
Dip S de Fr des Aff
EDWARD L. MURA
B Ec. LLB.

OUR REF **BSW 2536/0**

YOUR REF

DATE **26 July 1991**

Hon R.M. Hope, QC, AC
Chairman
Heritage Council of
New South Wales

URGENT

FACSIMILE: 247 1054

Dear Mr Hope

CHAELUNDI STATE FOREST

I refer to my letter of 23 July 1991 concerning an application under Section 136 on behalf of Mr Corkill for an order by you preventing work in compartments 180, 198 and 200 of Chaelundi State Forest.

My client, Mr Corkill, was informed by a journalist this afternoon that the Minister for Forests, Mr West, had issued a press release stating that the Heritage Branch of the Department of Planning had rejected his application for an interim conservation order over this property. If Mr West is correctly reported, and if his statement is true, may I express my client's astonishment at the manner of dealing with his application.

On my client's behalf, I wrote to you on Tuesday this week requesting your personal consideration of an order under Section 136 of the Heritage Act to preserve, pending further inquiry, areas identified by leading forest ecologists as containing the greatest density of arboreal mammals in Australia and probably the greatest number of endangered species. My client's application provided scientific evidence for the proposition that the activities planned by the Forestry Commission in these compartments would destroy these environmental values. I concluded with an invitation to you to let me know where I might despatch the considerable volume of expert statements supporting these facts. I have heard nothing from you.

In the circumstances, the press release shows the Heritage Council has:

1. **Failed to consider the evidence available;**
2. **Failed to even communicate its consideration of the matter to us;**
3. **Abdicated its power in relation to the natural environment;**
4. **Committed gross errors of fact; and**
5. **Treated my client with discourtesy and contempt.**

.../2

In summary, the failure to consider the evidence referred to in my letter amounts in my respectful submission to a failure to provide my client with the fundamental opportunity to state his case. I request immediate proper consideration of Mr Corkill's application.

Yours faithfully

*John Corkill
NCC*

NEW SOUTH WALES

MINISTER FOR PLANNING
MINISTER FOR ENERGY

MEDIA RELEASE JULY 26, 1991

FORESTRY COMMISSION TO MANAGE CHAELUNDI STATE FOREST

Minister for Planning and Energy, Mr Robert Webster, today said plans for the Chaelundi State Forest have been dealt with according to procedures set down in the Environmental Planning and Assessment Act.

Mr Webster said an environmental impact statement was prepared which contained sufficient information on proposed activity in the area and its impact on the environment.

He said the EIS was exhibited and submissions were received which were taken into account by the Forestry Commission.

The Director of Planning, in assessing the submissions to the EIS, concluded that certain changes should be made to protect the environmental attributes of the area. These changes were made.

"In recent years the practice has been to look beyond the Heritage Act for protection of both the built and natural environment in NSW," Mr Webster said.

"Other state agencies and local government have been assuming greater responsibility for protecting the State's heritage as a consequence of increased community appreciation of the value of heritage.

"The Forestry Commission has expertise as a land manager of State forests.

"It is therefore the appropriate government agency to deal with conservation of a remote natural area such as this," Mr Webster said.

Media Contact: Susan North 391 2015
Patrick Kennedy 368 2666

This is the annexure
marked "E" referred
to in the Affidavit of
John Corkill sworn the
1st day of August 1991

Before me :

New South Wales Government

Heritage Council of New South Wales

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001
Telephone (02) 391-2000
Fax (02) 391-2336
Contact

Our reference:

Your reference:

Mr B Woolf
Woolf Associates
Solicitors
10 Floor
82 Elizabeth Street
SYDNEY NSW 2000

Dear Mr. Woolf,

29 July, 1991

I refer to your letter of 23 July 1991, requesting a S.136 Order under the Heritage Act over certain compartments in Chaelundi State Forest.

The Heritage Council has a long standing policy of not recommending the use of the Heritage Act in instances where Government Agencies are obliged to comply with other legislation which adequately deals with matters that otherwise would require action under the Heritage Act.

In the present case, the Forestry Commission is the responsible authority under the Environmental Planning and Assessment Act. It is responsible to ensure that any proposal complies with the requirements of that Act. In the event that there is an allegation of inadequacy in the manner in which the Agency has discharged those responsibilities, the proper forum for such matters is the Land and Environment Court. The Heritage Council is not an arbitor in these types of matters.

Under S.136 both the Minister for Planning and the Chairman of the Heritage Council have the power to make Orders. They do not compete with each other in the exercise of the power.

The practice has always been that where I have been approached to make an Order I refer it to the Heritage Branch of the Department of Planning. If the Minister is available the matter is referred to the Minister for decision. That is what happened in this case and the Minister made the decision for the reasons which he has announced and which I understand accords with the policy described above.

R.M. HOPE
Chairman

This is the annexure
marked "F" referred
to in the Affidavit of
John Corkill sworn the
1st day of August 1991

Before me :

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

SUBPOENA FOR
PRODUCTION

Applicant's address
for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: The Secretary
Department of Planning
175 Liverpool Street
SYDNEY NSW 2000

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on day of 19 at am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council or Chairman of the Heritage Council or Minister for Planning to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between officers of the Department of Planning or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) the Chairman of the Heritage Council;

   (d) the members of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED:

BY THE COURT REGISTRAR

Last day for service:
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

TO: The Proper Officer
HERITAGE COUNCIL OF NEW SOUTH WALES
175 Liverpool Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

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(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on day of 19 at am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED:

BY THE COURT REGISTRAR

Last day for service:
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

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IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

APPLICANT

ROBERT MARSDEN HOPE
as Chairman of the Heritage
Council of N.S.W.
FIRST RESPONDENT

ROBERT WEBSTER
Minister for Planning &
Energy
SECOND RESPONDENT

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage
Council of N.S.W.
THIRD RESPONDENTS

NOTICE OF MOTION

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for service:

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SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

The Applicant will at on day of 19 at the Land and Environment Court, 388 George Street, Sydney move the Court for the following orders:

1. That the hearing of the proceedings be expedited.
2. That the Applicant have leave to apply to the Registrar forthwith for the fixing of a date for the hearing of the proceedings.
3. Such further or other order as the Court may deem fit.

FILED:

....
BRUCE STEPHEN WOOLF
Solicitor for the Applicant

Spare Copies

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

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Solicitor for the Applicant

IN THE LAND AND ENVIRONMENT

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No. of 1991

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Solicitor for the Applicant

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

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FILED:

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BRUCE STEPHEN WOOLF
Solicitor for the Applicant

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

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G. KIBBLE
as members of the Heritage Council of N.S.W.
THIRD RESPONDENTS

APPLICATION
CLASS 4

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

Full name of Applicant: JOHN CORKILL

Address: 3 Albert Street, FOREST LODGE NSW 2037

Occupation: Environmentalist

The Applicant seeks the following relief:

1. A declaration that the First Respondent acted unlawfully in refusing to consider the exercise of his power under Section 136(1) of the Heritage Act 1977 to make an order to cease work in Compartments 180, 198 and 200 of Chaelundi State Forest ("the said order").

2. A declaration that the purported decision of the Second Respondent on or about 26 July 1991 refusing to make the said order was unlawful.

3. A declaration that the adoption of the following policies by the First, Second and Third Respondents placed a fetter upon the exercise of the powers, functions and duties of the Respondents under the Heritage Act and amounted to an abdication of those powers, functions and duties contrary to law:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

(b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

(c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

where matters would otherwise require action under the Heritage Act..

4. A declaration that it was not reasonably open to the Respondents to decide that the said Compartments of Chaelundi State Forest are not items of State environmental heritage.

5. An order requiring the First Respondent to consider the request by the Applicant on 23 July 1991 to make the said order according to law.

6. An order requiring the Third Respondent to consider the request by the Applicant on 23 July 1991 to recommend to the Second Respondent that he make such Interim Conservation Order under the Heritage Act 1977 in relation to the area of land comprised in the said Compartments of Chaelundi State Forest according to law.

7. Further or other orders.

8. Costs.

Date: Signed: ....

To the First Respondent:

The Hon. ROBERT MARSDEN HOPE, QC
Chairman
Heritage Council of New South Wales
175 Liverpool Street
SYDNEY NSW 2000

To the Second Respondent:

The Hon. ROBERT WEBSTER, MLC
Minister for Planning and Energy
Level 12, Westfield Tower
100 William Street
DARLINGHURST NSW 2010

To the Third Respondents:

Mr NIGEL ASHTON
221 GREENWICH ROAD
GREENWICH NSW 2065

Mr STEPHEN DAVIES
c/-National Trust Centre
Observatory Hill
SYDNEY NSW 2000

Dr KEN CABLE
10/92 St. Pauls Street
RANDWICK NSW 2031

Mr PETER PHILLIPS
Suite 401,
541 George Street
SYDNEY NSW 2000

Ald. SHEILA SWAINE
38 Baron's Crescent
HUNTERS HILL NSW 2110

Mr WILLIAM WOOLDRIDGE
2 Deed Place
NORTHMEAD NSW 2152

Mr JOHN FERRIS
14 Viret Street
HUNTERS HILL NSW 2110

Mr LYNDSAY SHADDOCK
c/- Trinity Properties
18th Floor, St. James Building
111 Elizabeth Street
SYDNEY NSW 2000

Mr LINDSAY KELLY
Government Architect
26th Floor, State Office Block
Phillip Street
SYDNEY NSW 2000

Mr BILL GILLOOLY
Director
National Parks & Wildlife Service
54 Bridge Street
HURSTVILLE NSW 2220

Ms G. KIBBLE
Director
Department of Planning
Remington Centre
SYDNEY NSW 2000

A Callover will take place before the registrar at the time and place specified below OR

The hearing of (or the applicant's claim for interlocutory relief in) these proceedings will take place before the Court at the time and place specified below.

If there is no attendance before the Court or the Registrar, as the case may be, by you or your counsel or solicitor, or agent authorised by you in writing, the hearing or Callover may take place and orders may be made in your absence.

Time: am on the day of 19

Place: The Land and Environment Court of New South Wales
Level 6, American Express Tower
388 George Street (cnr King Street)
SYDNEY NSW 2001

....
Registrar

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: The Proper Officer
HERITAGE COUNCIL OF NEW SOUTH WALES
175 Liverpool Street
SYDNEY NSW 2000

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on day of 19 at am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

SCHEDULE

1. All notes, reports, files, memoranda, correspondence, communications, records, minutes and all copies thereof relating to the consideration by the Heritage Council of any request or proposal to protect the natural environment or items of State environmental heritage of natural significance by exercising its powers, functions or duties under the Heritage Act 1977 between 1 January 1988 to date.

2. All minutes, reports, notes, memoranda, correspondence, communications, records and documents and all copies thereof which record the following policies of the Heritage Council of New South Wales:

   (a) the policy that the Heritage Act 1977 is never to be used to protect the natural environment or items of natural environmental heritage;

   (b) the policy that the First Respondent is never to consider exercising his power under Section 136(1) of the Heritage Act if the Second Respondent is available to do so;

   (c) the policy that the Heritage Act 1977 is never to be used in relation to developments if the Crown and its public authorities are required to comply with Part 5 of the Environmental Planning and Assessment Act, 1979;

   from 1 March 1988 to date.

3. All minutes, reports, notes, memoranda, correspondence, communications, records, and documents and all copies thereof relating to the delegation under the Heritage Act 1977 of any powers, duties or functions by the Heritage Council to any person or body current between 1 July 1991 to date.

4. All diaries, reports, minutes, notes, correspondence, memoranda, files, documents, telephone log books, telephone message pads and notes relating to the consideration by any person of Mr John Corkill's application of 23 July 1991 for the making of order under Section 136 of the Heritage Act and application for the Heritage Council to consider recommending to the Minister the making of an interim conservation order from 23 July 1991 to date.

5. All minutes, reports, notes, memoranda, correspondence, communications, records and documents relating to communications between you or on your behalf and:

   (a) the Minister for Planning or those acting on his behalf;

   (b) the Minister for Conservation and Land Management or those acting on his behalf;

   (c) officers of the Department of Planning;

   (d) the Chairman of the Heritage Council;

   (e) officers of the Forestry Commission of New South Wales;

   from 23 July 1991 to date relating to the said application.

DATED:

BY THE COURT REGISTRAR

Last day for service:
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

Exhibits Clerk
Land & Environment Court of
New South Wales
GPO Box 3365
SYDNEY NSW 2001

in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE
as Chairman of the Heritage Council of N.S.W.
First Respondent

ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
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LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

TO: **BILL GILLOOLY**
NATIONAL PARKS AND WILDLIFE SERVICE
OF NEW SOUTH WALES
43 Bridge Street
HURSTVILLE NSW 2220

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on day of 19 at am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

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SCHEDULE

1. All files, statements, reports, draft and final assessments, records and documents, minutes, memoranda and correspondence relating to the Guy Fawkes River Wilderness Area, Chaelundi State Forest and any recommendation for the making of an Interim Protection Order in relation to a part of the said Forest.

DATED:

BY THE COURT REGISTRAR

Last day for service:
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

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IN THE LAND AND ENVIRONMENT

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ROBERT WEBSTER
Minister for Planning & Energy
Second Respondent

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LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE
as members of the Heritage Council of N.S.W.
Third Respondents

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IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

TO: DOMINIC HERSCHEL
c/ Level 2
151 Macquarie Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE

First Respondent

ROBERT WEBSTER

Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
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Third Respondents

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TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

THE COURT ORDERS THAT you shall attend and produce this Subpoena and the documents and things described in the schedule:-

(a) before the Court

(b) at Level 6,
American Express Tower,
388 George Street
(cnr King Street)
SYDNEY NSW 2001

(c) on day of 19 at am or, if notice of a later date is given to you, the later date at am and until you are excused from further attending; but -

(i) you need not attend or produce any document or thing on any day unless reasonable expenses have been paid or tendered to you;

(ii) instead of so attending, you may produce this Subpoena and the documents and things described in the Schedule to a clerk of the Court at the above place by hand or by post, in either case so that the clerk receives them no later than two days before the first date on which you are required so to attend, specified for attendances.

(iii) you need not comply with this Subpoena if it requires your attendance at a place in Sydney and is served on you after the last day for service shown below.

SCHEDULE

1. All diaries, reports, minutes, notes, files, memoranda, draft press releases, correspondence, telephone log books, telephone message pads, communication records and documents, final press releases relating to the application by John Corkill for an order under Section 136 of the Heritage Act 1977 and for the Heritage Council to consider recommending to the Minister the making of an interim conservation order in relation to Compartments 180, 198 and 200 of Chaelundi State Forest from 23 July 1991 to date.

DATED:

BY THE COURT REGISTRAR

Last day for service:
Issued at the rqeuest of BRUCE STEPHEN WOOLF
Applicant's Solicitor.

NOTE THAT:-

1. if you do not comply with this Subpoena you may be arrested;

2. if, by paragraph (c)(ii), you are permitted to produce this Subpoena and other documents and things to a clerk of the Court at 388 George Street, Sydney you may produce them to the Clerk by hand at the office counter, level 6, at the place or by posting them to:

   Exhibits Clerk
   Land & Environment Court of
   New South Wales
   GPO Box 3365
   SYDNEY NSW 2001

   in accordance with paragraph (c)(ii);

3. in paragraph (c)(ii), "days" means days other than Saturdays, Sundays, and other holidays;

4. documents and things produced by you in accordance with this Subpoena may be returned by post to you at your address shown in the Subpoena but you may in writing on or attached to the Subpoena request that they be posted to you at another address given to you;

5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. of 1991

TO: DOMINIC HERSCHEL
c/ Level 2
151 Macquarie Street
SYDNEY NSW 2000

JOHN CORKILL

Applicant

ROBERT MARSDEN HOPE

First Respondent

ROBERT WEBSTER

Second Respondent

NIGEL ASHTON
STEPHEN DAVIES
KEN CABLE
PETER PHILLIPS
SHEILA SWAINE
WILLIAM WOOLDRIDGE
JOHN FERRIS
LYNDSAY SHADDOCK
LINDSAY KELLY
BILL GILLOOLY
G. KIBBLE

Third Respondents

SUBPOENA FOR PRODUCTION

Applicant's address for service:

WOOLF ASSOCIATES
SOLICITORS
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1556 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2536/0

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(a) before the Court

(b) at Level 6,
American Express Tower,
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SYDNEY NSW 2001

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5. any questions relating to the requirements of this Subpoena should be directed not to the Court but to the person who requested the issue of this Subpoena.

Part V Environmental Assessment

This brochure contains general information concerning the principles and operation of Part V of the Environmental Planning and Assessment Act. It has been designed principally for the benefit of State public authorities, local government and others involved in the administration of Part V. Any person who is interested in the workings of this part of the Act may also find this a useful information document.

PART V ENVIRONMENTAL ASSESSMENT

Development control is the process by which many forms of development are regulated by local government or the Department of Environment and Planning under the provisions of State, regional or local plans (environmental planning instruments). Consideration of the environmental effects of development proposals is required as part of the development control process. This is done under Part IV of the Environmental Planning and Assessment Act, 1979.

Some forms of development, however, are not subject to the development control process. Many of these are developments which require approval by some other public authority. Part V of the Environmental Planning and Assessment Act ensures that when a public authority makes a decision about development matters not subject to development control, it must still consider the potential environmental effects arising from its decision.

WHEN DOES PART V APPLY?

Part V applies to development where <u>all</u> the following factors, (a) to (d), are satisfied:

<u>(a) the proposed development is an 'activity'</u>

An 'activity' means
- the erection of a building;
- the carrying out of a work (in, on, over or under land);
- the use of land or the use of a building or work;
- the subdivision of land.

<u>(b) the development does not require development consent</u>

This means that an environmental planning instrument (e.g. a local environmental plan) does not require the proposed development to receive development consent under Part IV of the Act in order to be carried out. This situation may arise where:

* no environmental planning instrument applies to an area (e.g. in the far west of the State);

* an environmental planning instrument provides that certain types of development may be carried out 'without consent', (e.g. agricultural or forestry development in rural zones);

* special provisions of an environmental planning instrument exclude certain types of development from the need to obtain development consent, (e.g. the maintenance or repair of roads, the installation of water or sewerage mains or the provision of electricity service lines); or

- other legislation exempts certain development from the need to obtain development consent (e.g. prospecting, which is exempted from obtaining development consent by the Mining Act).

(c) the development is not prohibited by an environmental planning instrument

This means that an environmental planning instrument has not provided that the proposed development is 'prohibited from being carried out'. Where an environmental planning instrument absolutely prohibits development from being undertaken, Part V provisions cannot apply.

(d) the development requires an approval by a determining authority

This means that the development, in order to be carried out, requires an approval (i.e. consent, licence, permit or any form of authorisation) to be given by a determining authority (i.e. a Minister, a government department, a statutory authority, a local government council or a county council). Approvals given by a determining authority would be given under the legislation administered by the determining authority, e.g. a building approval given under the Local Government Act. An approval by a determining authority may include a decision by a determining authority to carry out its own development.

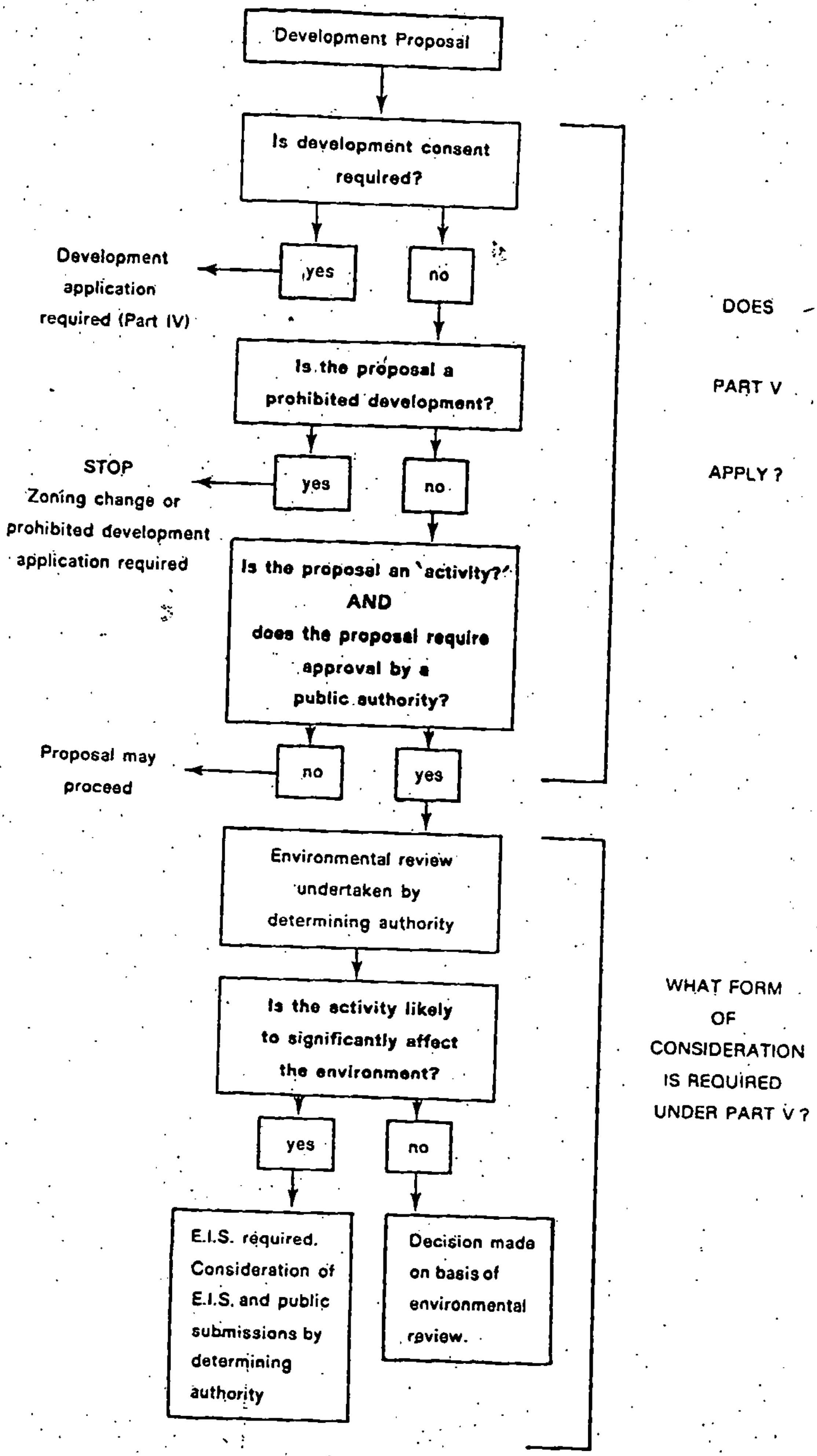
The provisions of Part V, therefore, apply where an 'activity' requires an 'approval' by a 'determining authority' in order for it to be carried out and the 'activity' does not require development consent and is not prohibited by the provisions of an environmental planning instrument. This is summarised in Figure 1.

TO WHOM DOES PART V APPLY?

Part V applies to determining authorities. The central principle of Part V is that it requires consideration of environmental effects in public decision making. This duty requires that whenever a public authority makes a decision relating to an activity, that public authority must consider the environmental implications of making that decision.

Part V operates as a safety net to the development control process, ensuring that environmental consideration is not avoided or neglected because development consent is not required. The combination of the environmental assessment provisions of Part V and the development control provisions of Part IV of the Environmental Planning and Assessment Act effectively means that any development which requires some form of approval will be subject to environmental consideration.

CRITICAL QUESTIONS IN APPLYING PART V



WHO PROPOSES AN 'ACTIVITY'?

An activity is brought to the attention of a determining authority when its approval is sought for the activity to be carried out or when the determining authority must make a decision on an activity proposed by itself. An activity may be proposed by any person, company or public authority. The person or body that proposes an activity is the proponent.

The procedures of Part V are in addition to a determining authority's own approval process. Part V requires a determining authority to give consideration to the environmental effects of an activity in its decision making, regardless of who proposes the activity. That consideration may be directed towards a proposal by another person or authority, or it may be directed towards a determining authority's own proposal (i.e. self-assessment).

HOW IS ENVIRONMENTAL CONSIDERATION UNDERTAKEN BY A DETERMINING AUTHORITY?

Part V places a duty upon a determining authority 'to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity' (see section 111 of the Act). This requirement obliges the determining authority to **identify** those matters and then to **examine** the nature of any effects, with a view to protecting or enhancing the environment through its decision.

In this process of identifying and examining the potential environmental effects, a determining authority is also required to consider the **scale** or **significance** of the potential environmental effects. Clause 56 of the Environmental Planning and Assessment Regulation contains a range of environmental factors which must be considered in a determining authority's assessment of the likely impact of an activity on the environment. These factors include:

(a) any environmental impact on a community;

(b) a transformation of a locality;

(c) any environmental impact on the ecosystems of the locality;

(d) a reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality;

(e) any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations;

(f) any endangering of any species of fauna or flora;

(g) any long-term effects on the environment;

(h) any degradation of the quality of the environment;

(i) any risk to the safety of the environment;

(j) any curtailing of the range of beneficial uses of the environment;

(k) any pollution of the environment;

(l) any environmental problems associated with the disposal of waste;

(m) any increased demands on resources, natural or otherwise, which are, or are likely to become, in short supply; and

(n) any cumulative environmental effect with other existing or likely future activities.

Through considering the range of environmental factors in clause 56 (or any other factors) which may be relevant to the activity and then relating that consideration to its decision, the determining authority may discharge its responsibilities under Part V. As a result, the activity may be modified, improved or not undertaken at all. Should the determining authority, conclude that the activity is likely to **significantly** affect the environment, its responsibilities for environmental consideration must be extended before any approval. This involves the preparation and assessment of an Environmental Impact Statement (E.I.S.). However, a large number of proposed activities which receive environmental consideration under Part V will not require an E.I.S.

WHEN IS AN ENVIRONMENTAL IMPACT STATEMENT REQUIRED UNDER PART V?

An E.I.S. is required under Part V where a determining authority considers that a proposed activity (is likely to significantly affect the environment); it is then the responsibility of the proponent (or the determining authority, if it is the proponent) to prepare an E.I.S.

The E.I.S. is prepared to describe a proposal and to identify and assess the effects of the proposal on the environment. This enables public understanding and comment, and is used by a determining authority as the basis for considering and assessing a proposal.

An E.I.S. under Part V must include the following matters:

(a) a full description of the proposal;

(b) a statement of the objectives of the proposal;

(c) a full description of the existing environment likely to be affected by the proposal;

(d) identification and analysis of the likely environmental interactions between the proposal and the environment;

(e) analysis of the likely environmental impacts or consequences of carrying out the proposal (including implications for use and conservation of energy);

(f) justification of the proposal in terms of environmental, economic and social considerations;

(g) measures to be taken in conjunction with the proposal to protect the environment and an assessment of the likely effectiveness of those measures;

(h) details of energy requirements of the proposed development and measures to be taken to conserve energy;

(i) any feasible alternatives to the carrying out of the proposal and the reasons for choosing the latter;

(j) consequences of not carrying out the proposal.

See clause 57(2), Environmental Planning and Assessment Regulation.

In addition, when preparing and E.I.S. the proponent must consult with the Department of Environment and Planning on any specific requirements.

A determining authority is required to place an E.I.S. on public exhibition and advertise the exhibition. The minimum period for exhibition is 30 days. Environmental Impact Statements are exhibited at a number of specified locations as well as at the Head Office of the Department of Environment and Planning. Any interested person may examine an E.I.S. and make a written submission to the determining authority.

A determining authority must assess the E.I.S. and consider all submissions made during the exhibition period before it is permitted to approve or carry out an activity.

Details of procedures are contained in the Department's Manual for Environmental Impact Assessment which may be purchased from the Department's Information Branch.

PUBLIC INFORMATION AND RIGHTS

* Advertisement and exhibition of Environmental Impact Statements.

  When an E.I.S. is required, it is placed on public exhibition by the determining authority for a minimum period of 30 days. At the commencement of the period of exhibition the determining authority must place notices in both a State-wide circulating newspaper and a local newspaper (in the vicinity of the proposal) stating that an E.I.S. has been prepared, where and when it may be examined and inviting public comment. These newspaper notices must also be placed at least once again during the period of exhibition.

  The E.I.S. is exhibited at:

  - the Head Office of the Department of Environment and Planning
  - the N.S.W. Environment Centre (57 Wentworth Ave, Surry Hills)
  - the N.S.W. Government Information Centre (55 Hunter St, Sydney)
  - the office of the determining authority
  - the office of the council in whose area the activity is proposed
  - the principal office of the proponent.

* Purchase

  A determining authority may require a proponent to provide copies of an E.I.S. for sale to the public. Anyone may purchase a copy from the determining authority. The maximum cost of an E.I.S. is $25.

* Making submissions

  Anyone is entitled to make submissions to the determining authority with respect to the proposal during the period of public exhibition. Submissions must be in writing. The address to which submissions should be sent is included in the newspaper notices and is also available at exhibition locations.

  A determining authority is required to examine and consider all submissions made during the exhibition period.

* Public inquiry

The Minister for Planning and Environment may direct a public inquiry to be held in respect of an activity which is the subject of an E.I.S. Where an inquiry has been directed by the Minister, any person may make a submission to the inquiry. Newspaper advertisements indicate when an inquiry is to be held. The findings and recommendations of any public inquiry under Part V are made public and must be considered by the determining authority before it may make a decision.

* Public reports

Under Part V, the determining authority is required to prepare a report of its examination of the E.I.S. and all submissions including those from the public. This report is required to be made public by the determining authority.

If a public inquiry is not to be held, the Department of Environment and Planning may on occasions prepare a report of its consideration of a Part V E.I.S. together with submissions. When the Department decides to prepare such a report, the determining authority cannot approve the activity until the Department's report is prepared, and has been considered by the determining authority. The Department's report is made public.

* Appeal rights

The provisions of Part V do not provide rights of appeal to the court concerning decisions by determining authorities. Any rights of appeal associated with activities are only those rights provided for in the statutory processes within which an approval may be given, i.e. in other legislation.

However, the Environmental Planning and Assessment Act does provide that any person may bring proceedings in the Land and Environment Court where it is alleged that a breach of the Act has occurred, i.e. alleged failure to comply with the provisions of the Act. Such proceedings have been taken regarding: inadequate environmental consideration by a determining authority; inadequacy of an E.I.S. and failure to prepare an E.I.S. when it was appropriate to do so. A person can apply to the Court for an order to remedy or restrain a breach of the Act.

WHERE CAN I LEARN MORE?

Listed below are the Department's offices. You can contact the Department if you have any inquiries about the operation of Part V of the Environmental Planning and Assessment Act. The offices also have a wide range of publications about planning and environmental matters.

The Department's Manual for Environmental Impact Assessment contains relevant information concerning Part V of the Act and Environmental Impact Statements. The manual is available for purchase from the Department.

Head Office (including the Sydney Central, Sydney North and Western State planning teams and the
Environmental Protection Division)
175 Liverpool Street,
Phone (02) 266 7111
Postal address: Box 3927 G.P.O. Sydney 2001

Western Sydney Region
31-39 Macquarie Street
Parramatta 2150
Phone (02) 689 8111

Macarthur Region
288 Queen Street
Campbelltown 2560
Phone (046) 26 4400

Central Coast Region
49 Mann Street
Gosford 2250
Phone (043) 24 7766

Northern Region
49 Victoria Street
Grafton 2460
Phone (066) 42 0622

Hunter Region
20 Auckland Street
Newcastle 2300
Phone (049) 26 2566

South East Region
251 Crawford Street
Queanbeyan 2620
Phone (062) 97 6911

Botany Region
52 Bay Street
Rockdale 2216
Phone (02) 597 1233

Illawarra Region
200 Crown Street
Wollongong 2500
Phone (042) 28 4644