30.35

The 'non-wood' value of North Washpool.

Introduction.

The general Washpool area[1] represents the largest wet forest wilderness remaining in NSW[2] and contains the largest Coachwood forest in the world. It encompasses a range of forest types from open forests through extensive wet forests to rainforests.

In assessing the value of such natural areas, economists apply techniques of cost-benefit analysis to consider the social and economic viability of proposals to preserve natural ecosystems. How to measure such benefits objectively is a debatable point, as many of the benefits cannot be traded on the market place, and hence have no easily determined market price. Benefits such as recreation, health, aesthetics and education for those who actually visit the area can be measured to some extent, but there are also indirect psychological benefits to those do not use the area but know of it's existence[3].

Harry Recher, a scientist with a formidable reputation, that includes having performed studies for the Forestry Commission NSW recently struggled with quantifying this psychological value, **from simply knowing that something exists**, in a recent study[4].

The paucity of information on the non-wood resources of this area is a crime, and is a direct consequence of the

The cry that conservationists are trying to 'lock-up' profitable land in nature reserves is far from just[5]. Australia's National Park System

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[1] Comprising South Washpool, North Washpool and Willowie Scrub.

[2] Pugh, D. North Washpool : EIS Defficiencies and Logging Impact. Unpublished paper, September 1989.

[3] Lunney, D and Recher, H. The Living Lndscape : An Ecological View of National Parks and Nature Conservation, p 296, in Recher et al. (2nd Ed.). 1986. A Natural Legacy. Pergamon Press, Australia.

[4] Ibid. Study performed at Nadgee Nature Reserve.

[5] Ibid. Approximately 4% of the State in Nature Reserves, 1982.

does not fully sample the continent's ecosystems, and the small size of many parks is a reflection of historical attitudes of not appreciating the importance of natural areas.

Habitat Value.

Fauna

The Washpool area is the largest refuge in the region for animal species adversely affected by human induced disturbances, introduced plants and introduced animals (e.g. feral cats).

Mammals

There are fourteen species of mammal that are dependant on tree hollows for shelter and breeding.

Arboreal Mammals

The comparably high density of gliders in this area may be attributable to the availability of tree hollows.

Species of Special Conservation Significance[6]

Yellow-bellied Glider, Dome-Headed Bat[7]

Ground Dwelling Mammals

An outstanding feature of the Washpool area is the low number of feral animals, and the absence of these predators has led to an apparent abundance of such ground dwellers as the Tiger Quoll.

Species of Special Conservation Significance

Parma Wallaby, Long-nosed Potoroo, Rufous Rat Kangaroo, Tiger Quoll.

Avifauna

Of particular significance is the occurrence of the NSW subspecies of the Rufous Scrub Bird, as NPWS estimates that are a very few number

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[6] Carr et al., Dec 1988. Submission to the Director of the NPWS, by the Wilderness Society, under Section 7(1) of the Wilderness Act (1987), for the Identification and Protection of the North Washpool Wilderness Area (Desert and Malara Creeks). All subsequent species references are taken from this submission unless otherwise indicated.

[7] Sandy Gilmore (pers. comm., Nov 1990)

of breeding pairs in existence (100 -200 pairs)[8].Seventeen species of birds in this area are obligatory tree hollow users, in that they are completely dependant on tree hollows for shelter and/or breeding.

Species of Special Conservation Significance
Pacific Baza, Grey Falcon, Peregrine Falcon, Wompoo Pigeon, Channel-billed Cuckoo, Powerful Owl, Sooty Owl, Noisy Pitta, Rufous Scrub Bird, Paradise Riflebird, Olive Whistler.

Effects of Logging
For the EIS[9] the Commission undertook no faunal surveys. Avifauna is described on the basis of expected occurrence, generally from standard reference texts, and includes a large number of species which would **not** occur, as appropriate habitat is not within this area. As the Commission refers to trees suitable for hollow-dependant fauna as 'over-mature', it is not surprising to find they have a policy of removing such trees.

Reptiles, Amphibians, Invertebrates, Aquatic Fauna.
Although Washpool in its entirety is inadequately surveyed for all animal groups, it is this group that is the least surveyed in the EIS. Reptiles and Amphibians are not detailed apart from a list of expected occurrences, invertebrates barely warrant a mention, and aquatic fauna are not considered at all.

Species of special Conservation Significance
Pouched Frog, Fletcher's Frog, Loveridges Frog[10], Stephen's Banded Snake.

Flora

Of the XX species recorded as occurring in the Washpool area, approximately seventy are of special interest, being rare or poorly collected, or having a restricted distribution. For many of these, the species record at Washpool has extended the known range, and two species were previously undescribed[11].

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[8] National Parks and Wildlife Service 1981. Proposed Forest Operations in the Washpool Area.

[9] Forestry Commission of NSW, 1980. Proposed Forest Operations in the Washpool Area. Environmental Impact Statement.

[10] Sandy Gilmore (pers. comm., Nov 1990)

[11] Fox, M. 1983. A Vegetation Survey of the Washpool Area, Northern New South Wales. Department of Environment and Planning. Undescribed Species XXXX

The National Parks and Wildlife Service[12] describes the stands of Sydney Blue Gum / Tallowwood /Brush Box associations as some of the finest examples left unlogged in NSW, reaching a height of 70 metres or more.

Effects of Logging

What are the long term effects of logging such an area? Logged rainforest areas, even after 10 or 20 years[13], will be distinguished by :

1) large numbers of pioneer species
2) fewer tree species
3) fewer specialised life forms
4) more shrubs and juveniles
5) higher incidence of dieback
6) higher soil pH
7) higher soil calcium
8) lower soil aluminium
9) higher soil electrical conductivity

Additionally, regeneration and reports of regeneration progress are rarely, if ever carried out by the Forestry Commission[14].

Teaching and Scientific Value.

The World Heritage Committee has placed six areas in Australia on it's World Heritage List :

1) south-west Tasmania (including the Franklin River)
2) Great Barrier Reef (Queensland)
3) Willandra Lakes (New South Wales)
4) Lord Howe Island (New South Wales)
5) Kakadu National Park (Northern Territory)
6) South Washpool

As fewer and fewer natural areas are left, we will become increasingly reliant on places such as these for teaching and research into natural systems.

Wilderness Value.

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[12] NPWS 1981

[13] Fox, M. 1983.

[14] Pugh, D. 1989 (p.8)

IN THE LAND AND ENVIRONMENT

COURT OF NEW SOUTH WALES

No. 40208 of 1990

JOHN CORKILL

Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES

Respondent

30.36

SHORT MINUTES

Applicant's address for service:

HILLMAN & WOOLF
Solicitors
10th Floor
82 Elizabeth Street
SYDNEY NSW 2000
DX: 1558 SYDNEY
TEL: 221 8522
FAX: 223 3530
REF: BSW 2489/0

Without admission of liability and upon the parties giving the following undertakings to the Court:

1. the Respondent by its servants, agents, licensees and contractors shall not carry out or consent to or approve the carrying out of roading works or logging or burning activities (excluding such rehabilitation and erosion control, stabilisation and drainage activities as are sanctioned by the Scientific Committee established pursuant to the North Washpool Agreement annexed hereto and burning for the purposes of bush fire control or bush fire hazard reduction in accordance with the Casino District Fire Suppression Plan) in respect of the land comprised within Compartments 687-693 and 697-699 inclusive of the Washpool State Forest No. 815 and Compartments 695, 696 and 700-713 inclusive of the Billilimbra State Forest No. 815, without compliance with the provisions of Sections 111 to 113 of the Environmental Planning and Assessment Act, 1979 including the obtaining, examination and consideration of an environmental impact statement within the meaning of Part V, Environmental Planning and Assessment Act,

1979 in respect of the whole or any part or parts of the said lan

2. the parties undertake to perform the North Washpool Agreement;

the Court grants leave to file in Court a notice of discontinuance and by consent orders:

1. That the Respondent pay the Applicant's costs as agreed or otherw as taxed.

1979 in respect of the whole or any part or parts of the said lan

2. the parties undertake to perform the North Washpool Agreement;

the Court grants leave to file in Court a notice of discontinuance and by consent orders:

1. That the Respondent pay the Applicant's costs as agreed or otherw as taxed.

NORTH WASHPOOL AGREEMENT

THIS AGREEMENT is made on 5th April, 1991 between

JOHN ROBERT CORKILL, C/-Big Scrub Environment Centre Inc., 88A Keen S[illegible], LISMORE NSW 2480 ("the Applicant")

and

FORESTRY COMMISSION OF NEW SOUTH WALES, 95 York Street, SYDNEY NSW 2[illegible] "the Commission")

A. The parties have been in dispute concerning the legalit[illegible] timbe[illegible] harvesting, roading and associated activities and approva[illegible] rom September, 1980 to date in North Washpool (comprising Compa[illegible] s 687 693 and 697-699 inclusive of the Washpool State Forest N[illegible]5 an Compartments 695, 696 and 700-713 inclusive of the Billi[illegible] Stat Forest No. 815) ("the said activities") and the liability fo[illegible] exten of any necessary reinstatement of affected land.

B. The parties recognise that some rehabilitation and ero[illegible] ontro measures may be appropriate at North Washpool whatever the [illegible]ty o the said activities.

C. The parties believe that the costs of litigating these i[illegible] can b better devoted to performing appropriate rehabilitation [illegible] rosio control measures at North Washpool.

D. The parties consider that the public interest is bes[illegible] ved b accepting the recommendation of Committees of scientific [illegible] erts.

E. The parties will abide by the recommendation of the Committe[illegible]

IN CONSIDERATION of the Applicant discontinuing proceedings No. 4[illegible] f 199 between the parties hereto in the Land and Environment Court of New [illegible] Wale and the Commission agreeing to pay the Applicant's costs of those pr[illegible] ngs

THE PARTIES AGREE AS FOLLOWS:

SCIENTIFIC COMMITTEES

1. The parties shall establish two Scientific Committees, a Reh tation and a Soils Committee.

2. Each party shall nominate a scientist with experience otany, vegetation disturbance ecology or rehabilitation to c e the Rehabilitation Committee.

3. The Rehabilitation Committee shall investigate the extent of rbance to natural vegetation systems by the said activities in No shpool and recommend what steps, if any, should be taken to rehab e the disturbed areas.

4. Each party shall nominate a scientist with qualifications or rienc in soil conservation to comprise the Soils Committee.

5. The Soils Committee shall investigate the roads, snig tracks dump and creek crossings in North Washpool which were constructed ed fo the said activities. It shall recommend what measures, if an uld b taken to prevent potential erosion and remedy actual on, t stabilise soils and to maintain permanent roads.

JOINT COMMITTEE

6. Where the Committees investigate the same area of land, they for a Joint Committee for the purposes of making recommendations.

DISAGREEMENTS

7. If the members of any Committee or Joint Committee dis on an expert scientific question, then the parties shall choose entis independent of the parties to chair the Committee at any ut no later than 28 days after the disagreement or such later t s th parties may agree. The matter in dispute and any relevant ma shal be submitted to the chairperson whose decision shal th

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recommendation of the Committee. If the parties cannot a[illegible]pon a chairperson, then they shall invite the Chief Judge of the Land and Environment Court or his or her nominee to appoint a chairperson. The parties shall be notified in writing by the Committee of any such disagreement.

POWERS OF COMMITTEES

8. The members of the Committees shall have full and free access to North Washpool and to any specialist papers or research concerning the climate, vegetation, soils or growth data of that area or similar montane wet temperate and sub-tropical rainforest and wet sclerophyll areas in the possession of the parties and the parties agree to provide such papers and research without specific request to the relevant Committee.

9. The Committees shall undertake investigations within 3 months of the date of this Agreement or such later time as the parties shall agree for the purposes set out in clause 3 and 5 above.

REPORTS

10. The Committees shall report in writing to the parties within 3 months of the completion of their investigations. The reports may contain recommendations for rehabilitation or soil conservation measures as the case may be.

11. Once the Rehabilitation Committee is satisfied that all rehabilitation measures which have been recommended are likely to succeed, it shall prepare a final report to the parties and thereupon dissolve.

12. Once the Soils Committee is satisfied that all soil conservation or erosion control measures which have been recommended are completed and are effective the Committee shall prepare a final report to the parties and thereupon dissolve.

PERFORMANCE OF RECOMMENDATIONS

13. The parties agree to accept and perform the recommendations of the Committees.

14. The Commission agrees to meet the reasonable costs of the Committees and the performance of any measures recommended.

15. The members of the Committees shall be entitled to reasonable remuneration and repayment for actual expenses incurred in performing their duties.

CASUAL VACANCIES

16. If a Committee member resigns, the party appointing that member shall appoint another scientist with relevant qualifications or experienc within 28 days or such further time as the parties shall agree. If a independent scientist chosen in accordance with Clause 7 resigns, th provisions of Clause 7 shall apply to the appointment of anothe independent scientist.

AMENDMENTS

17. The parties may amend this agreement in writing signed by or on behal of the parties and the amended agreement (with the amendment underlined) shall be filed in the Registry of the Land and Environmen Court of New South Wales.

NOMINEES

18. Each of the parties may from time to time nominate a person corporation to exercise their powers under this agreement and t nominating party may revoke the nomination. Such nomination revocation shall be notified in writing to the other party and to t Committees.

19. The nominations pursuant to Clauses 2 and 4 and the appointments pursuant to Clause 7 (in case of disagreement on any expert scientific question) are set out in the Schedule hereto.

IN WITNESS WHEREOF the parties have signed below on the day and year first mentioned above.

The Seal of Office of the)
)
FORESTRY COMMISSION OF)
)
NEW SOUTH WALES was)
)
hereunto affixed in the)
)
presence of:)

.....

.....

Signed by JOHN CORKILL in)
)
the presence of:)

.....

J.R. Corkill

SCHEDULE

The FORESTRY COMMISSION OF NSW hereby nominates ROSS HORNE to the Rehabilitatio Committee and DR PETER CORNISH to the Soils Committee.

JOHN CORKILL hereby nominates PROFESSOR LEN WEBB A.O. to the Rehabilitatio Committee and DR JOHN MCGARITY to the Soils Committee.

The parties agree to appoint the following persons in the event of disagreemen pursuant to clause 7 as Chairpersons of the respective Committees.

ALEXANDER FLOYD : REHABILITATION COMMITTEE

DR ALEC COSTIN : SOILS COMMITTEE

30.37

PILOT BAT SURVEY OF NORTH WASHPOOL

H. Parnaby,
Mammal Department, Australian Museum, Sydney

Summary

Nine insectivorous bat species were recorded during a trapping and netting survey over 3 nights, bringing the total recorded from North Washpool area to 10 species. Trapping results are considered to be rich in terms of numbers of individuals and species. Significant occurences include the presence of the Golden-tipped Bat and a comparatively large number of Pipistrelles. A further 7 insectivorous and 2 fruit bat species are likely to occur in the area.

Background

A preliminary assessment of the bat fauna of North Washpool using bat traps and mist nets was undertaken during the three nights of 13-15 December, 1990. Extreme time constraints limited the scope of this work, however the bat fauna of this area was so poorly known that this represents a useful addition to knowledge of the mammal fauna of the area. This work supplements the vertebrate survey reported by Gilmore (1990) for the same area.

Trap Sites

Location and altitude of the eight sites are shown in Table 1. Forest types at each site are summarised below, taken from Forestry Commission forest type maps, Washpool 1:25 000 (December 1986) and Malara Creek 1:25 000 (June 1990):

Site 1 - Wet sclerophyll/rainforest ecotone: New England Blackbutt, Tallowwood/Sydney Blue Gum and Myrtle/Viney Scrub.
Site 2 - Rainforest: Yellow Carabeen/Crabapple and Coachwood Crabapple.
Site 3 - Wet sclerophyll/rainforest ecotone: Coachwood Crabapple; Myrtle/Viney Scrub; and Tallowwood/Sydney Blue Gum >40m.
Site 4 - Wet sclerophyll/rainforest ecotone: Tallowwood/Sydney Blue Gum; Myrtle/Viney Scrub.
Site 5 - Rainforest - Myrtle/Viney Scrub.
Site 6 - Dry sclerophyll/ rainforest ecotone: New England Blackbutt <25m; Yellow Carabeen/Crabapple.
Site 7 - Wet sclerophyll: Tallowwood/Sydney Blue Gum >40m.
Site 8 - Dry sclerophyll: Grey Gum/Grey Ironbark/White Mahogany.

Bat traps were used at sites 1-7, set for between 1 and 3 consecutive nights. Mist nets were set at site 8 for about 2 hrs following dusk on 15/12/90. Seven nets were set: 3 across

the dam, 1 along the dam wall, 2 in surrounding vegetation and 1 parallel with the edge of Desert Spur Fire Trail; a total of 380 ft of net.

Species Accounts

Species are discussed below in descending order of total number of individuals captured. Species and number of individuals captured at each site are summarised in Table 2. Registration numbers of voucher specimens lodged in the Australian Museum are given in brackets. Only the Bentwing Bat and the Eastern Horseshoe Bat are cave roosting species, the rest utilise tree hollows.

1. Bentwing Bat Miniopterus schreibersii The majority were captured in a trap placed over a creek at site 3.

2. Pipistrelle Falsistrellus tasmaniensis Captured at four of the 6 productive sites. (M23969, M23970).

3. Chocolate Wattled Bat Chalinolobus morio Captured at four of the six productive sites. (M23961, M23971).

4. Large Forest Eptesicus Eptesicus darlingtoni Captured at three of the six productive sites. (M23963, M23965)

5. Goulds Long-eared Bat Nyctophilus gouldi. Trapped in low numbers as in the survey of Parnaby (1986). Captured in both dry sclerophyll, wet sclerophyll forest, and rainforest sites. (M23966, M23968).

6. Eptesicus pumilus This species is frequently trapped in northeastern NSW but is apparently less commonly encountered at higher altitudes (Parnaby 1986). This species has not been reported from caves in northeastern NSW in the course of extensive research on cave species by P. Dwyer and is thus presumed to utilse tree hollows. (M23964, M23973).

7. Eastern Horseshoe Bat Rhinolophus megaphyllus This species is normally trapped in low numbers. (M23967).

8. Goulds Wattled Bat Chalinolobus gouldii The two individuals captured were from site 3. Recorded by Tidemann but not captured during the extensive survey of Parnaby (1986). (M23962).

9. Broadnosed Bat Scotorepens orion Captured only in the lower elevation dry sclerophyll forest at site 8. (M23972).

Discussion

This survey suggests that the area contains a rich bat fauna as the trapping results are comparatively high in terms of number of individuals and species captured per site

compared with the results of an extensive trapping survey of northeastern New South Wales (Parnaby 1986) using similar (in some cases identical) traps. Thus mean number of bats captured per trap night during this survey (excluding results from mist nets) was 9.0 compared to a range of 0.44 to 7.12 for 14 areas in northeastern NSW in the bat trapping survey of Parnaby (1986).

Although the Pipistrelle is a widely distributed species in eastern New South Wales, it evidently only occurrs at higher elevations (above about 700 m) in northeastern NSW where it was trapped in low numbers (Parnaby 1986). Thus the high number of Pipistrelles captured during this survey is significant as it is not a common occurrence.

Gilmore (1990) recorded a specimen of the Golden-tipped Bat (Phoniscus papuensis) from this area, trapped in rainforest in a tributary of Desert Creek (altitude 250m). This represents only the sixth recorded locality of this species from New South Wales, of a total of 16 Australian localities (Parnaby, unpublished). The status of this infrequently encountered species is unclear. Either it is unusually adept at avoiding traps and nets (mist net capture of this species has not been reported), or it is an uncommon species. This is not due to a lack of trapping effort. For example, three extensive trapping studies produced the following results: Bega region, 3 individuals (Lunney and Barker 1986); Wattigan State Forest, 1 individual (P. Wilson, pers. comm.); and northeast NSW, 1 individual (Parnaby 1986). Listing of this species on Schedule 12, National Parks and Wildlife Act 1974, therefor appears justified.

A further seven insectivorous and two flying fox (Pteropus) species could reasonably be expected from this area based on the habitat present and their occurrence in adjoining regions. Tidemann (1981) recorded The Greater Broadnosed Bat Scoteanax rueppellii, the Little mastiff-bat Mormopterus norfolkensis, and the Large-footed Bat Myotis adversus from just south of the survey area. Tidemann (loc. cit.) also recorded Eptesicus vulturnus, a species usually found in drier forest types, from moist rainforest and wet sclerophyll forest. It is likely that the latter species was E. pumilus, a species not adequately defined prior to the taxonomic revision of Kitchener et al. (1987). An additional species, the Large Pied Bat Chalinolobus dwyeri could also be expected - I have trapped this species on a dry sclerophyll-wet sclerophyll ecotone near Lismore (Parnaby 1986). Several other species known to forage above the forest canopy and thus less likely to be captured during surveys are the White-striped Bat Tadarida australis, and the Yellow-bellied Freetail Bat Taphozous flaviventris. Thus it is likely that the total number of insectivorous bat species from the area is at least 16. Two flying fox species are also likely to visit the area, these being the Grey-headed Flying Fox (Pteropus poliocephalus) and the Litte Red Flying Fox (Pteropus scapulatus).

Further surveys of the bat fauna in this region are required to: a), more extensively sample the area, particularly lower elevations; b) sample the high flying canopy species and c), sample at different seasons to assess possible seasonal differences in species composition.

Acknowledgements

The local knowledge and assistance of the following people greatly facilitated this survey: Donella Anderson, Cathy Eggert, Jon Harvey and Andrew Steed.

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TABLE 1

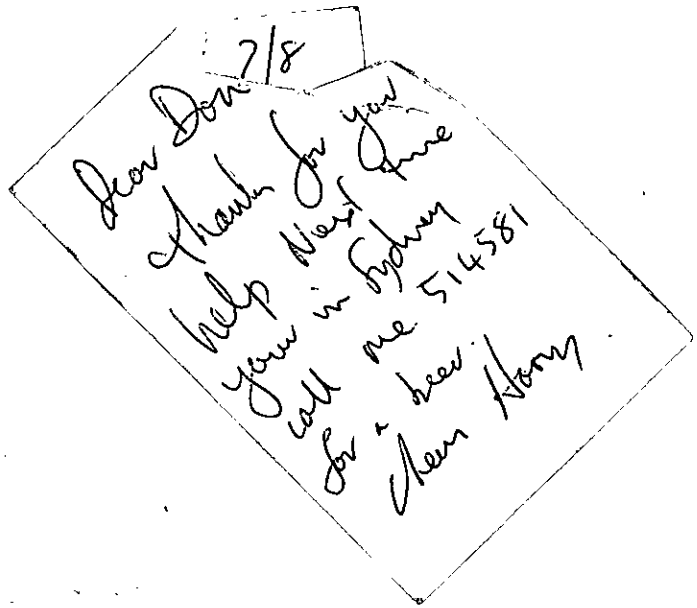
Location of trap sites: Grid references are for 1:25 000 topographic sheet Malara Creek 9339-I-S; asterisked sites refer to Washpool Sheet 9339-II-N.

Site	Alt	Grid Ref.	Compartment		
1	880m	422685	667	Crabapple Rd	TRAP
2	860m	410664	679	Old Ewingar Spur Trail	"
3	740m	402658	695	Berry Rd, Creek	"
4	840m	381643	695	Berry Rd	"
5	850m	404652	688	Ewingar Spur Trail	"
6	950m	370642*	695/6	Ridge top	"
7	750m	363647	695/6?	Unnamed track	"
8	340m	428611*	N. Park	Desert Spur Fire Trail	NETS

TABLE 2

Trapping results by species and site. Traps were used for sites 1-7, mist nets at site 8. Numbers given are for females, males. Note: nil captures for site #4 and #7.

#	Date	E.pm	E.dl	C.mr	C.gl	N.gd	M.sc	F.ts	S.or	R.mg
1	14/12	1m	5,3	1f		1m				1m
	15/12		2f							1f
2	14/12		1f	3,2		1,1	1,1	24,3		
	15/12			5,2						
3	14/12		1,1	1m	1m		11,11	1f		
	15/12		1,1	1f	1m		10,16	1f		
4	14/12-16/12									
5	15/12							1f		
	16/12			1f				1f		1m
6	15/12						1m	1,2		
	16/12									
7	16/12									
8	15/12	2f				2,1			2f	
TOTAL		3	15	16	2	6	51	34	2	3


Dear Don 2/8
Thanks for your
help. Next time
you're in Sydney
call me 514581
for a beer.
Cheers Tony

15/7/91

NORTH WASHPOOL

Introduction

This report is the result of preliminary assessments of vegetation and soil degradation resultant from roading and logging operations in North Washpool. The aim was to examine representative examples of the major forms of disturbance and in no way should be considered to have identified all sites or issues of concern.

Similarly this report is still incomplete and requires further work. It is being distributed to members of the two Committees established to asses and make recommendations on the rehabilitation of impacted soils and vegetation in North Washpool, and is not intended for wider circulation.

It is intended to outline the bulk of my concerns derived from site inspections of North Washpool and many years spent in cool subtropical rainforests of the upper Clarence valley. A final report will be distributed as soon as time allows, probably not for another month.

Any comments or suggestions on this draft will be welcomed.

Please forgive spelling, grammatical, etc. mistakes at this time as I have not had time to proof read it yet, and I have to finish it now to go away. Note references not yet done.

Dailan Pugh,
4.7.1991

30.38.

Steedy,

for your info

Regards

Dailan.

Introduction
1 Area of Assessment
2 Background Chronology
3 Management Practices
4 Vegetation Regeneration and Rehabilitation
  1 Nature of Disturbances
  2 Recovery Process
  3 Rainforest Regeneration
  4 Inhibition
  5 Freeing
  6 Supplementary Plantings
5 Soil Rehabilitation
  1 Compaction
  2 Stripping
  3 Erosion
  4 Desert Road
6 Site Assessments
  1 Logging Dumps and Sites Subject to Extensive Machinery Disturbance
  2 Roads and Tracks
  3 Heavily Logged and Open Sites
  4 Filter Strips and Stream Crossings
7 General Recommendations
8 References

1 AREA OF ASSESSMENT

North Washpool straddles the Gibraltar Range in a tract of mountainous wilderness in the Clarence valley, some 70 km. north-west of Grafton in north eastern N.S.W. To the south the area is bounded by the Washpool National Park and to the north by Ewingar State Forest.

Its rugged terrain is clothed in a unique assemblage of cool subtropical and montane rainforests intergrading with tall old growth eucalypt forests. Together with the park it encompasses the largest stand of unlogged rainforest and largest wet forest wilderness left in N.S.W.

To date 22 species of vertebrates listed on Schedule 12 of the National Parks Act, 1974, as endangered fauna, have been found during North East Forest Alliance (N.E.F.A.) surveys of the area, of particular note are the Hastings River Mouse (listed as in Imminent Danger of Extinction), Golden- tipped Bat, Spotted- tailed Quoll, Koala, Parma Wallaby, Crested Hawk, Powerful Owl, Sooty Owl, Wompoo Pigeon and Pouched Frog.

The area commonly referred to as North Washpool incorporates the entire catchment of Desert Creek in Washpool State

Forest (cmpts.686-694, 697-699. 2 823ha.) and the catchment of Malara Creek, north to Main Creek, within Billilimbra State Forest (cmpts. 695, 696, 700-713 and part 679. 4,063ha.) It is within the Commission's Casino West Management Area, Casino District and Coffs Harbour Region.

The area encompassed in the 1990 court case was slightly larger, encompassing the entire compartment 679.

Rainforest logging commenced in North Washpool in 1981/2 and continued through to 1988. A blockade in 1989 stopped any further logging. Logged areas in compartments 688, 694, 695 and that part of compartment 679 to the south-east of Main Creek along with roads represent the area being assessed by the two scientific committees established by N.E.F.A. and the Commission.

The Committee has identified the area concerned as totalling 200 hectares of rainforest subject to logging, with a total length of snig tracks estimated as 14.5 kilometres and 21 identified log dumps.

2.BACKGROUND CHRONOLOGY

1976. Inventory of wilderness in eastern N.S.W. and south-eastern Queensland (Helman et. al. 1976) identifies Washpool as one of 20 wilderness areas remaining.

1979 National Parks Association of N.S.W. proposes the creation of a Washpool National Park.
,July. Forestry Commission agree to prepare an Environmental Impact Statement (E.I.S.) for proposed operations in the Washpool area.

1980, Dec. Forestry Commission releases an E.I.S. entitled 'Proposed Forest Operations in the Washpool Area' which covered 43,283 of forested country outlined by Helman (1976).

1981. N.P.W.S. report on E.I.S. condemns it as deficient, misleading and inadequate.

1982,May, Department of Environment and Planning report on E.I.S. condemns it as being deficient and inadequate.
,Oct. N.S.W. Cabinet reach their historic rainforest decision, three key areas of proposed park omitted as concession to logging interests- Redbank Creek, Desert Creek and Malara Creek catchments (the later two comprise North Washpool).
,Dec.14. Forestry Commission release their determination of the E.I.S.

1983,April. Washpool National Park dedication passed through parliament. Dedications in 1983-84 give a total park area of 27 700 ha.

Logging of North Washpool's rainforests begins in ernest (Cmpt. 679).

1984. North Washpool nominated for the National Estate.

1985/86. Berry Road constructed into North Washpool along length of compartment 695. Survey tracks constructed into the Malara Creek valley.

1988,Dec. Wilderness Society (Armidale branch) nominate North Washpool as a wilderness area under the Wilderness Act, 1987. N.P.W.S. thereby given two years to undertake assessment.

1989. Jan. Construction of Desert Road commenced, delays due to wet weather, approx. 5 km. constructed by August.

,Aug.20. North East Forest Alliance (N.E.F.A.) and The Wilderness Society establish blockade to stop further work on Desert Road. Commission moves bulldozers to Berry Road and begins construction through rainforest. Blockade moved to Berry Road. 12 people arrested.

.Sept.5.Baryugil Aboriginal Community and N.E.F.A. demand Commission stops roading as Aboriginal sites endangered. Commission subsequently agrees to stop.

.July. Consultants report, recommending declaration of the Desert Creek valley as an Aboriginal Place with a core area of 1,130 ha.to remain unlogged to protect remaining sites, released by Minister.

,Aug.10.Minister of Forests stops imminent logging in North Washpool pending Cabinet consideration of N.P.W.S. wilderness assessment.

,Sept.4. Cabinet refuses wilderness nomination and gives the all clear for logging.

,Sept. N.P.W.S. releases the wilderness assessment which states that North Washpool meets the criteria for dedication as wilderness and "would readily qualify for addition to the World Heritage... on the basis of containing natural heritage of outstanding universal value."

,Sept.6. Commission announces they intend to log 15 000 cu.m. gross of rainforest timbers (520 ha.) and 138 000 cu.m. gross of Brush Box and eucalypts (3 460 ha.) in North Washpool.

,Sept.9. N.E.F.A. reinstates blockade to delay logging while a court case is prepared.

,Sept.10. J. Corkill applies for injunction to Land and Environment Court on grounds that the Forestry Commission had failed to fulfil the requirements of the Environmental Planning and Assessment Act, 1979, to properly asses the environment to be affected and prepare an adequate E.I.S.

Commission forced to agree to desist from logging until court hearing.

,Oct.29. After four day hearing Justice Hemmings grants injunction stating;

"Regrettably, there is conceded to be a history of departure by the Commission from not only its own approvals on the logging of this area, but apparently a continuous avoidance of the obligations imposed by the Environmental Planning and Assessment Act. In such circumstances, it is difficult to have confidence that, unless restrained, the Commission will observe its statutory duties."

,Nov. North Washpool nominated for world heritage listing.

1991,April 5. Commission agrees out of court to prepare an E.I.S. before undertaking further roading or logging in North Washpool and to establish a Soils and a Regeneration Scientific Committee to control erosion and ensure adequate regeneration of illegally roaded and logged areas.

April 8. Agreement signed by both parties.

3.MANAGEMENT PRACTICES

The Commission's 1980 E.I.S. explicitly and repeatedly states that rainforests within North Washpool will not be logged
(e.g. pp. 21, 36 and 44) and that subtropical rainforests within the Casino West Management Area will only be logged on a 50% canopy retention harvesting prescription (e.g. pp. 13, 20 and 56).

The Forestry Commission's (1982) contradictory determination of the E.I.S. stated;

"(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..."

"(c)The harvesting in rainforest stands shall be to maximum economic utilisation of quota logs, subject to the provisions of individual harvesting plans..."

"(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."

Amendments to the Casino West Management Plan in 1983 (1.7.3.1. p.30) state that in October 1982 the Government

determined that North Washpool rainforests were to be logged in lieu of other areas of the Grafton Management Area transferred to National Parks, noting;

"It was accepted that harvesting would be in accordance with the harvesting prescriptions outlined in the Environmental Impact Statement..., based on the prescriptions of the 1980 Grafton Management Plan."

and that in the rainforests (2.3.4.2 p.43);

"(11)Harvesting otherwise shall be directed to maximum economic utilisation of logs included in the allocation to Big River Timbers (Veneer) Pty. Ltd.,and retention of those trees whose harvesting would not be debited against the commitment."

Logging of subtropical rainforests elsewhere in the Management Area was still prescribed to "retain at least 50% canopy cover... of the pre-existing species range."(p.44)

Harvesting plans subsequently prepared for compartments 679, 688 and 695 show that there was a subsequent change as they explicitly state that all rainforest logging will 'retain a 50% canopy cover'. The draft plan for Cmpt. 694 does not mention this prescription.

Despite repeated assertions by Casino District Foresters that sub-tropical rainforests were being logged on a 50% canopy retention basis, it is apparent that both warm temperate and subtropical rainforests in North Washpool were logged on a maximum utilisation basis. It is also apparent that rainforests in Ewingar State Forest were logged far in excess of the 50% prescription.

The 1983 amendment to the Casino West Management Plan (2.3.4.1. p.42) states;

"Logging shall be excluded from:
(x)Within 20 m of those Class IV or better standard roads, and within those filter strips as defined in the Standard Erosion Mitigation Conditions... within rainforest stands in (North Washpool)"

No apparent attempt was made to exclude logging from any roadsides, with some of the greatest disturbances being adjacent to roads. One filter strip in Cmpt. 694 was grossly disturbed and logged.

The Management Plan (2.3.4.2 p42) states that "Erosion control prescriptions as defined in the Standard Erosion Mitigation Conditions" "shall apply".

The Standard Erosion Mitigation Conditions (S.E.M.C.) impose a variety of conditions upon the Commission and their licensees, including; the construction of cross-banks to specifications and replacement of surface material 'as far

as practicable' on minor roads and tracks immediately after logging has ceased; retention of filter strips of at least 20 metres on each side of a stream with a catchment in excess of 100 hectares; no felling of trees into streams within filter strips; no entering of filter strips by logging machinery; stockpiling of top soil during construction of logging dumps and upon completion of logging (even if further logging is contemplated in the near future) the levelling, drainage and responding of topsoil, and if necessary revegetating and ripping.

All of these conditions have been breached in North Waspool: cross banks have failed to be constructed (e.g. sites r.1, r.2, r.3, r.4, r.5, r.7), have been constructed at inadequate spacings (e.g. sites r.6, r.10), and have been inadequately constructed (e.g. sites r.10, r.11); filter strips have been logged, entered with machinery, and had trees dropped in creeks (e.g. site s.4); and no attempts whatsoever were made to rehabilitate logging dumps.

The Commission (1980 p25) notes that a Harvesting Plan will be prepared by the supervising forester and distributed to all operators, special licensees and the supervising foreman before the logging operation commences.

Logging began in compartment 679 in 1977 and occurred every year up to 1988 and yet the harvesting plan dated 16/5/89 states that "all forest types are in an overmature condition" and "There are no obvious signs of recent harvesting operations", even though by that time harvesting of the entire compartment had been completed, with the last logging as recently as late 1988.

Logging history maps show that compartment 688 was logged 1986, 87 and 88 with the harvesting plan dated 1/12/88, and compartment 695 logged 1985, 86 and 87 with the harvesting plan dated 7/8/90. Compartment 694 was logged 1985, 86 and 87 with an unauthorised and unsigned, and thus presumably draft harvesting plan hand dated 6/2/86. The map supplied with the draft 694 plan is at a scale of 1:25 000 and is not up to the required standard.

The location of roads and logging dumps shown on Harvesting Plans are very different to those found in the field. The Commission also failed to keep any compartment History files, to annually update logging history maps or to show the full extent of logging on logging history maps (particularly Cmpt. 694).

The Commission's 1980 E.I.S. (p.98) notes that further information should be obtained as a matter of some urgency from Aboriginal informants about the reputed site near Redbank Creek, employ an Anthropologist/Archaeologist on an initial one year contract to liaise with the N.P.W.S. and

advise how this monitoring can be done and undertake an Archaeological Survey in proposed logging areas likely to contain sites (the Desert Creek valley being identified by a consultant as requiring assessment).

The Commission made no attempt to fulfil these obligations and consequently logged the Redbank site and bulldozed Desert Road through part of another significant site.

4.VEGETATION REGENERATION AND REHABILITATION

4.1. Nature of Disturbances.

Rainforests are not static ecosystems which progress in an orderly fashion to a climax state. Rather they are dynamic ecosystems in a continual but slow state of flux as trees die and form gaps, with regeneration determined as much by chance events as species availability and suitability. On the most protected sites this process has stabilised to some degree, with the rainforest able to reach its most complete successional development for the site's attributes.

The most frequent natural disturbance in North Washpool's rainforests is that caused by the death and collapse of individual trees. Such disturbances affect limited patches and, unless windthrown, result in no soil disturbance or loss of nutrients.

There are three natural agents which can cause extensive disturbance to rainforest:

(i)Fire; often impacts on rainforest margins where it can cause massive disturbance. Rarely does a hot fire penetrate far into an mature rainforest, rather the impact is borne by a variety of specialised species with varying degrees of fire tolerance which occupy the dynamic ecotone separating the fire prone open eucalypt forests from the fire sensitive rainforests. Naturally infrequent fires maintain this boundary in a state of flux, dependant on time since the last fire as well as site qualities.

(ii)Cyclonic winds; may be the principle agent responsible for natural large scale disturbances within mature rainforests in North Washpool. They can flatten large areas but more frequently only heavily disturb pockets of forest, particularly on ridges. Disturbance involves loss of canopy but does not significantly affect soil structure or remove nutrients.

(iii)Landslips; are a potential source of large disturbances, though only one slip in unlogged forests in

North Washpool has been noted to date (r.14). Such disturbances usually are of relatively small size, though can cause canopy loss and significant losses of topsoil.

Disturbances associated with logging are superimposed over and above the natural disturbance regime of the forest. Logging concentrates on the better developed stands, causes extensive disturbances, concentrates on select species and growth forms, causes massive soil disturbance (compaction, stripping of topsoil, erosion), removes nutrients (in logs and eroded material), and interferes with natural regeneration mechanisms.

Following logging the remnant rainforest is left significantly more vulnerable to wind damage, fire incursions (as occurred in Ewingar S.F. in 1968) and mass soil movement (as along Desert Road).

It is apparent on a number of sites in the Coachwood rainforests and more heavily disturbed complex rainforests that even 8 years after logging that remnant trees are still dying. It is not known how long this process will continue before it stabilises at the pre-logging rate, though remnant trees can be expected to continue to die as a consequence of the logging operations for a number of decades yet.

Weed species are common on disturbed sites, with over 30 species being recorded to date in North Washpool and adjacent areas in Ewingar State Forest.

Roads provide avenues for the proliferation and dispersal of weeds. Parramatta Grass has penetrated to the end of Berry Road. Tickbush lines most roads, from which it is able to infest heavily disturbed sites.

Blackberries have been noted at one site (junction r.4 and r.5) in North Washpool and a number in Ewingar State Forest.

Lantana is common on some fire disturbed sites at lower altitudes in the Desert Creek valley, and logged sites in Ewingar State Forest. It has not been noted at higher altitudes in North Washpool.

The proliferation of weeds and native secondary species on disturbed sites gives them greater ability to colonise natural openings in adjacent unlogged forest (e.g. see Giant Stinging Tree, 4.2).

4.2 Recovery Process

The Regeneration Committee has identified two principle modes of rainforest succession in North Washpool;

a. RELAY FLORISTICS: on the richer sites a relay regeneration process involves the successive replacement of earlier stages by later stages,

b. INITIAL FLORISTIC COMPOSITION: on the poorer sites an initial regeneration process includes establishment of species in initial regeneration that persist to advanced or mature stages.

These processes overlap at some sites and are variously thwarted by degraded site conditions, proximity to eucalypt ecotones and dominance by certain plant species.

One other distinction needs to be recognised, that between internal regenerative mechanisms and that occurring near eucalypt ecotones. A differing suite of species are best adapted to eucalypt ecotones and their frequencies of fire disturbance. In effect internal processes may be overlaid by ecotonal processes.

Five distinct rainforest units where regeneration processes can be expected to significantly differ can be recognised; complex subtropical (dominated by Yellow Carabeen - Rosewood), simple subtropical (dominated by Crabapple- Corkwood- Purple Cherry), 'warm temperate' (dominated by Coachwood - Crabapple), the ecotone between subtropical rainforest and eucalypt forest and the ecotone between 'warm temperate' rainforest and eucalypt forest.

Regeneration in or near ecotones can be expected to regress to earlier successional stages, e.g subtropical to warm temperate. The prolific growth of eucalypts on a number of heavily disturbed rainforest sites near ecotones in North Washpool is evidence of this process.

Fox (1983) found that in the Washpool area logged rainforests were differentiated by computer analysis from unlogged rainforests as either a discrete group or grouped with wet sclerophyll forest sites. This distinction was evident at sites selectively logged 20 years previously.

Logged subtropical rainforest sites were grouped with moist eucalypt sites with rainforest understorey, and with some warm temperate rainforest sites.

She further noted that logged rainforest is distinguished from unlogged rainforest by large numbers of pioneer species, fewer tree species, fewer specialised life forms, more shrubs and juveniles, higher incidence of dieback, higher soil pH, higher soil calcium, lower soil aluminium and higher soil electrical conductivity.

Fox (1983) 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 time scale on the process of regeneration, ignore this concept. There is a fundamental and qualitive change when pristine vegetation is modified in any way."

King and Chapman (1983) found that the closed canopy of heavily logged Coachwood rainforest had been reduced from 35 m. to 10-12 m. with emergents up to 25 m., also noting that there was an increase within the rainforest of species from ecotonal situations. They estimated that structural recovery would take between 140 and 250 years, depending on the degree of disturbance.

From regeneration on a number of sites it is apparent that Brush Box (*Lophostemon confertus*) will dominate some rainforest sites, at which it was not present before, for the period of its lifespan. This is in the order of 1 000 to 2 000 years. Such stands can not be considered to have developed to their pre-logging condition at least until the Brush Box have dropped out. Brush Box are only indicative of the resorting and development of species required for the rainforest to return to something like its original stage of development.

Giant Stinging Tree (*Dendrocnide excelsa*) is widespread in regeneration throughout the subtropical rainforests, forming dense stands in a number of locations (e.g. 1.1, 1.5). It can be expected to persist as a dominant at such locations for some hundreds of years. As found by Hopkins et al. (1974) the consequent greater availability of its seeds will enhance its ability to capture naturally disturbed sites in adjacent unlogged rainforest, possibly leading to a limited degradation in the seral status of surrounding rainforest.

Brush Box and Giant Stinging Tree are just two examples of a suite of rainforest species with varying adaptions to regeneration on disturbed and open sites which are favoured by disturbance to rainforest.

Sydney Blue Gum (*Eucalyptus saligna*) and Tallowwood (*Eucalyptus microcorys*) are present in regeneration on a number of rainforest sites in North Washpool. They have lifespans in the order of 300 and 600-1 000 years respectively. Where such sites occur towards the rainforest margin they will have increased long term vulnerability to being burnt out. Two advantages of their presence are in stabilising the microclimate and aiding structural recovery by encouraging height growth of regenerating rainforest species.

The Commission recognises four forms of rainforest in North Washpool: type 2, dominated by Yellow Carabeen; type 3, dominated by Crabapple - Sassafras - Corkwood - Silver Sycamore(?); type 11, dominated by Coachwood - Crabapple; and type 23/26, which is a catchall for the above types where they were not considered to contain significant merchantable volumes.

This typing is inadequate for assessing the broad species and structural groupings that existed on sites prior to logging, and thus unsuitable for determining the nature of the regeneration required to return sites to "close to their original type. Consideration must be given to determining and mapping ecological typings for at least the affected compartments.

Complex subtropical rainforests (broadly corresponding to type 2) principally occur on krasnozem soils in sheltered locations towards watercourses. These forests were targeted by heavy logging, often amounting to virtual clearfelling. They have been noted to have the most significant regeneration problems.

Most such areas heavily logged are now dominated by Solanum with patches smothered by Wild Raspberry, ferns and vines. Parts of many such areas have poor or no regeneration of secondary or mature phase species (e.g. sites 1.3, 1.4, 1.5, r.6, r.12, r.13 and s.4). Giant Stinging Tree is widespread with significant patches now dominated by this species (e.g. sites 1.1 and 1.5).

Common regeneration species include Solanum, Wild Raspberry, Brown Beech (*Pennantia cunninghamii*), Giant Stinging Tree, Brittlewood (*Claoxylon australe*), Anchor Vine (*Palmeria scandens*), Mat rush (*Lomandra spicata*), Pennywort ( ) and Perrywinkle (*Pollia crispata*).

The poor regeneration of these complex rainforests is most probably due to a variety of factors, possibly including; intensity of disturbance, microclimate alteration, suppression by Solanum and other species, changes to soil microbiology, and inadequate propagules of suitable pioneers.

Solanum apparently has an inhibitory effect on its own seedlings and forms even aged stands with an expected lifespan of 5-10 years. In many areas Wild Raspberry is common under the Solanum and appears to be capturing sites where the Solanum is starting to die out. The author has identified a similar process with Wild Tobacco (*Solanum mauritanium*) in Yabbra State Forest, where Wild Tobacco then re-establishes itself in the Wild Raspberry and the cycle begins again.

Regeneration on these heavily disturbed sites is not expected to be a linear succession but rather involve a number of cyclic steps, which will occur as cohorts of early successional species senece at around the same time and thereby cause relatively extensive disturbance and open up the canopy.

The lack of adequate diversity in regeneration is also of concern as it appears that where regeneration does progress it will be dominated by a limited number of species. It may take many centuries for an approximation of the original density and diversity of species to be reinstated.

It is also apparent that, particularly in proximity to the simpler subtropical stands, that once complex stands are going to be converted to simpler forms due to the greater regenerative ability of such species as Crabapple and Corkwood on heavily disturbed sites.

Another problematic area is towards the ecotone of subtropical rainforest and eucalypt forest. The dominant regeneration pattern of this ecotone is related to infrequent wildfire disturbance. The broad pattern identified by the author through this ecotone is from dominance by Sydney Blue Gum> Tallowwood> Brush Box> Corkwood> Crabapple etc.

In many of the heavily disturbed subtropical and 'warm temperate'rainforests near this ecotone there is a marked reversion to earlier successional stages, with Brush Box, Tallowwood and/or Sydney Blue Gum expected to become dominant on many sites (e.g. s.1, s.2, d.5, d.9, d.11, d.14 and d.17).

While this is a natural regenerative process there is a moral dilemma in that the Commission refuses to acknowledge that rainforest dominated by Sydney Blue Gum, Tallowwood and/or Brush Box is in fact rainforest. This implies that the Commission would no longer classify such sites as rainforest. If the re-classification of these regenerating rainforests as non-rainforest is to be the outcome then such regeneration can not be considered acceptable.

4.4 Inhibition

The opening of the canopy resultant from roading and logging will significantly increase wind damage and temperature extremes, affecting both retained trees and regeneration. King and Chapman (1983) investigated an area of Coachwood rainforest in Doyles River State Forest 25 years after logging and observed that on old logging dumps and snig tracks there was little regeneration of rainforest tree

species, which they attributed to the incidence of heavy frosts which killed or damaged young trees.

A number of sites have been identified where regeneration is being inhibited and retarded by dominance of a variety of plants, most of concern are;

a.Solanum (*Solanum sp.5*) is widespread and can form dense stands, particularly on heavily logged 'relay' sites. It is evident from a number of sites (e.g. sites r.3, r.6, d.12, s.4, r.11, r.12, r.13, l.3, l.4 and l.5), with poor or simplified regeneration of later successional species, that Solanum is apparently suppressing regeneration. Consideration should be given to the possibility of this resulting from chemical inhibition. Requires thinning to liberate existing regeneration and plantings of relay pioneer and mature phase species. Further assessments and monitoring needs to be undertaken to assess the extent, nature and consequences of this problem.

b.Tickbush (*Helichrysum rufescens*) lines roads and forms dense stands on more productive sites subject to extensive machinery disturbance (e.g. sites d.7, d.8, d.9). It directly suppresses regeneration due to density of growth, though other mechanisms may also be involved. Requires radical manual thinning to liberate existing regeneration and plantings of relay pioneers.

c.Patches of dense vines, of various species, effectively smother regeneration in scattered localities (e.g. sites d.4, s.2, d.7 and l.5). More commonly vines pull down emergent regeneration. Molucca Bramble (*Rubus hillii*) is widespread and causing problems at some sites. Freeing of regeneration during assessments should be considered.

d.Wild Raspberry (Rubus rosifolius) is a problem species of more open sites, where it can form dense patches with little other growth (e.g. l.3). Such sites require plantings of suitable species.

e.Brakens dominate a number of patches with little other regeneration (e.g. d.4, s.4 and l.5). Requires thinning and planting of suitable pioneers.

f.Callicoma (*Callicoma serratifolia*) forms dense stands in simple rainforest towards creeks. Needs monitoring.

4.5 Freeing

Regeneration can be aided by freeing desired species from competition with less desirable species. This can be achieved by hand slashing openings around desirable species

in dense stands of problem species and by cutting back vines where they are pulling down regeneration.

4.6 Supplementary Plantings

The possibility exists to hasten and guide regeneration in the right direction by supplementary plantings of selected species. Plantings can be separated into early (pioneer, secondary) and late (mature, climax) successional species and should be determined as being ecologically suitable for a given site.

Plantings of secondary species should be undertaken as soon as practicable on all open sites where assessed as being required. Plantings of mature phase species should take place over the next few years as plants become available.

Frugivorous birds are one group expected to have been adversely affected by the rainforest logging that has occurred. For example pigeons are expected to find autumn and winter fruits a limiting resource. Species of trees, occurring in North Washpool, known to supply significant and suitable fruits in this period are Bangalow Palm (*Archontophoenix cunninghamiana*), Strangler Fig (*Ficus watkinsiana*), Pencil Cedar (*Polyscias murrayi*), White Cedar (*Melia azedarach*)?, Sour Cherry (*Syzygium coryanthum*), and Pigeonberry Ash (*Cryptocarya erythroxylon*).

Of these, Pigeonberry Ash and Strangler Fig were most common in the more complex rainforests, Pigeonberry Ash has been targeted in logging operations and is not yet regenerating on many sites while the remnant Strangler Figs in the more heavily logged rainforest will suffer accelerated mortality (due to exposure) for many years yet.

Survival of Strangler Figs may be enhanced by targeting them for plantings of quick growing species to provide protection for trunk (root column) and reduce wind stress as quickly as possible.

Pencil Cedar and Bleeding Heart (*Omalanthus populifolius*) are common in regeneration on a number of sites and are secondary successional species, they should be considered for plantings on poorly regenerated and species poor sites, having the added benefit of attracting a number of frugivorous birds and the seeds they carry.

5. SOIL REHABILITATION

5.1 Compaction

Compaction of forest soils during logging operations is caused by the weight of machinery, loads and falling trees. The single passage of machinery has been shown to cause major compaction (e.g. Incerti, Clinnick and Willatt 1987) while repeated loadings have been shown to increase compaction effects (e.g. Seymour 1981).

Soil compaction, resultant from logging, has been shown to significantly increase soil density, reduce hydraulic conductivity, reduce infiltration capacity, reduce productivity and reduce aeration (e.g. Jakobsen and Moore 1981)

Jakobsen and Moore 1981 and Jakobsen (1983) found that in krasnozem soils studied compaction was generally greatest in the top 25-30 cm. of the soil profile though some effect down to 50 cm. was noted.

Jakobsen (1983) considered;

> "Compacted forest soils, in the absence of ameliorative treatment, recover slowly under the influence of climatic processes and the activities of roots and soil fauna. However, it may take 10-20 or more years for soil to recover after shallow compaction ... while compaction of deeper layers may persist for 50-100 years... When biological activity in the soil is severely reduced by compaction, recovery may be further retarded."

Log dumps and snig tracks have been noted to be most severely compacted in logging operations. It is thus surprising that penetrometer readings obtained by the Commission for the Committee, show that logging dumps are less compacted than undisturbed forest. This may be due to rocks and roots getting in the way.

Compaction can be expected to be a significant factor in the retardation of regeneration on a number of sites. It is considered that sites in Cmpt. 679 at lower elevations on yellow earths (e.g. r.4, r.5, and d.6) need to be assessed for compaction.Consideration needs to be given to utilising different methodology to determine compaction, e.g. bulk densities.

While it is recognised that repeated machinery disturbances will damage extant regeneration and may aggravate regeneration problems, it is considered that on some sites the long term benefits will far outweigh any immediate setbacks. As well as sites recommended for ripping by Floyd and N. and H. Nicholson, five additional sites should be considered - r.8, d.18, d.6, r.4 and r.5, the later 3 particularly so.

5.2 Stripping

Topsoil has been noted to have been stripped from many tracks and logging dumps (particularly the approaches to ramps). The exposed subsoils provide a less suitable stratum for regeneration, and due to their poorer structure and nutrient status can be expected to be retarding regeneration of many sites.

5.3 Erosion

Inadequately drained roads and snig tracks, particularly on steeper slopes, and improperly constructed creek crossings are major sources of erosion following logging. As the Commission failed to ensure the construction of cross banks on many tracks, constructed them at inadequate spacings on others, constructed some inadequately (which subsequently failed) and constructed at least one creek crossing improperly, erosion is a significant problem in North Washpool.

Machine construction of cross banks should be considered for sites r.4 ,r.5 and r.7, creek crossing at site s.3 could be removed and possibly d.6 restored and ripping done at the same time. Manual construction/reconstruction of cross banks should be considered for sites r.1, r.2, r.3, r.6, r.9, r.10, r.12 and any other sites revealed by a comprehensive assessment.

The collapse of embankments above and below Desert Road and the newly constructed extension of Berry Road have already caused unacceptable environmental degradation and are threatening further mass soil movements unless mitigation measures are urgently applied.

5.4 Desert Road

Construction of Desert Road commenced in January 1989 and was stopped by a blockade in August 1989, at which time it had been constructed some 5 km. into North Washpool. When reinspected a year later, in September 1990, erosion was evident and a large section had collapsed with consequent scouring out of the gully below. A number of cross banks had been recently constructed across the road. When next inspected in May 1991 erosion had worsened with significant gullying in a number of places.

There needs to be an assessment of the impact this has had upon Desert Creek and any possible remedial actions identified and implemented.

The Commission has blamed protestors for blocking drains and causing this erosion. The drains were not blocked during the blockade but reputedly by unknown persons some time later. It is also important to note that there were no drains above

the section of road that collapsed to be blocked and that the worst erosion elsewhere has occurred since the drains were cleared and cross banks installed. The Commission has only itself to blame.

There needs to be an assessment of the impact this has had upon Desert Creek and any possible remedial actions identified and implemented.

During construction of the road part of a significant Aboriginal site was destroyed. Following representations by the Baryugil Aboriginal Community the Regional Forester replied that "The Forestry Commission agrees to shift the existing road, if possible to avoid site 6, and to carry out any restoration work to that site that the Community might request". This aspect must be incorporated into any consideration of Desert Road.

In 1987 the Commission estimated the costs of constructing Desert Road (10km.) and associated feeder and logging roads as $429 800, with anticipated royalties of $834 140 and marketing costs and overheads totalling $530 885 the logging of the Desert Creek valley was anticipated to lose $126 545.

Since then the Commission has agreed not to log 1 130 hectares to protect Aboriginal sites in the Desert Creek valley, and more recently the Minister for Forests, Mr. West, and the Regional Forester, Mr. Bruce, have insisted that no further rainforest logging will occur in North Washpool.

There can thus be no justification, for either financial reasons or for access to resource, for undertaking a proposed reconstruction of the road and it must be closed, rehabilitated as far as feasible to ensure long term stability and revegetated as the highest priority.

The extension to the end of Berry Road (site r.14), hastily constructed through steep rainforest during the 1989 blockade, should be rehabilitated. Its primary use was to be a link to Desert Road and it is probably Similarly unjustifiable.

6.SITE ASSESSMENTS

All sites mentioned have been inspected by the author, though additional information from inspections by others is included. Where appropriate references to reports by A. Floyd and H. & N. Nicholson are designated by F or N respectively along with their site numbers, e.g. F2 represents Floyd's site 2, these should be consulted for additional information and recommendations.

Sites are coded according to their nature: with d=logging dump or extensive machinery disturbance, r=road or track, l=heavily logged and open sites, and s=filter strips and stream crossings. Locations of all sites are shown in Appendix 1.

In discussions of sites the words 'relay' and 'initial' refer to the two successional modes described in 4.2.

6.1 LOGGING DUMPS AND SITES SUBJECT TO EXTENSIVE MACHINERY DISTURBANCE.
Sites;

d.1 Cmpt. 679, logging dump,
d.2 Cmpt. 679, logging dump,
d.3 Cmpt. 679, logging dump; regeneration of mature phase inadequate, consider supplementary plantings.
d.4 Cmpt. 679, logging dump and surrounding area; patches of inadequate regeneration, patches dominated by ferns, grasses or vines, consider plantings of initial pioneers. N4.
d.5 Cmpt. 679, logging dump?
d.6 Cmpt. 679, logging dump; poor regeneration, soil rehabilitation recommended, dump appears subject to waterlogging, poor regeneration of secondary species- some indication of retardation, good diversity of mature phase though some concern with growth, consider ripping and reconstruction of dump and/or planting with pioneer species. Base of snig track at back of dump actively eroding- not inspected. Large number of logs abandoned on and adjacent to dump- could be considered for cutting into lengths to lay across road.
d.7 Cmpt. 679, extensive logging dump and adjacent area; poor regeneration- dominance by tickbush and wattles, vines around margins, consider thinning of tickbush and wattles with plantings of relay pioneers and freeing of regeneration from competition and vines. N11, F2.
d.8 Cmpt. 679, area between tracks of extensive soil disturbance: poor regeneration- dominance by tickbush, consider thinning of tickbush and plantings of relay pioneers. N10.
d.9 Cmpt. 679, logging dump; N6, F3
d.10Cmpt. 679, logging dump, N9
d.11Boundary Cmpts. 695 and 694, logging dump. N13 F5.
d.12Cmpt. 695, machine disturbed area adjacent to Berry Road; poor regeneration- dominance by Tickbush and Solanum; consider thinning, freeing and plantings of relay pioneers. N18 F7.
d.13Cmpt. 695, gravel quarry adjacent to Berry Road; still in use, will require major rehabilitation work when closed.
d.14Cmpt. 694, logging dump; N14 F8.
d.15Cmpt. 694, logging dump; N15.
d.16Cmpt. 695, disused gravel quarry; no rehabilitation, poor regeneration- Solanum and poor substrate; consider

reconstruction, soil enhancement and plantings. Also consider inspecting and freeing regeneration across road.
d.17Cmpt. 695, logging dump; N17 F9.
d.18Cmpt. 695, large area subject to extensive machinery disturbance, end of Berry Road; compaction?, poor regeneration; consider ripping and planting with Brush Box and Tallowwood.

6.2 ROADS AND TRACKS
Sites;

r.1 Cmpt. 679, feeder road (d.1-d.3); moderate grade, no cross banks, no erosion noted, poor regeneration limited number of places, vines pulling down regeneration some places; consider hand construction of cross banks, freeing of regeneration from vines and limited plantings of initial and relay species depending on site. Only one snig track was inspected- no cross banks, no erosion noted. Patches of heavily logged rainforest along road.
r.2 Cmpt. 679, snig track (east d.4); moderate grades, no crossbanks, minor erosion on steeper section, inadequate regeneration where branches (N5); consider hand construction of cross banks, regeneration liberation and plantings of hardier mature phase species.
r.3 Cmpt. 679, snig track; moderate slopes, no cross banks?, poor regeneration, moderate erosion at bottom, needs further assessment.
r.4 Cmpt. 679, feeder road (r.5 to d.4); moderate slopes, no cross banks, serious erosion, poor regeneration, soil stripped and possibly compacted, some areas waterlogged; consider machine construction of cross banks, ripping and plantings of initial pioneers.
r.5 Cmpt. 679, old Ewingar Trail (s.1 to d.7); moderate slopes with some steep sections, no cross banks, serious erosion, waterlogging of soil, poor regeneration; consider machine construction of cross banks, ripping and extensive plantings of initial and relay (d.6 to d.7) pioneers. N1, N2 and N3.
r.6 Cmpt. 679, snig track (from new Ewingar Trail); steep slopes, inadequate spacing of cross banks, moderate erosion at base, poor regeneration- Solanum inhibition; consider hand construction of cross banks, thinning of Solanum and planting of relay mature stage species. N7.
r.7 Cmpt. 679, track, used as snig track (d.8 to d.10); steep slopes, no cross banks, moderate erosion at base, poor regeneration; consider construction of cross banks and plantings with hardier mature phase species.
r.8 Cmpt. 694, feeder road, from Berry Road to d.14; compaction, poor regeneration; consider ripping and planting with pioneers.
r.9 Cmpt. 694, feeder road, d.14 to d.15; stripping, moderate erosion- failure of cross bank, poor regeneration in places; consider manual reconstruction of cross bank and limited plantings.

r.10Cmpt, 694, snig track, south of d.15; moderate- steep slopes, inadequate spacing of cross banks, erosion starting, stripping, poor regeneration in places; consider construction of additional cross banks and plantings.
r.11Cmpt. 694, snig track (east from Berry Road); poor regeneration- dominance by Solanum. Consider thinning and plantings of relay species. Requires further inspection. N16.
r.12Cmpt. 694, snig track, south of d.17; gentle to steep slopes, failure of cross banks on steep slopes - from d.17 to first creek crossing and scattered throughout, serious erosion in places, poor regeneration- dominance by Solanum; consider manual reconstruction of cross banks and extensive plantings of relay species. Stream crossings need stabilisation. See also 1.5.
r.13Cmpt. 695, snig tracks off Berry Road, to north-east of d.17; poor regeneration in places- dominance by Solanum; consider freeing and plantings in limited areas.
r.14Cmpt. 695, partly constructed extension to Berry Road; slumping- unstable cut and fill in two unstable gully heads with evidence of old natural large slip in one, erosion, poor regeneration; consider closing, stabilising, draining and revegetating road. N19. Strip along beginning of this road (near Berry Road) subject to extensive machine disturbance also has poor regeneration and needs planting.

6.3 HEAVILY LOGGED AND OPEN SITES
Sites;

1.1 Cmpt.695, heavily logged head of gully, adjacent to F6; good regeneration, dominated by Bleeding Heart and Giant Stinging Tree; consider control of Giant Stinging Tree.
1.2 Cmpt.694, heavily logged subtropical rainforest (Crabapple, Yellow Carabeen) west of d.14; good regeneration- dominated by Crabapple, Corkwood, Possumwood, Wild Raspberry and Solanum, inadequate spacing and failure of cross banks- serious erosion in places; consider whether relative densities and diversity of regeneration needs assistance, manual construction and reconstruction of cross banks.
1.3 Cmpt. 695, heavily logged subtropical rainforest area around streams (s.4), west of d.15; regeneration poor- particularly on eastern and southern aspects, large area dominated by Solanum with little regrowth beneath, patches dominated by Wild Raspberry and bracken with little other regrowth; consider freeing and extensive plantings of relay pioneers.
1.4 Cmpt. 694, heavily logged subtropical rainforest in gully, end r.13, north-east d.17; poor regeneration- dominance by Solanum and vines; consider freeing and plantings of relay species.
1.5 Cmpt. 695, heavily logged subtropical rainforest area around stream, along r.12 south of d.17; poor regeneration- dominated by Solanum, with patches dominated by Giant

Stinging Tree, braken and Molucca Bramble; consider freeing and extensive plantings of relay species.
1.6 Cmpt. 695, heavily logged subtropical rainforest; good regeneration. N8.

6.4 FILTER STRIPS AND STREAM CROSSINGS
Sites;

s.1 Boundary Cmpts. 679-695, Berry Road crossing of Main Creek; extensive disturbance, loose soil pushed in creek, serious erosion from Berry Road and old Ewingar Trail; needs further assessment.
s.2 Boundary Cmpts. 695-679, old Ewingar Trail, first creek crossing; extensive disturbance, serious erosion from road. N1.
s.3 Cmpt. 679, old Ewingar Trail, second creek crossing; serious erosion of approaches and crossing, poor regeneration; consider machine construction of cross banks, removal of crossing and planting of initial secondary species.
s.4 Cmpt. 694, three snig track crossings of streams (two flowing) and heavy logging, in filter strip; earth ramps constructed across stream beds- evidence of erosion in high flows, trees dropped and left in stream beds, filter strip heavily logged and disturbed by machinery, serious erosion, poor regeneration- patches dominated by Solanum and areas smothered by brakens, Wild Raspberry, Smooth Nettle and Perrywinkle; consider clearing of logs from stream bed, removal of stream crossings and extensive plantings of relay secondary species. Restoration of filter strip should be given a high priority. Extensive heavy logging in surrounding area (1.3).

7.GENERAL RECOMMENDATIONS

It is evident from the processes currently in place in North Washpool that if nothing is done:

(i)Soil erosion will continue to worsen and further mass soil movements will be inevitable. Sites with deep compaction of soils and/or stripped topsoils will take a long time to recover.

(ii)Complex subtropical rainforests (e.g. type 2) will be reduced in extent and replaced by simpler rainforests of more robust species (e.g. type 3). Some localities will become dominated by Giant Stinging Tree, while others may go through a slow cyclic regeneration process until some indeterminate regeneration process becomes established.

(iii)Towards eucalypt ecotones Brush Box, Tallowwood and/or Sydney Blue Gum will dominate many sites, taking hundreds or thousands of years before they drop out and a more mature rainforest is reinstated.

(iv)On many sites subject to extensive machinery disturbance regeneration will be significantly retarded due to compaction, stripping/erosion of topsoil and/or dominance by inhibitory species.

To assist the respective Committees fulfil their responsibilities to recommend measures to "prevent further soil erosion, and stabilise soils" and "ensure the regeneration of particular impacted areas to rainforest close to the original type" in North Washpool, site specific recommendations have been made in the proceeding section and the following generalised recommendations are made;

7.1.The most urgent priority should be to close, stabilise and revegetate Desert Road and the 1989 extension to Berry Road (r.14).

7.2.Drainage of all roads and tracks should be brought up to at least the standard of the S.E.M.C. This should entail a thorough inspection of all roads and tracks with the repair of all failed cross banks and construction of new banks where required to divert flows into vegetation. The 'riffling' proposed by the Committee will help stabilize steep and bare slopes.

7.3.Eroding creek crossings should be stabilized as soon as possible.

7.4.An ecological typing of all impacted forests in North Washpool should be undertaken so as to identify the original species composition, to act as a guide for assessing regeneration and to delineate suitable species for planting.

7.4.All areas logged in excess of the 50% canopy retention prescription should be identified from aerial photographs and inspected on the ground to determine the status and nature of regeneration.

7.5.Sites where there is poor regeneration of mature phase species should be identified, monitored and considered for supplementary plantings. Suppressed regeneration could be freed during inspection or identified for monitoring. Species poor sites should be identified and considered for supplementary plantings.

7.6.Records of species and volumes of timber removed should be examined to obtain as accurate an indication as possible

as to the right numbers and species to plant out in areas considered for replanting with mature phase species.

7.7.Pencil Cedar and Bleeding Heart are apparently efficient secondary species, as well as providing useful fruit sources, and should be considered for plantings on suitable sites. Attempts should be made to reduce mortality of Strangler Figs.

7.7.Representative and replicated sites should be established in examples of all the major problem areas to enable accurate assessments of changes over time. The basic measurements taken in the surveys of the logging dumps for the Committee will be of limited use in future analysis, it is thus suggested that more precise data be collected at a representative selection of permanent sites.

7.8.It is suggested that signs be erected along major access routes into north Washpool, explaining what is being done and asking people not to interfere with markers or equipment.

8.REFERENCES

Department of Environment and Planning,1982, Proposed Forest Operations in the Washpool Area, Environmental Impact Assessment.

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Fox, M, 1983 A Vegetation Survey of the Washpool Area, Northern New South Wales. Dept. Environment and Planning, Sydney.

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Incerti, Clinnick, Williat 1987

Jakobsen 1983

Jakobsen , Moore 1981

King and Chapman (1983,

Seymour 1981

APPENDIX 1. MAP 1.

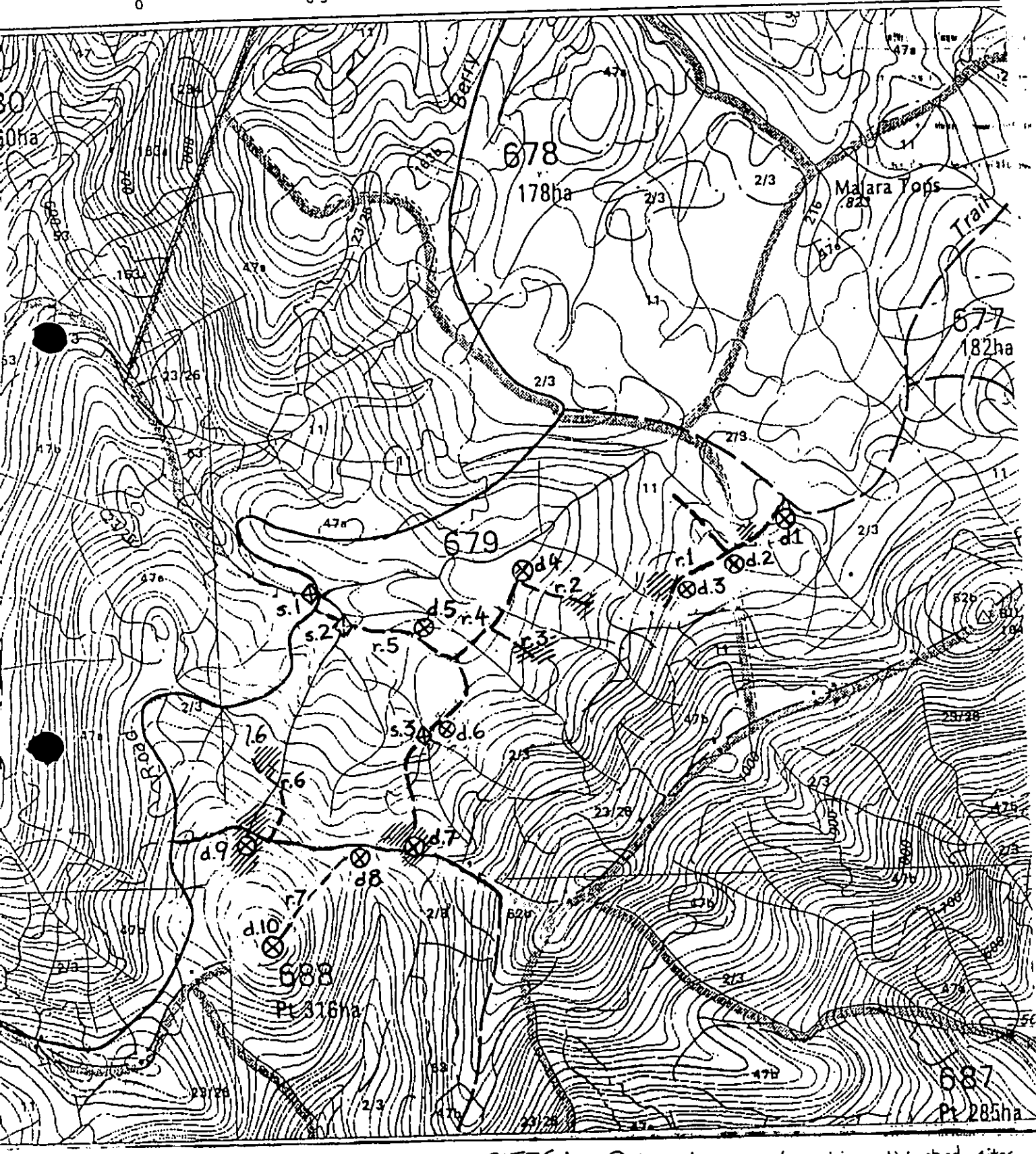
Compartment 679

Scale — 1 : 15 000

0 0·5 1 km.

Contour interval 10 m

G N



SITES:

- ⊗ Log dumps and machine disturbed sites
- ⊕ Filter strips and streams
- ---- Roads and tracks
- //// Heavily logged sites

APPENDIX 1 MAP 2

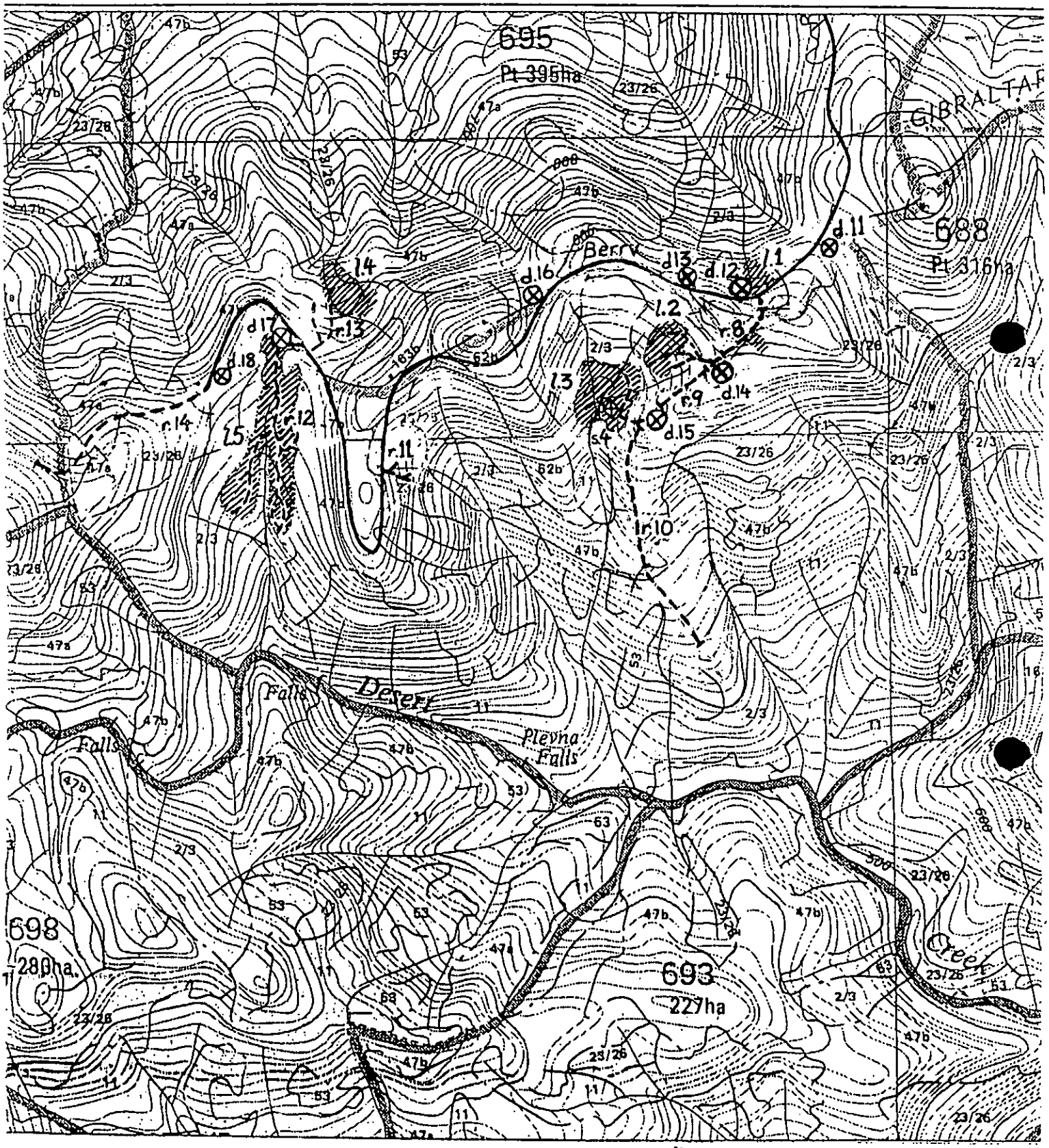
Compartment 694

Scale — 1 : 15 000

0 0·5 1 km.

Contour interval 10 m

G N



SITES: ⊗ Log dumps and machine disturbed sites

⊕ Filter strips and streams

---- Roads and tracks

//// Heavily logged sites

30.39

NORTH WASHPOOL

NATURAL AND CULTURAL HERITAGE

CONSERVATION

August 1990

CONTENTS

SUMMARY

PART 1: INTRODUCTION

PART 2: INVENTORY OF HERITAGE VALUES

2.1 World Heritage
2.2 Regional Setting
2.3 Landforms, Geology and Soils
2.4 Flora
2.5 Fauna
2.6 Wilderness
2.7 Aboriginal Cultural Heritage
2.8 European Cultural Heritage

PART 3: EVALUATION OF HERITAGE VALUES

3.1 World Heritage
3.2 Regional Significance
3.3 Landforms, Geology and Soils
3.4 Flora
3.5 Fauna
3.6 Wilderness
3.7 Aboriginal Cultural Heritage
3.8 European Cultural Heritage
3.9 Impact of Proposed Logging

PART 4: OPTIONS FOR PROTECTION

REFERENCES:

Appendix 1: Native Vegetation Associations

Appendix 2: Rare, Threatened or Significant Plant Species recorded the Washpool Area.

Appendix 4: Vertebrate Fauna from the Washpool Area.

SUMMARY OF THE HERITAGE VALUES OF NORTH WASHPOOL

The tall old growth forests, (Wet and dry sclerophyl) coachwood rainforest and wilderness are the pre-eminent heritage conservation values of the North Washpool. Ecologically it is an integral part of the larger Washpool Wilderness area. Furthermore, protection of these values would automatically enhance the heritage conservation values and ecological integrity of the existing park/ wilderness and area/ world heritage area.

WORLD HERITAGE

- North Washpool would readily qualify for addition to the World Heritage listed Australian East Coast Temperature and Subtropical Rain Forest Parks which includes the adjoining Washpool National Park, on the basis of containing, either alone or in association with Washpool National Park, natural heritage of outstanding universal value.

- North Washpool has an essential influence on the natural heritage value and ecological integrity the Washpool component of the World Heritage Area.

REGIONAL SIGNIFICANCE

- North Washpool, either alone or in association with the Washpool, Gibraltar Range and Nymboida National Parks has regional significance for landscape and biological conservation, habitat diversity, environmental education, wildernesss, tourism and recreation.

WILDERNESS

- North Washpool, qualifies as an addition to the existing Washpool Wilderness Area. The larger area contains features of outstanding wilderness significance including the largest undisturbed tall forest and highest proportion of rainforest and tall old growth forest of any wilderness in New South Wales.

FLORA

- North Washpool includes part of the Willowie Scrub, the largest remaining area of warm temperate rainforest dominated by Coachwood in the World. Protection of North Washpool would complete protection of the Willowie Scrub.

- North Washpool is expected to support most or all of the 14 rare, threatened or significant plant species known from the Washpool area. One of the rare species has only recently been found in North Washpool. This highlights the need for more intensive surveys in the area.

- The Malara Creek section of North Washpool includes aspects and topographic features which have lead to the development of extensive dry sclerophyll forest types which are poorly represented in Washpool National Park.

- North Washpool supports a rich mosaic of rainforest and eucalypt forests. It is exceptional for the richness of gradations between different rainforest types and forest with eucalpyt canopy over rainforest understorey.

FAUNA

- The most diverse species assesmbleges for many faunal groups are found not in rainforest, but in wet sclerophyl forests, and can largely be related to the structural diversity of these communities.

- The North Washpool area is considered significant for vertebrate fauna because of:

  (i) the likely presence of rare species such as Rufous Scrub-bird (*Atrichornis rufescens*), Tiger Quoll (*Dasyurus maculatus*), Long-nosed Potoroo (*Potorous tridactylus*), Pouched Frog (Assa darlingtoni),

  (ii) high population densities of gold growth dependent and tall open forest dependent species, such as arboreal mammals, owls and parrots,

  (iii) importance as a comparatively unroaded area with associated lack of feral species including Black Rats (*Rattus rattus*) and House Mice (*Mus musculus*) and in particular carnivores such as the Fox (*Vulpes vulpes*) which have decimated rat kangaroo and medium terestrial mammal populations over much of Australia.

ABORIGINAL CULTURAL HERITAGE

- The local Aboriginal people of the Bundjalung are a culturally aware, tribal group of descendant owners of the cultural resource.

- North Washpool has and continues to represent a rugged but productive hinterland for the Clarence Valley Aboriginal people, containing rainforest and wet eucalypt forest plant and animal resources not available in developed land systems of the main Clarence River Valley.

- Established ceremonial sites in the Desert Creek and claimed sites in the Malara Creek must be seen to have regional social and scientific significance. No similar concentration of sites is known for Washpool National Park.

- The known and projected cultural resources have systemic values rarely seen in cultural systems in eastern NSW.

EUROPEAN CULTURAL HERITAGE

- The principal historic values of the area relate to the significance squatting run at Yalgilbar, an impressive record of accord between European settlers and the local Aboriginal people and the early gold mining history in remote and regged rainforest of the Washpool area.

Coachwood *Ceratopetalum apetalum* is the most common tree in the warm temperate rainforests of Willowie Scrub. This rainforest area covers about 3000 hectares and extends from Washpool National Park into the catchments of Malara and Desert Creeks in the North Washpool area. The Willowie Scrub is the largest remaining area of Coachwood warm temperate rainforest in Australia and therefore in the World.

Photo: G.Biddle

Tiger Quoll (or Spotted-tailed Quoll) *Dasyurus maculatus* is the largest remaining marsupial carnivore in Australia. The escarpment forests of the NSW North Coast, and particularly Washpool area have been suggested as a nationally significant refuge area for this species.

Photo: Nev Fenton

Malara Creek provides a combination of clear water, exposed bedrock and forest setting. It is the ideal setting for those seeking solitude in an unaltered environment.

Photo: G.Biddle

PART 1: INTRODUCTION

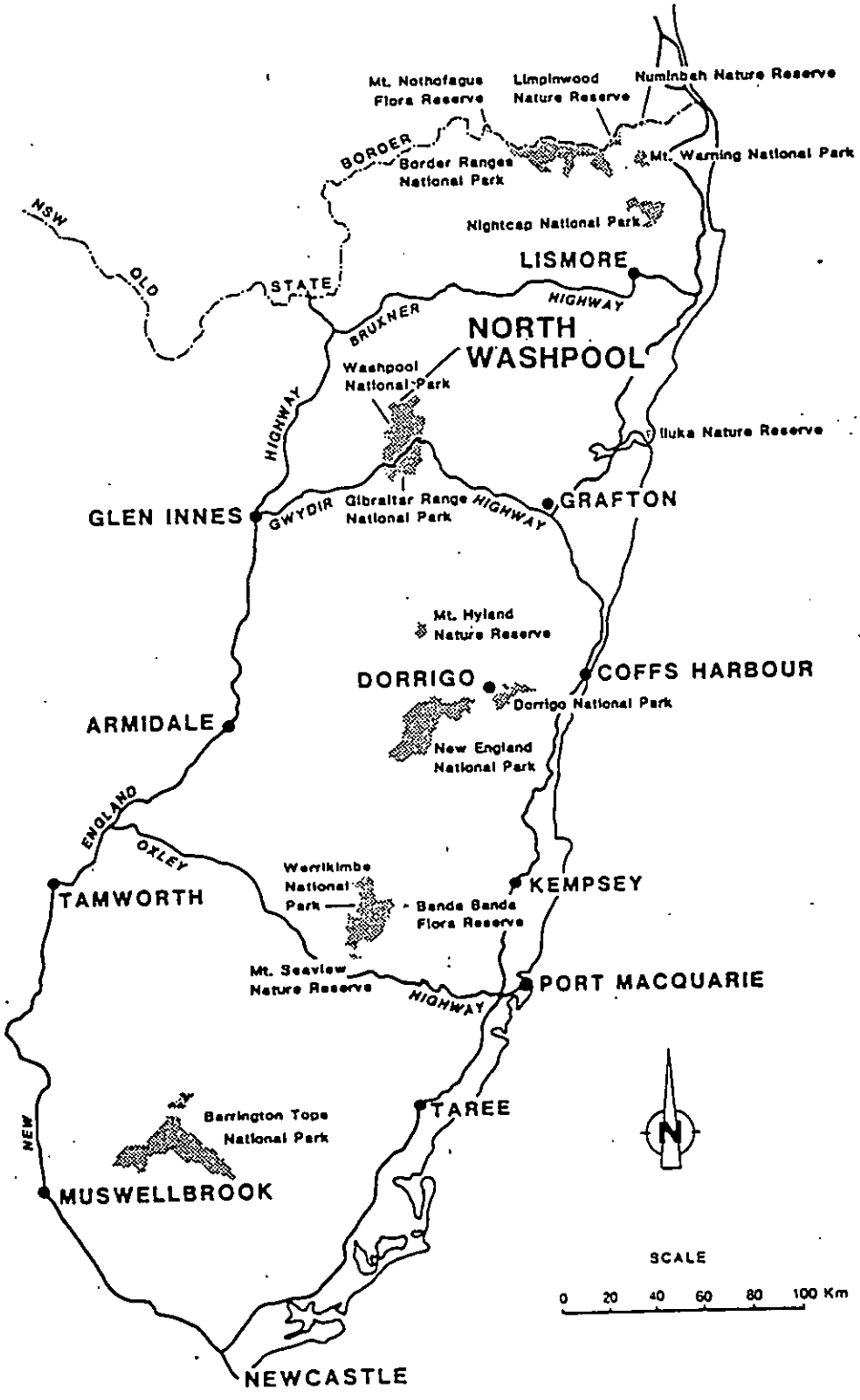
In response to a community nomination the National Parks and Wildlife Service has assessed wilderness values in the North Washpool area. The assessment by the National Parks and Wildlife Service, which is the subject of a separate report, identified an area which satisfied the requirements of the Wilderness Act 1987, for identification and declaration as an addition to the existing Washpool Wilderness Area in Washpool National Park.

The area identified as wilderness approximates an area proposed for inclusion within Washpool National Park as early as 1979.

North Washpool is part of a larger area, the Washpool wilderness area, with important natural and cultural heritage values, of which wilderness is but one component.

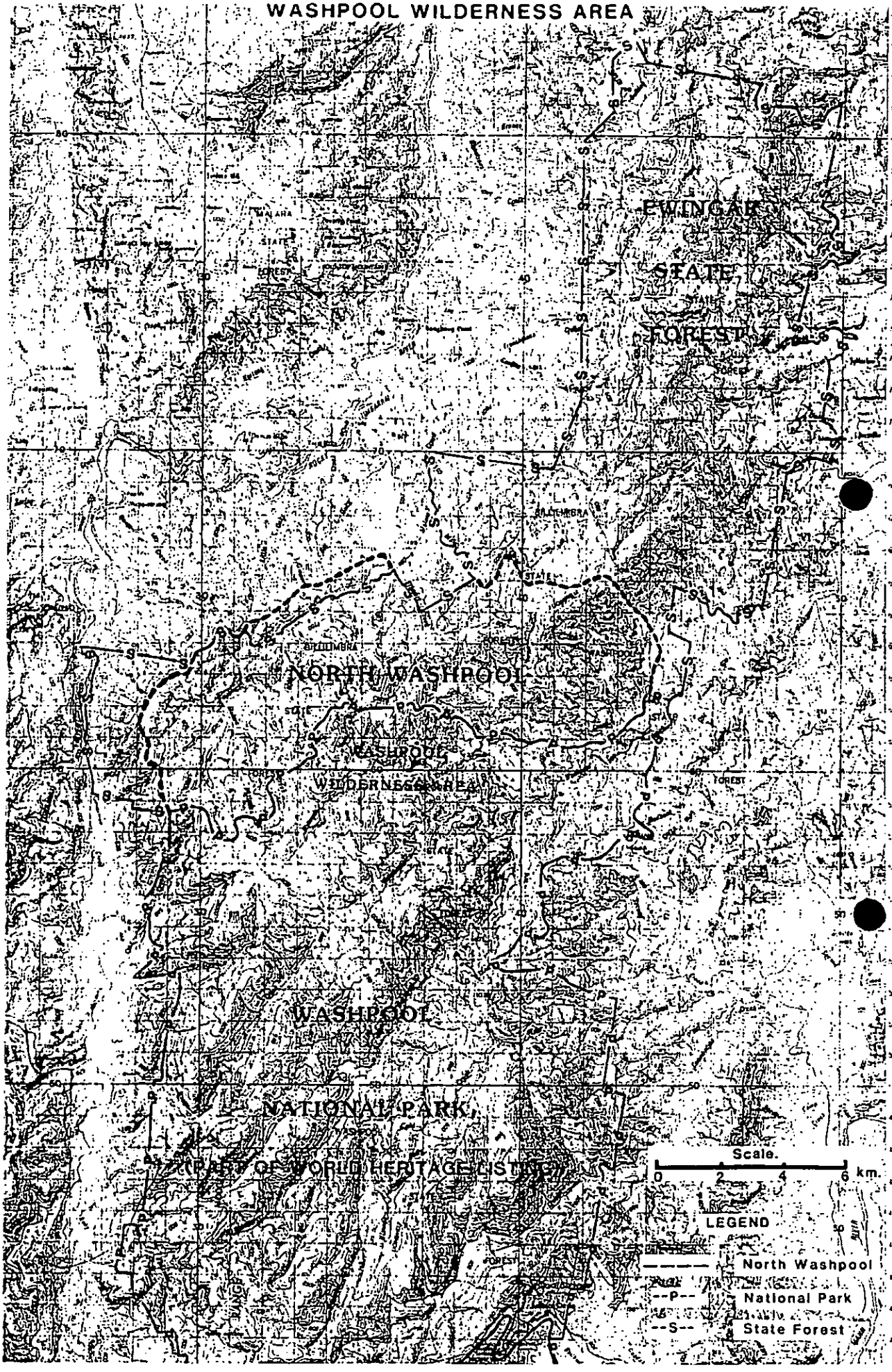
This report identifies and assesses the heritage conservation values for North Washpool viz. wildlife, wilderness, World Heritage listing, Aboriginal, historic, recreation and education values, and develops options for their protection.

World Heritage Sub-tropical And Temperate Rainforest Parks Of Eastern Australia



NORTH WASHPOOL ADDITION TO WASHPOOL WILDERNESS AREA

MAP 2.



PART 2: INVENTORY OF HERITAGE VALUES

2.1 WORLD HERITAGE

The International Convention for the Protection of the World Cultural and Natural Heritage (The World Heritage Convention) provides a permanent legal and administrative framework for international co-operation to safe-guard the cultural and natural heritage of mankind.

In accordance with Article 2 of the Convention, the following is considered as "natural heritage":

> "natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view;
>
> geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value form the point of view of science, conservation or natural beauty".

A natural heritage property is considered to be of outstanding universal value for the purposes of the Convention if it meets one or more of the following criteria:

(i) outstanding examples representing the major stages of the earth's evolutionary history; or

(ii) outstanding examples representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment;as distinct from the periods of the earth's development, this focuses upon ongoing processes in the development of communities of plants and animals , landforms and marine areas and fresh water bodies; or

(iii) contain superlative natural phenomena, formation or features, for instance, outstanding examples ofthe most important ecosystems, areas of exceptional natural beauty or exceptional combinations of natural and cultural elements; or

(iv) contain the most important and significant natural habitats where threatened species of animals or plants of outstanding universal value from the point of view of science or conservation still survive.

The Operational Guidelines for the implementation of the World Heritage Convention state in relation to the protection of World Heritage Areas:-

"Whenever necessary for the proper conservation of a cultural or natural property nominated, an adequate "buffer zone" around a property should be foreseen and should be afforded the necessary protection. A buffer zone can be defined as an area surrounding the property which has an essential influence on the physical state of the property and/or on the way in which the property is perceived; the area constituting the buffer zone should be determined in each case through technical studies. Details on the size and characteristics of a buffer zone, as well as a map indicating its precise boundaries, should be provided in the nomination file relating to the property in question." (para 1A)

Washpool and Gibraltar Range National Parks together represent one of a group of six (6) geographically disjunct centres of rainforest included in the World Heritage listed property known as the "Australian East Coast Temperate and Subtropical Rain Forest Parks" (see map 1). These parks were accepted for listing in 1986 on the basis of their natural heritage values which include:

* outstanding examples of the major rainforest types in New South Wales;

* sites in which rainforest forms a large proportion of the total vegetation cover;

* rainforest stands sufficiently large and appropriately buffered by surrounding vegetation for the long term integrity of their vegetation to be assured;

* the major regional centres of rainforest present at the time of European settlement; and

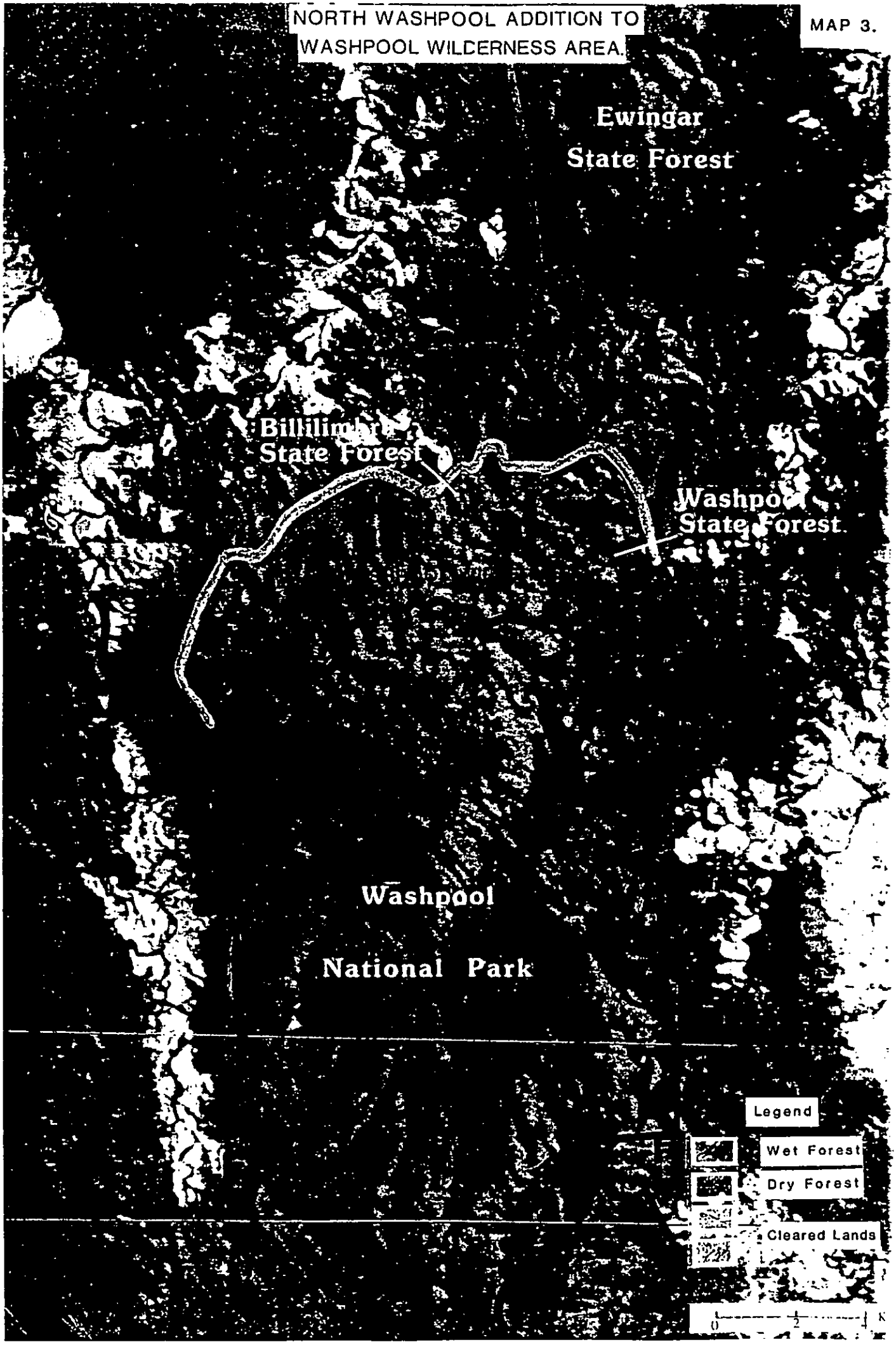
* sites with other features of international or national significance in addition to the rainforests; for example, outstanding geological or scenic features or particularly fine examples of sclerophyll communities.

The other in Australia listed under the World Heritage Convention include Kakadu National Park, the Great Barrier Reef, Willandra Lakes Region, Western Tasmania Wilderness National Parks, the Lord Howe Island Group and Uluru National Park.

2.2 REGIONAL SETTING

North Washpool adjoins the northern boundary of Washpool National Park with both areas lying north of the Gwydir Highway midway between Grafton and Glen Innes. (see Map 2)

North Washpool together with Washpool, Gibraltar Range and Nymboida National Park lie in an interesting but as yet incompletely understood block of rugged mountainous country bounded by the Timbarra (Rocky), Mann and Clarence Rivers. The western boundary approximately follows the Demon Fault while the eastern boundary approximates the escarpment. (see Map 3)

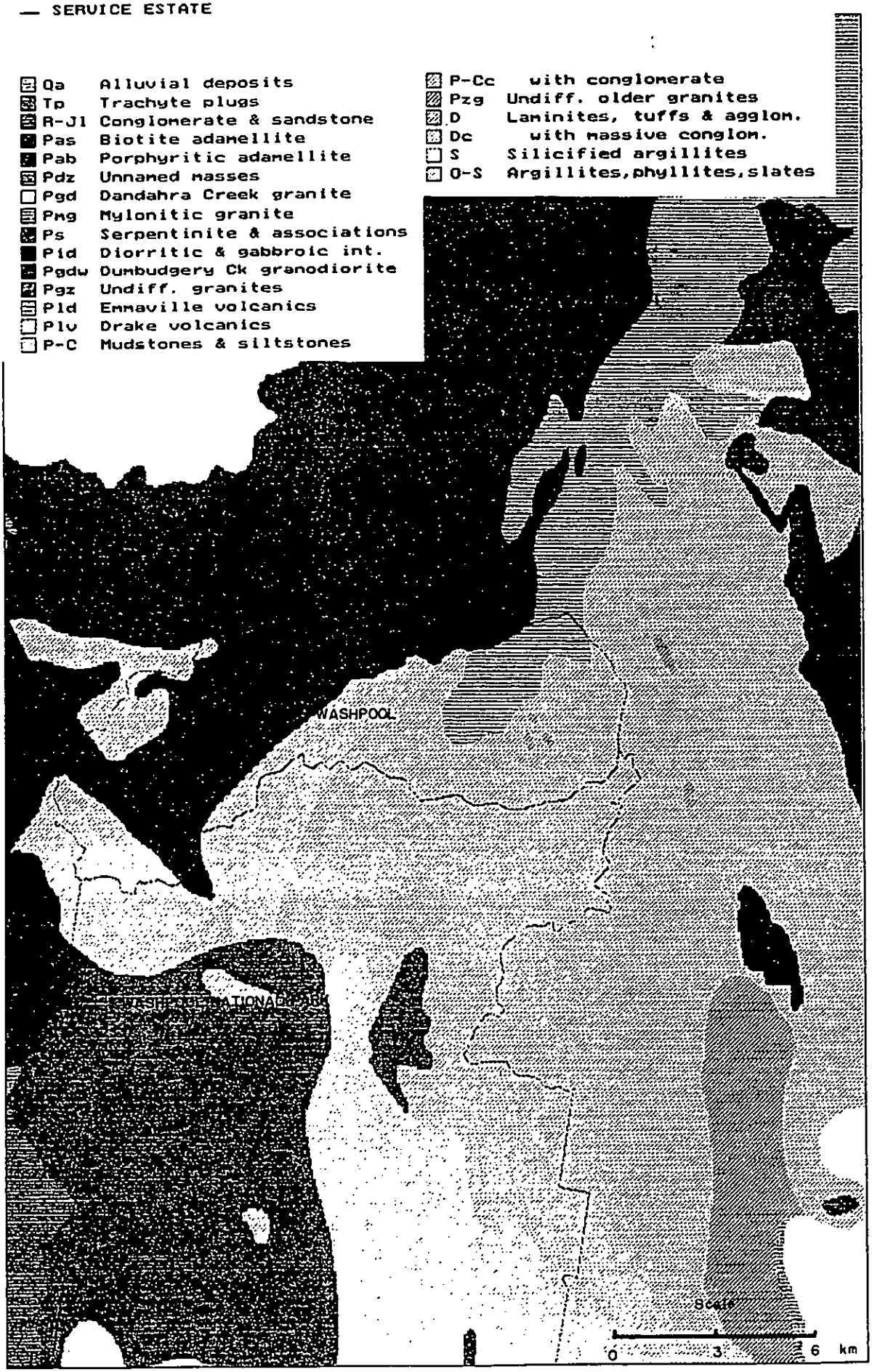

NORTH WASHPOOL ADDITION TO
WASHPOOL WILDERNESS AREA.
MAP 3.
Ewingar
State Forest
Billilimbra
State Forest
Washpool
State Forest
Washpool
National Park
Legend
Wet Forest
Dry Forest
Cleared Lands
0
1
2
K

GEOLOGY OF THE
WASHPOOL AREA

MAP 4

— WILDERNESS NOMINATION AREA
— SERVICE ESTATE

Qa Alluvial deposits
Tp Trachyte plugs
R-J1 Conglomerate & sandstone
Pas Biotite adamellite
Pab Porphyritic adamellite
Pdz Unnamed masses
Pgd Dandahra Creek granite
Pmg Mylonitic granite
Ps Serpentinite & associations
Pid Diorritic & gabbroic int.
Pgdw Dumbudgery Ck granodiorite
Pgz Undiff. granites
Pld Emmaville volcanics
Plv Drake volcanics
P-C Mudstones & siltstones
P-Cc with conglomerate
Pzg Undiff. older granites
D Laminites, tuffs & agglom.
Dc with massive conglom.
S Silicified argillites
O-S Argillites,phyllites,slates



The Gwydir Highway divides the larger area into two large relatively unmodified tracts of natural land the 'Mann River' and the 'Washpool'. These areas have been recognised as including World Heritage values, Wilderness Areas and (the Washpool, Coombadjha and Mann) Wild and Scenic Rivers.

2.3 GEOLOGY, LANDFORMS AND SOILS

North Washpool is situated on the eastern edge of the New England Fold Belt where the Ordovician - Silurian sediments were metamorphosed over the Devonian to Permian periods by the intrusion of the granite of the New England Batholith to form argillites, slates and phyllites. Siliceous volcanic activity (Drake Volcanics) were associated with this intrusion; these volcanics are related to the volcanics in the Coombadjha Volcanic Complex to the south in the Washpool Wilderness Area. Stanthorpe Adamellite and older metamorphosed sedimentary rocks also occur in the area. Geology of the area is shown on Map 4.

The variability of the area in terms of soil parent material topography and vegetation results in a variety considerable complex of soil types. Red earths, brown earths, red podzolic soils and yellow poszolic soils occur in the area. Red earths and brown earths are the most fertile types and are able to support rainforest and wet sclerophyll forest.

The Gibraltar Range is the main topographic feature of the North Washpool area. It runs generally from south-west to north-east through the area and is the watershed between the two catchments - Desert Creek to the east and south of the range and Malara Creek to the west and north.

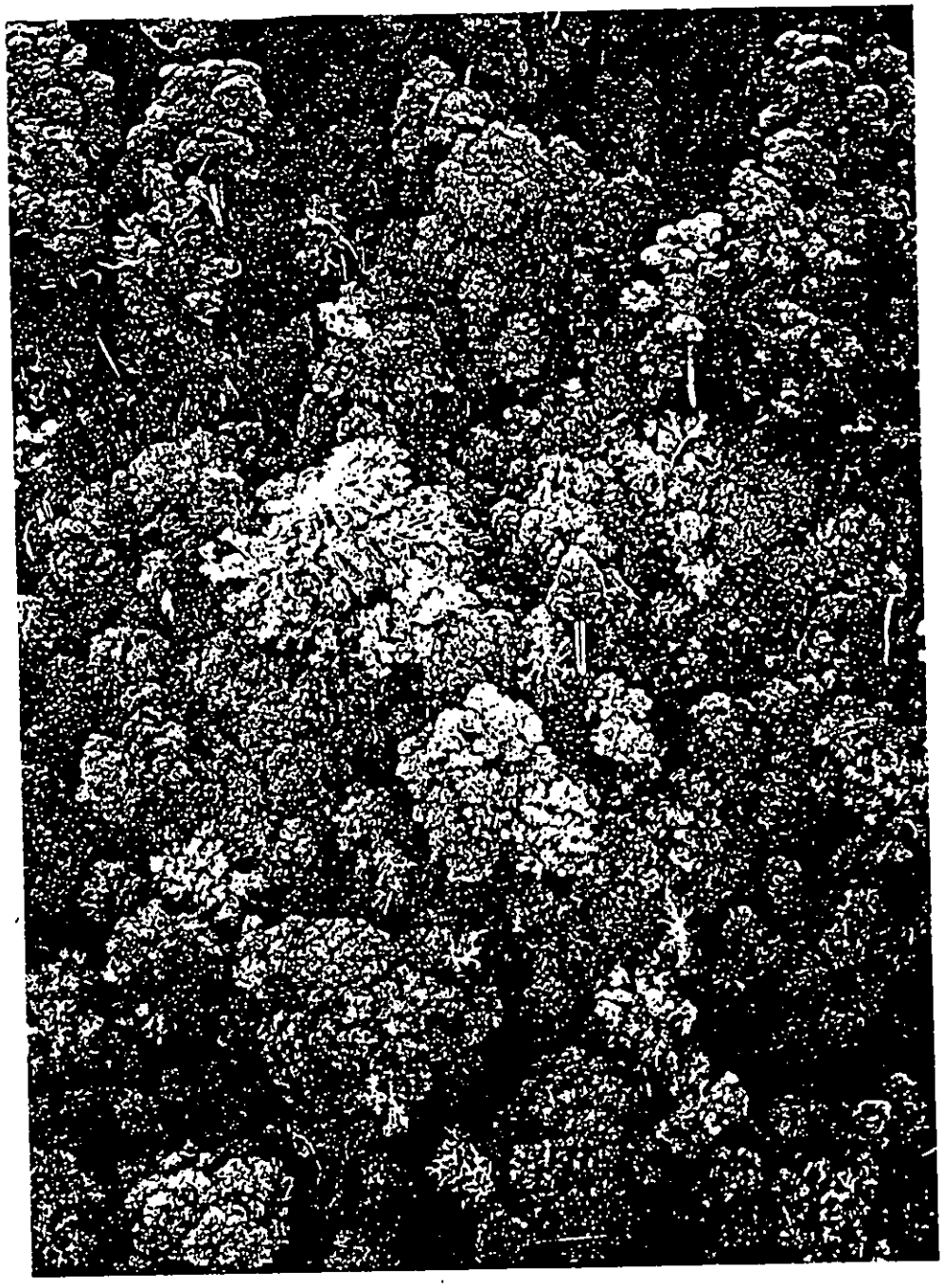
A number of the peaks on the Gibraltar Range reach over 1000m in altitude, with Hayden's Trig (1175m) and Mount Billilimba (1041m) being the most prominent in North Washpool. Map 5 shows elevation classes in the Washpool area.

Desert Creek has an altitudinal range of over 800 metres. The slopes from Desert Spur to the south of the creek and Gibraltar Range to the west and north to the creek are often very steep but smaller gently sloping plateau-like remnants are present in some areas. Small narrow canyons and waterfalls are common along Desert Creek.

Slopes are also steep in parts of the upper catchment of Malara Creek and canyons, waterfall and cascades are also common. There is however a relatively large area in Malara Creek basin between Gibraltar Range and the main creek which is more gently inclined, forming a topographic middle altitude shelf or terrace.

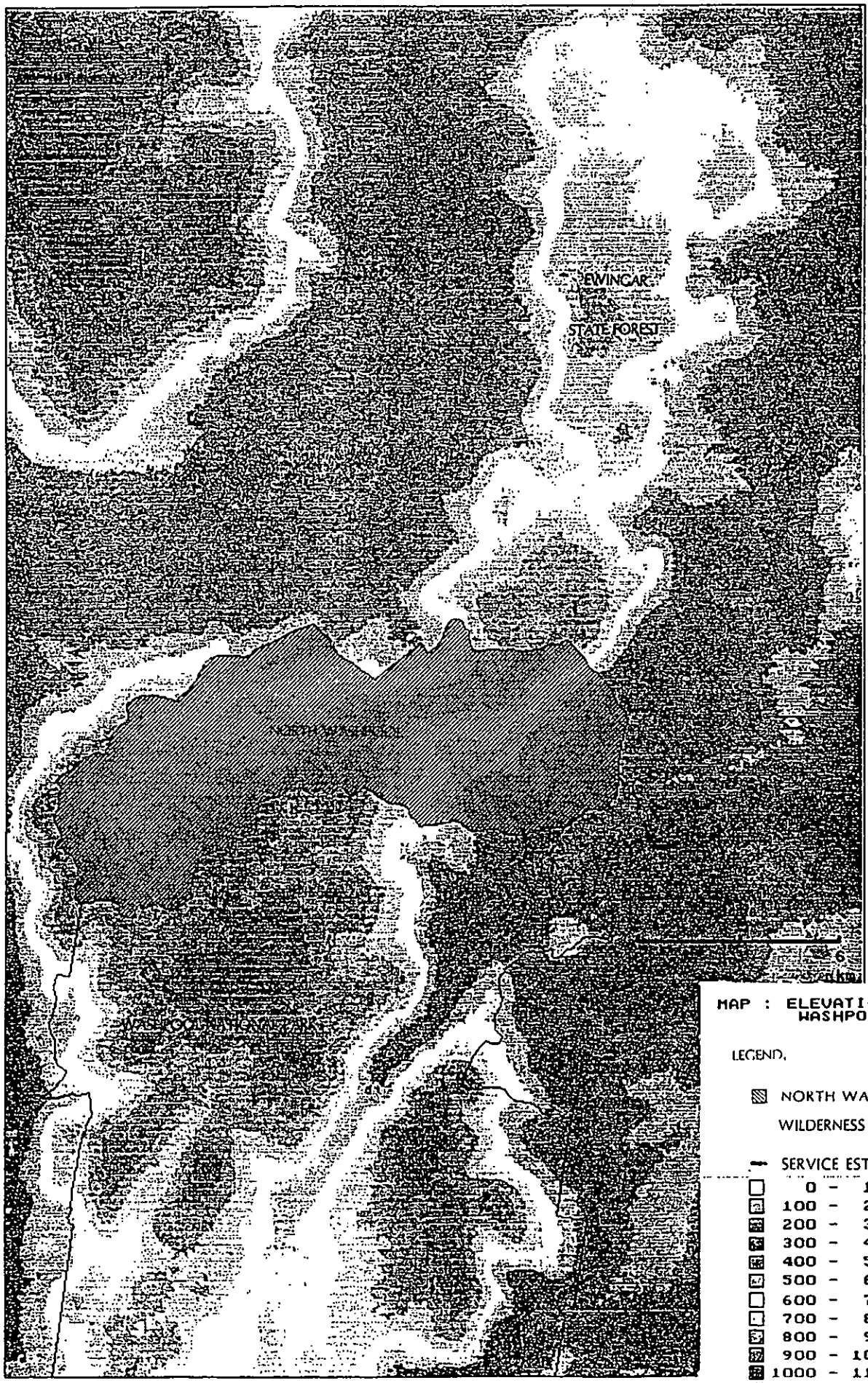
Red Cedar *Toona australis* was the "Red gold" of the east coast rainforest and was eagerly sought out by early timbergetters. The "Cedar King" Bill Haydon disappeared while looking for cedar in the Desert Creek area and today the Washpool area retains what are probably the best stands of Red Cedar left in New South Wales.

Photo: S.Barnett



The temperate rainforests of the North Washpool area are predominantly of the warm temperate type but include many areas where subtropical rainforest species are relatively common. The area provides good opportunities to study the inter-relationships between the two rainforest types.

Photo: G.Biddle



MAP : ELEVATION OF THE WASHPOOL AREA

LEGEND.

- NORTH WASHPOOL WILDERNESS NOMINATION AREA
- SERVICE ESTATE
- 0 - 100 metres
- 100 - 200 metres
- 200 - 300 metres
- 300 - 400 metres
- 400 - 500 metres
- 500 - 600 metres
- 600 - 700 metres
- 700 - 800 metres
- 800 - 900 metres
- 900 - 1000 metres
- 1000 - 1100 metres
- 1100 - 1200 metres
- > 1200 metres

2.4 FLORA

There is little published information on the vegetation of North Washpool. Fox (1983) provides the most comprehensive analysis of the vegetation of Washpool area generally; this includes data from 8 sites in North Washpool. FC NSW (1980) discussion of the vegetation of the Washpool area included data from unpublished reports by Floyd (1978, 1980) and from 8 other sites (2 of which were south of the Washpool area). The Floyd reports provide information on Willowie Scrub (Floyd 1978), part of which extends into North Washpool, and southern Washpool (Floyd, 1980), which, while totally outside North Washpool, does provide useful background material for assessment of North Washpool.

The Washpool area, which includes North Washpool, is the largest remaining virtually undisturbed moist forest unit in northern New South Wales (Fox, 1983). Vegetation in North Washpool is very diverse ranging from subtropical rainforest to dry sclerophyll forest. (see Map 6) Four broad vegetation types - rainforest, wet sclerophyll forest, dry sclerophyll forest and scrub - occur. Appendix One lists the native vegetation associations.

Major features of the vegetation are the diversity of warm temperate rainforest types, the interactions between different rainforest subforms and between rainforests and sclerophyll forest, and the extensive tall old growth sclerophyll forests.

Rainforest (Closed Forest)

The most extensive subform is warm temperate rainforest. Subtropical rainforest is more limited in extent.

Subtropical rainforest occurs as patches throughout the area and as a small area on undulating land in the head of Malara Creek. It is generally confined to sheltered moist aspects in gully heads with deep soils and at the junction of creeks with deeper alluvial soils. It appears to be correlated with the distribution of soils derived from the Drake Volcanics, the soils from granites and metamorphic rocks being generally too poor to support this subform.

Floyd (1978) commented that subtropical rainforest in the Washpool area is set as "islands in a sea of warm temperate rainforest" and therefore contain fewer species than the more extensive areas of subtropical rainforest to the north, in areas such as Wiangaree Plateau.

Intergrades between subtropical and warm temperate rainforest types are very common and several intermediate associations can be recognised. Within the true subtropical types present there is an altitudinal gradation from lowland subtropical rainforest to a higher altitude type which resembles an impoverished form of the cool subtropical rainforest on Wiangarie Plateau.

MAP : VEGETATION OF NORTH WASHPOOL

	VEGETATION TYPE		North Washpool Total area		Malara Creek Catchment		Desert Creek Catchment	
			Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
■	2/3	Yellow Carabeen - Crabapple-Sassafras-Corkwood-Silver Sycamore	482.0	6.6	125.8	2.9	356.3	12.3
	7	Palm	0.3	0.0	0.3	0.0	0.3	0.0
■	11	Coachwood-Crabapple	507.3	7.0	217.0	5.0	289.5	10.0
■	23/26	Myrtle-Viney Scrub	739.8	10.2	176.8	4.0	563.0	19.5
□	47	Tallowwood-Sydney Blue Gum	41.0	0.6	41.0	0.9	0.0	0.0
□	47a	Tallowwood-Sydney Blue Gum Site height gen. >40m	970.5	13.3	784.5	17.9	186.0	6.4
□	47b	Tallowwood-Sydney Blue Gum Site height gen. <40m	1409.3	19.4	508.8	11.6	900.5	31.2
▩	53	Inland Brush Box	250.3	3.4	121.8	2.8	128.5	4.4
■	62a	Grey Gum-Grey Ironbark White Mahogany Site height gen. >25m.	1270.3	17.4	967.0	22.0	303.3	10.5
■	62b	Grey Gum-Grey Ironbark White Mahogany Site height gen. <25m.	928.3	12.7	838.0	19.1	90.3	3.1
■	62ra	Grey Gum-Grey Iron bark White Mahogany Regeneration site height generally >25m.	8.3	0.1	8.3	0.2	0.0	0.0
■	62rb	Grey Gum-Grey Iron bark White Mahogany Regeneration site height generally <25m.	2.5	0.1	2.5	0.1	0.0	0.0
▩	65	Forest Red Gum-Grey Gum/ Grey Ironbark-Roughbarked Apple	15.8	0.2	15.8	0.4	0.0	0.0
▩	163a	New England Blackbutt Site height gen. >25m.	208.0	2.9	208.0	4.7	0.0	0.0
□	163b	New England Blackbutt Site height gen. <25m.	448.8	6.2	376.0	8.6	72.8	2.5

Warm temperate rainforest occurs on less fertile soils, such as those derived from sedimentary, metamorphic and quartz-rich igneous rocks. It is dominated by trees of the family Cunoniaceae - Coachwood, Corkwood, Callicoma and Crabapple.

Willowie Scrub is recognised as the largest remaining area of warm temperate rainforest domiinated by Coachwood in Australia, and therefore of world significance. It occurs largely in the north-western part of the Washpool Wilderness Area but extends into Desert and Malara Creeks in North Washpool (Floyd, 1978).

Two associations are recognised in the warm temperate rainforests of the area - the Coachwood - Yellow Carabeen Association, and the Coachwood - Crabapple Association. The first is intermediate between the subtropical rainforest and the second warm temperate rainforest association. This second association is a true warm temperate rainforest type.

Floyd (1978) notes that the warm temperate rainforests of the area encompass a broad range of associations of Coachwood with Yellow Carabeen, Crabapple, Corkwood and Callicoma.

Cyclone damage is particularly prevalent in the warm temperate rainforests of the area, giving rise to low and broken stands and vine tangle.

Wet Scrub

This vegetation type occurs in North Washpool on high exposed ridges along the Gibraltar Range in areas such as Hayden's Trig where soils are shallow and rock is common but precipitation is high. Oval Mint-bush and Lemon-scented Tea-tree are very common and may be overtopped by New England Blackbutt. A mixture of rainforest and sclerophyllous shrubs occur with the dominants.

Dry Scrub

Dry scrub occurs on steep rocky outcrops on some of the north facing slopes of Desert Creek and the north and west facing slopes of Malara Creek. This type ranges from a depauperate dry rainforest to xerophytic shrub communities. Xerophytic species such as Dwarf Cypress Pine, Lemon-scented Tea-tree and Grey Myrtle occur on skeletal soils. Rainforest species such as Sweet Pittosporum, Rusty Fig, Silky Oak, Shatterwood and Red Cedar, occur on sites with deeper soils.

Wet Sclerophyll Forest (Tall Open Forest)

Fine examples of this forest type occur in both the Desert and Malara Creek catchments. The tall tree layer consists mainly of Brush Box, Sydney Blue Gum and Tallowwood in varying combinations and abundances. These associations are recognised - Brush Box, Tallowwood - Sydney Blue Gum, and New England Blackbutt.

Tallowwood *Eucalyptus microcorys* is a common dominant of the tall old growth forests of the North Washpool, with heights of 70 metres and more, these ancient moist hardwoods often have an understory of developing rainforest. A large Sydney Blue Gum *E.saligna* can be seen in the background; this species is another common dominant of these old growth forests.

Photo: S.Barnett.

The Brush Box association occurs where fires are very infrequent or even absent. Brush Box is the major overstorey species; a few emergent Sydney Blue Gum and Tallowwood may be present. The understorey is frequently well developed rainforest. In some cases this association may be a late stage in a succession to pure rainforest and it frequently intergrades with rainforest.

The Tallowwood - Sydney Blue Gum association occurs on sites where fire is more frequent. Sydney Blue Gum and Tallowwood are usually of equal importance and some Brush Box is usually present. The understorey is commonly made up of a thick layer of pioneer rainforest shrubs and small trees. On sites when fires are more common the understorey tends towards a fire-prone mix of Bladey Grass, Kangaroo Grass and Bracken Fern. Sydney Blue Gum is the most common canopy tree on these sites with some Tallowwood; Brush Box is infrequent.

The New England Blackbutt association is very similar to the Tallowwood - Sydney Blue Gum association in structure, except that New England Blackbutt is the clear dominant. It only occurs above 600m altitude, generally on poorer soils with a higher quartz content than the other wet sclerophyll forest associations. The understorey is of broad-leaved shrubs which tend to only burn under infrequent extreme fire conditions. Associated small trees and shrubs include White Banksia, Tree Heath, Giant Grass Tree and Lance Beard-heath. On poorer drier ridges and slopes where fires are hot and frequent this association forms a dry sclerophyll forest type.

The tall open forests of North Washpool include extensive areas of "old growth" tall open forest. This is essentially tall open forest in which many of the upper canopy members have reached physiological maturity (that is, the net growth of those trees is minimal). Such forests are characterised by the presence of individual physiologically mature trees, standing dead trees (stags), and large dead trunks or logs above a threshhold value which varies between forest types and reflects maximum tree size in combination with site potential productivity. For example, Dunning and Smith (1986) recorded a mean of 16 and a range of 8 to 30 mature trees per hectare in unlogged mature moist hardwood forest of the Blue Gum - Tallowwood - Brush Box type in Mt Boss SF. The disturbance regime of a particular site influences the rates of production and loss of old growth attributes. This means that history of perturbation does not provide a sound basis for differentiating old growth from non old growth forest.

A striking feature of the old growth tall open forests of the North Washpool area is the presence of large specimens of Brush Box, Tallowwood and Sydney Blue Gum which may reach 70 metres and more in height. A well-developed rainforest understorey is another feature of much of this old growth forest type in the area.

Dry Sclerophyll Forest (Tall Open Forest to Open Forest)

This forest type is common on the fire-prone dry lower slopes of the catchments of both Desert and Malara Creeks. This forest type is particularly well developed to the east of Malara Creek but is not common in the existing Washpool Wilderness Area.

Three associations occur in North Washpool - New England Blackbutt, Grey Gum/Grey Ironbark - White Mahogany, and Forest Red Gum - Grey Gum/Grey Ironbark - Roughbarked Apple.

The dry sclerophyll New England Blackbutt association occurs on poorer drier ridges and slopes than the wet scleropyll New England Blackbutt association but the two may adjoin. The dry sclerophyll association has a fire-prone understorey of grasses and scattered shrubs and the trees are normally only average to low in height with fire-damaged crowns.

The Grey Gum - Grey Ironbark - White Mahogany association is the most widespread dry sclerophyll forest type in North Washpool. Below the open upper canopy of dominant eucalypts is an open grassy understorey with scattered shrubs such as Giant Grass Tree and Twisted Burrawang.

The Forest Red Gum - Grey Gum/Grey Ironbark - Roughbarked Apple association is very limited in occurence in North Washpool, being confined to steep, dry lower to mid slope sites in areas such as north and west of Malara Creek. It grades into the previous association and normally has a grassy understorey.

Like the wet sclerophyll forest, the dry sclerophyll forest of North Washpool is essentially undisturbed by human activities. The possible exception is some change in fire regime associated with the grazing of cattle in the area. Fire however is an integral part of the ecology of this forest type and there is no evidence to suggest that the North Washpool dry sclerophyll forest has been appreciably modified by recent human activities. These therefore remain as fine examples of old growth tall open and old growth open forest.

Plant Species

Information on plant species present in North Washpool is limited. Eight of the sites sampled by the National Herbarium (Fox 1983) and/or Floyd (1978) were in the area but species lists are not available for all of these sites. Fox (1983) records 501 plant species from the Washpool Area. It can be confidently predicted that most of these species occur in North Washpool.

Twenty six species additional to those recorded by Fox (1983) have been collected in the area during limited sampling by National Parks and Wildlife Staff.

The Upper Malara Creek catchment contains a mosaic of rainforest and old growth eucalypt forest. Tongues of rainforest extend from Willowie Scrub,(in background), across saddles in the Gibraltar Range and down gullies and tributaries of Malara Creek. Eucalypt forest occupies the ridges and slopes running west and north-west from Gibraltar Range and extends as tongues along old firepaths into the Willowie Scrub rainforest. The North Washpool area provides an exceptional site for undertaking studies of the inter-relationships of these broad vegetation types. Roading and logging of the area would inevitably result in changes in fire frequency and intensity which have the potential to alter the Willowie Scrub.

Photo: G.Biddle

It remains unclear how important North Washpool is as a refuge for rare, threatened or significant species. Floyd (1978, 1980) recorded three such species in the Washpool area. Fox (1983) lists 70 species (for the Washpool area) regarded as rare, resitricted in geographic distribution district, at or near their geographic limits, or represented by only a few collections in the National Herbarium of New South Wales.

Appendix Two lists rare, threatened or significant species known to occur in the Washpool area. The 14 species listed result from a combination of the records of Floyd (1978, 1980), critically editing of the list of 70 species in Fox (1983) and more recent limited work in North Washpool by National Parks and Wildlife Service staff. These include 3 species listed as rare or threatened (Briggs and Leigh 1988) - *Dodonaea megazyga, Marsdenia longiloba and Syzygium moorei* - and 11 species regarded as significant. 6 of these species are known to occur in the North Washpool area; whether the remainder do is presently unknown. The fact that one of the rare or threatened species (*Dodonaea magazyga*) has recently been recorded by the National Parks and Wildlife Service for the first time in the Washpool area (from North Washpool) suggests that further more intensive studies are needed to clarify the botanical importance of the area.

2.5 FAUNA

Introduction

Twelve amphibian species, 31 reptile species, 122 bird species and 52 mammal species have been recorded in North Washpool area. Based on the forest habitat associated with the occurrence of these species, all are expected to occur within the proposed North Washpool wilderness, with the exception of the Brush-tailed Rock Wallaby and several exotic pest species.

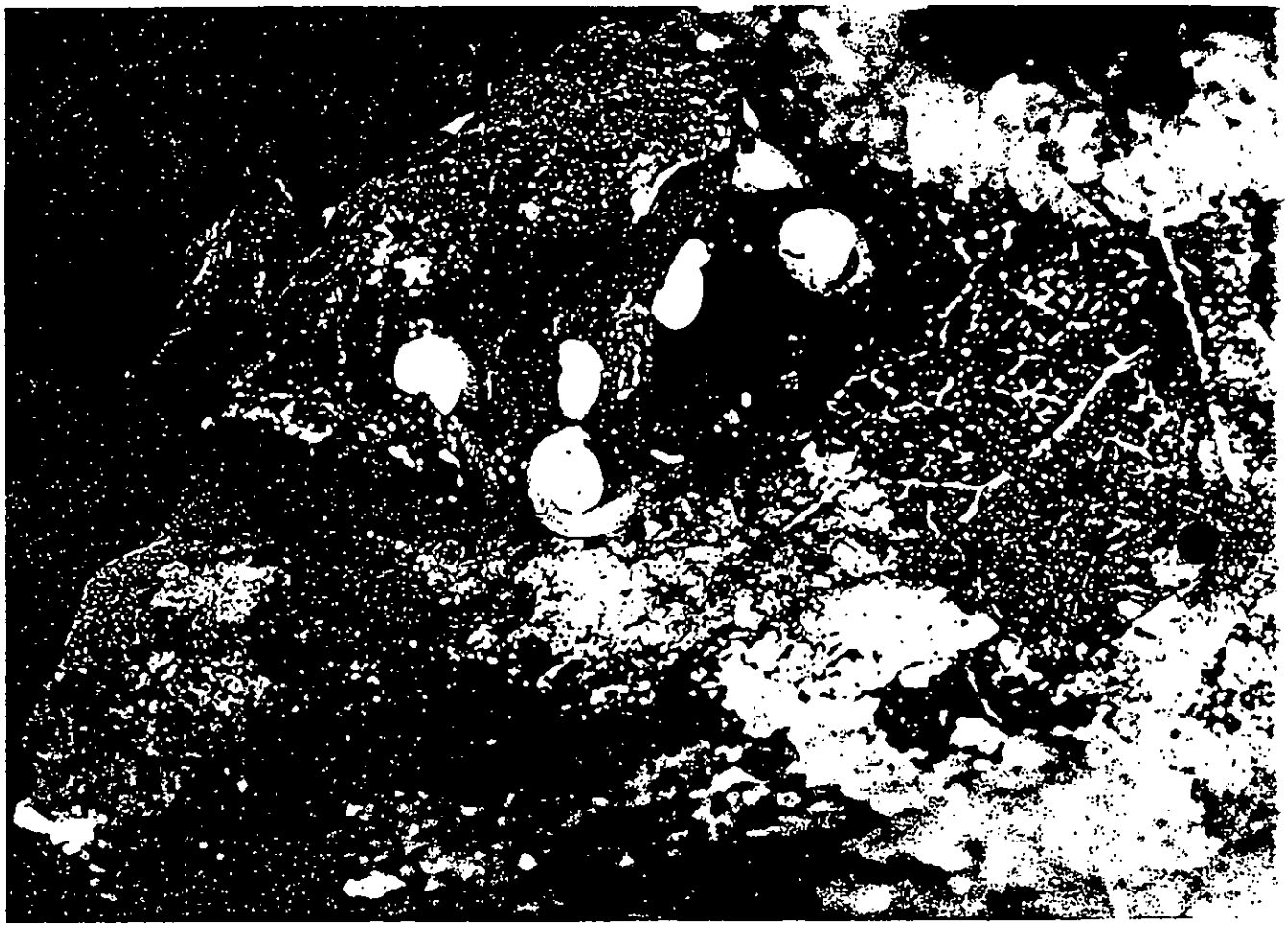
The variety of mammals is very high even compared with much larger areas elsewhere, and includes all the large hollow dependent arboreal mammals, a large variety of kangaroos, wallabies and rat-kangaroos (macropods) large variety of small terrestrial and scansorial marsupials and rodents and a substantial list of insectivorous bat species.

The population densities or indices of them indicate the Washpool area is high quality habitat for Tiger Quolls. Greater Gliders were recorded in very high densities compared with south coast forests. The records of Yellow bellied Gliders in wet sclerophyll forest by Osborne (1982), is a noteworthy habitat, a habitat they were rarely recorded from, in Mackowski's (1986) more extensive survey.

The following rare or significant species are expected within the North Washpool wilderness: Pouched Frog, Fletcher's Frog, Loveridge's Frog, Major Skink, Stephen's Banded Snake, Pacific Baza, Wompoo Fruit-Dove, Glossy Black-Cockatoo, Powerful Owl, Sooty Owl, Rufous Scrub-bird, Tiger Quoll, Brush-tailed Phascogale, Yellow-bellied Glider, Squirrel Glider, Long-nosed Potoroo, Rufous Bettong and Parma Wallaby. Both the latter species have undergone significant range reductions in N.S.W. and are associated with refuges on the North Coast where the fox is relatively uncommon.

The Powerful Owl is the largest Australian Owl with a home range estimated between 800 and 1000 hectares a pair. The high densities of prey in the wet sclerophyll forests of the Washpool Area, plus large trees with potential nest sites, provide a combination representing optimum habitat.

Photo: E. McNabb



The Pouched or Marsupial Frog *Assa darlingtoni* has a series of isolated populations in high elevation wet forests on the Far North Coast. The male frogs incubate the eggs in pouches of skin on their flanks.

Photo: H.Ehmann (NPI)

Very few species and individuals of feral animals were recorded during the surveys of the Washpool area. This is attributed to the dense nature of the wet forests and their lack of fragmentation by roads and other types of disturbance.

Fluctuations in animal abundance over timespans of years to centuries are typically interpreted as reflecting changes in the carrying capacity of forest stands in relation to limiting resources such as food, nest sites, cover or microclimatic requirements.

Important determinants of the carrying capacity of a particular stand of forest for vertebrate fauna are, firstly forest type, which reflects a limited range of climate, soil and other site variables, as well as the quantity and quality of herbage, nectar and even insect populations available to consumers. Secondly, the history of the stand with respect to fire, silvicultural treatments, harvesting etc., thirdly the size and edge to area ratio, fourthly the context of the stand, with respect to adjacent stands and fifthly sources of potential plant and animal propagules or colonists and microclimate can all influence fauna populations, such that a particular population is prevented from reaching the carrying capacity defined by summing the innate, resource based carrying capacity of a series of stands.

Most of the energy flow in a forest is through the litter soil sub-system (Richards 1981a, 1981b) and detritus based food chains may well support many more terrestrial vertebrates than food chains based on grazing of live tissues. Thus the removal of most of the bole biomass from the site, as in maximum economic utilization has implications for the many terrestrial vertebrates supported by detritus based food chains.

PRIORITIES FOR CONSERVATION

(i) Wet forest dependent fauna

Species with more general requirements on a spatial gradient usually occupy a range of successional stages within the development of a stand of a particular forest type. They all have relatively good dispersal capabilities and taking these attributes together are unlikely to be detrimentally effected by intensive forest management. In contrast, a subset of 'forest dependent' species exists which, frequently is restricted to the wetter end of the spectrum of tree habitat (Kikkawa 1968, 1974) and/or is dependent on resources provided by particular age classes of trees or stands on sites of higher nutrient status (Braithwaite 1984). Tyndale-Biscoe and Calaby (1975) have identified a group of such mammal species in eucalyptus forest. Significantly less work has occurred on reptiles and amphibians.

(ii) Old growth dependent fauna

Old growth wet sclerophyll forest is the habitat of utmost importance to many specialized forest wildlife species. It provides a diverse vegetation structure and a corresponding abundance of resource that are limiting within younger forest habitats.

Thomas et.al. (1988) discuss the ecological characteristics of old growth forests. They point out old growth forests are characterized by attributes including: plant and animal species composition; sizes and densities of live trees, stags and logs; complex stratification of foliage in a vertical plane; horizontal patchiness associated with small scale disturbances and death of individual dominant trees and a minimum stand size related to specific ecological functions. The quantities of the above attributes obviously vary between forest types and sites of varying potential productivity.

The factors which promote faunal habitat within old growth forest include:

- Tree hollows of many shapes and sizes used as roosting and nesting sites
- Large gaps between mature trees where aerial insectivorous birds and bats forage
- Comparatively large quantities of nectar, pollen and fruit and other plants such as mistletoe which grows mostly on older trees. These resources are crucial to many nectarivorous birds and mammals.
- Large dead stags and fallen logs where some heliothermic reptiles forage, hibernate and lay their eggs.
- Comparatively high richness and cover of vascular epiphytes and bryophytes.
- The greater rigidity of the trunks of large trees reduces wind sway and provides a more stable nest platform compared to tees with slimmer trunks.
- Stable levels of a shade tolerant cover, utilized by ground foraging vertebrates for protection from predation.
- Low levels of introduced predators.

The importance of old growth forest for a variety of fauna has been demonstrated throughout the world (Harris 1984, Thomas et.al. 1988) and Australia is no different. Many of our more specialized and unique forest wildlife species require this habitat and will suffer continuing declines in abundance unless it is preserved in a well planned system of retained habitat.

MIGRATORY SPECIES AND THE IMPORTANCE OF THE WASHPOOL AREA IN A WIDER CONTEXT

As pointed out by Austin and Miller (1978) "given the mobility of animals, consideration of regional representativeness may not provide adequate objectives of conservation".

The availability of insects, nectar and fruit vary latitudinally, altitudinally and locally reflecting the distribution and abundance of the plants which form the base of animal food chains. Seasonal variation in climate variables influence their energy balance and or activities. These activities can extend to seasonal quiescence such as torpor or migratory movements the latter being a feature of marked influence on the terrestrial vertebrate assemblages of the Northern Rivers.

Nix (1976) conducted a simulation of plant growth over Australia and New Guinea based on long term climatic averages and found it provided a good explanation from the pattern of bird movements. A conclusion of the anaysis was that the far north coast of N.S.W. and south coast of Queensland are a primary overwintering area. This is attributable to the relatively high winter temperatures and long growing season of this region compared with the rest ot south eastern Australia. (Helyar and Thompson 1982.)

A significant proportion of the 122 bird species recorded in the Washpool area occur seasonally or as irregular vagrants.

An important group of migrants are species whose breeding distribution is largely restricted to the rainforests of the ranges. There is a general movement away from the higher elevation rainforest during winter by Wompoo Fruit-dove (*Ptilinopus magnifica*), Topknot Pigeon (*Lopholaimus antarcticus*), Noisy Pitta (*Pitta versicolor*), Rose Robin (*Petroica rosea*), Brown Warbler (*Gerygone mouki*), Figbird (*Sphecotheres viridus*), Satin Bowerbird (*Ptilonorhychus violaceus*) and Regent Bowerbird (*Sericulus chrysocephalus*).

In the case of the above species the consequences can be expected to extend well beyond the North Washpool area in assessing the effects of stand manipulation.

As pointed out by Recher et.al. (1983) all of the forested land along the east coast of Australia, (from the tablelands to sea level) needs to be managed as a unit. The regular north-south migrations of many bird species along this stretch is well known (Nix 1976) as are more localized altitudinal movements and more nomadic movements in response to nectar and fruit availability.

2.6 WILDERNESS

The need for wilderness conservation was expressly recognised in the 1974 report of the National Estate Inquiry under the Chairmanship of Justice Hope. That Inquiry concluded:

> "The loss of all wilderness would be a considerable contraction of human experience".

The Inquiry saw wilderness as an important part of the National Estate, both for the preservation of nature and as a human need:

> Wilderness, paradoxically is vital to our civilisation. The ecologist calls for Wilderness as an indicator of disturbance of the delicately balance life support systems of the world.
>
> "But our last wilderness is rapidly disappearing under the assaults of increasing population and aggressive technologies. Australia, unlike so many other countries, still has a chance to set aside a few major wilderness areas, but that chance will soon be lost."

The literature on the values of wilderness is extensive and predates the birth of the modern wilderness movement by almost a century. Smith, a Tasmanian forester, has collated a list of the values and benefits of wilderness which include; genetic resources, ecological study, wildlife preservation, environmental base-line data, individually perceived values such as freedom, challenge, exercise, solitude, inspiration, learning and what he describes as values in public administration such as future land use options and emergency resources.

The North Washpool, Washpool and Gibraltar Range areas were first identified as wilderness areas in 1976 (Helman et.al.)

Three distinct areas in Gibraltar Range National Park, identified in the 1980 Plan of Management, were declared wilderness in June, 1982. In May 1985, an extensive area (24,000ha) of Washpool National Park was declared wilderness.

The 1986 Wilderness Working Group identified the Washpool Wilderness area as covering approximately 36,000 hectares of the Washpool and North Washpool area.

Also in 1986 World Heritage Nomination of the Subtropical and Temperate Rainforest Parks of Eastern Australia identified the Washpool Wilderness as containing:

(i) the largest block of unlogged tall forest in NSW,
(ii) the largest proportion of rainforest area, and

(iii) significant stretches of wild and scenic rivers and riparian fringes dominated by rainforest.

A separate report has assessed the North Washpool area as an extension to the wilderness area within Washpool National Park.

2.7 ABORIGINAL CULTURAL HERITAGE

The middle Clarence River Valley constitutes the western hinterland of the Bundjalung people's territory; the high relief country of the Washpool National Park (including Bililimbra and Ewingar State Forest) marks the western boundary of that land. Bundjalung people have an unbroken tradition of living and working in the study area (as traditional owners; as tenants on Ogilvie's station, Yulgilbar, in the last half of the 19th Century; as asbestos miners at Baryulgil from 1918 to 1979; as residents and workers at the rural community of the Baryulgil Square and at Malabugilmah, to the present time).

Amongst the 10 or so extended families who claim descent from the original owners in the area, there is demonstrable understanding, and valuing, of traditional Aboriginal cultural and economic patterns of life. It can be argued on a number of grounds that the local Aboriginal community is better informed about the physical and metaphysical qualities of the Washpool area, than any one else.

After the first depredations on the population which were largely unseen losses to European disease, the relations between the middle Clarence River valley people and the cedar getters and later the squatters, were amicable, if paternalistic. The continuity of the Aboriginal community traditions is attributable to this, and the fact of a ready and stable employment market at the asbestos mine for sixty years from 1918.

A recent anthropolgical study has brought together evidence from Aboriginal elders, and other sources, of six ceremonial sites in the Dessert Creek area, and an unspecified number of sites in the Malara Creek, as yet unlocated (Donnelly, 1989). Some prior records had been made of a bora ground at Hong Kong Point (Malara Creek), by Service officers in the late 1970's.

Archaeological knowledge of the area is based on Bell (1980), archaeological survey work done for the Forestry Commission. Bell found few sites on his survey, but he recommended further ground searches in the less steep areas. Bell characterised the "potential" resource as being most likely to be found on ridge lines, saddles and summits (he included; stone artefact scatters, ceremonial sites, scarred trees, but the recent work also suggest shelters, burials and campsites on the Malara Creek terracettes).

2.8 EUROPEAN CULTURAL HERITAGE

Edward and Fred Ogilvie's pioneer station "Yulgilbar", was established adjacent to the study area in 1840. Much of the lower relief middle Clarence River valley, probably exploiting the open woodland character maintained by prior Aboriginal burning, was pastoral within 20 years. Early forest exploitation in the rugged hinterland , until the development of road access (still incomplete), was confined to cedar getting. No significant sized town developed in competition to Grafton in the middle Clarence River valley, which has implications for the character of the study area.

Gold mining has an important, if brief, life at Malara Tops, it being regionally a very early example of alluvial mining (1850's). At Lionville and Solferino reef gold was mined later in the 1890's and early this century a mining population of some thousands lived on the diggings.

The gold workings and evidence of the town site at Malara Tops has all but disappeared under regenerating rainforest. There is a reasonable expectation, however, that archaeological evidence is retained.

More recently, the area has been the focus of activist public agitation for the formation of national parks and for conservation purposes, other than those consistent with forestry operations. As with Terania Creek, the place has contemporary significance because of this late 20th century activity.

PART 3. EVALUATION OF HERITAGE VALUES

3.1 WORLD HERITAGE

North Washpool qualifies for addition to the World Heritage List for the Australian East Coast Temperate and Subtropical Rain Forest Parks on the basis of containing either alone or in association with Washpool National Park the following natural heritage values:

* outstanding examples of the major rainforest types in New South Wales

- North Washpool contains one sixth of the Willowie Scrub which has been described as the largest remaining undisturbed rainforest area in NSW.

- the Willowie Scrub is the largest stand of Coachwood (*Ceratopetalum apetalum*) warm temperate rainforest remaining in Australia, and therefore in the world. It is outstanding not simply because of its size, but because the internal variation of canopy structure suggest that a number of seral stages may be present. It thus provides a unique scientific reference site for the study of regeneration processes within warm temperate rainforest.

* sites in which rainforest forms a large proportion of the total vegetation cover;

- North Washpool contains a large proportion of rainforest and rainforest dominated communities

Subtropical rainforest		482ha	6.6%
Warm temperate rainforest		507ha	7.0%
Wet scrub		720ha	5.1%
Wet sclerophyll forest-frequently with a well developed rainforest understorey	Total	1219ha 2928.5ha	16.8% 35.5%

* rainforest stands sufficiently large and appropriately buffered by surrounding vegetation for the long term integrity of their vegetation to be assured;

- integrity can be assured if rainforest and critical protection areas are protected from significant disturbances.

* the major regional centres of rainforest present at the time of European settlement;

- the Coachwood warm temperate rainforest was once extensive in the southern end of Washpool, the eastern Dorrigo, Carrai plateau and the Mount Boss-Doyles River area. It has been greatly altered by logging, dieback and fire.

* sites with other features of international or national significance in addition to the rainforests; for example, outstanding geological or scenic features or particularly fine example of sclerophyll communities.

- North Washpool includes fine examples of tall moist forest and dry sclerophyll communities as follows:

Tallowood (*Eucalyptus microcorys*)	770.5ha	13.3%
Grey Gum (*E. propinqua*)	1270.3ha	17.4%
New England Blackbutt (*E. andrewsi*)	208 ha	2.9%
Total	2248.8ha	33.6%

The North Washpool area has an essential influence on the physical state of the existing Washpool World Heritage Area. In particular the Malara Creek area the sclerophyl forested ridges, leading down to the north west towards settled lands, provide potential fire paths. Evidence of past fire incidence exists on the rainforest fringes, wet scrubs and wet sclerophyll forests.

The North Washpool area also has an essential influence on the way on which the existing Washpool World Heritage Area is percieved, particularly with relation to the Willowie Scrub and the wilderness value of the Washpool area.

3.2. REGIONAL SIGNIFICANCE

North Washpool together with Washpool, Gibraltar Range and Nymboida National Parks is of regional significance for:

Landscape conservation

A large conservation reserve on the north-east margin of the New England Tableland which demonstrate the geological process that created the new England Tableland and other important geological and geomorphological events such as the Great Escarpment and the Demon Fault.

Ecological significance

The area encompass habitats representative of the New England Tableland and the north coast rivers. A number of animal species are at their geographic limit for species which migrate between the coast and highlands.

Environmental education

The area includes one of a group of six geographically separate centres of rainforest subject to the World Heritage Convention as Subtropical and Temperate Rainforest Parks of Eastern Australia. The World Heritage Convention status offers opportunities for promoting, among visitors, an increased awareness and understanding of the importance of the conservation of east Australian rainforests.

Wilderness

The area includes two large, relatively unmodified tracts of natural land identified as having wilderness value. Washpool and Coombadjha Creeks are recognised as important wild and scenic rivers.

Regional tourism

The area provides opportunities for tourism on the New England Tablelands and the north coast. With camping grounds, picnic areas and walking tracks in the adjacent two national parks the area offers outstanding opportunities for outdoor recreation in the north coast hinterland.

3.3 GEOLOGY, LANDFORMS AND SOILS

Geologically, the North Washpool area is of some significance because it samples part of the Drake Volcanics, a complex which is poorly sampled in Washpool National Park.

The Malara Creek basin is of particular importance because it samples an aspect and landform which is very poorly represented in the rest of the Washpool area.

3.4 FLORA

The North Washpool area is part of a continuum of naturally vegetated land which extends along the rugged ranges and escarpments of north-eastern New South Wales. Whilst a relatively small part of the north-eastern region of New South Wales, the Washpool area, of which North Washpool is an integral part, is the largest remaining undisturbed moist forest area in northern New South Wales.

The area is outstanding for the diversity of plant communities present and the mosaic distribution of wet sclerophyll and rainforest communities.

The vegetation of the North Washpool area, particularly in the Desert Creek catchment, represents a broad altitudinal sequence of forest types. Protection of such altitudinal sequences is important if species and species associations are to be conserved in the long term and particularly if climatic change occurs.

All the forests in the area are in an undisturbed natural condition and reflect the fact that they have developed solely in response to natural (non-human) factors. Such areas are very rare.

Rainforest

Australia's rainforest was only a small proportion of the world's total, even before its reduction by Europeans. However, because of extended isolation the Australian rainforests contain many endemic taxa, and may contain about 5% of all the world's rainforests species (Bell, 1981). As the world's rainforests contain about half of all species on the planet, it follows that the Australian rainforests are a great storehouse of genetic diversity.

About three quarters of the Australian and NSW rainforests have been destroyed since European settlement. This is a proportional reduction greater than the world average (Adam 1987).

Rainforests in Australia have been compared to an arc of island habitats in a sea of eucalypt forest. This arc stretches from the north-west of the continent, across the north and down the east coast to Tasmania. Nowhere else in the world is there such an extended transect (some 27° of latitude) through a more or less continuous series of rainforest types. The NSW rainforests provide a crucial link in this continuum from tropical monsoonal and wet tropical rainforests through a range of moist and dry subtropical rainforest and their transition with warm temperate types to cool temperate rainforests in montane habitats in coastal NSW and at lower altitudes in Victoria and Tasmania.

Numerical analysis of the Australian rainforests (Webb and Tracey 1981) separates the cool rainforests of the south-east region of Australia (region A) from the warm forests of the north-east region B and the northern and subcoastal region C. The rainforests of region A include the subtropical and the warm and cool temperate rainforests. Region B includes the tropical rainforests, while region C includes the mosoonal and dry rainforests. The three rainforest vegetation region shown to be widely different ecological entities. The three areas appropriate "core areas" somewhere near where ancient widespread floras from Gondwana crystallised under different climatic - edaphic - topographic conditions. Each therefore evolved under essentially different environmental conditions.

Region A is subdivided into three vegetation provinces. A1 include the subtropical rainforests while A2 includes the warm temperate rainforest and the New South Wales cool temperate rainforests. Each province has a core area which represents the main area of occurrence of community types that are well within the limits of their distribution. That of A1 is from Bangalow in far north-eastern NSW to Bundaberg in south-east Queensland. The core area of A2 is from Barrington Tops to the Dorrigo and eastern New England Plateau. The warm temperate rainforests of the Washpool area therefore lie within this core area.

The most extensive areas of rainforest in North Washpool are of the warm temperate subform. Willowie Scrub, which is largely within Washpool National Park but extends into the Desert Creek and Malara Creek catchments in the North Washpool area, is the largest stand of warm temperate rainforest in Australia and the largest area of Coachwood dominated rainforest in the world. It is also outstanding because it encompasses a broad range of associations of Coachwood with Yellow Carabeen, Crabapple, Corkwood and Callicoma. This range of associations and the presence of internal variations of canopy structure in the area suggest that a number of seral stages may be present (Floyd 1978, 1980; Fox 1983). The area is therefore of particular value for studies of the ecology of Coachwood and a unique scientific reference site for the study of regenerations processes within warm temperate rainforest.

Subtropical rainforest is more limited in extent in North Washpool than warm temperate rainforest, being confined to more sheltered sites on better soils. The lowland subtropical rainforest is however floristically well developed, although very limited in area (Adam, 1987). The lack of Black Booyong in the Washpool area is particularly significant, as this species is usually common in subtropical rainforest of the type in the area and it is present both to north and south.

A feature of both the warm temperate and subtropical rainforests is the range of gradations between the two rainforest subforms and between the subforms and wet sclerophyll forest. The area is therefore an important reference area for study of the dynamics of these forest types.

Wet Sclerophyll Forest (Tall Open Forest)

Tall open forests occur predominantly in south-eastern and south-western Australia with scattered occurrences further north into Queensland. The inter-relationship between rainforest and sclerophyll forest are an uniquely Australian phenomena and are therefore of considerable scientific interest (Adam, 1987).

Old growth tall open forests of North Washpool are generally heterogeneous in the diameter and spacing of trees, a factor which is thought to contribute to their diversity as habitats for flora and fauna (Reid 1990).

The most striking structural attributes of the old growth tall open forests of North Washpool are the large diameters and heights of the old growth trees. The Tallowwood - Sydney Blue Gum - and Brush Box Associations in the area are particularly well developed tall old growth forest with some trees reaching 70 metres and more. It is expected that the largest of such trees would be in excess of 1000 years of age (FC NSW 1982). A well developed rainforest understorey is a feature of much of the old growth tall open forest in the area.

Also significant is the presence in North Washpool of a mosaic of gradations between the wet sclerophyll forest and rainforest subforms. These include areas of wet sclerophyll forest now surrounded by rainforest indicating a long period free of fire or other disturbance.

Dry Sclerophyll Forest (Tall Open Forest to Open Forest)

North Washpool contains fine examples of this forest type. These areas are also significant because they are essentially free of widespread catastrophic disturbance, possibly the only disturbance being some change in fire regime associated with cattle grazing. These forests are therefore generally old growth areas also.

The dry sclerophyll forests of North Washpool have grassy and/or sclerophyllous shrub understories. The shrubby understorey is floristically very diverse in some parts of the area. The presence of this species - rich shrub layer is a result of the high light regime in the understorey of these eucalypt - dominated communities; compared with the canopies of forests elsewhere in the world, eucalypt trees have relatively open canopies which cast little shade. Limited sampling of the open forests of the area has revealed the presence of a number of herb and shrub species previously unrecorded for the area and it is anticipated that more intensive surveys would reveal the presence of others.

Scrub

Wet and dry scrubs contain several significant plant species including Dwarf Cypress Pine and Blue Mountains Red Mahogany.

Significant Plant Species

It remains unclear how important the rainforests, sclerophyll forest and scrubs which occupy most of North Washpool are as a refugia for rare, threatened or significant plant species.

There are 3 rare or threatened species (Briggs and Leigh, 1988) and 11 significant species known from the Washpool area (See Appendix Two). One of the rare or threatened species has only recently been found during the limited Service fieldwork, indicating that further more intensive studies are needed to clarify the importance of the area.

3.5 FAUNA

Habitat area requirements for priority species conservation

The escarpment between the tablelands and coastal plains of northern N.S.W. is a very important area biogeographically with many species reaching the edge of their range here, and or occurring in different altitudinal zones within the range of more than 1000 metres. The area, due to distance from population centres and steep slopes, has not been subjected to the alterations wrought elsewhere by European land use. The climatic, geological and land form variation combined to provide a rich variety of habitats and supports a consequently rich biota. With the more accessible forests mostly converted to regrowth forests composed of trees less then 100 years of age, the remaining "up river" wet sclerophyll forests are now

being exploited.

This has consequences for the long term viability of the more specialized wet forest and or old growth dependent species, whose long term survival is facilitated by retaining large populations, in a relatively stable environment, not subject to artifically induced changes in predation and competition. For some of the rarer species such as predators at the top of the food chain, with comparatively large home ranges, very large areas of productive forest provide our best chance of maintaining them, in perpetuity.

In maintaining viable populations the relative area and spatial patterning of refuge old growth habitat and regrowth is expected to be important, but information is needed on home ranges and dispersal capabilities of forest-dependent species to enable recommendations to be formulated confidently.

The Forestry Commission claims moist hardwood forests are relatively well conserved in N.S.W. in National Parks. Unfortunately this statement is only of relative value and does not take account of the habitat area required to conserve the rarest of the old growth forest dependent species such as Sooty Owl and Powerful Owl with home ranges of 300ha and 1000ha per pair respectively. If we adopt the minimum viable population of 250 pairs used by Mackowski (1986) this necessitates areas of 75,000ha and 250,000ha.

The system of Flora Reserves and Forest Preserves in State Forests are of virtually no value for the conservation of rarer old growth dependent fauna species. As pointed out by Curtin et.al. (1987) the mean area of reserves on the north coast is 209ha.

The role of wildlife in essential ecological processes: pollination, seed dispersal, herbivore consumption.

There is increasing evidence that vertebrate wildlife are important for the long term stability and productivity of forest ecosystems as pollinators, invertebrate population regulator and seed and spore dispersers.

Vertebrate roles include: pollinators, facilitating long distance pollen dispersal and outcrossing compared to Honey bees (*Apis mellifera*) and other insects (D.A. Paton, pers. comm.): consumers of herbivorous arthropods (Clark 1964, Loyn et.al. 1983): dispersers of fungal and higher plant spores and seeds (Bennett and Baxter 1989). Passage through an animal's alimentary canal facilitates the germination of mycorrhizal fungal spores (Lamont et.al. 1985, Maser et.al. 1978) and the germination of seeds (Floyd 1977).

Many of the above processes involved co-evolved relationships which are commercially desirable within native forests. They have not been adequately researched and may represent significant unpriced benefits of retaining adequate areas of forest types and sites otherwise suitable for harvesting, in an undisturbed state.

3.6 WILDERNESS

The North Washpool area as a nominated extension to Washpool Wilderness Area meets the requirements for wilderness as specified in the Wilderness Act 1987, viz.

> the area is, together with its plant and animal communities, in a state that has not been substantially modified by humans and their works or is capable of being restored to such a state;
>
> the area is of a sufficient size to make its maintenance in such a state feasible; and
>
> the area is capable of providing opportunities for solitude and appropriate self-reliant recreation.

Beyond meeting the basic requirements for wilderness the area contains features of outstanding significance as wilderness including the largest area of unlogged tall forest and the highest proportion of rainforest in any wilderness area in New South Wales.

3.7 ABORIGINAL CULTURAL HERITAGE

North Washpool has represented (and still does a rugged, but productive hinterland, for the Clarence Valley Aboriginal people, containing rainforest and wet eucalypt forest plant and animal resources, not available elsewhere in developed landsystems of the main Clarence River valley. The material evidence of this past landuse (within the study area), is undoubtedly better preserved, and better understood by Aboriginal people, than in any other comparable nexus of Aboriginal community and warm temperature forest system in NSW. The presence of a concerned, and culturally aware, tribal group of descendant owners of the cultural resource, supports a characterisation of the site-in-landscape as a well-preserved, and locally constituted, system of historical evidence.

The ceremonial sites in the Desert Creek are unquestionably of regional significance, although they are not (in the main) manifested by physical objects or landscape features. No similar concentration of sites is now known for the Washpool National Park, although claims have been made for important mythological sites in the southern parts of the park (Paine, unpublished ms).

The claimed, but unlocated, sites in the Malara Creek valley must be seen to have a first rank significance in scientific terms (principally because of the potential to test settlement and economic procurement models, and for the opportunity to understand metaphysical and material cultural systems in late 20th century Aboriginal communities).

The known and projected cultural resources within North Washpool has social and scientific values that are expressed most strongly as systemic values. The elemental parts are limited, but aggregated they have systemic values rarely seen in cultural systems in eastern NSW. The constraint is to conserve the system as much as the parts.

The bora grounds and secret ceremonial sites require particular conservation treatment, notably to retain their cryptic and isolated status. This is the second constraint on future use of the area, arising from the statement of significance.

The local community has initiated, through its purchase of Collum Collum Station adjacent to the study area, a tourist-oriented enterprise to officer packages in Aboriginal bush craft and cultural tours, which tours will offer a unique recreational and educational opportunity in "wilderness" settings, that is, in essentially unimpacted forest systems. This contemporary use of the natural environment for Aboriginal employment and social regeneration is a constraint on future uses of the study area.

3.8 EUROPEAN CULTURAL HERITAGE

The principal historical values of the area turn on the presence of a regionally significant squatting run at Yulgilbar, and an Aboriginal population within continuous links to the original Bundajalung owners of the land. Edward Ogilvie and his descendants (eg. Jessie Street) had an impressive record of accord with local Aboriginal people, and a concern for Aboriginal cultural and issues. The study area takes value from the proximity of this unusually cordial nexus of pastoralist family and Aboriginal community.

The early gold mining history of the Washpool area, as an enterprise in remote and rugged rainforest country, has particular value for that reason. The diggings as such, are not unusual; the evidence of the human dimension of mining life in the forest (eg. transport, provisioning, social life) is regionally unusual, matched possibly by the Palmer River gold workings in northern Queensland.

There are few specific historic elements that constrain future landuse options for the study area. Some use options will, however, be enhanced by the acknowledgement of the history of the place. These include the previously mentioned Aboriginal use of the forest hinterland as an adjunct to the tourist venture they plan for Collum Collum Station.

3.9 IMPACT OF PROPOSED LOGGING

Flora

Fox (1983) reports that "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". Furthermore, logged rainforest were found to be qualitatively different from unlogged rainforest, regardless of the time since logging. Fox concludes "There is a fundamental and qualitative change when pristine vegetation is modified in any way!". Similar remarks would equally apply to other forest types.

Logging and roading in North Washpool pose major threats to the vegetation of the adjoining Washpool Wilderness Area. Greatest threats would probably come from operations in the Malara Creek area. Lying to the north-west of Willowie Scrub, the most important vegetation unit in the Washpool area, Malara Creek catchment would be the source of the potentially most intense wildfires. In its present condition, the chances of human lit wild fire in the area is small but following roading and logging the access and ground fuel would increase the chance of human induced fires which could sweep up the north-western flanks of Gibraltar Range into the Willowie Scrub area. It is a well established fact that most fires are human ignited on the edge of or close to roadways. One such fire has the potential to deface what is arguably the finest natural study area for the natural interactions between warm temperate and subtropical rainforests and between rainforest and the sclerophyll forest.

Other likely impacts of logging on flora include:

- degradation of soil structure or stability with attendant effects on vegetation
- soil compaction
- increased erosion
- altered streamflows
- loss of nutrients
- a reduction in populations of some rare, threatened or significance species
- an increase in exotic plants
- an increase in pioneer and early successional plant species
- a decrease in later stage rainforest plant species
- inadequate regeneration in some areas
- an increased chance of introduction of pathogens
- an altered microclimate
- a general increased chance of wildfire

Fauna

Beyong-stand influences including "edge effect", the influence of roads, population fragmentation and the context of refuge habitat

A concept which has been promoted uncritically is that of 'Edge effect'. The creation of a large ratio of edge per unit area between stands of different age will benefit non forest-dependent species. Recent studies overseas indicate that edges and roads are utilized to a greater degree by predators and nest parasites. Many Australian predators exhibit a distinct bias to using tracks and roads through densely forested vegetation, suggesting that these areas may be subject to increased mortality of prey species.

Taylor et.al (1985) surveyed the mammal fauna within a series of dense vegetation types in the Upper Henty Region in Western Tasmania. They only trapped large carnivorous mammals along roads or tracks or beside creeks, and they concluded, the development such as roading assists the movement of large carnivorous mammals with possible consequences on predation levels.

Timber harvesting may increase populations of marginal and non-dependent forest inhabiting species, such as ground dwelling herbivores and carnivores and insectivores that are widespread.

Roads are obviously a barrier to some species that do not fly, yet are able to move from tree to tree. Surprisingly even small mammals that frequently move on the ground, find a road a major barrier to movement. Barnett et.al. (1978) found road crossing by small mammals was inversely related to road width and even long unused and partly overgrown tracks, severely restricted or stopped the movement of small mammals. By contrast roads facilitate the ingress of many predators including carnivorous mammals.

Competition from early successional species and habitat generalists may be important. The results of Ambuel and Temple (1983) suggest that forest-edge and farmland bird species exclude certain forest-dependent bird species from smaller forest fragments more effectively than do area-dependent changes in habitat or degree of isolation. Loyn (1985), Howe (1984, 1986) and Recher et.al. (1987) have all differentiated bird species by the degree to which their populations increase or decline with different degrees of habitat fragmentation.

The consequences of proposed logging can be reasonably presumed to be a significant reduction in available nest hollows and large logs for a period of some hundreds of years even without subsequent harvests. Many of the remnant "habitat" trees have their lifespan shortened through wind exposure and post logging fire damage, and in combination with the fact that those which remain will, even assuming they live out their potential lifespan, likely die well before the regeneration has reached a stage of developing large hollows. Subsequent harvests will further exacerbate this attenuation of hollow trees and a likely prognosis is a hiatus of several hundred years during which very few hollow trees will exist and old growth forest dependent populations will crash.

Although regrowth forests support many species in dense populations, these tend to be the widespread and or abundant species such as insectivorous birds and small mammals.

Hydrological and water quality changes induced by timber harvesting

Other off-site consequences of timber harvesting are associated with water quality and flow regime.

Lowered soil moisture in dry seasons and reduced stream flows consequent on the establishment of densely stocked regrowth stands beyond the stage of crown closure, have the potential to affect the suitability of gully habitats and streams for amphibians, and possibly other vertebrates.

Effects are likely to be greater for species dependent on gullies and low order streams within small catchments, but the extent of the impacts on fauna has not been investigated so far.

Consequences of incremental loss and fragmentation of old growth forest

In choosing areas to establish national parks, one of the major criteria should be to include forest types that have a high carrying capacity for forest dependent fauna. This presupposes that we have the information necessary to make such decisions. The work by Braithwaite et.al. (1988) is an example of the results needed for a range of forest types, but it covers only a subset of the forest dependent fauna and only a single region.

Pickett and Thompson (1978) point out that internal disturbance dynamics are critical design features of reserves. They point out "The design of reserves should be based on minimum dynamic area, the smallest area with a natural disturbance regime which maintains internal recolonization sources and hence minimizes extinctions. Determination of minimum dynamic area must be based on knowledge of disturbance-generated patch size, frequency and longevity, and the mobilities of the preserved species."

Clearly fires have figured prominently in the distribution of vegetation in the area and the regeneration of the sclerophyllous species, as well as wind damage to rainforest (Forestry Commission 1980).

Suckling (1982) Loyn (1987) and Bennett (1987) further point out that many small remnant populations will continue to disappear, as time since isolation is one of the independent variables influencing extinction in remnants.

The shape, area and context within which a particular forest stand exists, can influence its actual wildlife carrying capacity which might be less than its potential carrying capacity. Many of the reserves that are presumed to cater for the requirements of forest dependent species are relatively narrow corridors with high edge to area ratios. This is undesirable for reasons which include altered microclimate and the influence on such dynamic attributes as immigration, emigration, intra and interspecific competition and rates of predation and parasitism. These aspects are directly influenced by the relative suitability of surrounding forest stands, for dispersal, cover, locomotion and so on. Pickett and Thompson (1978) point out that internal disturbance dynamics are critical design features of reserves. They point out "the design of reserves should be based on minimum dynamic area, the smallest area with a natural disturbance regime which maintains internal recolonization sources and hence minimises extinctions. Determination of minimum dynamic area must be based on knowledge of disturbance-generated patch size, frequency and longevity, and the mobilities of the preserved species".

Clearly fires have figured prominently in the distrubtion of vegetation in the area and the regeneration of the sclerophyllous species, as well as wind damage to rainforest (FCNSW 1980)

PART 4: HERITAGE PROTECTION OPTIONS

The options for protection of identified natural and cultural heritage values in the North Washpool study area have been identified as follow:

OPTION 1

Reservation of the Malara and Desert Creek catchments as national park (or flora reserve under Forestry Act)

OPTION 2

Reservation of the Malara Creek catchment and part of the Desert Creek catchment (including rainforest and proposed Aboriginal Place core area) as national park (or flora reserve), the balance to be retained as state forest.

OPTION 3

Reservation of southern two thirds of Malara Creek catchment and rain forest block of Desert Creek catchment as national park (or flora reserve), the balance to be retained as state forest.

OPTION 4

Reservation of southern two thirds of Malara Creek catchment as national park (or flora reserve), the balance to be retained as state forest.

OPTION 5

Status quo

OPTION 1

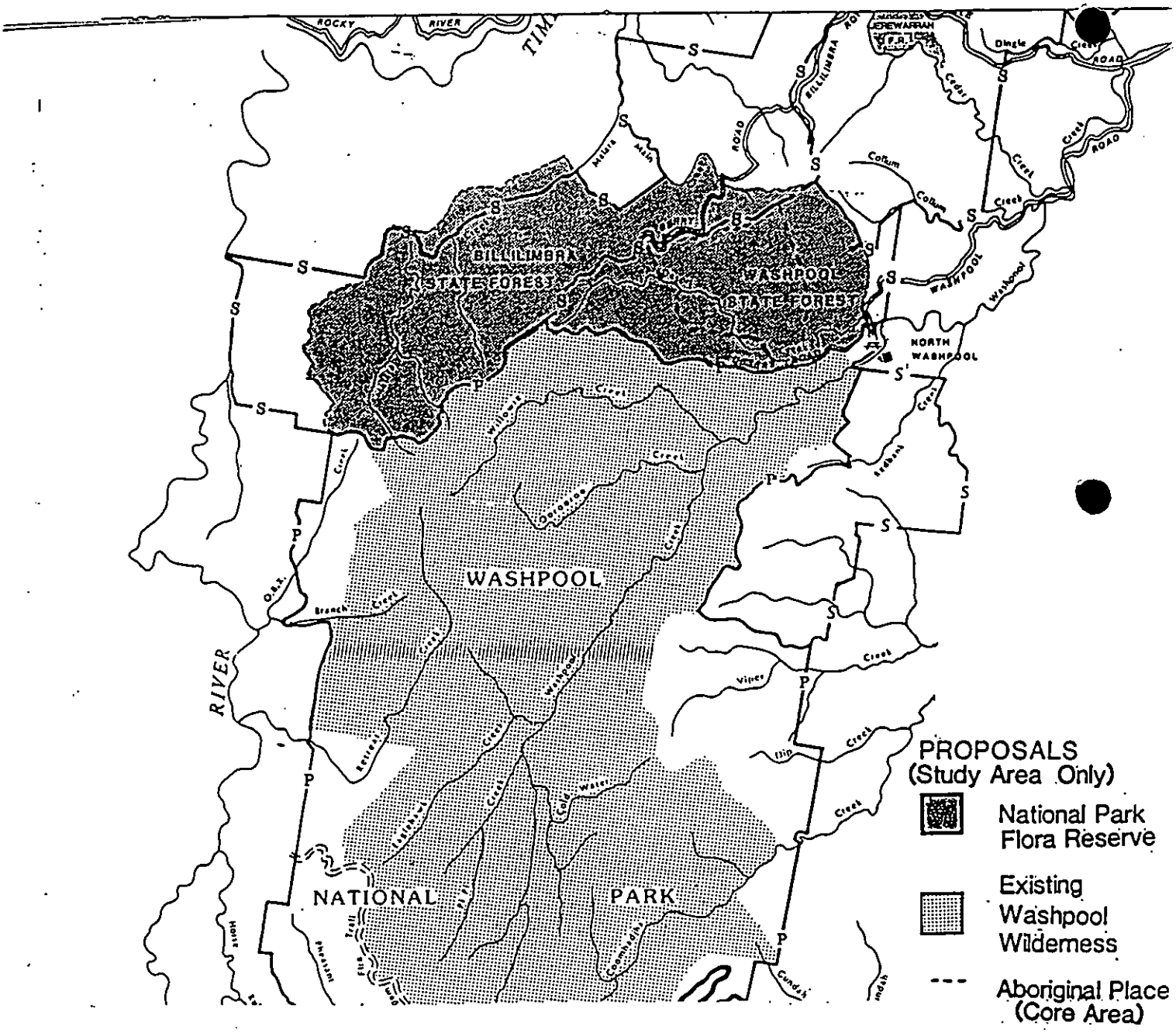
Protect the identified wilderness and other identified important heritage values by:-

Reservation of the Malara and Desert Creek catchments as national park (or flora reserve under Forestry Act).

(Including (i) Proclamation as Wilderness Area.

(ii) Incorporation into World Heritage Area.

(iii) Proclamation of Desert Creek catchment as an Aboriginal Place.)



OPTION 2

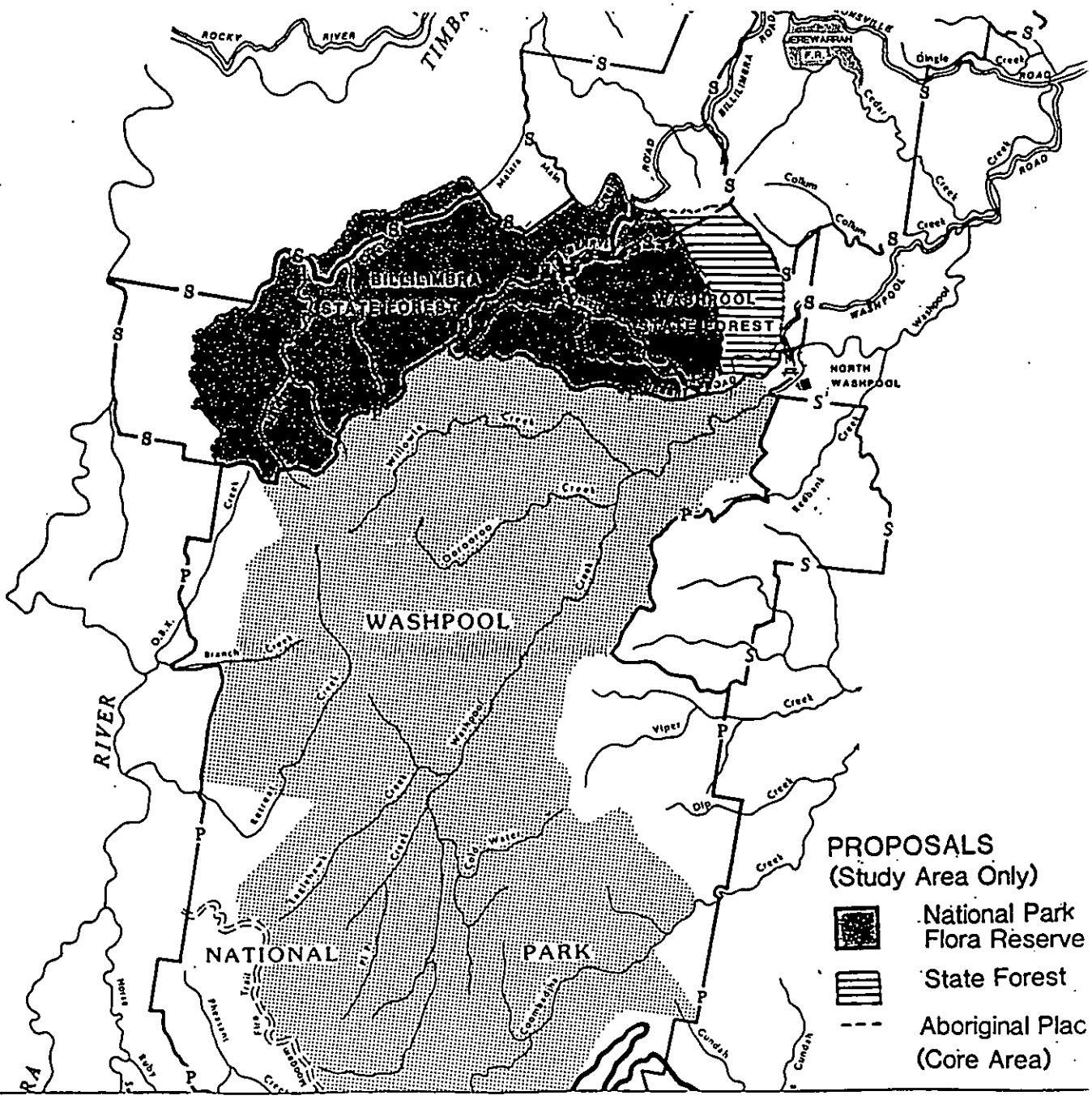
Protect the identified wilderness and other identified important heritage values by:-

Reservation of the Malara Creek catchment and part of the Desert Creek catchment (including rainforest and proposed Aboriginal Place core area) as national park (or flora reserve), the balance to be retained as state forest.

(Including (i) Proclamation (of reserved component) as wilderness area.

(ii) Incorporation (of reserved component) into World Heritage Area.

(iii) Proclamation of Desert Creek catchment as Aboriginal Place.)



OPTION 3

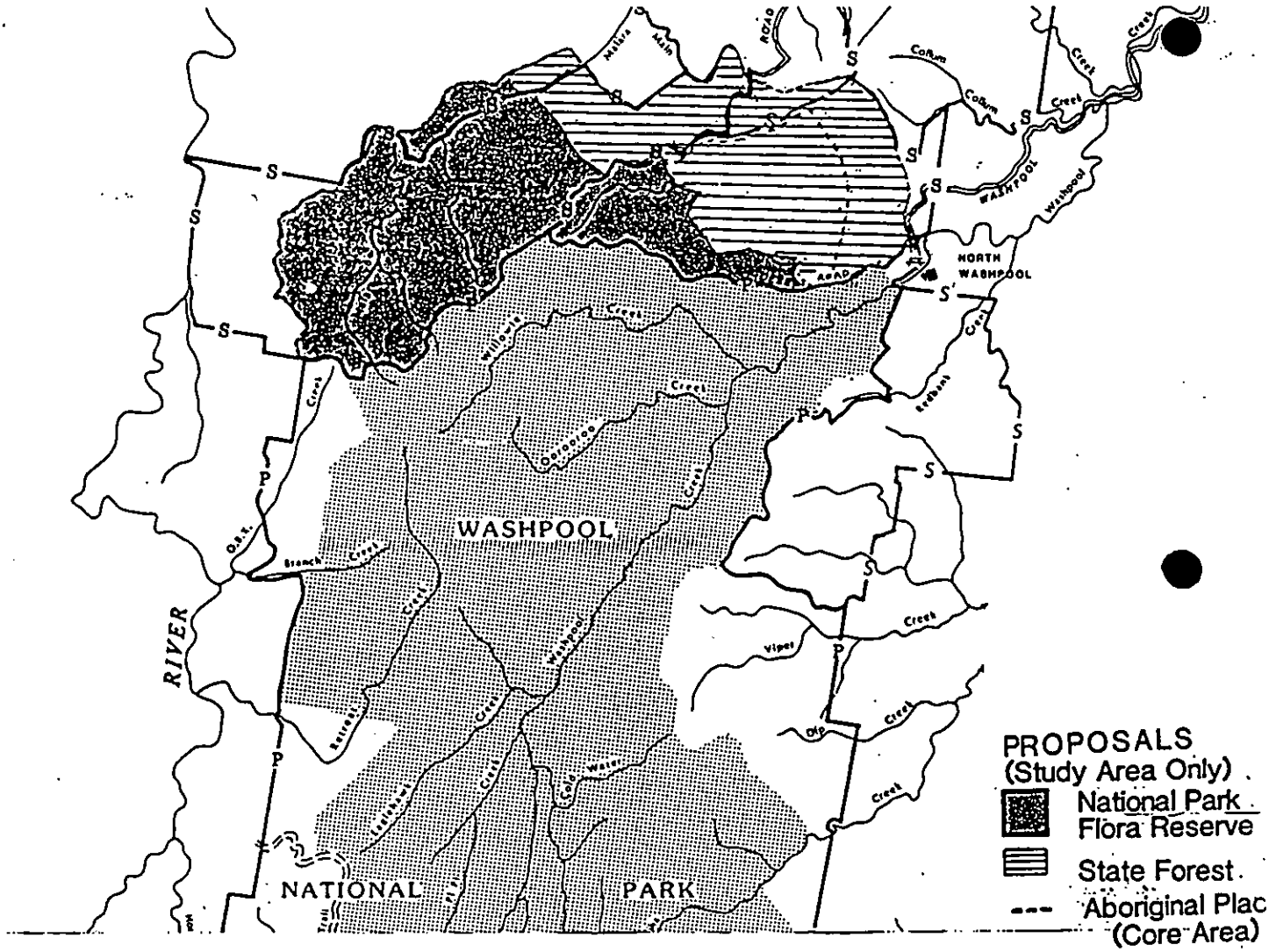
Protect the identified wilderness and other identified important heritage values by:-

Reservation of southern two thirds of Malara Creek catchment and rain forest block of Desert Creek catchment as national park (or flora reserve), the balance to be retained as state forest.

(Including (i) Proclamation (of reserved component) as wilderness area.

(ii) Incorporation (of reserved component) into World Heritage Area).

(iii) Proclamation of Desert Creek catchment as an Aboriginal Place.)



OPTION 4

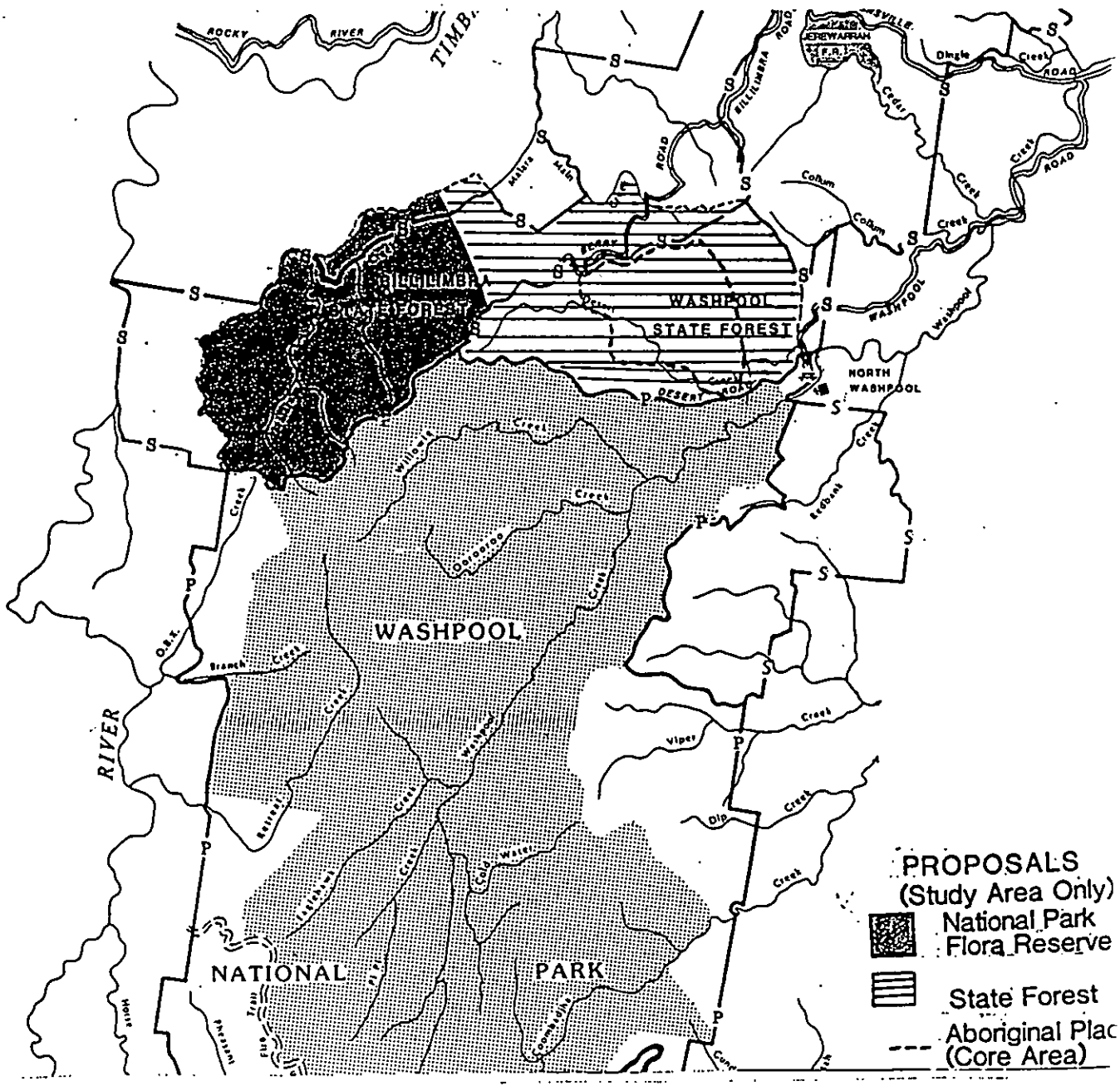
Protect the identified wilderness and other identified important heritage values by:-

Reservation of southern two thirds of Malara Creek catchment as national park (or flora reserve), the rest retained as state forest.

(Including (i) Proclamation (of reserved component) as wilderness area.

(ii) Incorporation (of reserved component) into World Heritage area.

(iii) Proclamation of Desert Creek catchment as an Aboriginal Place.)

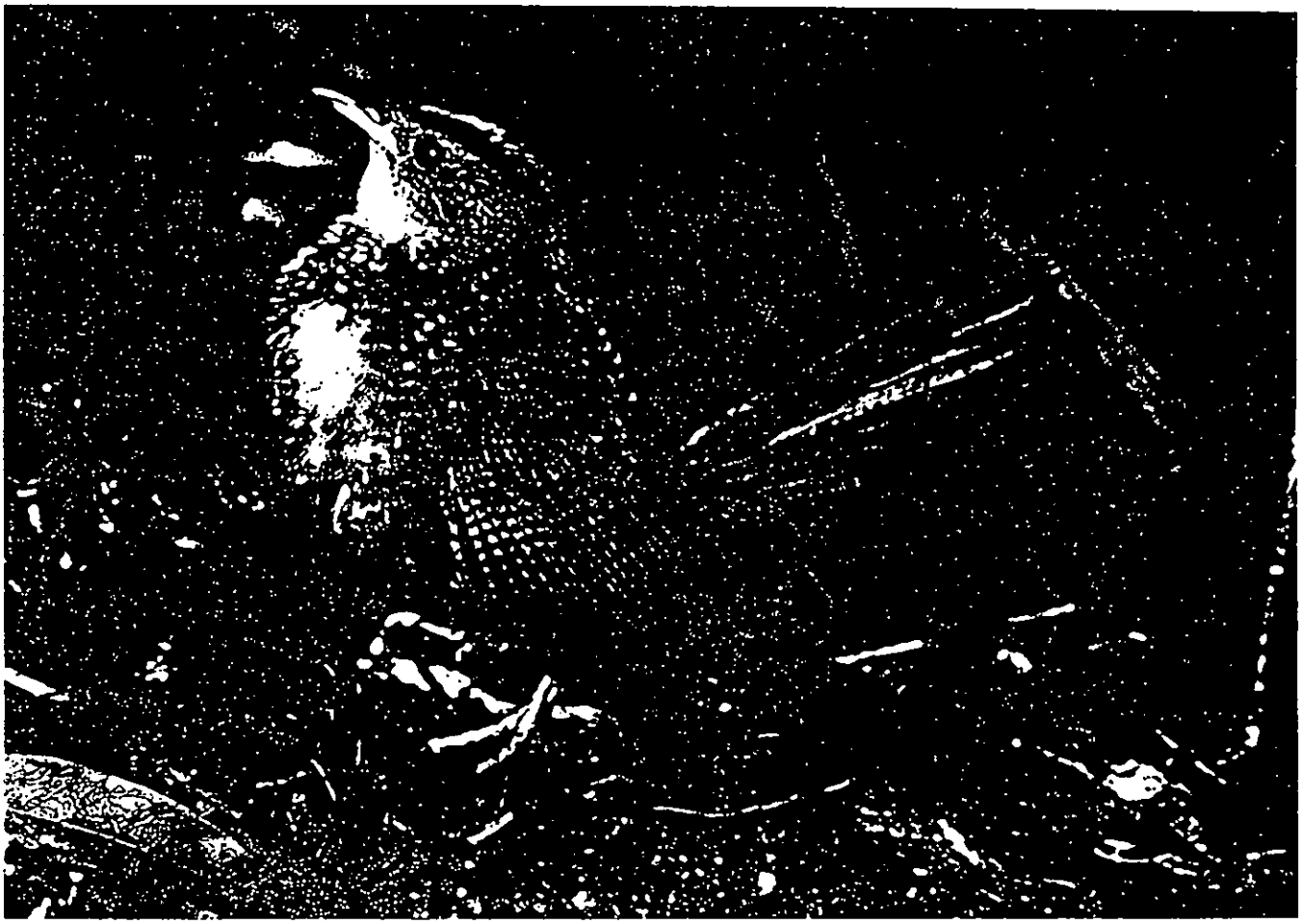


OPTION 5

Status quo :

(Includes roading and logging tall old growth hardwood forest and rainforest in identified wilderness and forests of identified oustanding heritage value.

Logging of Malara catchment has the potential for significant environmental impact on the existing national park/ wilderness area/ World Heritage Area as a result of radical change in access and likely change in fire regime.)



The Rufous Scrub-bird *Atrichornis rufescens* is a very secretive and "primitive" song bird occuring in a series of relict and apparently isolated populations in high elevation wet forests on the NSW North Coast, with about 40 territories in Queensland. It is extinct on lower elevations.

Photo: L.Klumpes

The Long-nosed Pot oroo *Potorous tridactylus* has a diet dominated by the spores of underground fruiting fungi. It is thought to aid the establishment of the symbiotic relationship between the fungus and tree roots, which aids the uptake of nutrients by the tree.

Photo: G.A.Hoye (NPI)

The Greater Glider *Petauroides volans* is a solitary herbivorous non-social gliding possum. Its occurence at high densities in old growth wet sclerophyll forests on the NSW North Coast is attributed to their high productivity. It is an important prey species for the Powerful Owl.

Photo: R.Whitford (NPI)

The Yellow-bellied Glider *Petaurus australis* lives in social groups which occupy comparatively large home ranges. It is dependent on plant sap, nectar and sugary exudates, as well as insectsfor its diet. These social groups require a large number of nesting hollows and therefore need forests with a high density of old trees.

Photo: R.Whitford (NPI)

The Parma Wallaby *Macropus parma* extinct on the NSW South Coast is now restricted to North Coast escarpment wet forests and reaches the northern limit of its range in the Washpool area.

Photo: R.A.Williams

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Appendix One

Native Vegetation Association found in North Washpool.

1. Rainforest (Closed Forest)

a) Subtropical Rainforest
   (i) Yellow Carabeen - Pigeonberry Ash - Sour Cherry Association (Lowland subtropical rainforest).
   (ii) Yellow Carabeen - Pigeonberry Ash - Purple Cherry Association.
   (iii) Pigeonberry Ash - Purple Cherry - Corkwood Association.

b) Warm Temperate Rainforest
   (i) Coachwood - Yellow Carabeen Association.
   (ii) Coachwood - Crabapple - Corkwood Association.

c) Depauperate Warm Temperate Rainforest

2. Wet Sclerophyll Forest (Tall Open Forest)

a) Brush Box Association

b) Tallowwood - Sydney Blue Gum Association

c) New England Blackbutt Association

3. Dry Sclerophyll Forest (Tall Open Forest to Open Forest)

a) New England Blackbutt Association (drier sites than 2(c))

b) Grey Gum - Grey Ironbark - White Mahogany Association

c) Forest Red Gum - Grey Gum/Grey Ironbark - Roughbarked Apple Association.

4. Scrub

a) Dry Scrub: Dwarf Cypress Pine - Lemon Scented Tea-tree - Grey Myrtle Association.

b) Depauperate Dry Rainforest

c) Wet Scrub: Lemon Scented Tea-tree - Oval Mint Bush Association.

Appendix Two

Rare, Threatened or Significant Plant Species Recorded from The Washpool area.

Callitris monticola (Dwarf Cypress Pine). A species near its southern limit in the study area, with disjunct occurrences north to Dave's Creek in Lamington N.P. (S.E. Qld.). It occurs in Dry Scrub in the Washpool area.

Diplazium dilatatum (Athyrium dilatatum) (Giant Lady-fern). Previously known from the Richmond River and north, the collection by National Herbarium staff from the Washpool area is a new southern limit for the species.

Dodonaea megazyga (3RCa). This is a rare shrub. It has several disjunct occurrences - Wollemi, Barrington Tops, Gibraltar Range and the northern part of the Mount Warning Sheild. It was collected recently in North Washpool by NPWS staff.

Erythrina respertillio (Bat's Wing Coral Tree). This species is close to its southern limit (Nymboida) in the Washpool Area.

Eucalyptus notabilis. (Blue Mountains Mahogany). This species has disjunct occurrences from the Blue Mountains to Dave's Creek in Lamington N.P. (S.E. Qld.).

Grevillea floribunda. The collections by National Herbarium staff from the Washpool Area was the first for the North Coast of NSW.

Lastreopsis munita (A Shield-fern). Previously known only from the Richmond River and north, the collection by National Herbarium staff extends the known southern limit of the species.

Macrozamia fawcettii (Twisted Burrawang). This species is confined generally to the Clarence Valley from Casino to Woolgoolga. Good populations occur in the Washpool area.

Marsdenia longiloba (Slender Marsdenia) (3EC-). This endangered vine occurs north from coffs Harbour to far south-east Qld. Additional to the National Herbarium staff collection for the Washpool Area, there are only three old records from NSW - Alstonville (1917), Upper Copmanhurst (1911) and Coffs Harbour (1903).

Passiflora aurantia (Blunt-leaved Passionfruit). The collection by National Herbarium staff from the Washpool area extended the known southern limit of this species (previously Casino).

Psychotria simmondsiana (Small Psychotria). The collection by National Herbarium staff extended the known southern limit of this species (previously Alstonville).

Streptothamnus moorei (Coast Redberry Vine). This species is close to its southern limit in the Washpool area; southern limit is Cangai, Clarence River.

Syzygium moorei (Durobby) (2VCi). The collection of this species by National Herbarium staff from the Washpool area extends its southern limit. It was previously thought to be confined to the Mount Warning Shield. This is a vulnerable tree of lowland subtropical rainforest and is poorly conserved.

Symplocos stawellii (White Hazelwood). This species was recorded by Floyd (1980) from the Washpool area. It has a scattered distribution from the Hawkesbury River to the Atherton Tableland.

Records are from Floyd (1978, 1980), Fox, National Herbarium (1983) and Hunter, NPWS.

Information on species distribution are from Beadle (1989), Floyd (1989), Brooker and Kleinig (1983), Stanley and Ross (1983, 1986) and Williams (1984).

Conservation Codes follow Briggs and Leigh (1988).

APPENDIX 3

VERTEBRATE FAUNA FROM THE WASHPOOL AREA

All the vertebrate wildlife recorded from the proposed North Washpool wilderness, plus the contiguous Washpool National Park to the south and Ewingar State Forest to the north are listed in Appendix 1. These recoreds have been sythesized from surveys conducted by Barker (1981), Clancy (1989), Holmes (1980), Osborne (1982), Pulsford (1982) and Ramsay (1919).

AMPHIBIANS

FAMILY MYOBATRACHIDAE	
Assa darlingtoni	Pouched Frog
Lechriodus fletcheri	Fletcher's Frog
Limnodynastes dumerilii	Eastern Banjo Frog
Mixophyes iteratus	Giant Barred Frog
Philoria loveridgei	Loveridge's Frog
Pseudophryne coriacea	Red Backed Toadlet
Ranidella signifera	Common Eastern Froglet
FAMILY HYLIDAE	
Litoria chloris	Red-eyed Tree Frog
Litoria latopalmata	
Litoria lesueurii	Lesueur's Frog
Litoria peronii	Peron's Tree Frog
Litoria phyllochroa	Leaf Green Tree Frog

Total amphibian spp. 12

REPTILES

FAMILY GEKKONIDAE	
Phyllurus cornutus	Northern Leaf-tailed Gecko
FAMILY PYGOPODIDAE	
Pygopus lepidopodus	Common Scaly-foot
FAMILY AGAMIDAE	
Amphibolurus muricatus	Jacky Lizard
Amphibolurus nobbi	Nobbi
Physignathus lesueurii	Eastern Water Dragon

FAMILY VARANIDAE	
Varanus varius	Lace Monitor
FAMILY SCINCIDAE	
Egernia cunninghami	Cunningham's Skink
Egernia frerei	Major Skink
Egernia major	Land Mullet
Egernia saxatilis	Black Rock Skink
Egernia whitii	White's Skink
Lampropholis challengeri	
Lampropholis delicata	
Lampropholis guichenoti	
Saiphos equalis	
Sphenomorphus quoyii	Eastern Water Skink
Sphenomorphus murrayi	
Sphenomorphus scutirostrum	
Sphenomorphus tenuis	
FAMILY CHELIDAE	
Emydura signata	
FAMILY TYPHLOPIDAE	
Ramphotyphlops nigrescens	
FAMILY BOIDAE	
Morelia spilota	Diamond Python
FAMILY COLUBRIDAE	
Dendrelaphis punctulatus	Common Tree Snake
FAMILY ELAPIDAE	
Cacophis squamulosus	Golden Crowned Snake
Cryptophis nigrescens	Eastern Small-eyed Snake
Demansia psammophis	Yellow-faced Whip Snake
Hemiaspis signata	Black-bellied Swamp Snake
Hoplocecphalus stephensi	Stephen's Banded Snake
Notechis scutatus	Eastern Tiger Snake
Tropidechis carinatus	Rough-scaled Snake
Pseudechis porphyriacus	Red-bellied Black Snake

Total reptile spp. 31

BIRDS

FAMILY PHALACROCORACIDAE	
Phalacrocorax carbo	Great Cormorant

FAMILY ANATIDAE	
Chenonetta jubata	Maned Duck
FAMILY ACCIPITRIDAE	
Aviceda subcristata	Pacific Baza
Haliastur sphenurus	Whistling Kike
Accipiter fasciatus	Brown Goshawk
Accipiter cirrhocephalus	Collared Sparrowhawk
Accipiter novaehollandiae	Grey Goshawk
FAMILY ACCIPITRIDAE	
Aquila audax	Wedge-tailed Eagle
Hieraaetus morphnoides	Little Eagle
FAMILY FALCONIDAE	
Falco peregrinus	Peregrine Falcon
Falco berigora	Brown Falcon
FAMILY MEGAPODIIDAE	
Alectura lathami	Australian Bush Turkey
FAMILY TURNICIDAE	
Turnix varia	Painted Button-quail
FAMILY COLUMBIDAE	
Ptilinopus regina	Rose-crowned Fruit-Dove
Ptilinopus magnificus	Woompoo Fruit-Dove
Lopholaimus antarcticus	Topknot Pigeon
Columba leucomela	White-headed Pigeon
Macropygia amboinensis	Brown Cuckoo-Dove
Chalcophaps indica	Emerald Dove
Phaps chalcoptera	Common Bronzewing
Leucosarcia melanoleuca	Wonga Pigeon
FAMILY CACATUIDAE	
Calyptorhynchus lathami	Glossy Black-Cockatoo
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo
Cacatua galerita	Sulphur-crested Cockatoo
FAMILY LORIIDAE	
Trichoglossus haematodus	Rainbow Lorikeet
Glossopsitta pusilla	Little Lorikeet
FAMILY POLYTELITIDAE	
Alisterus scapularis	Australian King Parrot
FAMILY PLATYCERCIDAE	
Platycercus elegans	Crimson Rosella
Platycercus eximius	Eastern Rosella
FAMILY CUCULIDAE	
Cuculus variolosus	Brush Cuckoo
Cuculus pyrrhophanus	Fan-tailed Cuckoo

Chrysococcyx lucidus	Shining Bronze-Cuckoo
Eudynamis scolopacea	Common Koel
Scythrops novaehollandiae	Channel-billed Cuckoo
FAMILY STRIGIDAE	
Ninox strenua	Powerful Owl
Ninox novaeseelandiae	Southern Boobook
FAMILY TYTONIDAE	
Tyto alba	Barn Owl
FAMILY PODARGIDAE	
Podargus strigoides	Tawny Frogmouth
FAMILY AEGOTHELIDAE	
Aegotheles cristatus	Australian Owlet-nightjar
FAMILY CAPRIMULGIDAE	
Caprimulgus mystacalis	White-throated Nightjar
FAMILY APODIDAE	
Hirundapus caudacutus	White-throated Needletail
FAMILY ALCEDINIDAE	
Ceyx azurea	Azure Kingfisher
Dacelo novaeguineae	Laughing Kookaburra
Halcyon sancta	Sacred Kingfisher
FAMILY CORACIIDAE	
Eurystomus orientalis	Dollarbird
FAMILY PITTIDAE	
Pitta versicolor	Noisy Pitta
FAMILY MENURIDAE	
Menura novaehollandiae	Superb Lyrebird
FAMILY ATRICHORNITHIDAE	
Atrichornis rufescens	Rufous Scrub-bird
FAMILY HIRUNDINIDAE	
Hirundo neoxena	Welcome Swallow
FAMILY MOTACILLIDAE	
Anthus novaeseelandiae	Richard's Pipit
FAMILY CAMPEPHAGIDAE	
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Coracina papuensis	White-bellied Cuckoo-shrike
Coracina tenuirostris	Cicadabird
Lalage leucomela	Varied triller
~~*FAMILY MUSCICAPIDAE*~~	
~~*Zoothera dauma*~~	~~White's thrush~~

Manorina melanophrys	Bell Miner
Meliphaga lewinii	Lewin's Honeyeater
Lichenostomus chrysops	Yellow-faced Honeyeater
Lichenostomus leucotis	White-eared Honeyeater
Melithreptus albogularis	White-throated Honeyeater
Melithreptus lunatus	White-naped Honeyeater
Phylidonyris novaehollandiae	New Holland Honeyeater
Phylidonyris nigra	White-cheeked Honeyeater
Acanthorhynchus tenuirostris	Eastern Spinebill
Myzomela sanguinolenta	Scarlet Honeyeater
FAMILY DICAEIDAE	
Dicaeum hirundinaceum	Mistletoebird
FAMILY PARDALOTIDAE	
Pardalotus punctatus	Spotted Pardalote
Pardalotus striatus	Striated Pardalote
FAMILY ZOSTEROPIDAE	
Zosterops lateralis	Silvereye
FAMILY PLOCEIDAE	
Emblema temporalis	Red-browed Firetail
FAMILY ORIOLIDAE	
Oriolus sagittatus	Olive-backed Oriole
Sphecotheres viridis	Figbird
FAMILY DICRURIDAE	
Dicrurus hottentottus	Spangled Drongo
FAMILY PARADISAEIDAE	
Ptilonorhynchus violaceus	Satin Bowerbird
Sericulus chrysocephalus	Regent Bowerbird
Ailuroedus crassirostris	Green Catbird
Ptiloris paradiseus	Paradise Riflebird
FAMILY CORCORACIDAE	
Corcorax melanorhamphos	White-winged Chough
FAMILY ARTAMIDAE	
Artamus superciliosus	White-browed Woodswallow
Artamus cyanopterus	Dusky Woodswallow
FAMILY CRACTICIDAE	
Cracticus torquatus	Grey Butcherbird
Strepera graculina	Pied Currawong
FAMILY CORVIDAE	
Corvus coronoides	Australian Raven

Total bird spp 122

MAMMALS

FAMILY ORNITHORHYNCHIDAE	
Ornithorynchus anatinus	Platypus
FAMILY TACHYGLOSSIDAE	
Tachyglossus aculeatus	Echidna
FAMILY DASYURIDAE	
Dayurus maculatus	Spotted-tailed Quoll
Phascogale tapoatafa	Brush-tailed Phascogale
Antechinus stuartii	Brown Antechinus
Sminthopsis murina	Common Dunnart
FAMILY PERAMELIDAE	
Isoodon macrourus	Northern Brown Bandicoot
Perameles nasuta	Long-nosed Bandicoot
FAMILY PHASCOLARCTIDAE	
Phascolarctos cinereus	Koala
FAMILY PETAURIDAE	
Pseudocheirus peregrinus	Common Ringtail Possum
Petauroides volans	Greater Glider
Petaurus australis	Yellow-bellied Glider
Petaurus breviceps	Sugar Glider
Petaurus norfolkensis	Squirrel Glider
FAMILY PHALANGERIDAE	
Trichosurus vulpecula	Common Brushtail Possum
Trichosurus caninus	Mountain Brushtail Possum
FAMILY BURRAMYIDAE	
Cercartetus nanus	Eastern Pygmy-possum
FAMILY POTOROIDAE	
Potorous tridactylus	Long-nosed Potoroo
Aepyprymnus rufescens	Rufous Bettong
FAMILY MACROPODIDAE	
Petrogale penicillata	Brush-tailed Rock-wallaby
Thylogale stigmatica	Red-legged Pademelon
Thylogale thetis	Red-necked Pademelon
Macropus parma	Parma Wallaby
Macropus parryi	Whiptail Wallaby
Macropus rufogriseus	Red-necked Wallaby
Macropus giganteus	Eastern Grey Kangaroo
Macropus robustus	Common Wallaroo
Wallabia bicolor	Swamp Wallaby

FAMILY PTEROPODIDAE	
Pteropus poliocephalus	Grey-headed Flying Fox
FAMILY RHINOLOPHIDAE	
Rhinolophus megaphyllus	Eastern Horseshoe Bat
FAMILY MOLOSSIDAE	
Mormopterus norfolkensis	Eastern Little Mastiff Bat
FAMILY VESPERTILIONIDAE	
Nyctophilus gouldi	Gould's Long-eared Bat
Miniopterus schreibersii	Common Bent-wing Bat
Chalinolbus gouldii	Gould's Wattled Bat
Chalinolobus morio	Chocolate Wattled Bat
Myotis adversus	Large-footed Mouse-eared Bat
Nycticeius rueppelli	Greater Broad-nosed Bat
Nycticeius orion	Eastern Broad-nosed Bat
Eptesicus pumilus	Little Cave Eptesicus
Eptesicus regulus	King River Eptesicus
Eptesicus vulturnus	Little Forest Eptesicus
Eptesicus sagittula	Large Forest Eptesicus
FAMILY MURIDAE	
Hydromys chrysogaster	Water Rat
Melomys cervinipes	Fawn-footed Melomys
Rattus fuscipes	Bush Rat
Rattus lutreolus	Swamp Rat
FAMILY LEPORIDAE	
Oryctolagus cuniculus	Rabbit
Lepus capensis	Brown Hare
FAMILY CANIDAE	
Canis familiaris dingo	Dingo
Vulpes vulpes	Fox
FAMILY FELIDAE	
Felis cattus	Cat
FAMILY BOVIDAE	
Bos taurus	Cattle

Total mammal species 52

INTRODUCTION

An inventory of wilderness in eastern New South Wales and south-eastern Queensland (Helman *et al*,1976) identified the Washpool area as one of the 20 wilderness areas remaining.

In December 1980 the Forestry Commission of New South Wales released an Environmental Impact Statement entitled "Proposed Forest Operations in the Washpoool Area" (herein termed E.I.S.) which covered 43,283 hectares of the forested country outlined by Helman et al (1976).

As a consequence of the October 1982 cabinet decision a total of 27,700 ha. was gazetted as National Park in 1983-84. As a concession to logging interests three key areas were omitted: Redbank, Desert Creek, and part of Malara Creek.

The area herein termed North Washpool is basically comprised of the Desert and Malara Creek sections excluded from the Park at that time.

As the result of the declaration of the park there was some alteration of boundaries of the Forestry Commission's Casino West Management Area. Some parts were transferred to the park and other areas were transferred from the Grafton Management Area to Casino West, giving as an end result, about the same area that existed previously.

The Casino West Management Area is subdivided into the Ewingar and Richmond Range Working Circles. Ewingar is comprised of Washpool, Billilimbra and Ewingar State forests, and various other Crown lands.

The Forestry Commission commenced construction of Berry Road into North Washpool, along the Gibraltar Range, in 1985 and commenced rainforest logging.

In December 1988 the Wilderness Society nominated North Washpool as wilderness, under the Wilderness Act (1987).

In January 1989 the Commission commenced the construction of the Desert Spur road though prolonged wet weather substantially delayed work.

Herin some of the numerous deficiencies in the Commission's E.I.S. are noted, and some of the aspects that need consideration in the preparation of an adequate Environmental Impact Statement are outlined.

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D. Pugh

September 1989

W NORTH WASHPOOL : EIS DEFICIENCES + LOGGING IMPAC

CONTENTS

1.1 Area for which E.I.S. is sought

1.2 Proposed Operations - Rainforest

1.3 Proposed Operations - 'Hardwoods'

2.1 Adequacy of Forestry Commission E.I.S.

2.2 Climatic considerations

2.3 Geological and soil considerations

2.4 Vegetation considerations

2.5 Faunal considerations

2.6 Aboriginal considerations

2.7 Financial considerations

2.8 Roading considerations

2.9 Management considerations

3.0 The likely environmental impact of logging the North Washpool area

3.1 The impact of roads and heavy machinery

3.2 Impact of logging

3.3 Impact of fire

3.4 Effects on streams

References

Appendixes

1.1 AREA FOR WHICH E.I.S. IS SOUGHT

The area for which the preparation and consideration of an Environmental Impact Statement is being sought incorporates the entire catchment of Desert Creek in Washpool State Forest and the catchment of Malara Creek, north to Main Creek, within Billilimbra State Forest.

Herin the area is termed North Washpool.

Specifically the area is comprised of:

Desert Creek catchment, Washpool State Forest;	
Compartments 686-694, 697-699	2,823 ha.
Malara Creek catchment, Billilimbra State Forest;	
Compartments part 679 (148 ha.), 695, 696, 700-711	4,063 ha.
Total area	6,886 ha.

The preparation of an Environmental Impact Statement for North Washpool by the Forestry Commission is considered inappropriate due to their apparent inability to satisfactorily assess the environment and the impact of their operations upon it, and their vested interest, which prejudices their approach, findings and conclusions.

It is requested that an impartial party be commissioned to prepare the E.I.S.

1.2 PROPOSED OPERATIONS: RAINFOREST

Berry Road was extended into North Washpool in 1985 and rainforest logging commenced in the 1985/86 financial year. Stated prescriptions are to log sub-tropical rainforest on a 50% canopy retention basis and warm-temperate rainforest on a maximum economic utilization basis, though the Commission apparently intends to log both on a 50% canopy retention basis in the future (P.Paunovic pers.comm.).

In the Commission's 1983 amendments to the Casino West Management Plan (1979) it is estimated that a total of 36,000 m^3 nett (46,800 m^3 gross) of quota quality rainforest timbers are available in North Washoool. This would involve the logging of 452 hectares of rainforest in the Desert Creek catchment for a yield of 24,000 m^3 nett and 194 hectares in the Malara Creek catchment for a yield of 12,000 m^3 nett.

As at June 1988 some 6,219 m^3 nett had already been procured from North Washpool (Casino West Management Report 1987/88). Apparently none has been removed since (P.Paunovic, pers.comm.).

The Commission (Department of Environment and Planning 1982 p.168) stated that at the end of the 1980/81 quota year only 8,361 m^3 nett of harvestable rainforest timbers remained in the Ewingar/Billilimbra State Forests (outside the Washpool Area) and that all available rainforest would have been logged by the end of 1982.

Over the period 1981/88 a total of 20,123 m^3 nett of quota rainforest timbers were removed from the Ewingar Working Circle (Table 1). With the subtraction of the volume obtained from North Washpool a total of 13,904 m^3 nett was removed (as well as 1,584 m^3 non quota sawlogs), this is two thirds more than the Commission estimated to be available.

As at 31/5/1980 the outstanding allocation of rainforest timbers to Big River Timbers was given as 67,862 m^3 nett, with an annual quota of 6,260 m^3 nett (Department of Environment and Planning 1982 p.168).

At the end of the 1982/83 quota year this allocation was reduced to 25,300m³ nett, though the quota remained the same. Since then 11,943m³ nett of quota rainforest timbers have been harvested leaving an outstanding allocation of 13,357 m³ nett.

The average annual volume of quota rainforest timbers removed from the Ewingar Working Circle over the period 1985/88 was 1,538 m³ nett. At this rate it can be expected to take 8.7 years to harvest the allocation, though apparently (P.Paunovic pers. comm.) there has not been any rainforest logging in the area for over a year. Big River Timber's requirement for this allocation is certainly questionable if they have been still able to continue their operations without it.

The Department of Environment and Planning (1982) outlined a number of alternatives to the utilization of rainforest timbers for veneer production. Some Hoop Pine, Slash Pine, Poplar and eucalypts have been used to supplement Big River Timber's supply since then (P.Paunovic pers. comm.).

Once general purpose rainforest logging is completed in North Washpool the Commission intends to continue their 'speciality purpose' logging and obtain salvage logs in 'hardwood' logging operations.

Table 1. Rainforest timbers harvested in the Ewingar Working Circle 1981 to 1988 (taken from Casino West Management Reports 1981/82 to 1987/88)

FINANCIAL YEARS	RAINFOREST TIMBERS m³ gross	RAINFOREST TIMBERS m³ nett	YIELD PER HECTARE m³ nett/ha	QUOTA R.F.TIMBER m³ nett	'BRUSHWOOD TIMBER PROD' m³ nett*
1981/82	8749[1]	6730	59	5781	5781
1982/83	3132[1]	2409	65	2399	2399
1983/84	3969[1]	3053	63	2999	2999
1984/85	5641[1]	4339	34	4331	4331
1985/86	2821	2169[2]	19	2012	2169
1986/87	2421	1862[2]	32	1689	1886
1987/88	1489	1145[2]	50	912	1187
TOTALS	28222	21707		20123	20752

[1]. A conversion factor of nett - gross of 1.3 was applied.
[2]. A conversion factor of gross - nett of 0.769 was applied.
* The figures in this column are taken from the Casino West Management Report 1987/88, Appendix II. It is apparent that the figures do not match up with those supplied elsewhere in the Management Reports. The figures for 1981/85 state only quota rainforest volumes, the 1986/87 figure appears to be an error, while the 1987/88 figure is the gross quota 'brushwood' figure. This is only one example of the numerous mistakes and inaccuracies in the Reports.

1.3 PROPOSED OPERATIONS: 'HARDWOODS'

The term 'hardwood' is not an ecological definition and is utilized in this section solely because it is applicable to the Commission's terminology and data. Most rainforest trees ('brushwoods') are hardwoods, while the Commission classes the rainforest species Brush Box as a 'hardwood'.

The proposed 'hardwood' logging operations will remove virtually all merchantable, economically accessible, mature 'hardwood' sawlog trees except for those retained for environmental reasons (Forestry Commission 1980 p.70). The Commission's current policy is to principally only retain a clump

of 5 trees, of value for wildlife habitat, per 5 hectares.

The Forestry Commission (1980 p.41) notes that further harvesting for sawlogs, once the current cutting cycle is completed, is not likely to be practicable until the resultant regeneration has established itself and grown to sawlog size, perhaps in about 100 years.

Two mills have traditional 'hardwood' quotas for the Ewingar Working Circle: Duncans Holdings Ltd (located at Sandilands) - 14540 m^3 nett; and Robb and Brown Ltd (located at Casino) - 6,460 m^3 nett. A further 72,000 m^3 nett is intended to be removed to supply mills in the Grafton Management Area.

The Commission (1980 p.38) estimated that the Desert Creek catchment would provide hardwoods for 4 years and the northern Malara Creek catchment for 2.2 years at a cutting rate of 21,000 m^3 nett per annum. The 1983 ammendment to the Casino West Management Plan (1979) states that an area encompassing some 11,000 m^3 nett of available timber would be transferred to the Grafton supply zone from the Casino West supply zone.

The Grafton supply zone now encompasses the Malara Creek catchment south-west of Stewart Creek and logging is anticipated to supply Grafton mills with an annual quota of 3,130 m^3 nett over a period of 23 years (Forestry Commission 1987).

At an annual rate of 21,000 m^3 nett per annum the remaining Casino West supply zone of North Washpool is anticipated to supply 119.200m^3 nett of timber over a period of 5.7 years.

The Casino West Management Report 1987/88 indicates that there is no intention to commence 'hardwood' logging operations in North Washpool at least until after the 1989/90 financial year.

2.1 ADEQUACY OF FORESTRY COMMISSION E.I.S.

The Department of Environment and Planning (1982 p.59) notes that a number of aspects identified by the Department in the Commission's draft Environmental Impact Statement (1980) were not fully dealt with in the final draft. Following public exhibition of the E.I.S. subsequent submissions identified a large number of deficiencies, including many that had been identified by the Department.

The National Parks and Wildlife Service (1981 p.32) considered that the Environmental Impact Statement appeared to be deficient in respect of clause 57 (2) of the Regulations to the Environmental Planning and Assessment Act. 1979. In general they found that the layout of the E.I.S. and the display of data can be misleading and in places, appears to be incorrect. They also noted that there are a number of internal inconsistencies.

The Department of Environment and Planning and the National Parks and Wildlife Service considered that the description of the existing environment is inadequate and that therefore there is not sufficient data to adequately assess the environmental impact and consequences of the proposed operations. They also noted that the consideration of feasible alternatives to the proposed activities was not adequately undertaken by the Forestry Commission.

The Department of Environment and Planning notes that the consideration of the likely effectiveness of the proposed mitigation measures was not adequate and the actual means of applying the measures on site was not considered to ensure satisfactory mitigation of impact.

The National Parks and Wildlife Service notes that the E.I.S. does not provide any basis for assessment of impacts upon fauna.

Extracts from their assessments are included in Appendices A, B.

2.2 CLIMATIC CONSIDERATIONS

The Gibraltar Range National Park headquarters, situated at 1,000 meters elevation to the south of the Washpool National Park, recorded an annual average rainfall of 2,450 mm. for the period 1965-1979 and the Tick Gate (980 m), some 10 km to the east, recorded 2,540 mm. Maximum annual rainfalls recorded were 3,760 mm and 4,166 mm. respectively, in 1976 (Forestry Commission 1980).

Temperature variations recorded at Park Headquarters were from -11.3°C in July 1968 to 47.5°C in January 1969. Mean annual extremes were from -5°C to 35°. Snowfalls occurred yearly (Forestry Commission 1980).

Occassional destructive cyclonic winds cause isolated windthrows and blowdowns. Associated heavy rains cause flooding, with resultant damage to forest roads (Department of Environment and Planning 1982).

The Forestry Commission (1980) considers that large areas of their 'myrtle and viney scrub' type rainforest (which is relatively extensive in North Washpool) is regenerating warm temperate rainforest following "blow-downs" or the result of constant climatic extremes.

The opening of the canopy resultant from roading and logging will significantly increase wind damage and temperature extremes in the rainforest. This potentially severe impact wasn't addressed in the E.I.S.

The high rainfall, particularly prolonged heavy downpours, pose a significant threat to the stability of disturbed soils and indicates that erosion will be a significant problem with roading and logging activities.

The significant impacts of global warming (caused by CO_2 buildup) on roads, regeneration and the environment generally need to be assessed and measures taken now to minimise them.

2.3 GEOLOGICAL AND SOIL CONSIDERATIONS

The geological mapping used in the E.I.S. is of poor accuracy, (Forestry Commission 1980 p.68) and a number of major errors have been noted (National Parks and Wildlife Service 1981, Appendix 1). No detailed soil mapping has been carried out (Forestry Commission 1980. p.69).

The map presented in the E.I.S. indicates that the higher elevations in North Washpool are chiefly comprised of Drake Volcanics (Plv and Pld). The lower elevations in Malara Creek valley are mostly Permian intrusive rocks (Pas) and in Desert Creek valley Paleozoic metamorphics (θ-s).

The soils formed from Drake Volcanics and Paleozoic metamorphics are considered by the Commission (1980 p.121) to be relatively stable and resistant to erosion, though with a tendency to slip and slump when wet. They note that slumping of road batters and areas adjacent to old logging and snig tracks is still occurring on the Drake volcanics geological type.

The Commission (1980 p.121) considers the soil formed from Permian intrusive rocks are erodible and note that there are extensive erosion gullies in cleared land outside the forest in the Pas geological type.

The Commission intends to undertake roading and logging activities on slopes up to 30°. The Standard Erosion Mitigation Conditions are likely to be unsuitable guidelines for erosion control on slopes in excess of 25° (State Pollution Control Commission cited in Department of Environment and Planning 1982 p.52, Justice Hemmings 1989).

It is apparent that the Commission's proposed operations will significantly decrease landscape stability and increase soil erosion. There is a need to undertake detailed soil mapping and revise the Standard Erosion Mitigation Conditions before operations proceed.

2.4 VEGETATION CONSIDERATIONS

The vegetation of North Washpool is a mosaic of rainforests and associated eucalypt forests. Cool subtropical rainforest occurs on the most favourable sites, merging into extensive warm temperate rainforest at higher elevations and in more exposed situations. Limited occurrences of dry rainforests occur along some creeks at lower elevations. Intermixed with these rainforests, particularly in marginal situations, are developing rainforests in which Brush Box forms a co-dominant.

On the more fire prone and less favourable sites rainforests grade into the Sydney Blue Gum - Tallowwood association, with a rainforest understorey. Intermixed with this extensive association are numerous stands of New England Blackbutt. With increasing fire frequency and deteriorating site conditions the rainforest understorey becomes sparse.

On the poorer soils with lower rainfall amnd more frequent fires, particularly at lower elevations, there are extensive forests dominated by White Mahogany, Grey Ironbark and Grey Gum. The most fire prone stands have a grassy understorey.

Scrubs occur at high elevations on rocky outcrops.

The rainforests of North Washpool form a continuum with the Willowie Scrub and the heavily logged rainforests to the north. Together with the Willowie Scrub these rainforests represent the largest unlogged expanse of rainforest remaining in N.S.W., as well as encompassing the largest Coachwood forest in Australia.

Fox (1983 p.93) notes that the species list for the Washpool area contains seventy species that are of special interest, being rare or poorly collected, or having a restricted distribution. For many of these, the species record at Washpool has extended the known geographic range. Two species found in the herbarium survey were undescribed species.

Fox (1983 p.101) found that in the Washpool area logged rainforests were differentiated from unlogged rainforests as either a discrete group or grouped with wet sclerophyll forest sites. This distinction was even evident at sites selectively logged 20 years previously.

Fox (1983 p.102) further noted that logged rainforest is distinguished from unlogged rainforest by large numbers of pioneer species, fewer tree species, fewer specialized life forms, more shrubs and juveniles, higher incidence of dieback, higher soil pH, higher soil calcium, lower soil aluminium and higher soil electrical conductivity (Appendix C).

The National Parks and Wildlife Service (1981) describes the Sydney Blue Gum - Tallowwood - Brush Box associations in the Washpool area as some of the finest examples of such forest left unlogged in the State. Some trees reach a height of 70 metres or more.

The Casino West Management Report (1986/87) notes that wet sclerophyll forests are renowned for their patchy regeneration and that in the Richmond Range Working Circle there are areas with a low stocking of non-merchantable trees with a sea of lantana and vines and others simply a sea of lantana. Recent logging in 1984 was noted to have resulted in no regeneration.

The Casino West Management Report (1987/88) notes that a number of areas of the Blue Gum - Tallowwood type in the Ewingar Working Circle lack suitable regeneration, some sites only with a covering of Acacia species.

The Commission (1980 p,160) considers that the most moist wet sclerophyll forests suffer a very significant impact from logging. They state (p.142) that the only practical silvicultural option to bring about a suitable recovery from the impact of logging for this type is to plant an overstorey species in the larger gaps where assessment shows regeneration is not sufficient.

The E.I.S. (p.47) further notes that there will not be any expenditure on post logging treatment except where necessary to obtain adequate cover of tree species.

Despite inadequate regeneration of a number of areas the only planting carried out in the Ewingar Working Circle in the period 1981/88 was over an area of 15-20 hectares in compartment 632. As is noted a number of times in the Casino West Management Reports assessments of regeneration are rarely carried out.

For the E.I.S. the Commission sampled two sites, and utilized the data from four sites surveyed by Floyd in 1978 , on or near the southern boundary of North Washpool.. Subsequently the Herbarium (Fox 1983) sampled three sites on or near the southern boundary.

The Forestry Commission needs to adequately assess the vegetation throughout North Washpool, and the regeneration of logged forests in the vicinity. Particular attention needs to be paid to the Brush Box, Sydney Blue Gum - Tallowwood and New England Blackbutt asociations, drier eucalypt forests and scrubs.

Fox (1983) is critical of the methodology, lack of data, and conclusions in the vegetation sections of the E.I.S. (Appendix C). She notes that the eucalypt associations that would be most affected by proposed logging were inadequately sampled.

2.5 FAUNAL CONSIDERATIONS

The general Washpool area is of outstanding significance for fauna in that it represents the largest wet forest wilderness remaining in N.S.W. It encompasses a range of forest types from open forests through extensive wet forests to rainforests, over an altitudinal range from 200 metres A.S.L. to over 1,100 metres A.S.L.

It is the largest refuge in the region for animal species adversely affected by human-induced disturbances and introduced plants and animals. It's expanse increases the ability for genetic exchange between vulnerable animals and thence genetic viability and continuing evolution.

North Washpool is an integral part of the wilderness area and the proposed operations will destroy its wilderness qualities and detract from the wilderness values of the Washpool area as a whole.

The proposed logging and roading in North Washpool will cause: a

severe reduction in populations of hollow-dependent fauna; a reduction in populations of fauna preferring mature forest, rainforest, a stable microclimate and some specialized food resources; an increase in introduced predators; an increase in fauna from more open habitats; and a degradation of habitat for aquatic fauna (see section 3).

Osborne (1982) found that the densities of Greater Gliders recorded in the Washpool area were comparatively high compared to other areas and Yellow-bellied Gliders widespread, which he considered may be related to the availability of tree-hollows. He considered that the low number of feral animals was an outstanding feature which may partially explain the high density of ground dwelling mammals and the apparent abundance of the Tiger Quoll.

Seventeen of the bird species and fourteen of the mammal species recorded in the Washpool area are obligatory tree hollow users and hence are dependent on mature exucalypt forests (Osborne 1982).

Species of animals of special conservation significance recorded within the Washpool area are: Pacific Baza, Grey Falcon, Peregrine Falcon, Wompoo Pigeon, Channel-billed Cuckoo, Powerful Owl, Sooty Owl, Noisy Pitta, Rufous Scrub-bird, Paradise Riflebird, Olive Whistler, Parma Wallaby, Long-nosed Potoroo, Rufous Rat Kangaroo, Tiger Quoll, Pouched Frog, Fletcher's Frog, and Stephen's Banded Snake.

The N.S.W. subspecies of the Rufous Scrub-bird is of particular significance as Ferrier considered that any activity which reduces their numbers, even by only a few territories is significant to the survival prospects of the species due to the very low number of breeding pairs (100 - 200) (National Parks and Wildlife Service 1981).

For the E.I.S. the Commission undertood no faunal surveys. The avifauna is described on the basis of expected occurrence, generally from standard reference texts, and includes a large number of species for which suitable habitat doesn't exist. Reptiles and amphibians are given no consideration aside from a list of expected occurrences. The invertebrates are given scarce attention and aquatic fauna are not considered at all.

Subsequent to the E.I.S. the National Parks and Wildlife Service and Total Environment Centre completed their wildlife surveys, the former of which included a few sites low down in the Desert Creek valley and on Gibraltar Range south of the head of Desert Creek.

North Washpool is still inadequately surveyed for all animal groups, while reptiles, amphibians, invertebrates, and aquatic fauna are inadequately surveyed throughout the Washpool area.

A full faunal survey needs to be undertaken in North Washpool before the impact of proposed operations can be adequately assessed. It is particularly important that all potentially suitable sites for the Rufous Scrub-bird be investigated before further roading or logging occurs in North Washpool.

2.6 ABORIGINAL CONSIDERATIONS

The National Parks and Wildlife Service notes that the local Aboriginal communities are reluctant to disclose any information on significant sites and they are likely to be revealed only when they are immediately endangered (Forestry Commission 1980, Appendix 14).

The Service further noted that anthropological investigations cannot be undertaken hurriedly with any real chance of success or

reliability.

For the E.I.S. the Commission employed David Bell for seven days to undertake an archaelogical survey. He spent most of his time traversing a limited number of transects and in discussions with Service and Commission personnel. No time was spent liasing with the Aboriginal community. The limited period of the survey and his methodology do not substantiate his conclusions.

David Bell was informed of a site near Redbank Creek, though did not visit the area, and so noted that the site should be located and recorded with some urgency before logging was undertaken (Forestry Commsission 1980, Appendix 15).

In the E.I.S. the Commission agreed to: obtain further information as a matter of some urgency about reputed sites near Redbank Creek; monitor logging operations as they progress to ensure that there has not been any disturbance to sites; employ an Anthropologist/Archaeologist on an initial one year contract in the near future; and undertake further Archaeological surveys in those proposed logging areas which were not surveyed and which may contain sites.

Logging began in the Redbank area in 1982/83 and will soon be completed. The Commission apparently made no attempt to comply with their agreement and may well have already damaged or destroyed any sites present. Similarly North Washpool was not surveyed prior to logging.

2.7 FINANCIAL CONSIDERATIONS

Over the period 1980/88 the Commission recorded a total loss of $300,000 in the Ewingar Working Circle (Table 2). This represents an average annual loss of $37,373. In recent years the Commission's losses have dramatically increased even though no major road construction activities were undertaken. The 1987/88 Casino West Management Report notes that there appears to be little chance in the foreseeable future of the commercial accounts for Ewingar getting back onto the right side of the ledger.

The current and proposed road construction costs in North Washpool can be expected to dramatically increase the Commission's losses for Ewingar.

The financial situation outlined in the E.I.S. is inaccurate and misleading. In addition to monetary costs, there is a necessity to incorporate environmental costs in monetary terms into accounting.

2.8 ROADING CONSIDERATIONS

Roads create a significcant environmental impact on: soil stability, instability increasing with increasing slope and variable with soil structure; flora and fauna, impact increasing with increasing wetness of forest (See Effects of Roads)

Roads are the principle source of runoff and erosion in logging operations and hence are responsible for the majority of stream degradation in the long term (See Effects on Streams)

For the E.I.S. no assessment of the impacts of roads on flora or fauna was made, while no attempts were made to assess the runoff and soil instability occassioned by existing roads in the area. To date no post-construction stabilization procedures, as outlined in the E.I.S. (p.124) have been instigated or the need for them adequately assessed.

Table 2. Annual Profit/Loss statements for the Ewingar Working Circle. Data from Casino West Management Reports 1984/88

FINANCIAL YEAR	PROFIT/LOSS $
1980/81	-125,000
1981/82	- 35,000
1982/83	-180,000
1983/84	+ 30,000
1984/85	+ 95,000*
1985/86	+ 65,755
1986/87	- 50,501
1987/88	- 99,241
TOTAL	-298,987
ANNUAL AVERAGE	- 37,373

* The 1985/86 Management Report states that in 1984/85 Ewingar showed a profit of $294,400 though this is not supported in the graph in the 1984/85 Management Report

Note: Data for 1980/85 is only approximate as they are derived from a graph provided in the 1984/85 Management Report

While the Commission has altered its proposed roading patterns for North Washpool since the E.I.S. it gives (p.45) an indication of the proposed extent of roads intended to be constructed. In the order of 27.3 km of primary, 23.8 km of secondary, 18.1 km of feeder and 46.3 km of logging tracks are proposed for construction in North Washpool.

Using the 1980 costs provided in the E.I.S. (p.46) the total cost of these works at 1980 prices would be $693,700. At todays prices, and with the Commission s burgeoning overheads, this figure would be substantially higher, and dramatically increase the Commission's losses for Ewingar.

District Forester Peter Paunovic (pers.comm.) notes that the construction of the Desert Spur road will cost $200,000 for 10 km. which represents a 67% increase in costs from those given in the E.I.S. This implies that total roading costs may be in the order of $1,156,000 at 1989 prices.

2.9 MANAGEMENT CONSIDERATIONS

A revised Management Plan for the Casino West Management Area was due to be prepared by 1985. The Casino West Management Report for 1987/88 states that the Plan period has been formally extended with revision due by June 1991 at the latest. It is irresponsible that the Management Area is to be allowed to operate without a current Plan for at least six years.

The statistics provided in the annual Casino West Management Reports are often miscalculated and misleading, with a number of internal inconsistencies.

Harvesting Plans are required to be drawn up for affected individual logging areas at the outset of operations for the logging area (Forestry Commission 1979).

A Harvesting Plan for Compartment 679 (a portion of which is within North Washpool) of Billilimbra State Forest was prepared by Forester Garry Douglas on the 16/5/89. In that it is stated "all forest types are in an overmature condition" and that "there are no obvious signs of recent harvesting operations".

This document is a fabrication because the 1986/87 Casino West Management Report states that by the end of June 1987 a total of 3,150 m^3 nett of rainforest timbers had already been removed from the Compartment which means the compartment was logged without a Harvesting Plan being prepared.

Many of the recommendations and suggestions made in the E.I.S. have not been applied in practice. Nor have further assessments of North Washpoool's environment, and the effects of operations upon it, been instigated.

The Commission's agreements to urgently locate and record sites of Aboriginal significance in the Redbank Creek area before logging commenced, and undertake further archaeological surveys in proposed logging areas have not been complied with.

The Commission (Department of Environment and Planning 1982 p:169) states that it is greatly involved in forest research, including both before and after logging, and much of this concerns monitoring logging effects. Any information or data resulting from such work is stated to be incorporated into management plans. Further that in some instances, additional monitoring of logging effects and modification of operations may be warranted.

The only harvesting prescriptions, applicable to wildlife conservation , applied in the area are that: mature and overmature trees of value for wildlife habitat shall be retained to provide an average frequency of one to two per hectare (depending on size), preferably in clumps of up to five trees per five hectares; trees identified as being used for feeding by yellow-bellied gliders, and one or two nearby refuge trees, shall be retained.

The Commission does little research into the impact of logging on wildlife and despite their assurance (Forestry Commission 1987) that logging prescriptions may be modified in accordance with the findings of further documented research few, and inadequate, attempts are made to do this in practice.

For example, no satisfactory attempt has been made to incorporate the documented research of Wyong District Forester Charlie Mackowski (1984, 1987) and Dunning and Smith (1986), which found that a minimum of 3-5 evenly distributed hollow bearing trees per hectare, plus suitable recruitments, are required to maintain populations of possums and gliders.

3 THE LIKELY ENVIRONMENTAL IMPACT OF LOGGING THE NORTH WASHPOOL AREA

A forest is the sum of numerous interactions and complex inter-dependencies that the plants and animals have developed over millions of years of co-evolution. The damage or destruction of each link starts a new chain reaction that spreads throughout the forest.

Knowledge of how the components of a forest function and inter-relate is extremely limited. As such the effects of man-induced disturbance to a natural ecosystem are mostly unknown. Enough research into certain aspects has been undertaken to show that the proposed roading, logging and burning of forests in the Desert Creek and Malara Creek valleys will have a variety of significant adverse impacts upon the environment.

Some consequences of the proposed operations will be:

- a degradation of soil structure and stability
- extensive soil compaction
- an increase in erosion
- altered streamflows
- loss of nutrients
- degradation of aquatic habitats
- a severe reduction in hollow-dependent fauna
- an increase in fauna from more open habitats
- an increase in introduced predators
- a reduction in fauna preferring mature forest, rainforest, a stable microclimate and some specialized food sources
- a reduction in populations of endangered species, with increased risk of elimination of some species
- an increase in introduced plants
- a degradation of forest structure
- an increase in pioneer and early successional plants
- a decrease in later successional rainforest plants
- inadequate regeneration on some sites
- an increased chance of the introduction of pathogens
- an altered microclimate in wetter forests
- an increased chance of wildfire

THE IMPACT OF ROADS AND HEAVY MACHINERY

Logging roads and snig tracks together may account for an average of 16% of the logging areas. The steep terrain, major construction works needed for some sections of roads and practice of wet weather logging indicate that roads and the use of heavy machinery will have a significant effect on both the environment within the area and surrounding rural communities.

1. Compaction

Compaction of forest soils during logging operations is caused by the weight of machinery, loads and falling trees. The single passage of machinery has been shown to cause major compaction (e.g. Incerti, Clinnick and Willatt 1987) while repeated loadings and logging cycles have been shown to increase compaction effects (e.g. Seymour 1981). Compaction effects have been shown to dramatically increase with soil moisture (e.g. Greacen and Sands 1980) while, to some extent, gravel and organic matter in the soil reduce compaction effects (e.g. Wronski 1984).

Shear stress and wheel slip can increase the compaction effect of static loads by up to 2 and 5 times respectively (Greacen and Sands 1980). Wronski (1984) found that after two or more passes of logging vehicles the full depth of the A horizon of the soil was compacted immediately beneath the wheel tracks and to a lesser extent up to 0.75 m from the edges of the tracks.

Wronski (1984) found that soils covering 23% of an area were visibly compacted or severely disturbed during thinning operations in a karri forest. Incerti *et al* (1987) found that 10% of a logged area of Mountain Ash had significant changes in soil physical properties and saturated hydraulic conductivity was reduced across the entire coupe area.

Van Loon (1966) found that on average 16% of the Sydney Blue Gum - Tallowwood association was tractor disturbed (snig tracks and logging dumps) during logging operations. The Forestry Commission's practice of maximizing soil disturbance in this type can result in disturbance and exposure of up to 70% of the total area (Forestry Commission, 1982a). This practice may therefore result in the majority of the logging area being affected by compaction.

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

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

Soil compaction, resultant from logging, has been shown to significantly:

(i) increase soil density (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al* 1987). Incerti *et al* (1987) found density increases of 27% and 38% on major snig tracks and log landings respectively. Greacen and Sands (1980) report

increases in densities of 20-30%.

(ii) reduce infiltration capacity (Langford and O'Shaughnessy 1977, Greacen and Sands 1980, Jakobsen and Moore 1981, Wronski 1984). This can lead to increased surface runoff, loss of water from site, and erosion

(iii) reduce hydraulic conductivity (Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al.* (1987) found that saturated hydraulic conductivity was reduced across an entire logging coupe.

(iv) reduce productivity, this is chiefly attributed to the reduction and restriction of root penetration and growth with increased soil density (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Jakobsen 1983, Wronski (1984). Wronski found that eighteen months after logging, root length density in soil compacted by one or more passes of machinery was only one-sixth of that in undisturbed soil. Jakobsen estimated the productivity of a 32 year old snig track on krasnozem soils at about 20% of the undisturbed area. Greacen and Sands predict a 15% reduction in volume yield due to compaction from tractor logging.

(v) reduce aeration (Greacen and Sands 1980, Jakobsen and Moore 1981, Wronski 1984). This may interfere with the function of soil microorganisms and plant roots.

(vi) reduce nutrient availability and uptake (Greacen and Sands 1980).

(vii) reduce and destroy beneficial soil organisms, for example mycorrhizal fungi (Greacen and Sands 1980) and worms (Jakobsen and Moore 1981).

Wet weather logging has been shown to be very detrimental to soil structure (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Wronski 1984). Greacen and Sands report that one passage of a tractor over wet soil made it almost impermeable to water and the effect was equivalent to four passages over dry soils. As they further note:

> 'Wetter soils are more prone to compaction and the avoidance wherever possible of logging wet soils is probably the most important management practice for prevention or reduction of compaction damage.'

Webb, Tracey and Williams (1972) found that even 12 years after the clearing of a small plot of sub-tropical rainforest by a bulldozer, *Lantana camara* still dominated a significant proportion of the area. They attributed this to high light intensity and the persistent dryness and compaction of the soil resulting from frequent passage of the bulldozer during clearing.

2. Other Effects of Machines

Direct and often complete destruction of soil structure is caused by the tilling or puddling effects of machines (Jakobsen and Moore 1981, Wronski 1984). Wheel ruts are major sources of both runoff and erosion.

Wronski (1984) concluded that where tracks constitute less than 2% of a block area severe rut formation would result in c.8% of the shallow root system being severed. This would further enable easy entry for disease organisms into the roots. He notes that the first pass of a heavy vehicle kills the understorey vegetation in the track which increases exposure and causes higher temperatures and reduced soil moisture in the top 100 mm of the

soil profile during summer.

Other adverse effects of machines include direct destruction of plants and animals, excessive noise levels, pollution, and the transport of weed seeds and diseases.

Logging trucks affect the local population by reducing road safety, and increasing road damage, bridge damage, noise levels, and pollution. Dobinson (1985) notes that road pavement damage increases in relation to the fourth power of axle load and that therefore a truck loaded to the permissable limit will do 14,000 times the damage of an average car to road pavements. He further notes that bridge life depends on the extent of concentrated load by an axle group and the gross weight of the vehicle on the bridge.

There is no doubt that use of rural roads by logging trucks causes significant damage, the resultant damaged roads and bridges are long term problems that the local community has to cope with and (when some of the council's limited funds are available) meet the costs of repairing.

3. Runoff

The reduced infiltration capacity of road surfaces, areas subject to compaction and heavily disturbed soils, combined with reduced canopy interception and transpiration, cause an increase in water runoff following logging.

Bren and Leitch (1985) conclude that the introduction of forest roads could markedly influence both the stormflow and peak flow. On a road with a grade of 2-6% they found that for less than c.10 mm. between 0 and 50% of the rainfall impinging on the road surface leaves as runoff, while for storms the percentage returned as runoff increases and in the largest storm encountered subsurface flow caused 20% more runoff than could be accounted for on the basis of runoff from the road and overland flow. They concluded that the diminution of runoff by simply passing across an infiltrating slope does not appear to be feasible.

Richards and Charley (1983) consider that potentially the loss of nutrients from an ecosystem by overland flow is far more significant than leaching. They note that poorly located and badly constructed logging roads and skid trails greatly enhance the loss of phosphorus, nitrogen and other nutrients.

Langford and O'Shaughnessy (1977) report increases in streamflows, peak flows and stormflows of 10 to 20% following clearfelling of forests. Streamflows can actually be reduced in the long term by the increased transpiration of the regenerating forest.

4. Erosion

Roads, snig tracks and areas of disturbed soil are the major sources of erosion following logging. Langford and O'Shaughnessy (1977) cite American studies which found that 93% of soil erosion resulted from landslides and mudflows initiated at roads, even though roads and embankments constituted only 6 % of the area. In another study cited clearfelling without roads increased sediment loads from 10 mg/l to 50 mg/l on steep slopes, while the introduction of roads increased it to 320 mg/l.

Langford and O'Shaughnessy cite Gilmour as attributing most sediment as coming from inadequately drained snig tracks and poorly

constructed stream crossings. Kriek and O'Shaughnessy are cited as finding significant increases in sediment yields following 'good practice' logging operations in Mountain Ash forests, sediment yields up to 3 times greater than undisturbed forest were recorded and in one case a road embankment slump increased it to 5 times.

Justice Hemmings (1989) considered the Standard Erosion Mitigation conditions imposed on operations by the Forestry Commission are likely to be unsuitable guidelines for erosion control in the steeper catchments in the Mistake State Forest. For the Washpool area the State Pollution Control Commission commented that logging on slopes greater than 25° would need to be in a manner contrary to the Standard Erosion Mitigation Conditions (Department of Environment and Planning 1982).

The Commission intends to construct major roads, involving extensive cut and fill operations, on steep slopes in the North Washpool area. This combined with their intention to construct minor roads and snig tracks across streams and on slopes up to 30° indicates that the proposed operations will result in significant erosion.

5. Effects on Fauna

Studies overseas have found the edge effect resultant from forest fragmentation to significantly increase nest predation by generalist predators from surrounding habitats (Andren and Angelstam 1988, Gates and Gysel 1978, Wilcove 1985, Yahner 1988). Roads, particularly in wetter forests, create an edge effect and must thereby have a significant impact upon prey species.

Dingoes and feral cats have been noted to frequently utilize roads (Osborne 1982, Gilmore pers.comm., pers.obs.) the latter appearing to be largely restricted to their vicinity in wetter forests (pers.obs.). Kookaburras utilize creek and road corridors for foraging in wetter forests (pers.obs., Gilmore pers.comm.)

The predation of medium-sized ground-dwelling marsupials, such as the Long-nosed Potoroo and Black-striped Wallaby, has been noted to increase as a result of greater access provided by roads for foxes and dingoes (Shields and Kavanagh 1985, Loyn 1985, Forestry Commission 1988).

Smith *et al* (1989) only found the predatory Barred Frog (*Mixophyes fasciolatus*) along roads in rainforest and considered that many large snakes may possibly also only occur along roads in rainforest. Tyler (1976) suggests that the dispersal of Cane Toads may also be assisted by roads.

Oxley, Fenton and Carmody (1974) found that roadways in Canada inhibited the movements of small forest mammals and chiefly attributed this to road clearance. They considered that roadways may have important effects on some populations of animals due to fragmentation of gene pools and attribute Diamond as being concerned with this effect on some species of rainforest birds.

Roads have been noted to form an effective barrier for exchanges between populations of small mammals (McIlroy 1978, Barnett, How and Humphreys 1978). Barnett *et al.* (1978) found that roads severely restricted or stopped the movement of small mammals even when the road consisted of a long-unused and partly overgrown track.

Road-kills by vehicles could be significant if species tend to congregate periodically on roads or if the road passes through prime habitat.

Rainforest Dragons have been observed to congregate on roads at certain times and Fletchers Frog often uses puddles in roads for breeding (pers.obs.).

Changes in the microclimate, predation, and plant species along roads would significantly alter the fauna in the vicinity of roads.

6. Effects on Flora

The altered microclimate, changed soil environment, and disturbance of soil and vegetation along roads allows for the dispersal and proliferation of weeds (Amor and Piggin 1977, pers.obs.) and species from earlier successional stages (pers. obs.)

Hopkins, Kikkawa, Graham, Tracey and Webb (1977) point out that the increased densities of early successional pioneer tree species along permanent roads, and their resultant prolific seed, can lead to a limited degradation in the seral status of surrounding rainforest.

The pathogen *Phytophthora cinnamomi* has caused severe dieback of eucalypts in Victoria and Western Australia, and patch dieback of rainforests in Queensland. There is abundant evidence that car tyres and machinery are a major contributor to its rapid dispersal (Gerrettson-Cornell and Dowden 1978, Forests Department of Western Australia 1979, Dawson and Weste 1985). Gerrettson-Cornell and Dowden particularly recommend avoiding any activity that may increase waterlogging of the soil and thus the chance of infection.

7. Other Effects of Roads

The canopy gaps caused by roads, snig tracks and logging generally, cause increased penetration by sunlight, winds, and more extreme temperature fluctuations. Thus the microclimate along and adjacent to roads is significantly altered in the denser forests, with consequent effects on the more sensitive plants and animals.

Shooters, timber and plant (e.g. orchids) poachers, and commercial marijuana growers are active in the region. They mostly rely upon forestry roads and tracks for access.

While roads are often established as fire breaks they are also major ignition sites for both accidental fires and deliberately lit fires (particularly those started by graziers eg Forestry Commission 1980 p.105). The perceived requirement by the Commission is to undertake regular hazard reduction burning along major roads, thereby significantly increasing the fire frequency in the vicinity of roads.

Leases for apiary sites are usually taken up as soon as road access is provided within a forest area (Forestry Commission 1980 p.106). This has important consequences for nectarivorous invertebrate and vertebrate species and for blossom feeders as bees remove very large quantities of nectar and pollen. In addition, honey bees affect the pollination and seed set of many plant species.

3.2 IMPACT OF LOGGING

A part of the rainforests of the North Washpool area are planned to be logged on a 50% canopy retention basis and other areas are to be logged for 'specialty purposes'. The eucalypt and Brush Box stands are planned to be logged on a maximum economic utilization basis and are not expected to

provide significant volumes for 100 years after logging.

The Forestry Commission (1980) estimated that logging would result in the removel of 60% of the overstorey canopy in the wet eucalypt dominated forests. While Dunning and Smith (1986) found that in practice normal logging of these types in Mt. Boss State Forest resulted in 75-95% canopy removal.

The only apparent specific constraints on logging are: that mature and overmature trees of value for wildlife habitat (and suitable recruitments) be retained at an average frequency of one per hectare, but preferably in clumps of up to five trees (per 5 ha.) and that trees identified as being used for feeding by Yellow-bellied Gliders be retained.

Logging will lead to major changes both in species abundance and forest structure, the more moist the forests the greater the effect and the longer the recovery time (Forestry Commission 1980).

The planned intensive logging will cause significant environmental degradation and adversely affect those animals most reliant upon a stable ecosystem and mature forest while favouring exotic fauna and those native species adapted to disturbed environments.

1. Loss of Hollows

It has been estimated that a total of 399 species of vertebrates use tree-hollows in Australia; 28% of frogs, 28% of reptiles, 17% of birds and 42% of mammals (Ambrose 1982). 142 of these use hollows in tall open-forest.

Dunning and Smith (1986) found that the number of hollow bearing trees (>96 cm.d.b.h.) in secondary rainforest varied from 0.3 per hectare on some logged sites to an average of 16 (8-30) per hectare in mature unlogged forest.

Species of animals dependent upon tree-hollows for denning and nesting are directly affected by the loss of hollow trees in logging operations (Recher, Rohan-Jones and Smith 1980, Forestry Commission 1980, 1981, Mackowski 1984, Dunning and Smith 1986, Smith and Lindenmayer 1988).

Mackowski (1987) studied 40 metre high Blackbutt forest with a Bladey grass understorey and found that wildlife hollows occur in trees of a diameter at breast height over bark (dbhob) greater than that at which crown width culminates and branches start being shed. In the case of Blackbutt this occurred at 100 cm dbhob (c. 150 years old) though it was not until the trees reached 140 cm dbhob (>224 years old) that hollows suitable for larger wildlife were created.

Mackowski (1984) estimated the longevity of Blackbutt at around 300 years, therefore hollows are only available for a limited period of time. As large hollows only form in trees above 120 cm dbhob their formation in Sydney Blue Gum would take over 220 years, Tallowwood over 300 years, and Brush Box in the order of 500 years.

For the 24 trees above 100 cm dbhob Mackowski (1987) dissected he recorded the average occupancy rate of trees by possums, gliders, birds and reptiles as : 100-119.9cm 1.14, 120-139.9cm 0.51, 140-159.9cm 2.80, and 160+ cm 2.84. In mature forest with a diverse understorey occupancy rates would be higher due to the higher productivity.

Mackowski (1987) recorded the average number of hollows per tree by

size class as: 40-59.9cm 0.33, 60-79.9cm 0.28, 80-99.9cm 0.50, 100-119.9cm 12.85, 120-139.9cm 12.16, 140-159.9cm 19.60, 160+cm 26.00. He also noted that all arboreal wildlife, other than Feathertail Gliders and reptiles, were restricted to choosing suitable hollows from the one third of Blackbutt hollows with smooth overgrown entries.

Saunders, Smith and Rowley (1982) note that hollows are variously utilized at different times of the year for nesting so that a single hollow may be utilized by a succession of species.

To maintain populations of hollow dependent possums and gliders at a natural level Dunning and Smith (1986) suggest that 3 evenly spaced or 5 randomly spaced self-sustaining potential nest tree clusters are required in each hectare of logged forest. Mackowski (1984) found that 3 hollow bearing trees per hectare were required and concluded that 0.45 hectares per hectare was needed to provide sufficient hollow trees in perpetuity.

Smith and Lindenmayer (1988) found that the total numbers of possums and gliders per site were significantly related to the number of 0.25 ha. blocks on each site supporting hollow trees and concluded that it is possible that maximum possum and glider density will only be reached when all 0.25 ha. blocks support hollow trees.

They further predicted that the prescription for the retention of a minimum of 15 trees for every 10 ha. clear-felled in Mountain Ash forests would reduce the total number of hollow-dependent possums and gliders to less than one eighth that of unlogged forest. Also that once the number of hollow trees falls below 4.2 per 3 ha. or when less than 1.7 0.25 ha. blocks contain hollow trees they predicted that the average density of Leadbeaters possum would be zero.

Lindemayer (pers.comm.) found that there are less hollow bearing trees on slopes and that the abundance of Leadbeaters Possum is negatively related to increasing slope.

The territorial requirements of hollow-dependent fauna needs to be considered when assessing the availability of hollows. Saunders *et al.* (1982) consider that the concentration of hollows in one area may pose behavioural problems for some species. Saunders (1979) notes that White-tailed Cockatoos space their nests out over the available breeding area and for about 15% of the breeding season the female attempts to limit access to trees around her nest site by other females.

Mackowski (1987) noted that large groups of trees too far apart may be unsuitable for evenly spaced territorial wildlife and could restrict successful dispersal of some species.

Following logging the sudden exposure of large trees to new wind stresses often leads to these trees dying or being thrown by the wind (Recher *et al.* 1980). Saunders (1979) notes that hollows are also lost by sections being broken off, collapse of floors of hollows, the ceiling falling in, being taken over by feral bees, human predation of nestlings, and because hollow trees are particularly susceptible to fire. Recher *et al.* (1980) also note that dead trees appear to be unsuitable to many species of hollow-dependent wildlife.

Tidemann and Flavel (1987) observed bat's roosts to be taken over by introduced bees on two occasions and by ants on another, and note that Starlings and possibly Indian Mynahs evict bats from hollows.

2 Other Effects on Fauna

invade logged forests (Shields and Kavanagh 1985, Dunning and Smith 1986). Dunning and Smith (1986) found that selective logging, 33% canopy retention, caused a significant decline in numbers of Challenger's skink.

The Forestry Commission found that in the Hastings Catchment logging had an initially severe impact on amphibians with a recovery in numbers with canopy re-establishment (Shields and Kavanagh 1985).

Birds from more open habitats, often transitory and non-breeding individuals, invade logged forest while birds most dependent upon mature forest decline in numbers or are lost (Pattemore and Kikkawa 1975, Milledge 1979, Recher *et al.* 1980).

McIlroy (1978) considers that forest bird diversity is correlated with plant species diversity and foliage height diversity. Cowley (1971) notes that certain species of birds are specific to certain plants or plant associations, for example the Glossy Black Cockatoo and She-oaks. He considers that the many birds with fairly restricted diets must move to a new area or die should their supply fail.

Kikkawa (1982) notes that species diversity of birds increases with structual complexity of vegetation and that foraging guilds of birds are most strongly influenced by the physical structure of forests. He hypothesised that the more complex the structure of rainforest the less likely it is to permit penetration of non-rainforest birds.

Recher *et al.* (1980) found significant correlations between canopy height and the number of understorey plant species and bird species diversity. They noted that species which nest in hollows or in the canopy and those which forage on tree trunks or in the canopy are absent from young logging regeneration.

Recher, Alan and Gowing (1985) note that the initial impact of logging on birds is a significant reduction in the numbers of individuals and species. They found that in 3-5 year old logging regeneration (in open forest) bird species that utilized the ground and shrubs were more abundant than in unlogged forest, though canopy species and bark foragers were reduced in abundance. The logged plots still had lower species diversity and abundance.

Many plants rely upon birds for insect control, cross-pollination and/or seed dispersal and an alteration in bird species may initiate an alteration in vegetation.

Noisy Miners have been observed to predominate in heavily disturbed wetter eucalypt forests where their maintenance of lerps (for their excretions) allows these insects to significantly damage their host trees (pers.obs). Holmes (1986) notes that Noisy Miners usurp areas and attempt to continually expel other species (some of which may otherwise control the lerp population).

Recher and Date (1988) consider pigeons to be vulnerable to human disturbance because they: depend on a succession of seasonal food sources; are conservative in their choice of food species; may require various fruit from geographically separated plant communities seasonally or even daily; move between food resources which makes them more vulnerable to predation and shooting; are sensitive to human approach; and have a low reproductive rate.

They predict that because of Wompoo Pigeon's dependency on a succession of fruit crops within the same tract of forest that most remaining habitats may be marginal for the long term survival of the southern subspecies. They consider that even the most selective logging practices may

Dependent residents of forest with special adaptations for a stable environment or mature forest requirements can be severely affected by logging operations (Tyndale-Biscoe and Calaby 1975, Milledge 1979, Recher *et al.* 1980, Loyn 1985, Shields and Kavanagh 1985).

Loyn (1985) notes that old trees provide food sources that may be less abundant in forests of younger trees, e.g. nectar, some insects in the bark and foliage, and nectar and fruit of mistletoe. He further states that it appears that old forest is needed to supply a regular abundant supply of insect food.

In a study of Mountain Ash, Ashton (1975) noted that older trees tend to flower later than younger trees on the same site. He found that the mature forest produced 2.15-15.5 times as many flowers as the pole stage trees, and 1.5-10 times as many as the spar stage forest. Fruit set of the mature forest was 1.6 times as great as that in the spar stage forest and 3.5 times as great as that in the pole stage forest. His results indicate that logging will greatly reduce the food available for species of animals that utilize these sources.

Loyn (1985) observed that the retention of 14 mature trees per hectare apparently failed to provide habitat for a significant small group of arboreal birds and mammals even up to 70 years after harvesting. Recher *et al.* (1980) found that forest 40-45 years old is too young for some species which depend upon mature forest for refuge, nest sites or foraging.

Browning (1977) considers that mature plant communities are not likely to be invaded by exotic fauna as their structure enables them to resist invasion. while disturbance increases a community's vulnerability to invasion. Further that the most important requirement to conserve the integrity of native ecosystems against invasion by exotic animals is to prevent their modification by man. Weir (1977) notes that extinctions of local species are paralleled by the spread of domesticated species or weeds.

Bowman and Harris (1980) found that a reduction in habitat complexity reduced predator foraging time, thereby increasing prey vulnerability and possibly predator numbers.

They note that monocultures used in intensive forestry minimize the diversity of predators and the potential for biological control, and thus facilitate pest outbreaks.

Animals with high site attachment are often killed in logging operations (Tyndale-Biscoe and Calaby 1975) while any remaining unlogged areas may be fully occupied and unable to support survivors forced out of logged areas.

Mackowski (1987) notes the importance of down timber to ground wildlife and that the harvest of timber in a rotation <40 years old would leave a minimal volume of down timber behind in the forest; further, that it would be less in volume than what falls to the forest floow in natural forest and would be less resistant to decompostiion by decay and fire. He considers that this may have significant effects on organisms that provide food for ground dwelling vertebrate wildlife and for tree nesting but ground foraging carnivores.

For reptiles, large logs provide enhanced basking sites and more stable internal microclimates for egg laying and hibernation. For most ground dwelling forest reptiles, either in or under large logs is their preferred habitat (pers. obs.).

Vagrant reptiles from more open habitats have been observed to

disturb Emerald Doves.

Dunning and Smith (1986) found that the numbers of Greater Glider, Ringtail Possum and Brown Antechinus declined in approximate proportion to the amount of forest biomass removed, while the Fawn Footed Melomys declined in greater proportion.

Lunney, Cullis and Eby (1987) found that Bush Rats declined in response to logging and that populations did not recover by 10-15 years, they concluded that this demonstrates that animals respond differently to dense ground cover in unlogged and regrowth areas. They also found that logging had no impact on Brown Antechinus.

Kavanagh (1987) observed that mature trees (c.200 years old) were preferred for foraging for nectar by Yellow-bellied Gliders because they prefer trees with the greatest numbers of flowers. He noted that they primarily selected trees of certain species, and secondarily trees of large size for foraging. Trees above 60 cm dbhob were clearly preferred, with 58% of observations in trees above 80 cm dbhob. Mackowski (1988) found that trees tapped for sap by Yellow-bellied Gliders had a minimum dbhob of about 32 cm, the minimum dbhob for Sydney Blue Gum was 36.1cm and New England Blackbutt was 51.5cm, though no localities occurred in young even-aged forest.

Kavanagh (1987) found that Yellow-bellied Gliders required a diversity of tree species for various, often seasonal, sources and were unlikely to persist all the year round in habitats composed of only one or two tree species.

Many researchers have concluded that the only sure way of preserving species dependent upon mature forest as habitat is to preserve large areas of mature forest intact (Tyndale-Biscoe and Calaby 1975, Recher *et al.* 1980, Shaw 1983, Loyn 1985, Shields and Kavanagh 1985, Lunney *et al.* 1987). Recher *et al.* note that it is possible that some species dependent upon mature forest which currently occur in buffer strips, reserves and in regenerating forest are derived from animals bred in mature forest. Once the area of mature forest is sufficiently reduced it will no longer be able to maintain these populations.

Shields and Kavanagh (1985) note that the preferred habitats of many species do not include narrow riparian strips or steep unloggable country. Mackowski (1984) notes that in many situations on the north coast of N.S.W. corridor retention in gullies will not maintain suitable habitat for possums and gliders.

Tyndale-Biscoe and Calaby (1975) suggest that an effective population of 1,000 individuals is near to the minimum to ensure the continuance of genetic viability. Dunning and Smith (1986) suggest a minimum population size of 500 and note that it is necessary that each population effectively isolated by vegetation or geographical barriers needs to be maintained at least at this size.

Mackowski (1986) considers that an unfragmented area of 15,000 hectares of suitable habitat should support a minimum effective population of Yellow-bellied gliders. The extent to which cleared land, heavily logged forest, severely burnt forest, unsuitable habitat (e.g. rainforest), and other factors act to effectively isolate populations of this and other forest dependent species needs to be assessed to determine their genetic viability.

3. Effects on Flora

Fox (1983) found that in the Washpool area logged rainforests were differentiated from unlogged rainforests as either a discrete group or grouped with wet sclerophyll forest sites. This distinction was even evident at sites selectively logged 20 years previously.

She further noted that logged rainforest is distinguished from unlogged rainforest by large numbers of pioneer species, fewer tree species, fewer specialized life forms, more shrubs and juveniles, higher incidence of dieback, higher soil pH, higher soil calcium, lower soil aluminium and higher soil electrical conductivity.

King and Chapman (1983) investigated an area of warm temperate rainforest in Doyles River State Forest 25 years after logging and found that in the heavily logged areas the closed canopy had been reduced from 35 m to 10-12 m with emergents up to 25 m. They observed that on old logging dumps and snig tracks there was little regeneration of rainforest tree species, which they attributed to the incidence of heavy frosts which killed or damaged young trees. They estimated that structual recovery would take between 140 and 250 years, depending on the degree of disturbance. They also noted an increase within rainforest in species from ecotonal situations.

The eucalypt and Brush Box overstorey of secondary rainforest often arise from a single regeneration event while the rainforest understorey develops in a series of successional stages. Each stage increases nutrient availability and produces a more favourable microclimate for succeeding species. It may take hundreds or thousands of years until a form of mature rainforest is arrived at.

Dunning and Smith (1986) suggest that successional change after logging of secondary rainforest may enhance eucalypt and acacia regeneration to the detriment of rainforest regeneration for at least 25 years after logging.

Justice Hemmings (1989), considered that the removal of the surrounds to pockets of rainforest, particularly of Brush Box, is likely to cause some degradation in status to such rainforest and is therefore likely to have an effect on the nature and extent of species therein. Further that the removal of a large number, if not the majority, of mature trees in a compartment is likely to significantly change the character of the environment.

The Forestry Commission (1982a) concluded that about 40 m. is required between 30 metre high eucalypt trees to provide for adequate seed distribution, this requires the retention of 6-8 seed trees per hectare.

Harvesting of seeds by ants and other insects has been observed to be rife (Ashton 1981, van Loon 1966, Forestry Commission 1982a). Ashton noted that more than 60% of the annual seedfall of *Eucalyptus regnans* may be removed, which in the warmer months involves nearly all the full fertile seed.

Poor and inadequate regeneration of eucalypts and Brush Box can often occur in moister areas of secondary rainforest (van Loon 1966, Forestry Commission 1982a, King 1985). Van Loon also noted problems in regenerating steep slopes which the Forestry Commission (1982a) attributed to soil washing away from the roots of young seedlings and excessive drainage of some sites.

Eucalypt and Brush Box regeneration is often poor in the absence of fire (van Loon 1966, Forestry Commission 1982a, King 1985). Van Loon

attributed this to the dense nature of the understorey and dense surface litter. King found that 35% of plots that did not receive a post logging burn had no regeneration.

The Forestry Commission (1982a) cite Curtin as finding that in an unburnt block 46% of plots on snig tracks were stocked with regeneration compared to only 5% of those away from tracks. They cite Curtin as finding regeneration height on unburnt blocks was one seventh that of burnt blocks. Compaction can be considered to be one of the causes of this reduced growth. They further note that mechanically cleared sites are usually satisfactory for regeneration establishment, though some unsuitable compacted sites are often present.

Ashton (1981) notes that the poor growth of eucalypt seedlings in mature forest soils has been attributed to phytotoxin from fungus, inhibitory substances from living roots and an inhibition of the nitrifying bacteria by leachate concentration from eucalypt leaves.

King (1985) found that there was no evident relationship between the total regeneration stocking and percentage canopy cover retained.

Hopkins (1981) notes that disturbance of rainforest can result in arrested succession or culminate in a forest type completely unlike the original. Gilmore (pers. com.) considers that it can result in a reduction in floristic diversity of mature-phase rainforest plants.

The development of the rainforest understorey will be affected where eucalypt and Brush Box regeneration is inadequate. The nature and significance of this effect needs to be assessed.

Amor and Piggin (1977) cite Moore as stating that exotic plants rarely establish in stable plant communities without prior disturbance and modification of the environment, and their abundance usually increases with increasing disturbance of the original plant community.

Prolific weed growth is one of the most important factors hindering the regrowth of secondary rainforest (van Loon 1966). Lantana is the principle problem weed in state forests of the north coast. It already occupies large areas of fire-disturbed forest in the south-east of the Desert Creek valley and can be expected to become a significant problem if extensive areas of forest are disturbed in logging operations.

4. Effects on the Microclimate

Climatic fluctuations are ameliorated to some extent by the open overstorey of secondary rainforest but more importantly and effectively by the dense canopy of the rainforest understorey. This produces a relatively stable and seasonally predictable microenvironment.

The removal of most of the overstorey during logging and the severe disruption to, or elimination of, the understorey canopy would greatly increase temperature extremes and wind velocities, and decrease relative humidity in the understorey.

Species of animals adapted to more stable environments often have low reproductive capacity (Cowley 1971, Tyndale-Biscoe and Calaby 1975, Barry 1984) and may have comparative longevity and utilize specialized resources (Barry 1984). Such animals may be sensitive to the environmental change associated with logging. Frogs and moisture-requiring invertebrates are likely to be significantly affected.

Many rainforest plants are sensitive to environmental change and may not be able to re-establish populations until earlier successional species have created a suitable microclimate.

The Forestry Commission (1982a) note that frost can damage regeneration and in extreme cases convert forest to grassland once opened up. They state that the risk of frost is greatest on high altitude sites with impeded air drainage, and that Tallowwood is more susceptible than Blue Gum to frost damage.

The sudden exposure of large trees to new wind stresses can result in their dying or being thrown by the wind (Recher *et al.* 1980). The Forestry Commission (1982a) note that young stands can be damaged by wind squalls.

The opening of the canopy causes increased drying of the understorey which may directly affect a number of species of animals (e.g. frogs) and plants. Dryness and higher ground temperatures would also increase the chance of wildfire occuring.

5. Other Effects of Logging

Reduced transpiration, canopy interception and infiltration capacity of the soil contribute to increased runoff and erosion following logging. Langford and O'Shaughnessy (1977) cite an American study that found that removal of the understorey which accounted for 22% of the basal area increased streamflow by 70 mm. Another American study cited found that clearfelling without roads increased sediment loads fivefold on steep slopes.

Logging can markedly decrease soil stability. Langford and O'Shaughnessy (1977) cite an American study by Swanston as finding that increased saturation of the soil mantle as a result of reduced transpiration and canopy interception can lead to a decrease in effective stress and shear strength and increased seepage forces in the soil, which consequently increases the risk of landslide. Swanston also attributed a marked decrease in soil strength about 3 to 5 years after clearfelling to the decay of root systems. Living tree root systems increase soil tensile strength.

The export of nutrients off-site in log form can be significant. Harwood and Jackson (1975) cite Attiwill as estimating that the bark and harvestable wood of a 51 year old eucalypt forest contained 50, 65 and 54 per cent of the above ground phosphorus, potassium, and calcium respectively.

Feller (1980) examined a Mountain Ash dominated secondary rainforest and found that while more than 70% of nitrogen, phosphorus and sodium was contained in the soil, the vegetation contained 65% of the potassium, 44% of the calcium and 39% of the magnesium - mostly in the stemwood and stembark of Mountain Ash.

Richards and Charley (1983) note that Crane and Raison found that short rotations in eucalypt forests, ca. 10 years, will greatly increase the rate of phosphorus loss because the logs will be mainly sapwood - which has much more phosphorus than heartwood.

Eucalypts have the tendency to accumulate specific nutrients, for example high bark calcium in Flooded Gum (Forestry Commission 1982 c), and so the loss of particular nutrients from the ecosystem may be disproportionate. As large quantities of nutrients are stored in eucalypt bark this loss would be less severe if de-barking was carried out on site.

Tree head disposal burning, control burning and wildfire can all have significant effects on the environment. Fire is the most common means employed by the Commission to obtain regeneration of secondary rainforest after logging. In this type fire is used to eliminate the rainforest component and promote fast growing eucalypts at the expense of slower growing Brush Box and eucalpyts.

The Commission carries out control burning in areas identified as strategic for fire protection or of high risk on an average cycle of 3-4 years. This frequent burning will degrade soils and vegetation while seriously affecting some animal species. In terms of ecosystem potential it is a downward spiral.

In the period 1986/88 3,881 ha was burnt in the Ewingar Working Circle by wildfires.

1. Nutrient Loss

Soil nutrients are a major determinant in the delineation of forest communities (Forestry Commission 1982a, Turner and Lambert 1986, Braithwaite 1986). Turner and Lambert consider that differences in soil nutrients lead to variations in distribution of forests, forest productivity and community complexity. They note that even small changes in nutrients can cause subtle changes in species.

Braithwaite (1986) and Barry (1984) consider that site fertility appears to be the major determinant of the distribution and numbers of some animals, the highest densities occuring in the most nutrient rich forests.

Barry (1984) notes that soil infertility acts indirectly to reduce animal abundance by typically stimulating plant chemical defence against herbivory. He cites Neldner as finding that 14 rainforest species had significantly higher mean levels of polyphenols when grown on coarse white sand than when grown on brown loam or krasnozem soil.

Rainforest plants generally have high nutrient requirements. The rainforest understorey of a 27 year old Flooded Gum stand comprised only 9.1% of the total above ground biomass and yet contributed 55%, 59%, 30%, 44% and 69% of the annual net accumulation of aboveground nitrogen, phosphorus, calcium, magnesium and potassium respectively (Forestry Commission 1982 c).

Turner and Kelly (1981) found that the nutrient status of Booyong rainforest and Flooded Gum stands were similarly rich and concluded that the Flooded Gum stands probably represented rapidly developing rainforest after fire disturbance. They noted that soils that had more than about 800 p.p.m. total phosphorus in the surface horizon generally supported Booyong type rainforest.

Lambert, Turner and Kelly (1983) found that individual species of rainforest plants accumulate one or more specific nutrients and directly affect soil nutrient status.

Turner and Lambert (1986) note that young forests have high nutrient demands, almost entirely derived from the soil, which peak at around the time of crown closure. With increasing maturity the forest requires less nutrients from the soil and meet most requirements from redistribution and mineralization of litter nutrients. While nutrient losses following logging on nutrient rich soils may not be limiting for regrowth, nutrient losses can significantly alter reconstructive succession on nutrient poor soils (Hopkins 1981).

Raison (1980) notes that fire mobilizes nutrients by incinerating organic material and heating soil. All fires lose some nutrients by transport in smoke which may be deposited elsewhere on land or in the sea, in addition to which there is an increased potential for nutrient loss by leaching, run-off and the erosive action of wind.

Raison notes that in any one fire nutrient loss is usually, but not always, small when compared with the total reserve of nutrients in the soil and biomass. Though he considers that since not all nutrients in the soil-plant system are equally mobilizable and hence available for use by plants, it may be more relevant to express nutrient losses as a proportion of the nutrients in the biomass or litter.

He considers that particularly in those ecosystems which depend on efficient nutrient accumulation, retention and recycling processes (which characterize many Australian ecosystems) frequent repeated burning may significantly deplete sites of nutrients or interrupt rates of nutrient cycling.

Harwood and Jackson (1975) consider that there are three major potential sources of nutrient loss in logging operations; export in the log harvest, losses to the atmosphere on burning, and downslope washing and deep leaching of nutrients mineralized in the ash. Langford and O'Shaughnessy (1977) cite an American study that found some streamflow nutrient concentrations doubled after wildfire.

Fire has been shown to result in large losses of nutrients to the atmosphere. Stewart and Flinn (1985) found that the burning of a clearfelled eucalypt forest resulted in a moderate to high intensity fire which consumed 50% of all debris and resulted in volatilization temperatures for all nutrients being exceeded and further nutrients lost through ash convection. They estimated total loss of nutrients from the debris and top 20 cm of surface soil to be 1.7% phosphorus, 6.5% nitrogen, 17.2% potassium, 19.9% magnesium and 32.8% calcium. Harwood and Jackson (1975) assessed the atmospheric losses of 4 nutrients in an 'unusually cold' slash burn from the above ground fuel following logging of a mixed forest; 50% of the fuel was consumed with resulting atmospheric losses from the burnt fuel of 18%, 17%, 12%, and 29% of phosphorus, potassium, calcium and magnesium respectively.

Fire has been noted to significantly increase soil pH, usually decrease organic carbon, increase exchangable potassium and calcium and increase extractable phosphorus (Stewart and Flinn 1985). Atkinson (1984) points out that nutrients so released in soluble form are readily removed by water. Large quantities of nutrients can be lost following fire, by wind and water transport of ashes and organic matter, and by leaching.

Turner and Kelly (1981) found that the soils of Blackbutt stands, with an average fire frequency of 280 years (Turner 1984), had higher soil pH, higher exchangable calcium, and lower total phosphorus and organic matter than Brush Box stands with a fire frequency of 325-380 years (Turner 1984).

As Ashton (1981) has pointed out, the fertility of soils is likely to be depleted in areas of high rainfall subjected to repeated burning. In terms of ecosystem potential it is a downward spiral.

2. Runoff and Erosion

Wildfires have been noted to result in very significant increases in surface runoff following rainfall (Langford and O'Shaughnessy 1977, Good 1973, Atkinson 1984). Langford and O'Shaughnessy (1977) attribute this to a reduction of the soils infiltration rate caused by high temperatures, and loss of litter and vegetation cover.

to be related to the time of year (Gill 1974, Anon 1984).

The Commission (1983) notes that the moist Blackbutt type carries an understorey of typically mesophytic shrubs and herbs, which may be converted to dense ferns by burning whilst the dry type has a drier and more open understory which is converted to grasses by burning. Further that post-logging top disposal by burning in New England Blackbutt stands usually has resulted in prolific wattle crops inhibiting the regeneration.

Floyd (1976) found that both fire intensity and frequency can cause major changes in the understorey vegetation of secondary rainforest, and that the intensity and duration of a fire will determine to a large extent the species composition of the regeneration.

Floyd (1976) and Ashton (1981) note that fires select for more fire-tolerant species. When comparing part of a Blackbutt-Sydney Blue Gum stand burnt 30 years ago and also part logged and burnt 14 years age Floyd (1976) found that the more diverse rainforest understorey was being replaced by quick-maturing, short-lived shrubs overtopped mainly by *Acacia binervata*.

Repetitive burning within the primary non-flowering period of an obligate seed-regenerating species can result in its reduction or complete elimination from a site (Floyd 1976, Ashton 1981). Gill (1974) notes that some eucalypts are sensitive to fire and their regeneration depends on seed held on the tree and shed after the fire, *E.regnans* is then vulnerable to fire until about 15-20 years of age when reproduction begins. Ashton (1981) notes that younger trees are more likely to be damaged or killed by fire than older trees. Secondary insect and fungal attack may follow fire damage (Forestry Commission 1982a).

Fire affects the seed resources of a forest in a variety of ways; all surface seed in burnt areas is killed (Floyd 1976), fire-induced seed fails can be lost by fire-induced erosion (Atkinson (1984) and predation (Forestry Commission 1982a), seed trees are often killed in fires before fullfilling their function (van Loon 1966, Forestry Commission 1982a), seed trees can shed their seed before a fire (Forestry Commission 1982a), and leaf fall following fires can blanket the ground and hinder seed contact with the soil (van Loon 1966, Forestry Commission 1982a).

Van Loon (1966) found that in burnt areas Tallowwood shed the majority of its seed in the first time period after burning. It has also been noted that eucalypt seed germination will not occur if the seed bed is dry and is likely to be inhibited by very low or high temperatures (Forestry Commission 1982a).

Fires create an ash-bed effect which has been observed to stimulate regeneration two to threefold for 2-3 years following fire (Ashton 1981). This has been attributed to enhanced nitrogen and phosphorus availability, nutrients released by dead micro-organisms and most importantly to the altered microbiological fauna (Ashton 1981).

O'Connell, Grove and Dimmock (1979) found that a high intensity fire caused crown scorch which probably prevented the withdrawal of phosphorus and nitrogen into the tree before leaf fall, subsequent leaf fall doubled and thereby increased the accession of phosphorus and nitrogen to the forest floor fourfold.

Fire greatly enhances eucalypt regeneration on less moist sites in logged secondary rainforest (King 1985, Forestry Commission 1982a). However, they have observed fire to favour the establishment of Sydney Blue Gum at the expense of Brush Box.

Humphreys and Craig (1981) note that fires can increase the water repellent (hydrophobic) properties of soils, thereby increasing surface runoff and erosion.

McArthur (in Langford and O'Shaughnessy 1977) found that streamflows for a 14,600 ha. area in Western Australia increased by 72% following wildfire. Various recovery periods of one to six years have been reported (e.g. Langford and O'Shaughnessy 1977).

Langford (in Langford and O'Shaughnessy 1977) found that in a Mountain Ash forest, streamflows declined significantly 6 to 15 years after wildfire, with an average 24% decrease of the average pre-fire streamflows per annum 6 years after the fire. This was attributed to increased transpiration of regrowth with streamflow still significantly less 36 years after the fire.

Wildfire can also result in significant erosion. Atkinson (1984) estimated soil losses of 30 to 48 t/ha, over a 10 week period, following a wildfire in Royal National Park. He suggests that for that terrain and climate 20 t/ha may be a more realistic estimate of soil loss following wildfire in an average year. Good (1973) found large increases in water sediment loads following wildfire with extreme erosion potential persisting for many months at one site.

Atkinson (1984) observed that large proportions of ash, charcoal, seeds and other organic matter were transported offsite in initial rain storms. Langford and O'Shaughnessy (1977) consider that fuel reduction burning consumes organic material leaving lines of weakness in the soil aggregates leading to long term deterioration in soil structure.

3. Effects on Plants

Wildfire is regarded by the Forestry Commission as the dominant cause of injury to forests. The Commission notes that severe fires: kill some trees; allow entry of decay organisms and termites through fire scars; cause loss of increment by whole or partial loss of crown; and lower wood quality by fire scarring or gum veins.

Young regrowth forests are highly susceptible to damage or destruction by fire, the forest's vulnerability declining with age. The conversion of old-growth forests to regrowth increases the Commission's desire for hazard reduction burning as well as their management costs. In young plantations/regrowth that is burnt out there is no emergency seed source, so re-stocking has to be manual.

Fire chiefly affects the composition and structure of the understorey, though overstorey trees can also be severely damaged or killed in fires. Rainforest plants are generally very susceptible to fire damage (Gill 1974) while many of the eucalypts associated with secondary rainforest have thin bark, no lignotubers and poor dormant bud development which means that they are also easily killed or damaged by fire (Bridges 1986, Gill 1974).

Ashton (1981) notes that fire results in the replacement of the normal soil microbiological flora by an entirely different one for a period of years.

Frequent low intensity fires (prescribed burns) have been noted to eliminate the shrub layer and allow grasses and ferns to dominate the understorey (McIlroy 1978, Gill 1974). 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

will mostly be greatest on birds which forage or nest in ground and shrub vegetation; those favouring more open habitats may benefit; and re-colonization and increasing abundance probably parallels vegetation recovery.

Birds that live or feed in the understorey are most affected by fuel-reduction burning. Loss of litter and litter invertebrates will directly affect those understorey birds reliant upon invertebrates for food. Understorey birds will also suffer from loss of nests, nest sites and cover, for some time dense and tangled regrowth may hinder the movements of some larger under-storey birds (Cowley 1971).

Reductions, and alterations, in populations of invertebrates, reptiles, frogs and small mammals following fire will also adversely affect the many birds that feed in the understorey but nest in higher strata.

Small ground mammals have been shown to be more effected by fuel-reduction burning than logging (McIlroy 1978, Anon 1984, Shields and Kavagnah 1985. Dunning and Smith 1986, Lunney *et al.* 1987). This is attributed to reduction in the available invertebrates, nesting/refuge sites, and a simplified ground flora (McIlroy 1978, Forestry Commission 1980).

Dunning and Smith (1986) chiefly attributed the post-logging decline of Brown Antechinus in secondary rainforest to the removal of the litter and log layer by burning. Lunney *et al.* (1987) found that fire reduced the numbers of Bush Rat and Brown Antechinus fivefold, though populations quickly recovered. They also found that even a low intensity fire eliminated Dusky Antechinus and that it had not reappeared by 3 years post fire.

Dunning and Smith (1986) attributed a decline in the Mountain Brushtail Possum and Fawn-footed Melomys on one plot to a post logging burn and concluded that post-logging burning may be as disadvantageous as canopy removal to species which utilize the ground and shrub stratum.

Fox and McKay (1981) found that the resident populations of Bush Rats were eliminated by fire and did not begin to re-establish themselves until three years after the fire, reaching a plateau after eight years. They considered this to be directly related to leaf litter and density of ground vegetation.

They found that Brown Antechinus reappeared 2 years after the fire and by four years the proportion of their occupation of plots had become constant. New Holland Mouse reached its peak abundance within the first year on a site and abundance decreased thereafter, though they were still present eight years after the fire. Common Dunnart reached its greatest density four years after the fire and showed a preference for the mid-seral stage.

Fox and Mckay (1981) cite Christensen and Kimber reporting greatly increased numbers of Yellow-footed Antechinus for forest stands unburnt for 40 years as opposed to stands unburnt for 30 years.

Many researchers have found that the introduced House Mouse can increase to plague proportions following burning of native forests (e.g. Lunney *et al.* 1987). Fox and McKay (1981) note that the House Mouse was most abundant within the first year after a fire and thereafter decreased rapidly to be absent on mid-seral stages, however it reappeared at low density in older plots.

3.4. EFFECTS ON STREAMS

Roading, logging and fire all combine to cause intial increases in

The Forestry Commission (1986) note that while slash burning can result in germination of desirable species it also leads to increased browsing of seedlings and may promote the growth of weeds and vines which in turn inhibit regeneration. Van Loon (1966) found that within 6 months burnt seed beds are generally overgrown with fire weeds and vines, in four out of twelve experimental burns extremely dense stands of wattle completely suppressed Tallowwood germinants. On six sites seeded with Tallowwood 28% of seedlings suffered browsing damage.

Leigh and Holgate (1979) found that grazing by native animals, particularly of certain species after fire, exerts a profound effect on a community's species composition and structual components. They note that control burning of small areas may lead to a progressive increase in unpalatable plant species within those areas due to intensified grazing pressure.

Many difficulties are associated with obtaining sufficient regeneration of Tallowwood (van Loon 1966, Forestry Commission 1982a). Sydney Blue Gum has been found to be generally very defective in regrowth stands (van Loon 1966).

The understorey of many logged stands of secondary rainforest in the Urbenville Management Area has been converted to Bladey grass by too frequent burning (pers.obs.). Bladey grass itself promotes a greater fire frequency.

Increasing fire frequency increases the flammability of the forest. Gill (1974) considers that in wetter forests flammabilities tend to decrease as succession proceeds and moisture retention within the forest becomes more effective. Hopkins (1981) notes that eucalypt regeneration tends to increase the possibility of fires as does the establishment of certain grasses.

4. Effects on Fauna

Fire consumes large quantities of the leaf litter, fallen timber and the understorey vegetation. In extreme conditions most of the foliage can be consumed and most plants damaged or killed. Animals are affected in a variety of ways; killed in fire, loss of food sources, loss of homesites, alteration/degradation of habitat, and increased competition and predation from species preferring more open habitats.

Invertebrates of the soils and surface litter can suffer high mortality rates in fires of even low intensity, with recovery periods of 3-6 years in drier forests (Leonard 1974, Anon 1984). Leonard (1974) observed that invertebrate densities were greatest on damp sites with a dense understorey and noted that recovery of populations is probably related to the recovery of the understorey structure. It may be expected that some of those invertebrates most reliant upon a stable moist environment will be severely reduced/eliminated until regeneration has sufficiently progressed to restore the pre-logging habitat.

Dunning and Smith (1986) found that post-logging burning probably has a more detrimental long term effect than logging, on reptile numbers, mainly due to the destruction of leaf litter and logs. They observed that normal logging practices in a secondary rainforest resulted in a shift from dominance by Murrays Skink and Challengers Skink to dominance by the Eastern Grass Skink.

Recher, Allen and Gowing (1985) note that: the species of bird affected by any given burn varies according to the intensity of the fire and amount and layer of vegetation burnt; changes in the abundance of birds after a fire probably occur in response to changes in vegetation structure; impact

runoff and erosion. This can result in increased flooding and stream bank erosion, and decreases in streamflows in dry periods or over the longer term from increased transpiration of regrowth. The increased fluctuations in water levels will have direct impacts on aquatic flora and fauna.

Since many of the soils in the Washpool area are deeply weathered, since steep slopes up to 30° may be logged, and since runoff coefficients can be as high as 0.86, the construction of roads, snig tracks, and log dumps may well lead to erosion and the transport of sediments to watercourses (National Parks and Wildlife Service 1981).

Increased erosion will increase turbidity and suspended sediment levels in streams, where stream-bed slopes level out sufficiently there will be extensive sedimentation (Langford and O'Shaughnessy 1977, Forestry Commission 1980, Atkinson 1984). Langford and O'Shaughnessy cite American studies in steep mountain catchments as finding that suspended sediment loads increased 5 to 100 times following logging, the major cause being mass slumping triggered by roads on steep slopes. They also note that ionic concentrations and water temperatures can increase after logging. The Forestry Commission (1980) note that the decomposition of plant material resultant from logging may reduce stream oxygen levels.

The State Pollution Control Commission (Department of Environment and Planning 1982) considered that the proposed logging in the Washpool area would have more than a minimal impact on suspended sediment, turbidity, dissolved loads, nutrients, oxygen concentrations and temperatures in streams.

The New South Wales State Fisheries (Department of Environment and Planning 1982) note that the eastern sub-species of the Murray Cod (*Maccullochella peeli*) and the Spiny Crayfish (*Euastacus valentulus*) are sensitive to changes in water quality.

The National Parks and Wildlife Service (1981) considers that some plant species restricted to creek beds may be detrimentally affected by increased sedimentation due to logging.

The aquatic environment of streams will be degraded by logging and this will undoubtably prove to be unfavourable for a number of aquatic plants and animals. Increased flooding, erosion, sedimentation of streams and degraded water quality will also affect people downstream.

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P.2/6

IN THE LAND AND
ENVIRONMENT COURT
OF NEW SOUTH WALES

No. 40208 of 1990
Coram: HEMMINGS J.
29th October, 1990

30.41

INTERLOCUTORY JUDGMENT

J. CORKILL

Applicant

v.

FORESTRY COMMISSION of N.S.W.

Respondent

HIS HONOUR: The applicant seeks declarations and other orders concerning the lawfulness of approvals granted by the Forestry Commission of N.S.W. ("the Commission") to the logging or harvesting of timber and related works in an area known as North Washpool. The Commission administers the Forestry Act 1916 and is responsible for all aspects of the management of State Forests and other Crown timber lands in N.S.W. It provides planning and research, supervision, fire control and road construction therein. Harvesting operations are authorised by the issue of various licences and approvals under the said Act.

The Commission disputes the challenge to the lawfulness of such approvals, and the applicant seeks interlocutory

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relief by way of an injunction to restrain such works until the final hearing of the matter.

The dispute concerns both the carrying out of roading, burning, snigging and incidental logging by the Commission, and logging by its licensees. However, no such works are contemplated by the Commission pending the final hearing of this matter. Interlocutory orders are sought with respect to a harvesting plan issued by the Commission for logging in an area of land within North Washpool known as Compartment 695 and having an area of 395ha. A licence had previously issued, but logging prohibited until approval of a harvesting plan. Such plan was issued on 10th August, 1990 and thereby enabled the following timbers to be cut from the compartment:

"i)	*Hardwood quota*	*18,000m^3 gross*
ii)	*Hardwood salvage*	*1,500m^3 gross*
iii)	*Brushwood quota*	*2,000m^3 gross*
iv)	*Brushwood salvage*	*200m^3 gross*
v)	*Poles, piles and girders*	*200m^3 gross*
vi)	*Hardwood - smallwood*	-

The plan accompanying the harvesting plan did not specify the actual areas intended therein for logging or, alternatively, the areas in which it was prohibited. However, all trees proposed for logging are required to be marked by officers of the Commission prior to commencement of operations. From a reading of the harvesting plan as a whole, it is quite clear that the approval authorised logging in rainforest areas contained within Compartment 695.

North Washpool is a vast area and logging activities have been progressively carried out since an approval was granted by the Commission in 1982. For that purpose the whole locality was the subject of an environmental impact statement prepared pursuant to the provisions of the Environmental Planning and Assessment Act, 1979 (the "E.P.& A. Act"). The majority of the study area was

subsequently proclaimed as a National Park and approval for logging was granted in areas identified by the National Parks & Wildlife Service as being of "low priority". Over 40km of roads have been constructed by the Commission for that purpose.

In late 1989 logging and roading activities were suspended in North Washpool to enable consideration of areas of alleged Aboriginal significance therein, and the possible declaration of the North Washpool as a wilderness area under the Wilderness Act 1987. The catalyst for these proceedings was a Government announcement in September 1990 that, after consideration of such matters, logging and roading activities would be resumed. Following such announcement, a harvesting plan for Compartment 695 was issued by the Commission.

There appears to be no issue that the licences and harvesting plans granted by the Commission to carry out logging or associated works are "approvals" and relate to an "activity" within the meaning of s.110 of the E.P.& A. Act, and that any such approval must be given in accordance with Part V thereof. The applicant submits that any approvals that have been granted were in breach of the obligations imposed by the provisions of s.111 and s.112.

The duty imposed by s.111 and s.112 is to compel a determining authority to be environmentally sensitive, and for that purpose to determine whether the proposal requires investigation and assessment in the manner prescribed therein. The obligations imposed by s.111 arise at the time the Commission gives "consideration of an activity", and are in addition to that imposed by s.112 when it proposed to "carry out" or to "grant an approval in relation to an activity". It is alleged that the said activities are likely to significantly affect

the environment but, in breach of s.112, the Commission has not obtained or been furnished with, and has not examined and considered, an environmental impact statement in respect thereof; cf. Bailey v. Forestry Commission of N.S.W. (1989) 67 LGRA 200. It follows, it is claimed, that the Commission could not and did not consider to the "fullest extent" reasonably practicable matters likely to affect the environment; s.111. This is denied by the Commission, but in any event it contends that a 1979 management plan for the district and the 1982 approval is sufficient compliance therewith. It is further contended that since 1982 the activity was further adequately assessed by ongoing surveys and reports.

The most significant "approval" under review in these proceedings is the decision of R.H. Squire, Management Officer of the Commission, made on 10th September, 1990. That decision was apparently confirmed by Cabinet. Mr Squire said, inter alia:

> "6. *The nature of the activity, its effects and justification are essentially no different from that contemplated by the 1982 determination based on the 1980 EIS, associated documents, and subsequent considerations by Government. The determination (copy attached) which followed consideration and decision by the Government (commonly referred to as the "Rainforest Decision"). Subsequent investigations have only served to confirm the assessment of these impact and subsequent modifications to operations have served only to reduce them. Furthermore, there no relevant change in the proposed activities which would significantly increase the impact, n any new information available which suggests an impact which was not anticipated. Substantial logging and roading works have already occurred in conformity with the determination. The proposed activity is a continuation of recent activities.*
>
> *It is therefore submitted that there has been substantial compliance with Section 111 of the Act and that the 1980 EIS and subsequent determination remain valid, relevant, and adequ*

as a basis for a decision to proceed with the presently proposed activity.

Accordingly, it is recommended that operations be prescribed in the 1982 determination and modified as outlined above be now approved to recommence."

The documents specifically considered by him were the -

* 1980 EIS for Proposed Forest Operations for Washpool
* NPWS Submission to EIS
* DEP Assessment Report, March 1981
* Faunal Study by Osborne and Masala
* National Herbarium Flora Study (M. Fox)
* Forestry Commission's Determination, 1982
* Report by T. Donnelly on Aboriginal Sites Investigations 1990
* NPWS Wilderness Area REport, 1990
* Casino West Management Plan (1979) as amended (1988)

The applicant submits that not any of all of the said documents satisfy the obligations imposed by s.111 or s.112 because -

1. In none of the above documents was a site specific study carried out of the environment of North Washpool.

2. Nor was any assessment made in that area of
   i) erosion;
   ii) soil degradation;
   iii) pollution of watercourses;
   iv) loss of nutrients;
   v) disturbance of impact on and consequences for vertebrate and invertebrate fauna;
   vi) disturbance of flora and loss of old-growth characteristics;
   vii) impacts on Washpool National Park;
   viii) impacts on stream ecology;

ix) impacts on visual amenity;

x) loss of archaeological relics or features;

xi) loss of anthropological significance;

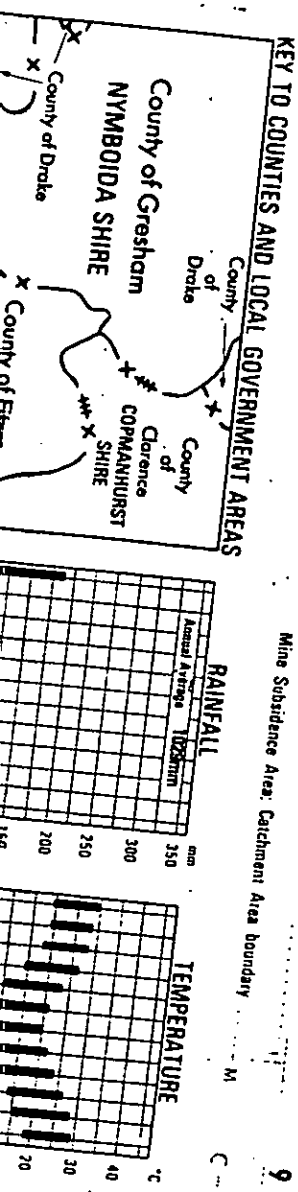
xii) ecological sustainability of the said activities.

However, the Commission submits that the said review by Mr Squire on 10th September, 1990 sufficiently discharged the obligations imposed by s.111 and s.112 of the E.P.& A. Act, and that no further consents are required.

I have no doubt that the Cabinet decision to authorise resumption of logging in the subject area was based upon such recommendations and on the likely assumption that there had been and would continue to be compliance with the requirements of Part V of the E.P.& A. Act.

It is clear that a serious question arises in these proceedings as to the adequacy of the 1980 environmental impact statement to assess the impact of logging in discrete areas such as North Washpool. An important question arises as to the need for further site specific assessment in accordance with Part V when granting subsequent approvals; see Jarasius v. Forestry Commission of N.S.W., 4th March, 1988 (unreported).

However, it is obvious that since 1982 the Commission has approved logging of rainforest areas in North Washpool in breach of the provisions of the E.P.& A. Act. It was ultimately conceded by Counsel for the Commission that all rainforest areas of North Washpool were expressly excluded from areas to be logged in the 1980 environmental impact statement. When logging was approved in December 1982, it was limited to the strategies and prescriptions in the said environmental impact statement. Notwithstanding such express exclusion, the Commission authorised rainforest logging



within North Washpool. I am satisfied that, until the institution of these proceedings, it was the intention of the Commission to authorise such logging in rainforest areas to resume.

In my opinion, the lawfulness of approvals to log rainforest areas which were expressly excluded from the only environmental impact statement prepared for the North Washpool area is a most serious matter for determination at the final hearing. I have no hesitation in determining that there are a number of serious issues raised in these proceedings as to the lawfulness not only of the 1990 approval to resume and subsequent harvesting plan, but also of the previous decisions upon which they were based. I am of the opinion that, subject to the exercise of the Court's discretion, such activities should be restrained pending further orders.

It does not follow that, merely because there are important issues to be tried on the final hearing of this matter, an applicant is automatically entitled to interlocutory orders. In the exercise of the wide discretion vested in the Court, consideration must also be given to the circumstances of the case and the balance of convenience. An undertaking as to damages, if ultimately unsuccessful, is not offered by the applicant. However, whilst the giving of such undertaking is most relevant, it is not in my opinion essential in a public interest matter such as this, which concerns alleged breaches of public law by a statutory authority.

During the hearing, in apparent acknowledgement of the seriousness of at least the likely lack of approval or assessment of impacts with respect to logging in rainforest areas, the Commission produced a plan of a limited area it proposes to log in Compartment 695 pending further orders. This is a departure from past

practices in this area as such proposed logging area now excludes identified rainforest areas and is limited to hardwoods. The Court was informed that any rainforest species logged within the hardwood area would therefore only be of a salvage nature and very small quantities. The Commission submits that such area should be logged because it was assessed in the environmental impact statement in 1982. Approval for continued logging is sought because in the opinion of the Commission it is essential in order to maintain proper management practices in the forest.

I accept that a total cessation of logging activities in the area prior to final hearing will probably cause some hardship and inconvenience to both the Commission and its licensees. In this high rainfall area the continuous availability of wet and dry weather logging sites is undoubtedly important for the proper maintenance of the activities of the Commission and the logging industry. However, the extent to which financial hardship will be suffered by licensees in the relatively short time to final hearing was, to say the least, unsatisfactory and unpersuasive.

Such inconvenience and hardship, if any, must be weighed against the possible environmental damage if the activity is allowed to continue until further order. I note that the Commission has drastically altered its intended logging until final order and, in particular, activities in this compartment have excluded rainforest logging altogether.

The applicant opposes any logging in Compartment 695, even if limited to hardwoods. It is submitted that the area is steep and with serious erodability potential, and has never been properly assessed. The locality has been identified as a likely habitat of rare and endangered

species. Logging as proposed, it is claimed, would have an inevitable adverse impact on the environment.

I accept that such limited logging activities as now proposed are in an area in which, at least in general terms, the overall impact of the activity has been assessed. It appears clear from the 1982 environmental impact statement that hardwood logging areas were assessed to some extent. The general locality has also been subjected to the reports referred to in the September 1990 decision to resume logging operations. However, in issue in these proceedings is the adequacy of that such assessment and reports.

I note that undertakings given to this Court by the Commission as to the extent of logging activities extend only to the time of determination of this interlocutory application. The evidence from Commission officers as to future activities relates only to present intention. Regrettably, there is conceded to be a history of departure by the Commission from not only its own approvals in the logging of this area, but apparently a continuous avoidance of the obligations imposed by the E.P.& A. Act. In such circumstances, it is difficult to have confidence that, unless restrained, the Commission will observe its statutory duties.

The appropriateness of logging either hardwood or rainforest timber in North Washpool is not in issue in these proceedings. The merits of that decision, subject to Government policy, is not reviewable by this Court and is a matter solely for determination by the Commission. What is in issue is whether, as a matter of law, that decision was made in accordance with the obligations imposed by Part V of the E.P.& A. Act.

In the circumstances, and in the absence of any real hardship, economic loss or inconvenience to the Commission or the logging industry, I am persuaded that the applicant is entitled to the orders that it seeks and that, until final order, I should restrain logging activities and related works in the North Washpool area, and Compartment 695 in particular.

The orders of the Court are:

1. Until final order, the Forestry Commission its servants, agents, contractors and licensees be restrained from approving, carrying out, permitting or suffering any logging, roading or burning activities in North Washpool State Forest and Compartment 695 in particular.

2. Matter be restored to the Registrar.

3. Costs reserved.

4. Transcript of proceedings be prepared.

I HEREBY CERTIFY THAT THIS AND THE PRECEDING NINE PAGES ARE A TRUE AND ACCURATE COPY OF THE REASONS FOR JUDGMENT HEREIN OF THE HONOURABLE MR JUSTICE N.A. HEMMINGS.

Marie Slate

ASSOCIATE

THE WILDERNESS SOCIETY INC

NORTH WASHPOOL ALTERNATIVE TIMBER STRATEGY.

30.42

There is a common perception that conservation groups, when proposing protection of native forests, and the subsequent cessation of logging, either ignore the effect of such proposals on employment in the timber industry, or assume that jobs in new areas such as tourism will replace any jobs lost. However, to ensure that this does not occur, the Wilderness Society has given very careful consideration to the possible effects of the protection of North Washpool Wilderness on employment in the local timber industry.

It is not realistic to assume that a person employed in a sawmill or in other logging operations can necessarily make a successful transition to employment of a completely different type in another industry. For this reason, whilst increased tourism and therefore job creation is often a direct result of conservation of native forests, it cannot be considered a complete solution to the problem of job displacement in the timber industry.

Provided that the timber industry in the region is viable and employs sound, responsible management techniques, as far as is possible, employment should be found within the industry for those whose jobs are displaced by the conservation of forests. This approach is quite feasible when the area and timber volume concerned are as small as those of the North Washpool region.

The intention of this report is to offer some possible strategies to ensure that the protection of the North Washpool Wilderness does not result in any loss of employment. Due to limited access to concise information the Wilderness Society has not been able to comprehensively assess the viability of the suggested options. However, we hope that through co-operation between the Society and the timber industry, the

practicable strategies can be identified and developed and those which are unsuitable be eliminated.

Rainforest Timber:

According to the New South Wales Rainforest Policy (Department of Environment & Planning, 1983), Big River Timbers Pty. Ltd. of Grafton were to be supplied with 25,300m^3 of rainforest timber from the Washpool area, this resource being principally obtained from the Desert Creek area in the northern part of Washpool during an eight year transition to non-rainforest timbers. The Casino West Management Plan (Forestry Commission, 1979) states that the supply of Brushwood logs to Big River Timbers shall be limited to a maximum of 6,260m^3 nett per year and reduced as practicable from 1983 as the company's annual requirement for rainforest logs is reduced by substitution of alternative (i.e. non-rainforest) timber supplies.

In the period from June 1984 to December 1988 approximately 39,125m^3 of timber was removed from Billilimbra, Ewingar, Cherry Tree and Washpool State forests. (Forestry Commission Timber Licences, numbers: 06304; 06345; 07881; 07933; 10086; 10118; 15027). As we only have information relating to the general Washpool area, not precise information detailing specific volumes taken from the area covered by the quota and proposed for protection, we cannot accurately state the current status of the quota. However, judging by the timber volumes removed from the general area and the guidelines laid down in the Management Plan it appears that the quota is now filled or is nearing completion. This being the case, protection of North Washpool should not result in the total amount of timber removed being much less than the allocated quota.

The Managing Director of Big River Timbers, Mr. K. T. Pidcock, in correspondence dated 27/7/88, maintained that progress in the transition to non-rainforest timbers had been made, but that the extent of the progress was confidential. It appears that the transition has been successful to date, as reported by an article in the Grafton 'Daily Examiner' (28/4/87), which suggests that the introduction of concrete formply production from Eucalypt regrowth has enabled the company to survive and prosper. In view of this progress the cessation of logging in the North Washpool area before completion of the rainforest timber quota should be able to be compensated for by one or a combination of the following options: (i) Utilisation of rainforest understorey in moist hardwood logging areas to make up the quota;

(ii) Substitution of plantation Hoop Pine for rainforest timber in production of Marine Plywood veneers; (iii) Acceleration of transition to non-rainforest timber products using plantation poplar, flooded gum and other hardwoods as timber resource.

Hardwood Timber:

The following suggestions relating to the hardwood resource of North Washpool are derived from the 1982 FORTECH Report, prepared for the Department of Environment and Planning. This report looked at alternatives to logging the entire Washpool area, including the catchments of Desert, Malara and Redbank creeks. We believe that if these alternatives have not already been implemented, that they are still viable means of ensuring nil job loss as a result of protection of North Washpool.

The alternatives suggested for hardwood mills, outlined by the FORTECH Report are:

(i) Rescheduling of Cutting Cycles: - If cutting cycles in the Casino West management area were brought forward from 2010 to 2000, there would be sufficient timber supplies to maintain mills with quotas for the Washpool area. From 2000, logging could commence in regrowth forests in the management area. The transition to regrowth is inevitable and twelve years preparation for this would be ample for the necessary modifications to be made.

(ii) Thinning Regrowth: - The practice of thinning regrowth forests is recommended both as a source of alternative timber and as a means of improving the size and quality of the final timber harvest. The FORTECH Report states that an annual resource of 65,800m^3 (nett sawlog volume) of thinnings is available from the Coffs Harbour and Murwillumbah management areas. This would involve some change in equipment and methods to deal with the smaller logs. However, this resource could provide an assured resource for those mills prepared to change. State government assistance may help implement this option.

Either or both of these options should be able to ensure the maintenance of employment levels until the turn of the century when pine plantations in the area come into full production. Pine from established plantations may also provide another alternative timber supply in the interim period.

Conclusion:

We believe that through application of the expertise and information base of the N.S.W. Forestry Commission and with the support of the N.S.W. Government, viable alternatives to logging the North Washpool area can be found and implemented. Through close co-operation, exchange of information and sharing of viewpoints between the Wilderness Society, the Forestry Commission and timber companies we can achieve the protection of the North Washpool Wilderness without any loss of employment.

The Wilderness Society,
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ATT. TIM ROBINSON

REPORT ON THE FAUNA OF THE DESERT AND MALARA CREEKS BILLILIMBRA AND WASHPOOL STATE FORESTS

GREG. P. CLANCY. B.Sc.
56 ARMIDALE ROAD,
COUTTS CROSSING,
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30.43

SEPTEMBER 1989

Prepared for the Armidale Branch of the Wilderness Society

REPORT ON THE FAUNA OF THE DESERT AND MALARA CREEKS BILLILIMBRA AND WASHPOOL STATE FORESTS

GREG. P. CLANCY

INTRODUCTION

This report was compiled from information gathered in the Desert Creek area of the north Washpool in August 1989 and from existing reports on the fauna of the Washpool area. It was commissioned by the Armidale Branch of the Wilderness Society in relation to their proposal to have the 'North Washpool' area officially declared wilderness.

METHODS

A limited field survey was carried out in the Desert Creek area during the period 7th to 9th August 1989. The following survey techniques were employed:

1. Mist Netting for birds - 3 x 1¼" mesh mist nets, 9m, 12m and 18m long respectively, were erected on 3m tall poles. The nets were set from late on the afternoon of the 7th until early in the afternoon of the 8th, being closed during hours of darkness.
2. Small Mammal Trapping - 34 X Elliott 'A' type aluminium traps were set on the evening of the 7th, along a trapline sampling a variety of site types. All traps were checked later in the evening and animals were immediately released following their identification. The traps were then closed for the night to avoid trapped animals dying from the cold. Traps were baited with a mixture of peanut butter and rolled oats and were all set on the ground, generally close to cover such as a rock or log. Six traps were set in the vicinity of the Washpool Rest Area on the night of the 8th.
3. Cage Trap - one large cage trap, baited with raw meat, was set on both nights in wet open forest.
4. Spotlighting - Vehicle based spotlighting was carried out on both nights, along forestry tracks on the first night and along the partly constructed Desert Creek road on the second night. Two spotlights were used on each night with five observers on the first night and three on the second.
5. Searching - When time permitted searching under rocks and logs was carried out specifically for reptiles and amphibians.
6. Collection of Predator Scats - A number of scats of the Dingo and Spotted-tailed Quoll were collected for bone and hair analysis. Bone fragments scattered along tracks, apparently from old disintegrated scats, were also collected.
7. General observation - fauna species observed, or in the case of birds, heard were identified and listed.

RESULTS

Twelve mammals, forty-eight birds and two reptile species were recorded during the recent survey. An additional thirty-six mammal, sixty-four birds, twenty-eight reptiles and eleven amphibian species have been recorded in the Washpool area by the author and others (see Appendices 1, 2, 3, and 4) and these are all expected to occur in the north Washpool. In addition one bird (Masked Owl) and two mammals (Feathertail Glider and Common Planigale) have not yet been recorded but are expected to occur.

Bird Banding - Two Pale-yellow Robins, one Eastern Yellow Robin and one White-browed Scrubwren were caught and banded. The Scrubwren was retrapped on the following day. Bands used were supplied by the Australian Bird and Bat

Banding Scheme, Australian National Parks & Wildlife Service, Canberra.
Mammal Trapping - The Elliott traps caught a total of one Fawn-footed Melomys, one Bush Rat and six Brown Antechinuses on the first night. The six traps caught one Bush Rat, one juvenile Fawn-footed Melomys, and two Brown Antechinuses on the second night.
Cage Trap - The cage trap did not catch any mammals, however a Pied Currawong was caught on the morning of the 9th August and was banded.
Predator Scats - The predator scats have not yet been analysed but two pieces of jaw bone were identified, by Linda Gibson of the Australian Museum, as being from a Pademelon (Thylogale sp.).
Spotlighting - The spotlighting surveys resulted in three Common Ringtails, six Greater Gliders and one Mountain Brushtail Possum being observed on the first night and one Long-nosed Bandicoot, one microchiropteran bat and one Brown Antechinus on the second night.

DISCUSSION

The results of the three day survey were rather disappointing due primarily to the low temperatures encountered and the accompanying strong winds. These conditions made field investigations difficult and would have, most likely, slowed down the activity of some species. In particular the dawn chorus of bird calls was disappointing. The small mammal trapping was reasonably successful but the spotlighting results were poor. In addition, fifteen migratory bird species would have been totally absent from the area as they would have been wintering further north. The Rufous Fantail and Black-faced Monarch are examples. Reptiles were scarce as they would have been hibernating and the low temperatures would not have suited small amphibians. Despite these difficulties and the limited results of the survey the diverse vegetation and natural condition of the North Washpool area indicate a rich fauna habitat. The results of previous surveys, as detailed in the appendices, clearly show a diverse faunal assemblage in the Washpool area.
Endangered Fauna - The following species shown in the appendices are listed on Schedule 12 (Endangered Fauna) of the National Parks and Wildlife Act, (1974):

(a) Fauna of Special Concern - Platypus, Spotted-tailed Quoll, Eastern Pygmy Possum, Feathertail Glider, Koala, Large-footed Myotis, Carpet Python, Rose-crowned Fruit-Dove, Emerald Dove, Glossy Black-Cockatoo, White-throated Needletail, Cicadabird, White's Thrush, Crested Shrike-tit, Rufous Fantail;

(b) Vulnerable and Rare Fauna: Common Planigale, Parma Wallaby, Major Skink, Pacific Baza, Peregrine Falcon, Wompoo Fruit-Dove, Powerful Owl, Masked Owl, Sooty Owl, Rufous Scrub-bird;

(c) Threatened Fauna: Long-nosed Potoroo, Brush-tailed Rock-Wallaby, Stephen's Banded Snake.

The Pouched Frog, Loveridge's Frog and Fletcher's Frog are listed on Schedule 12A - "Protected Amphibians" list.
From the above it can be seen that ten mammal, fifteen bird and three reptile species recorded (or expected) in the North Washpool are officially classified as Endangered. The area would be particularly important for the Parma Wallaby and the Rufous Scrub-bird. The northern limit of distribution of the Parma Wallaby occurs in the area. Maynes (1977) postulated that the northern range limit of this species appears to lie between 29° and 27°28'S (Ewingar to Washpool State Forest area). This species is listed as Vulnerable and Rare Fauna and has a limited and patchy distribution south to the Watagan Mountains.
The Rufous Scrub-bird is very limited in distribution now occurring in only about six isolated populations in highland areas of northern New South Wales and southern Queensland. Approximately ten territories are known to exist currently in the Gibraltar Range National Park and the southern Washpool.

Ramsay (1919) recorded the Scrub-bird at three localities at Storm Gully (now in Ewingar State Forest) however there have been no recent records in the North Washpool area. Despite this it is most likely that the species is still present as it is a very difficult bird to observe and when not calling it is impossible to locate. Adequate suitable habitat exists in the Desert Creek area and a specific survey with the aim of locating this species would be worthwhile.

Effects on Fauna Habitat of Desert Creek Road Construction

It is impossible, in the absence of a long term study, to clearly assess the impact of the construction of the Desert Creek road on wildlife habitat. It is possible, however, to make a number of predictions based on an inspection of the road on the 8-9th August and the existing knowledge of the fauna habitat of the area. The large road, and its associated excavation works, are intruding into hitherto undisturbed habitats. Apart from the loss of habitat due to tree and rock removal the resulting roadway is creating a barrier to the movement of small animals that require a canopy overhead when moving about. Another potential problem associated with roads in natural areas is their ability to provide easier access to feral animals. Feral animals are generally absent from the unroaded sections of the Washpool however they are present in areas that have been logged and roaded. An example is an observation that I made of a Hare a number of kilometres into the Washpool in an area with a number of roads and tracks. The invasion of natural areas by weeds is also encouraged when roads create artificial habitats potentially more suited to exotic weeds . Roads also encourage the importation of exotic seeds either on vehicles or people travelling in vehicles. The potential for faunal roadkills exists and this would vary depending upon the frequency and timimg of traffic movements. The frequency of nocturnal vehicle movements, which are presently occurring in the north Washpool, would influence the number of nocturnal animals killed. Most native mammals, some reptiles and amphibians, and a few birds are active at night. In addition to these effects the extensive road and track system that would be constructed and the logging operation itself would have severe and serious impact on the quality of fauna habitat in the Desert Creek area.

ACKNOWLEDGEMENTS

I wish to thank Dailan Pugh, Fiona Peek, John Turbill and Robyn McGregor who assisted with the fieldwork.

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Greg. P. Clancy
Environmental Consultant.

Appendix 1. DESERT AND MALARA CREEKS MAMMAL LIST (RECORDED AND PREDICTED)

FAMILY Genus	Species	Common Name	1	2	3	4	5
MONOTREMATA							
ORNITHORHYNCHIDAE							
Ornithorhynchus	anatinus	Platypus	+				+
TACHYGLOSSIDAE							
Tachyglossus	aculeatus	Short-beaked Echidna	+	+	+	+	
MARSUPIALIA							
DASYURIDAE							
Dasyurus	maculatus	Spotted-tailed Quoll	+ scats only	+	+		+
Antechinus	stuartii	Brown Antechinus	+	+	+		+
Sminthopsis	murina	Common Dunnart					+
Planigale	maculata	Common Planigale					
PERAMELIDAE							
Isoodon	macrourus	Northern Brown Bandicoot					+
Perameles	nasuta	Long-nosed Bandicoot	+	+	+	+	+
PHASCOLARCTIDAE							
Phascolarctos	cinereus	Koala		+	+	+	+
PETAURIDAE							
Pseudocheirus	peregrinus	Common Ringtail Possum	+	+	+		+
Petauroides	volans	Greater Glider	+	+	+	+	+
Petaurus	australis	Yellow-bellied Glider		+	+	+	+
P.	breviceps	Sugar Glider		+	+	+	+
P.	norfolcensis	Squirrel Glider		+	+		+
PHALANGERIDAE							
Trichosurus	vulpecula	Common Brushtail Possum					+
T.	caninus	Mountain Brushtail Possum	+	+	+		+
BURRAMYIDAE							
Cercartetus	nanus	Eastern Pygmy Possum		+			
Acrobates	pygmaeus	Feathertail Glider					
POTOROIDAE							
Potorous	tridactylus	Long-nosed Potoroo		+			+
Aepyprymnus	rufescens	Rufous Bettong				+	+

Appendix 1. (cont.)

FAMILY Genus	Species	Common Name	1	2	3	4	5
MACROPODIDAE							
Petrogale	penicillata	Brush-tailed Rock-wallaby					+
Thylogale	stigmatica	Red-legged Pademelon		+	+		+
T.	thetis	Red-necked Pademelon	+	+	+	+	+
Macropus	parma	Parma Wallaby		+	+		+
M.	parryi	Whiptail Wallaby				+	+
M.	rufogriseus	Red-necked Wallaby				+	+
M.	giganteus	Eastern Grey Kangaroo			+	+	+
M.	robustus	Common Wallaroo					+
Wallabia	bicolor	Swamp Wallaby		+	+		+
EUTHERIA							
PTEROPODIDAE							
Pteropus	poliocephalus	Grey-headed Flying-fox		+	+	+	
RHINOLOPHIDAE							
Rhinolophus	megaphyllus	Eastern Horseshoe-bat			+		
MOLOSSIDAE							
Mormopterus	norfolkensis	Eastern Little Mastiff-bat			+	+	
VESPERTILIONIDAE							
Nyctophilus	gouldi	Gould's Long-eared Bat			+		+
Miniopterus	schreibersii	Common Bent-wing Bat					+
Chalinolobus	gouldii	Gould's Wattled Bat			+	+	+
C.	morio	Chocolate Wattled Bat			+		
Myotis	adversus	Large-footed Mouse-eared Bat			+		
Nycticeius	rueppellii	Greater Broad-nosed Bat				+	+
N.	orion	Eastern Broad-nosed Bat				+	
Eptesicus	pumilus	Little Cave Eptesicus			+		
E.	vulturnus	Little Forest Eptesicus			+		
E.	sagittula	Large Forest Eptesicus			+	+	

Appendix 1. (cont.)

FAMILY Genus	Species	Common Name	1	2	3	4	5
MURIDAE							
Hydromys	chrysogaster	Water Rat			+		+
Melomys	cervinipes	Fawn-footed Melomys	+	+	+		+
Rattus	fuscipes	Bush Rat	+	+	+	+	+
R.	lutreolus	Swamp Rat			+		+
LEPORIDAE							
Lepus	capensis*	Brown Hare		+			
CANIDAE							
Canis	familiaris dingo*	Dingo	+ scats only	+	+	+	+
Vulpes	vulpes*	Fox					+
FELIDAE							
Felis	catus*	Feral Cat			+		+

KEY:
1 - This survey August 1989
2 - Clancy (1986-87) Washpool South
3 - Osborne (1982) Washpool South
4 - Osborne (1982) Redbank area
5 - Pulsford (1982)
* - Introduced species
+ - Recorded

Appendix 2. DESERT AND MALARA CREEKS BIRD LIST (RECORDED AND PREDICTED)

FAMILY Genus	Species	Common Name	1	2	3	4	5
ACCIPITRIDAE							
Aviceda	subcristata	Pacific Baza		+	+	+	+
Haliastur	sphenurus	Whistling Kite		+			
Accipiter	fasciatus	Brown Goshawk		+(B)	+	+	+
A.	cirrhocephalus	Collared Sparrowhawk		+			
A.	novaehollandiae	Grey Goshawk		+	+		+
Aquila	audax	Wedge-tailed Eagle	+	+	+	+	+
FALCONIDAE							
Falco	peregrinus	Peregrine Falcon		+			+
F.	berigora	Brown Falcon	+				
MEGAPODIIDAE							
Alectura	lathami	Australian Brush-turkey	BSF	+(B)	+		+
TURNICIDAE							
Turnix	varia	Painted Button-quail					+
COLUMBIDAE							
Ptilinopus	regina	Rose-crowned Fruit-Dove		+			
P.	magnificus	Wompoo Fruit-Dove	+	+	+		+
Lopholaimus	antarcticus	Topknot Pigeon		+(B)	+		+
Columba	leucomela	White-headed Pigeon		+	+		+
Macropygia	amboinensis	Brown Cuckoo-Dove		+	+		+
Chalcophaps	indica	Emerald Dove			+		
Phaps	chalcoptera	Common Bronzewing		+			
Leucosarcia	melanoleuca	Wonga Pigeon	+	+	+		+
CACATUIDAE							
Calyptorhynchus	lathami	Glossy Black-Cockatoo	+	+	+	+	+
C.	funereus	Yellow-tailed Black-Cockatoo		+	+		+
Cacatua	galerita	Sulphur-crested Cockatoo		+	+		+
LORIIDAE							
Trichoglossus	haematodus	Rainbow Lorikeet	+	+	+		+
Glossopsitta	pusilla	Little Lorikeet	+		+		+
POLYTELITIDAE							
Alisterus	scapularis	Australian King-Parrot	+	+	+		+
Platycercus	elegans	Crimson Rosella	+	+	+	+	+
CUCULIDAE							
Cuculus	variolosus	Brush Cuckoo		+	+		+
C.	pyrrhophanus	Fan-tailed Cuckoo		+	+	+	+
Chrysococcyx	lucidus	Shining Bronze-Cuckoo		+	+	+	+
Eudynamis	scolopacea	Common Koel			+	+	
Scythrops	novaehollandiae	Channel-billed Cuckoo		+(B)			
STRIGIDAE							
Ninox	strenua	Powerful Owl	+	+			+
N.	novaeseelandiae	Southern Boobook		+	+	+	+
TYTONIDAE							
Tyto	alba	Barn Owl		+			
T.	novaehollandiae	Masked Owl					
T.	tenebricosa	Sooty Owl					+

Appendix 2. (cont.)

FAMILY Genus	Species	Common Name	1	2	3	4	5
PODARGIDAE							
Podargus	strigoides	Tawny Frogmouth		+	+	+	+
AEGOTHELIDAE							
Aegotheles	cristatus	Australian Owlet-nightjar		+	+	+	+
CAPRIMULGIDAE							
Caprimulgus	mystacalis	White-throated Nightjar				+	
APODIDAE							
Hirundapus	caudacutus	White-throated Needletail		+	+	+	+
ALCEDINIDAE							
Ceyx	azurea	Azure Kingfisher		+	+		
Dacelo	novaeguineae	Laughing Kookaburra	+	+	+	+	+
Halcyon	sancta	Sacred Kingfisher			+		+
CORACIIDAE							
Eurystomus	orientalis	Dollarbird				+	
PITTIDAE							
Pitta	versicolor	Noisy Pitta	+	+	+		+
MENURIDAE							
Menura	novaehollandiae	Superb Lyrebird	+	+ (B)	+		+
ATRICHORNITHIDAE							
Atrichornis	rufescens	Rufous Scrub-bird			+		
HIRUNDINIDAE							
Hirundo	neoxena	Welcome Swallow	+	+ (B)			+
CAMPEPHAGIDAE							
Coracina	novaehollandiae	Black-faced Cuckoo-shrike		+	+	+	+
C.	papuensis	White-bellied Cuckoo-shrike				+	+
C.	tenuirostris	Cicadabird			+		+
Lalage	leucomela	Varied Triller	+				+
MUSCICAPIDAE							
Zoothera	dauma	White's Thrush	+	+	+		+
Petroica	rosea	Rose Robin	+	+	+		+
P.	multicolor	Scarlet Robin					+
Eopsaltria	australis	Eastern Yellow Robin	+	+ (B)	+	+	+
Microeca	leucophaea	Jacky Winter					+
Tregellasia	capito	Pale-yellow Robin	+	+ (B)	+		+
Falcunculus	frontatus	Crested Shrike-tit		+	+		+
Pachycephala	olivacea	Olive Whistler			+		
P.	pectoralis	Golden Whistler	+	+ (B)	+	+	+
P.	rufiventris	Rufous Whistler		+	+	+	+
Colluricincla	megarhyncha	Little Shrike-thrush			+		
C.	harmonica	Grey Shrike-thrush	+	+ (B)	+	+	+
Monarcha	melanopsis	Black-faced Monarch		+ (B)	+	+	+
M.	trivirgatus	Spectacled Monarch			+		+
Myiagra	rubecula	Leaden Flycatcher		+	+	+	+
M.	cyanoleuca	Satin Flycatcher		+			
Rhipidura	rufifrons	Rufous Fantail		+ (B)	+	+	+
R.	fuliginosa	Grey Fantail	+	+ (B)	+	+	+
R.	leucophrys	Willie Wagtail	+				+

Appendix 2. (cont.)

FAMILY Genus	Species	Common Name	1	2	3	4	5
ORTHONYCHIDAE							
Orthonyx	temminckii	Logrunner	+	+(B)	+		+
Psophodes	olivaceus	Eastern Whipbird	+	+	+	+	+
MALURIDAE							
Malurus	cyaneus	Superb Fairy-wren		+			+
M.	lamberti	Variegated Fairy-wren	+		+	+	+
ACANTHIZIDAE							
Sericornis	magnirostris	Large-billed Scrubwren	+	+	+		+
S.	citreogularis	Yellow-throated Scrubwren	+	+ (B)	+		+
S.	frontalis	White-browed Scrubwren	+	+	+	+	+
Gerygone	mouki	Brown Gerygone	+	+ (B)	+		+
G.	olivacea	White-throated Gerygone				+	+
Acanthiza	pusilla	Brown Thornbill	+	+	+	+	+
A.	reguloides	Buff-rumped Thornbill					+
A.	nana	Yellow Thornbill		+	+		+
A.	lineata	Striated Thornbill	+	+	+	+	+
NEOSITTIDAE							
Daphoenositta	chrysoptera	Varied Sittella	+	+		+	+
CLIMACTERIDAE							
Climacteris	leucophaea	White-throated Treecreeper	+	+	+	+	+
C.	erythrops	Red-browed Treecreeper	+	+	+	+	+
MELIPHAGIDAE							
Anthochaera	chrysoptera	Little Wattlebird		+			+
Philemon	corniculatus	Noisy Friarbird				+	+
Manorina	melanophrys	Bell Miner	+	+	+	+	+
Meliphaga	lewinii	Lewin's Honeyeater	+	+	+	+	+
Lichenostomus	chrysops	Yellow-faced Honey-eater	+	+	+	+	+
Melithreptus	lunatus	White-naped Honey-eater		+	+	+	+
Phylidonyris	novaehollandiae	New Holland Honey-eater		+	+	+	+
P.	nigra	White-cheeked Honeyeater		+			
Acanthorhynchus	tenuirostris	Eastern Spinebill	+	+	+	+	+
Myzomela	sanguinolenta	Scarlet Honeyeater	+	+	+		+
DICAEIDAE							
Dicaeum	hirundinaceum	Mistletoebird	+	+	+	+	+
PARDALOTIDAE							
Pardalotus	punctatus	Spotted Pardalote	+	+	+	+	+
P.	striatus	Striated Pardalote					+
ZOSTEROPIDAE							
Zosterops	lateralis	Silvereye		+	+		+
PLOCEIDAE							
Emblema	temporalis	Red-browed Firetail		+ (B)	+	+	+
ORIOLIDAE							
Oriolus	sagittatus	Olive-backed Oriole		+	+	+	+
Sphecotheres	viridis	Figbird			+		+
DICRURIDAE							
Dicrurus	hottentottus	Spangled Drongo				+	+

Appendix 2. (cont.)

FAMILY Genus	Species	Common Name	1	2	3	4	5
PARADISAEIDAE							
Ptilonorhynchus	violaceus	Satin Bowerbird	+	+(B)	+	+	+
Sericulus	chrysocephalus	Regent Bowerbird			+		+
Ailuroedus	crassirostris	Green Catbird	+	+	+		+
Ptiloris	paradiseus	Paradise Rifle-bird	+	+	+		+
CORCORACIDAE							
Corcorax	melanorhamphos	White-winged Chough					+
CRACTICIDAE							
Cracticus	torquatus	Grey Butcherbird				+	+
Gymnorhina	tibicen	Australian Magpie	+				
Strepera	graculina	Pied Currawong	+	+(B)	+		+
CORVIDAE							
Corvus	coronoides	Australian Raven		+		+	+

KEY:

1 - This survey August 1989
2 - Clancy (1986-87) Washpool South
3 - Osborne (1982) Washpool South
4 - Osborne (1982) Redbank area
5 - Holmes (1980)
+ - Recorded
BSF - Billilimbra State Forest
(B) - Breeding record

Appendix 3. DESERT AND MALARA CREEKS REPTILE LIST (RECORDED AND PREDICTED)

FAMILY Genus	Species	Common Name	1	2	3	4	5
CHELIDAE							
Emydura	signata	Northern Rivers Shortneck Tortoise					+
GEKKONIDAE							
Phyllurus	cornatus	Northern Leaf-tailed Gecko		+	+		+
PYGOPODIDAE							
Pygopus	lepidopodus	Common Scaly-foot					ESF
AGAMIDAE							
Amphibolurus	muricatus	Jacky Lizard					+
A.	nobbi	Nobbi			+		
Physignathus	lesueurii	Eastern Water Dragon		+	+		+
VARANIDAE							
Varanus	varius	Lace Monitor			+	+	+
SCINCIDAE							
Egernia	cunninghami	Cunningham's Skink					+
E.	frerei	Major Skink		+			ESF
E.	major	Land Mullet		+	+		ESF
E.	saxatilis	Black Rock Skink					+
Lampropholis	challengeri	Challenger's Skink		+	+		+
L.	delicata	Grass Skink			+		+
L.	guichenoti	Grass Skink					+
Saiphos	equalis	Three-toed Skink			+		+
Sphenomorphus	murrayi	Murrays Skink		+	+		+
S.	quoyii	Eastern Water Skink		+	+		+
S.	scutirostrum	skink	+	+	+		+
S.	tenuis	skink					ESF
TYPHLOPIDAE							
Ramphotyphlops	nigrescens	Worm Snake			+		+
BOIDAE							
Morelia (Python)	spilotes variegata	Carpet (Diamond) Python		+	+	+	+
COLUBRIDAE							
Dendrelaphus	punctulatus	Common Tree Snake					+
ELAPIDAE							
Cacophis	squamulosus	Golden Crowned Snake	+	+			+
Cryptophis	nigrescens	Eastern Small-eyed Snake		+	+		+
Demansia	psammophis	Yellow-faced Whipsnake					+
Hemiaspis	signata	Black-bellied Swamp Snake			+		+
Hoplocephalus	stephensi	Stephen's Banded Snake				+	
Notechis	scutatus	Eastern Tiger Snake			+		
Pseudechis	porphyriacus	Red-bellied Black Snake		+	+		+
Tropidechis	carinatus	Rough-scaled Snake			+		

KEY:

1 - This survey August 1989

2 - Clancy (1986-87) Washpool South

3 - Osborne (1982) Washpool South

4 - Osborne (1982) Redbank area

5 - Barker (1980)

\+ - Recorded

ESF - Ewingar State Forest

Appendix 4. DESERT AND MALARA CREEKS AMPHIBIAN LIST (PREDICTED)

FAMILY Genus	Species	Common Name	1	2	3	4
LEPTODACTYLIDAE						
Assa	darlingtoni	Pouched Frog		+		+
Kyarranus	loveridgei	Loveridge's Frog				+
Lechriodus	fletcheri	Fletcher's Frog	+	+		+
Mixophyes	iteratus	Giant Barred Frog		+		+
Pseudophryne	coriacea	Red-backed Toadlet				+
HYLIDAE						
Litoria	chloris	Red-eyed Tree Frog	+	+		ESF
L.	fallax	Eastern Dwarf Tree Frog				+
L.	latopalmata	Tree Frog				+
L.	lesueuri	Lesueur's Tree Frog		+	+	+
L.	peronii	Peron's Tree Frog			+	+
L.	phyllochroa	Leaf Green Tree Frog		+		ESF

KEY : 1 - Clancy (1986-87) Washpool South

2 - Osborne (1982) Washpool South

3 - Osborne (1982) Redbank area

4 - Barker (1980)

\+ - Recorded

ESF - Ewingar State Forest

30.44

SUMMARY OF NORTH WASHPOOL WILDERNESS NOMINATION

In December 1988, the Wilderness Society, in accordance with the N.S.W. Wilderness Act 1987, nominated the North Washpool area in northern N.S.W., for protection as a wilderness area. The nomination contains a detailed description of the area, and presents the case for wilderness protection for the area. The following are some extracts from the nomination:

* "The Wilderness Society recommends that the Director, after identifying the area as wilderness, should enter negotiations with the Forestry Commission to prepare a Wilderness Protection Agreement under Division 2, sections 10, 11, 12, 13 and 14 of the Wilderness Act 1987."

* "The proposed wilderness extension comprises parts of Billilimbra and Washpool State Forests, and lies to the immediate north of Washpool National Park. It covers the complete catchment area of Desert Creek and the upper catchment of Malara Creek and is bisected by the Gibralter Range."

* "The area covers 6738 ha and in conjunction with the Washpool National Park wilderness, comprises 34,453 ha."

* "Desert Creek drops steeply through a deep valley, which appears quite spectacular from Desert Spur. Its length of 13km makes it the second longest creek in the Washpool system; second only to Washpool Creek itself."

* "The wilderness condition of both Washpool National Park and the proposed extension area, has provided vital faunal habitat to ensure survival of many species. Due to its intact nature, the Washpool wilderness has ensured the exclusion of feral animals, such as the domestic cat and the fox, that have been responsible for reduction of native animal populations in many areas of Australia. As a result most of the animal populations in this area are in a natural state. The diverse ecosystems of the area....support a rich variety of fauna including rare and threatened animals such as:

Eastern Native Cat - imminent danger of extinction;

Long Nosed Potoroo
Brush Tailed Wallaby - threatened fauna;

Parma Wallaby
Common Planigale - vulnerable and rare fauna."
Rufous Bettong

* "Until recently the entire Ewingar forests (north of Washpool) were of wilderness quality. It is not known what detrimental effects the gradual decrease in size and quality of this wilderness area would have on its undisturbed fauna. Therefore, it is imperative that as large an area of wilderness as still remains should be given the highest protection, to ensure that the fauna of the Washpool wilderness remains in its natural, undisturbed state."

* "The vegetation of the Washpool area, including the Desert and Malara Creek catchments, is one of the area's special features. The major features of this area's vegetation, are the occurrence of the diverse warm temperate rainforests and the interaction between different rainforest types and between rainforest and sclerophyll forest."

* "The most valuable vegetation unit in the area is undoubtedly the Willowie Scrub. This is a large area of rainforest which occurs in the Washpool. It is the largest Coachwood forest in the world. It is also reported to be the largest remaining stand of any rainforest in N.S.W. The Willowie Scrub covers parts of the catchments of Willowie, Oorooroo, Malara and Desert Creeks. It is continuous with the rainforests of Desert and Malara Creeks and as such it is not wholly protected. The entire area of the Willowie Scrub is not adequately safeguarded from outside influences unless it is completely protected in wilderness condition."

* "The climatic change predicted for the near future makes necessary the conservation of larger areas than were needed under more stable conditions, to preserve as much biological diversity as possible. The rise in temperature and the changing rainfall patterns will affect frequency of flowering and fruiting which alters the range required by fauna, dependant upon these foods. The vegetation associations themselves will need to shift in latitude and or altitude within a few decades."

* "The N.S.W. Goverment Rainforest Decision of 1982, protected most of the Washpool wilderness in Washpool National Park. Desert and Malara Creeks were not included in the National Park as a compromise to timber interests in the region."

* "(In)....Desert and Malara Creeks, it is possible to see and study intact ecosystems. Each vital aspect of the complex forest ecosystem is visible here. There has been no logging to remove older trees and to open canopies, with associated imbalances in light penetration."

* "Logging in Desert Creek valley would increase the chance of noxious weed invasion. Opening up the Desert Spur trail for logging operations would decrease the remoteness of the Willowie Scrub, with a concurrent increase in accessibility, noise disturbance and a decrease in water quality. Any damage to the balance in the ecosystems of Desert and Malara Creeks will also increase the opportunities for feral animal invasion of Washpool National Park."

* "Washpool wilderness is too valuable to be considered on political grounds. It must be protected in its ecological entirety and recognised as a large single bioregion in an undisturbed state, not as a partially protected, partially exploitable resource."

A COPY OF NORTH WASHPOOL WILDERNESS NOMINATION CAN BE OBTAINED THROUGH THE ARMIDALE BRANCH OF THE WILDERNESS SOCIETY:

93 Faulkner Street (opposite Police Station) or,

P.O. Box 1155
Armidale. N.S.W. 2350.

* * *

WASHPOOL WILDERNESS NOMINATION — Natural Estate
— Heritage —

NAME OF PLACE WASHPOOL WILDERNESS, WASHPOOL GROUP OF STATE FORESTS

000342 102156000301
NOMINATION - AWAITING ADVICE FROM PANEL

LOCATION/BOUNDARIES:

THE WHOLE OF WASHPOOL CREEK CATCHMENT ABOVE ITS JUNCTION WITH DESERT CREEK PLUS DESERT CREEK CATCHMENT, PLUS RETREAT (EAST) CREEK CATCHMENT UPSTREAM OF MAP REFERENCE [illegible], PLUS MALARA CREEK CATCHMENT UPSTREAM OF ITS JUNCTION WITH MAIN CREEK, PLUS THE SOUTHERN CATCHMENT OF MAIN CREEK. SEE AREA OUTLINED ON TOPOGRAPHIC
80 KM. NORTH WEST OF GRAFTON.

TITLE INFORMATION:

STATE FOREST (94.6%), PLUS 2 SMALL SMALL POCKETS FREEHOLD (0.5%)

STATEMENT OF SIGNIFICANCE:

MOST SIGNIFICANT IS ITS NATURAL STATE, I.E. IT IS A LARGE, UNLOGGED FOREST VIRTUALLY FREE OF ANY INFLUENCE BY MAN. IT CONTAINS WHAT IS PROBABLY THE WORLD'S LARGEST UNLOGGED FOREST OF COACHWOOD AND WARM TEMPERATE RAINFOREST. ITS QUALITY IS HIGH COMPARED TO OTHER RECOGNISED 'WILDERNESS' AREAS BECAUSE OF ITS INTEGRITY AND SIZE, ITS LARGE RAINFOREST COMPONENT, THE DIVERSITY OF ITS VEGETATION AND THE HIGH AESTHETIC APPEAL OF ITS FOREST AND CREEKS. SUCH AREAS, NOW QUITE SCARCE, ARE OF GREAT SOCIAL IMPORTANCE, SINCE THEY PROVIDE RELIEF FROM DEMANDS AND EFFECTS OF AN INCREASINGLY 'UNNATURAL' ENVIRONMENT.

DESCRIPTION:

THE AREA IS HEAVILY FORESTED AND UNLOGGED, AND IS OF UNDULATING TO STEEP TOPOGRAPHY. IT IS DISSECTED BY CREEKS RANGING FROM GENTLY MEANDERING STREAMS FLOWING OVER CLEAN, PEBBLY BEDS AND FLANKED BY LUSH VEGETATION IN SHALLOW VALLEYS, THROUGH BOULDER-STREWN SECTIONS IN STEEP-SIDED HEAVILY FORESTED VALLEYS, TO STEEP AND ROCKY GORGES WITH MANY CASCADES AND WATERFALLS. VEGETATION IS VERY DIVERSE, COMPRISING WARM TEMPERATE RAINFOREST, MOIST HARDWOOD AND MORE OPEN DRY HARDWOOD TYPES, WITH MANY IMPRESSIVE STANDS. THE AREA HAS A HIGH AESTHETIC APPEAL, AND ITS LARGE SIZE AND UNTOUCHED STATE GIVE IT A HIGH WILDERNESS QUALITY. GEOLOGY COMPRISES METAMORPHICS AND VOLCANICS, WITH GRANITIC INTRUSIONS.

CONDITION:

EXCELLENT, DUE TO LACK OF PRESENCE OF MAN'S INFLUENCE, EXCEPT FOR PATCHES OF LANTANA IN LOWER 3-4 KILOMETRES OF WASHPOOL AND MALARA CREEKS, AND 4-WHEEL DRIVE FIRETRAIL ALONG GIBRALTAR RANGE NEAR WESTERN BOUNDARY. THREATENED BY PROPOSED LOGGING OPERATIONS THROUGHOUT MOST OF THE AREA.

BIBLIOGRAPHY:

WILDERNESS IN AUSTRALIA: EASTERN NSW & SE QLD - HELMAN ET AL, UNI OF NE
PROPOSED FOREST OPERATION IN WASHPOOL: EIS - FORCOMM
NORTHERN WILDERNESS AREAS: REPORT TO NPA OF NSW - KNOX
+ RUFUS VEGETATION OF WILLDWIE SCRUB - A. FLOYD, '79 - unpub.

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NORTH WASHPOOL WILDERNESS PROTECTION CAMPAIGN.

BACKGROUND: Washpool and Gibralter Range have the largest stands of coachwood forest in the world. It also contains some of the best developed wet sclerophyll forest in the state. But best of all, its a wilderness area of approximately 25000 ha of which only about 20000ha is contained within the national park.

The remaining areas include some leasehold land and the Desert creek catchment which is controlled by the Forestry Commission of NSW.

The Desert Ck catchment area lies to the north of Washpool NP and is seperated from the park by Desert spur trail, a track of unknown but presumably redeemable condition.

This area contains some pristine rainforest, both warm-temperate and sub-tropical; and some large areas of wet sclerophyll forest with an understorey which ranges from rainforest to wet or dry scrub.

The National Park is covered by a Section 59 order under th NPWS Act, which means it will be managed as a wilderness area. The northern end of the park contains the Willowie scrub, a totall -y undisturbed area of 3000ha of warm temperate rainforest. This makes it one of the most important rainforest sites in Australia.

This was recognised in 1982 after the state government listed Washpool and other NSW rainforestsas World Heritage status. It has also been suggested that Washpool would easily qualify as an international Biosphere Reserve.

Desert Ck area provides a buffer zone against fire and ot other intrusions as it fronts up to the Willowie scrub catchment. Any logging in this area puts the Willowie scrub at risk from fire, feral animal invasion and increased access for environmentally irresponsible recreationalists. In this respect the Desert ck catchment helps preserve the wilderness values of Willowie Scrub.

THE PROPOSAL: The Wilderness Society through its Armidale branch is investigating the use of the Wilderness Act, to protect the wilderness values of this region, by adding the Desert and Malara ck catchments to the National Park. In order to do this we must put forward a nomination to the Director of the National Parks and Wildlife Service. He must then consider the nomination in consultation with district NPWS offices, within two years. If he accepts that the area deserves protection as wilderness, he will put the nomination to State cabinet who then accept it or reject it presumably on political grounds.

FORESTRY PLANS FOR THE AREA

THE Northern Washpool forests are managed by the Forestry Commission in the Casino forestry district and are covered by the Casino West plan of management. They cover parts of Billilimbra and Washpool State Forests in the Ewingar group(ie:those forests west of the Clarence river.).

In 1982, when the Washpool National Park was gazetted by way of the NSW governments rainforest policy, 2983 ha of Billilimbra SF was added to the Casino West management area which maintained the total area of the Ewingar group, after a similar was removed for the creation of the national park.

These forests are made up of 15% rainforest and 85% hardwood(eucalyptus) type. Of the 15% which is rainforest, 5% of the area is sub-tropical and 10% is warm=temperate rainforest. However a greater percentage of the forests would contain rainforest because of the way in which the forestry commission defines rainforest; as mesophyllic forest having less than 4% eucalypt content. As a result of this definition, a lot of wet sclerophyll forest is actually rainforest. Of the 85% area of hardwoods, 50% is covered by moist hardwoods which

includes Sydney Blue gum, Tallowwood/Sydney Blue Gum, Brushbox and Flooded Gum associations. These wet sclerophyll forewts are probably very rich in rainforest species as the Casino West Management Plan states;

"These types(moist hardwoods) are found on sheltered sites with ample moisture and soils of moderate to high fertility mainly at the higher altitudes, with the Brushbox type descending to lower elevations. These types form wet sclerophyll forests , with generally dense under storeys of rainforest species."

Rainforest logging prescriptions allow for 50% canopy retention with an assumed removal of 60% of total merchantable volume. Big River Timbers (veneer) Ptyl Ltd has a quota for removal of rainforest timber of between 25300m^3 to 52000m^3 (1983). This quota is expected to be filled by logging the rainforest areas of northern Washpool. Rainforest logs produce veneer after peeling down to a core diameterof 15cm. The rest of the log is either used for the furniture trade or "MADE INTO PACKAGING OR PALLETS. ANY WASTE IS USED FOR FUEL IN THE PLANTS BOILERS."

Rainforest logs obtained from hardwood logging operations in wet sclerophyll forests go to the sawmill doing the logging and do not form part of the quota for Big River Timbers. The hardwood millers use the logs for house timber and special use is not generally made of these logs.

Therefore the forestry industry in the Washpool area intends to remove 50% of the rainforewt and unspecified quantities of the rainforest understory of the wet sclerophyll forest.

THE PROBLEMS

Several problems immediately arise to this otherwise simple nomination procedure. Firstly , the Forestry Commission is not going to like this nomination one iota. As an extra bit of background; in 1982 the state government placed several areas of rainforest under protection through its rainforest polic Washpool was one of these .As a result a major conflict arose with timber interests claiming it would ruin them. As a result a subsequent policy decision was made to exclude the Desert ck and Malara ck areas from the National Park and leave them to the Forestry Comm to manage in order to maintain logging quotas. Therefore the timber industry i will not take too kindly to propos-ls to remove this resource from their control again.

Here are some other problems;

a) Big River Timbers at Grafton is already importing rainforest timber to supplement what it obtains from these forests. It is the company which was promised the rainforest logs from Washpool.

b) Other sawmills and companies in the District intend to take hardwoods from the moist eucalypt forest in the area including some of the areas with rainforest understorey.

c) We have a conservative government in NSW and all the seats which would be effected by this wilderness preservatio - are held by National Party M.P.s, including Ian Causley the minister for Natural resources and part owner of Big River Timber (see point a).

WHERE DO WE GO FROM HERE?

Firstly , we nominate the area as a wilderness .Armidale branch is preparing a draft nomination at present. I would like to send this draft around to interested groups for comment ,before preparing the final nomination for submittance to the NPWS Director.When he receives it he is required to notify the Forestry Comm who will presumably make this information public. We must be prepared for any adverse reaction to this nomination otherwise we will lose a lot,of credibility and so will the nomination.

Therefore I would suggest the following strategy .We should have;a) some sort of alternative timber strategy worked out; some strong scientific opinion as to the natural values of the area,and c) some strong anti-rainforest logging support.

a)Alternative Timber strategies.

Iwould suggest that we push the idea of plantations for fu future resource .Hoop pines can be grown in plantations can be grown in plantations and are ideal for peeling for veneer, and are already growing in the area.

The second cutting cycle for the area is due to commence in 2010 so if plantations were established now the cutting cycle could be brought forward afew years to compensate for short term resource withdrawal.

Further research into alternative timber supplies is urgently needed.A tree called Paulownia is a possible plantation option.

b)Scientific Opinion.

Hopefully some people will be able to provide information on the value of the wet sclerophyll forests and the rainforests and the possible impact of fire on the rainforests .Support from the scientific community will add a lot of credibility to such a nomination and to the campaign to follow it..

Perhaps other groups have members who will be able to help in this respect?

Rainforest Logging

This angle has a certain confrontationist approach ,but may be useful.If we can put a strong case together against rainforest logging and tie it in with international campaigns along the same line , we may have some more success in influencing the general public.

I feel we should run this campaignin several stages . Firstly, the nomination and alternative timber campaign, which will involve a great deal of research.After the nomination goes in we will have to start a public campaign to show the government that there is public support for the nomination. The campaign will probably have the following elements;

1)Media- articles in papers etc on the value of wilderness, the value of rainforests and more specific Washpool information. Also the usual press releases ,radio interviews etc to give the campaign a high profile.

2)Lobbying -letters will have to come from all over NSW but specifically from Armidale ,Lismore and Grafton areas. Also some direct lobbying of local members and the relevant ministers.

3) A broad public education campaign on the wilderness values of this area.We should stress that Washpool is a World Heritage rainforest wilderness.

HOW DO WE DO THIS ??????????

We need the support of our members first and foremost. Members will be needed for all aspects of the campaign.We can keep the information up to our members by way of the newsletter.

We will also need the support of other groups in the region especially in the Lismore and Grafton area.I would hope that these

groups could be involved from the very beginning of the show and could then help the campaign the whole way through. Initial support could come by way of each group reviewing the nomination prepared by Armidale branch of TWS,. By taking into account any comments made and modifying the nomination accordingly we would have a more accurate and comprehensive nomination to submit. Then if each group could endorse the nomination it would carry more weight with the Director of NPWS.

The groups I have come up with to approach for assistance are as follows;

The Wilderness Society-Armidale branch
Newcastle "
Sydney "
Taree "

National Parks Association- Armidale branch
Three Valleys "
Grafton "
Tamworth "

Rainforest Information Centre -Lismore
Big Scrub Environment Centre - "
Northern Rivers Bushwalking Club= Grafton
Kempsey Greens
Bellinger Valley Conservation Group
Coffs Harbour Environment Centre
Ulitarra Society -Coffs Harbour .

If anybody knows of any other groups or individuals I should C contact ,please let me know. By working together we will achieve much more then as individuals. I would appreciate any feedback offered from this paper especially on possible options for the campaigns. I can be contacted on (067) 728862 or by mail c/o The Wilderness Society, P O Box 1155, Armidale, 2350.

DAVE CARR

WASHPOOL WILDERNESS CAMPAIGN

In 1982, the N.S.W. government implemented its "Rainforest Decision" and protected many N.S.W. rainforest areas including Werrikimbe, Dorrigo N.P., The Black Scrub in New England and Washpool National Park. Washpool contains the largest area of warm-temperate (coachwood) rainforest in Australia, plus a wide variety of forest types ranging from sub-tropical rainforest to dry sclerphyll forest. The area also has very high wilderness values as N.S.W.'s largest rainforest wilderness.

Unfortunately, National Park protection was only extended 75% of the actual wilderness area, with the three major areas being left out as a compromise to local timber interests, despite a FORTECH report saying there were two alternatives to logging the whole area. The Desert, Malara and Redbank creek catchments were excluded. These areas form an important part of the wilderness area and also protect the Willowie Scrub (3000 ha coachwood forest) from fire, weeds, and human impact.

Armidale branch is currently researching and planning for a campaign to protect the remaining areas, hopefully using the new Wilderness Act. We expect stiff opposition to the proposal from both the timber industry and the government, and the prospect of actually halting logging in these ares seems slim, however if we do not try and do something, yet another of our wilderness areas will be diminished.

As this is another rainforest issue, and there seems to be several other rainforest issues; it may be feasible to consider several other broad campaign options:

1) a reopening of the rainforest campaign as a background (framework) for all rainforest campaigns or

2) a broad forest campaign for all forest issues, to examine the role of the Forestry Commission, native forest management, long-term timber options with the specific forest campaigns as foci for this campaign.

Opening up the rainforest campaign again would be difficult, but is necessary if N.S.W. and Australia are going to take any stance on use of world rainforest. We can hardly comment on other countries' use of logging of rainforest if we allow our own to be logged. There are many areas of rainforest still unprotected, despite numerous alternatives existing to this timber use. Washpool, Barrington Tops, Macleay Gorges, Guy Fawkes River, the Liverpool Ranges are a few areas in northern N.S.W. with unprotected rainforest.

A broad rainforest/forest campaign would focus attention on the fact that there is still unprotected rainforest in N.S.W. and the individual campaigns of various groups could use this as a background. Such a campaign would be able to refer to all the other campaigns as examples. A possible result may be another "Rainforest Decision" protecting many areas at the one time.

More information on the Washpool campaign/background can be obtained from David Carr at the meeting or at The Wilderness Shop, 2/93 Faulkner ST Armidale 2350, ph 72 8862. (067).

HUGHES : WILD RIVERS OF NORTH EASTERN NSW. DATE?

1. INTRODUCTION

Some direct references to Desert CK area etc.

Info on effects of fire, weeds, areas water quality due to logging.

In the Environmental Impact Statement prepared by the Forestry Commission of New South Wales on proposals to log the forests of the Washpool Area relatively little mention was made of the substantial wilderness values of the area and there was virtually no reference to the particular recreational and other values of the major streams in the area. The objectives of this report are to describe the important values associated with these streams and to indicate their significance in a regional context. These objectives can be best met through the use of the Wild and Scenic River[1] concept. This concept was developed in the United States as a means of recognising and conserving riparian environments which have substantial recreational, aesthetic and nature conservation values. Should the major streams of the Washpool Area possess attributes such that they are eligible for classification as wild rivers then rational resource management requires that this knowledge be taken into account when making decisions affecting the use of lands within the area. This is particularly so if such decisions threaten to foreclose options for the conservation of wild river values.

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In section 2 of this report the Wild and Scenic River concept is briefly described along with some of the problems involved in adapting the concept to Australian streams. This leads to a discussion in section 3 of difficulties experienced in the establishment and application of criteria for the classification of streams in accord with the concept. In the light of this discussion a set of criteria for the classification of wild rivers in north eastern New South Wales is proposed. These criteria are applied in section 4 in order to compile an inventory of wild rivers in the region. A total of sixteen such streams are identified two of which, the Washpool wild river system and Coombadjha Creek, lie within the Washpool Area.

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[1] *The word river is used for convenience. The concept is applicable to streams of all sizes. The United States Wild and Scenic Rivers Act defines "river" as "a flowing body of water or estuary or a section, portion, or tributary thereof, including rivers, streams, creeks, runs, kills, rills and small lakes".*

2. THE WILD AND SCENIC RIVER CONCEPT

The Wild and Scenic Rivers concept was developed in the United States primarily in response to increasing demands for both wilderness and water-based recreation. It received legislative recognition in 1968 with the passing of the Wild and Scenic Rivers Act. This Act recognised the need to conserve some rivers or river sections in a free flowing state in essentially natural environments. Three classes of streams were established, classification depending upon the degree of disturbance of the river and its surrounds. These classes were described in the Act as:

> *"(1) Wild river areas - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.*
>
> *(2) Scenic river areas - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.*
>
> *(3) Recreational river areas - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have undergone some impoundment or diversion in the past."*

The objectives of this legislation were to conserve a range of river environments because of their recreational, aesthetic, nature conservation, cultural or other values. The Act recognised rivers as select parts of the environment representing particular values not found in other landscape elements.

Helman (1981) has reviewed the Act, its workings and the precepts upon which it is based with a view to determining the applicability of the concept to Australian streams. He concluded that the general values represented by Australian rivers are similar to those in North America and, despite significant hydrological, geomorphic and ecological differences between the streams of the two continents, that the Wild and Scenic Rivers concept could be applied in Australia.

The most substantial differences between Australian and North American rivers are that Australian streams tend to be shorter

and have highly variable and unpredictable flows. Australian rivers also have lower mean flows relative to the areas of their catchments. These differences imply that the recreational, aesthetic and nature conservation values of Australian streams may differ substantially from those of their North American counterparts and this in turn suggests that the emphases of an Australian Wild and Scenic Rivers system might differ from those in the United States.

Helman has argued that one of the most significant of such differences is that affecting recreation. The generally low but unpredictable flows of Australian rivers suggest that direct on-river travel is likely to be a less significant form of river recreation in Australia than in North America and thus that greater emphasis will be placed on other activities associated with rivers, such as bushwalking and camping. Australian rivers might also have a greater nature conservation significance than those in North America due to the often low and unreliable rainfall over most of the continent. This has been a significant factor in the evolution of much of the Australian flora. Along rivers moisture availability is far more reliable and thus riparian ecosystems are likely to contain vegetation communities substantially different from those generally found away from rivers. Together these arguments suggest that greater emphasis should be placed on the river corridor rather than the river in any adaption of the Wild and Scenic River concept to Australia. Helman has proposed a definition of the river corridor as:

> *"the river and its immediate environment which has recreational, nature conservation or scenic values associated with the river".*

He goes on to describe those streams suitable for inclusion in a wild and scenic river system as:

> *"those rivers, or sections of rivers, which, together with their corridor, represent select parts of the environment which have a significant value for nature conservation, recreation, aesthetic, historic or other special values".*

Helman adopts the American tripartite classification for such streams with wild, scenic and recreational categories. This report is concerned only with the first of these classes, wild rivers, which Helman defines as:

Desert Ck.

> *"Rivers that traverse, or whose catchments are, essentially natural areas that have had only minimal disturbance; do not have pondages or other water control structures; and where vehicle access is precluded or strictly limited."*

The use of the term wild carried no connotation as to wild-water but rather to the natural condition of the corridor through which the stream flows.

Wild rivers represent examples of the Australian environment prior to the development of lands and rivers consequent upon the arrival of European man. Such streams could thus be expected to have substantial value to present and future generations for their nature conservation, recreational and aesthetic attributes.

5. A COMPARATIVE ASSESSMENT OF THE REGIONAL SIGNIFICANCE OF THE STREAMS IN THE WASHPOOL AREA

5.1 Introduction

The prime objectives of this report are to describe the important values associated with the streams in the Washpool Area and to indicate their regional significance. In section 4.2 both Coombadjha Creek and Washpool Creek, with its major tributaries, were accorded wild river status. Fourteen other stream sections were also classified as wild rivers. Of the total of sixteen wild rivers, nine occupy lightly wooded, steep sided gorges typical of the New England gorge country. The Mann also traverses similar country although in a different geomorphic setting, entering its gorge after crossing river flats at the base of the escarpment. The Timbarra and Nymboida Rivers also enter steep-sided valleys after crossing undulating agricultural country, but their valleys are quite different from both the New England and Mann gorges and are more heavily timbered. The remaining four streams, Grady's Creek, Georges River, Washpool Creek and Coombadjha Creek, can be distinguished by their having riparian corridors dominated to a greater or lesser extent by rainforest[1] vegetation. Each of these four streams flows in an incised valley characterised by much wetter vegetation types than those dominating the valleys of the other twelve wild rivers. Along these four streams it is the vegetation and particularly the rainforest that, as much as any other factor, gives them their particular values. On nature conservation, aesthetic and recreational grounds these four streams should be considered as being clearly distinct from the other twelve. Together they have a total length of only 90 km corresponding to less than 15% of the total length of all wild river sections in the region. As such the streams in this group must be considered to have a substantial conservation significance

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[1] *The term rainforest is used here in an ecological sense to refer to closed forests with two or more tree layers and including special life forms such as vascular and non-vascular epiphytes, lianes ... vines (Baur, 1957; ... 1972).*

representing as they do the only remaining wild rivers in the north east whose valleys are dominated by the moister forest types.

Another factor giving added significance to the streams in this group is that they include the only two wild rivers in the region with essentially undisturbed catchments, these being Washpool and Grady's Creeks. Of these two Washpool Creek is by far the larger, thus representing the largest essentially undisturbed stream in north eastern New South Wales and therefore the last chance to conserve a stream of such a size and condition. Washpool Creek clearly has an outstanding significance compared to all other fifteen wild rivers.

Apart from the importance of Washpool and Grady's Creeks as undisturbed catchments, their nature conservation, aesthetic and recreational values are at least partly shared by Coombadjha Creek and Georges River. Having established the collective significance of these streams any further comparative analysis should be concerned with establishing the particular values of each of them and, in particular, the extent to which the attributes of Washpool and Coombadjha Creeks are duplicated by the two streams outside of the Washpool Area. Should their attributes not be duplicated then the streams of the Washpool Area could be said to be unique and their conservation significance would be even further enhanced. To this end it is necessary to make a somewhat more detailed examination of the attributes of the four streams than was made in section 4.2.

5.2 Detailed descriptions of the four rainforested wild rivers

5.2.1 Grady's Creek

Grady's Creek is the last substantial undisturbed stream in New South Wales with a wholly rainforested catchment. Although the stream has a length of only 12 km from its headwaters on the Wiangaree Plateau to the beginning of heavily disturbed forest on its southern bank, it has been classified as [illegible] because of its exceptional nature conservation value and its very high aesthetic and recreational values. The [illegible] gradient precludes rapid travel, ensuring that [illegible]

There are really only three major vegetation types along the stream. In its upper reaches it has a fringing corridor of cool temperate rainforest dominated by Antarctic Beech. This forest gives way upslope to a cool form of subtropical rainforest dominated by Red Carabeen, Corkwood, Rosewood and Pigeonberry Ash. About 4 km downstream of the headwaters a landslip has cleared about 12 ha of forest on the northern side of the stream. This landslip has had quite a significant effect on downstream water quality. Immediately above and below the slip tall Hoop Pine emerge above the beech forest and may represent sites of earlier slips (Floyd 1978). Downstream of the slip the beech forest gives way to the cool subtropical forest along the creek. The complexity of this forest appears to increase with further progress downstream, the forest becoming a warm subtropical rainforest dominated by Black Booyong. Giant Stinging Trees and Figs are common, while Red Cedar is a less common canopy species. Bangalow Palms and Maidens Blush tend to be the dominant understorey species.

The major aesthetic values of the stream are the water itself with many small pools and falls (Plate 1) and the rainforest, its canopy often towering over 30 metres above the stream, in places almost closing over it (Plate 2). A feature of the forest is the juxtaposition of shapes, colours and textures in its varied elements. Scenically the stream is somewhat limited due to its narrow and enclosed nature. However, there are some spectacular views of the jagged crowns of Hoop Pine emerging above the forest canopy on ridges some 200 m above the stream. One particular feature of the stream is the waterfall shown in Plate 3 which occurs on one of its tributaries. The combination of light, water, shape, space and sound at the base of this particular fall provides an outstanding aesthetic experience.

The recreational values of the stream are largely a function of its aesthetic values, that is with the appreciation of the rainforest and creek. It is an easy creek to walk down although there are a few small falls and the need to rock-hop across [illegible]

5.2.2 Georges River

In contrast to the undisturbed catchment of Grady's Creek that of Georges River has been extensively disturbed: by grazing in its headwaters, along its major tributary and along its lower reaches; by forestry operations, red cedar having been logged along the stream, with heavy logging along the ridges on both sides of the stream in places extending to within its visual corridor; and by frequent burning in parts of the catchment, largely due to the activities of adjacent landholders. Despite this fairly intensive disturbance a 17 km length of stream still has sufficient nature conservation, aesthetic and recreational attributes for it to be classified as wild. However, if such a classification is to be maintained, active management would be necessary, particularly to reduce the frequency of fires in parts of the upper catchment. Such fires often burn to the edge of the stream itself, the stream sometimes forming the ecotone between cool temperate rainforest and fire-affected dry sclerophyll forest. Some revegetation of cleared areas along the lower reaches of the stream would also be necessary.

The nature conservation value of the river lies largely in the variety of forest types traversed. In its upper reaches the river flows through towering Antarctic Beech forest (Plate 4). This forest often contains Coachwood as a codominant species and some extensive areas have been logged, logging in places approaching close to the stream. Moving downstream Coachwood becomes more common but the forest also becomes less well developed, eventually giving way to a fringing corridor of dry rainforest along the stream. Dominant genera in this rainforest are *Backhousia* and *Syzygium* with Sweet Pittosporum being common along the stream. This forest often has sclerophyllous emergents. About one kilometre below the junction with Cunnawarra Creek well developed warm temperate rainforest with some subtropical elements occurs along the stream particularly on small alluvial flats. The major species in this forest are Coachwood, Corkwood, Crabapple and Yellow Carabeen. The subtropical element of the forest becomes better developed downstream with Black Booyong and Red Cedar becoming fairly common along the river. Unfortunately only small or non-commercial cedars remain. Tall River Oaks also appear along this section of the river, often being festooned with a variety of epiphytes. As the [illegible] rainforest becomes

restricted to the immediate environs of the stream, usually with an overstorey of Blue Gum or Brush Box.

The aesthetic attributes of the stream are largely related to the rainforest and the river itself with small cascades and pools being common (Plate 5). There are several small falls along the stream the largest being about 30 m at the head of the gorge (Plate 6). Stream flows are too low and the gradient too steep for on-stream travel and bushwalking, with associated activities such as swimming and camping, is the most common recreational activity (Plate 7). The stream has considerable recreational value due to the range of forest types and scenic features encompassed within the river corridor.

5.2.3 Coombadjha Creek

Coombadjha Creek has a stream bed of similar size to that of Georges River and visual comparisons suggest that it would have a comparable average mean flow. A significant area of the stream's upper catchment was logged in the period 1961-66 and two roads cross it in this area. The middle and lower reaches of the stream and its catchment are largely undisturbed except for some selective logging early in this century for Red Cedar and other rainforest species in the lower part of the catchment.

Pure rainforest stands are not as common along Coombadjha Creek as they are along the three other streams, but for the greater length of the stream rainforest is the dominant vegetation type, either as pure stands or as well developed forest with Brush Box or Blue Gum as sclerophyllous emergents. Rainforest also occurs as an understorey in well developed Brush Box or Blue Gum forest. Much of the mixed rainforest/sclerophyll forest shows evidence of the influence of fire at some time in the past with the rainforest now appearing to be overtaking the sclerophyll elements at least in the immediate environs of the stream. A major feature of many of these mixed forests is the frequency with which very large emergent Brush Box are being overtaken by the Strangler Fig.

The wild river section begins in well developed warm temperate rainforest dominated by Coachwood and Corkwood but ... frequently interspersed with Brush Box and Blue Gum ... forest. Palms and vines occupy areas which appear to have

been subject to disturbance, possibly through landslips or blow downs. In some areas the rainforest contains a subtropical element with species such as Yellow Carabeen and Pigeonberry Ash. About 3.5 km downstream of the Coombadjha Road crossing a series of major waterfalls begins (Plate 8). The valley opens out here with a significant area of dry sclerophyll forest. Below the falls Brush Box and Blue Gum dominated forest again become dominant often with a well developed rainforest understorey (Plate 9). Bangalow Palms are a major aesthetic feature of this section, lining the stream and often being dominant in the understorey. As the stream gradient falls the rainforest becomes better developed and the frequency of sclerophyllous emergents falls (Plate 10). Christmas orchids are common on the forest floor and Bangalow Palms form a fairly dense understorey in the rainforest. This forest reaches its optimum development on a large area of river flat several kilometres long. The forest here is best described as lowland subtropical rainforest (Plates 11 and 12) with common species including Strangler Fig, Giant Stinging Tree, Sour Cherry, Yellow Carabeen and Pigeonberry Ash. Bangalow Palms and Maidens Blush dominate the understorey. Blue Figs are fairly common especially along the stream (Plate 13). Downstream of this area there are some considerable areas of regenerating rainforest apparently having been affected by fire or blow downs. This gives way to superb Brush Box forest with a rainforest understorey.

Coombadjha Creek has a wide variety of aesthetic features with both small and large waterfalls, a range of forest types with many colours, shapes and textures, and an attractive stream bed. In contrast to Grady's Creek and Georges River the stream offers some broad views from the tops of its waterfalls giving it a more expansive quality.

The frequency of large boulders, pools, small canyons and waterfalls along the upper reaches of the stream precludes any travel along the stream corridor except on foot. Progress is initially very slow but is amply rewarded by the ever-changing environment (Plate 14). In terms of recreational appeal the stream probably offers somewhat more than both Grady's Creek and Georges River, being more varied and [illegible] the former

5.2.4 Washpool Creek and tributaries

In section 4.2 the Washpool wild river system was defined as consisting of Washpool Creek and its closely spaced major tributaries, Eaglehawk, Babepercy, Pi Pi, Hianana and Coldwater Creeks. The Washpool wild river system contains two major riparian environments. The first of these is restricted to the streams in the upper catchment. Here the stream is large enough to be considered as a major aesthetic feature apart from the forest but is not so large as to effectively dominate the riparian experience still being within the forest (Plates 15, 16 and 17). Where these come together to form Washpool Creek proper the whole nature of the riparian environment changes. The stream bed is substantially wider than along the tributaries and becomes the major focus of the landscape (Plates 18, 19 and 20). The stream here is of such a size as to be better considered a river rather than a creek.

The two geomorphic zones identified above also differ in aesthetic and nature conservation attributes. The tributaries characteristically flow through well developed warm temperate rainforest dominated by Coachwood and Corkwood, sometimes with a dense understorey and sometimes being remarkably open. Moving downstream towards Pi Pi Flat, Blue Gums become more evident usually with a Coachwood dominated rainforest understorey. There are also some areas of dry rainforest characterised by emergent Red Cedar and Flame Trees (Plate 21). The flat itself provides a marked contrast to the dominant closed forest being characterised by towering Blue Gums with little or no understorey.

Downstream of Pi Pi Flat pure rainforest stands become less frequent with Blue Gums and Brush Box being common emergent species. The rainforest is often very well developed beneath these sclerophyllous emergents (Plate 22). There are also some magnificent stands of wet sclerophyll forest sometimes with Cabbage Palms in the understorey (Plate 23). Towards Oorooroo Creek dry rainforest becomes more common, the canopy being dominated by Shatterwood with fairly frequent Red Cedar emergents (Plate 24). The presence of such Red Cedars in substantial numbers both in the dry rainforest and in some patches of subtropical rainforest suggests that the stream largely

Table 5.1 SUMMARY OF THE MAJOR ATTRIBUTES OF WASHPOOL, COOMBADJHA AND GRADY'S CREEKS AND GEORGES RIVER

	Washpool	Coombadjha	Georges	Grady's
length (km)	43 (system) 25 (Washpool Creek)	17	17	12
mean flow (megalitres/day)	453	not available	212	not available
vegetation types	WTRF STRF DRF WSF DSF	WTRF STRF WSF DSF	CTRF WTRF STRF DRF WSF DSF	CTRF STRF
catchment undisturbed	Yes	No	No	Yes
disturbance to immediate environs of stream	none	very limited	significant	none
aesthetic values	outstanding	very high	high	very high
scenic values	high	high	limited	limited
nature conservation value	unique	very high	high	unique
average time required to traverse length of stream (days)	3 to 4	2 to 3	2 to 3	2
overall assessment of recreation value	outstanding	very high	high	high

escaped the attention of cedar getters. Below Oorooroo Creek pure rainforest stands are restricted to small sheltered localities. The rainforest here is subtropical. Both Cabbage Palms and Bangalow Palms are common with some large Strangler Figs and Blue Figs. There are some magnificent Water Gums along this section of the stream. Below Willowie Creek River Oaks become more common (Plate 25) often heavily festooned in epiphytes (Plate 26). Rainforest is restricted to sheltered gullies, dry sclerophyll forest being dominant. This forest usually has a dense understorey of Lantana. Lantana also occurs along the stream and is so dense towards the Desert Creek junction as to preclude a 3 km section of the river from being classified as wild.

The aesthetic values of the Washpool wild river system are difficult to describe, so varied and intricate are the stream and its surrounds. As the accompanying photographs indicate, the forest along the streams is a major aesthetic feature both as a community and in its individual elements. Both the major stream and its tributaries have substantial aesthetic values with many varied colours, moods and reflections. Waterfalls and long, deep, crystal clear pools are important features (Plates 27, 28 and 29). There are also seasonal variations in the aesthetic attributes of the stream, the attractive new leaves of Red Cedars in early spring, the bright red crowns of flame trees in November and December, the strong honey-like perfume of Cuttsia in late spring and early summer, and the white to red crowns of Corkwoods as they go from flower to fruit through November and December.

Recreation within the stream system is largely restricted to bushwalking and its associated activities with some fishing in the lower reaches. There are few if any streams in north eastern New South Wales that can rival the bushwalking values of the Washpool wild river system. It has virtually all of the major features sought in any walking trip and is of sufficient length to provide a very high quality wilderness experience. In discussing bushwalking generally in the Washpool Wilderness the Northern Rivers Bushwalkers Club (1981) says "The major topographical feature of interest to walkers is the diversity and quality of the creeks", and it is along the creeks that most

walking activity is centred, although ridges are important corridors to and from the streams and for travel between them. Travel along the stream corridors is generally straightforward and is within the capabilities of most people. Progress is often quite slow with much rock hopping (Plate 30). A possible recreational use of the middle and lower reaches of the stream when at higher than normal levels would be travel by air mattress as is practised on some other wild rivers in the region (Plate 31). Because of the gradient of the stream this would be restricted to those with whitewater skills.

The major recreational attractions of the stream system are the forest scenery, the many tributary waterfalls, the large crystal clear pools and the existence of a complete sense of isolation in superb undisturbed surrounds. Above all the feature that gives the Washpool wild river system its outstanding recreational value is the sheer length of undisturbed streams within the system. With side walks it is possible to enjoy a wilderness experience of seven or even more days within the confines of the system. This is far in excess of the useful recreation time that could be spent on any of the other rainforested wild rivers. In fact, the system probably allows for the longest purely wilderness journeys that could be experienced anywhere within the region under examination.

5.3 A Comparative Analysis

Each of the four rainforested wild rivers described above has its own distinctive attributes and values and it is difficult to make any objective comparative assessment of them. Helman (1980) has used stream length as the criterion on which to base a rough ranking. Another possible objective measure would be to use stream flow. However the use of such single criteria does not appear to be appropriate for the ranking of streams with such a diverse range of values, rather some assessment of a range of attributes is required. To facilitate such a comparison the information contained in sections 4.2 and 5.2 is summarised in Table 5.1.

Many of the assessments of the attributes listed in this table are subjective and, while based on extensive field knowledge, are open to challenge. On the basis of the two most objective measures, length and mean flow, Washpool Creek is clearly the most substantial of the four streams while Grady's Creek is the smallest. Another possible criterion that is largely objective is the degree of naturalness of the riparian corridor and catchment. On this basis Washpool and Grady's Creeks would be ranked most highly while Georges River would be ranked lowest.

Aesthetic and scenic comparisons are very difficult. Both Washpool and Coombadjha Creeks offer some very good extensive riparian scenery, but such views along both Georges River and Grady's Creek are limited. Aesthetic values have been graded primarily on a combination of variety and naturalness. Variety exists both within particular landscape elements such as within a particular type of forest and between such elements. The undisturbed and highly diverse vegetative, scenic and stream characteristics of the Washpool wild river system ensure that its aesthetic values cannot be described as anything other than outstanding. By comparison the other streams, although having high to very high aesthetic values, lack the full range of diversity exhibited by Washpool Creek especially the more expansive views, moods and reflections offered by the middle and lower reaches of the creek.

As with aesthetic values it is difficult to assess and compare the nature conservation significance of these streams. Certainly Grady's Creek has a very substantial nature conservation significance as indicated by the dedication of the Grady's Creek Flora Reserve. Most of the vegetation associations encompassed within the corridors of the other streams are represented, to a greater or lesser extent, in existing reserves, but others are poorly represented if at all. Of particular significance are the Red Cedar and dry rainforests along Washpool Creek and the lowland subtropical rainforest on Coombadjha Creek.

Washpool Creek is quite remarkable for the frequency of large Red Cedar along much of its length. The stream corridor probably represents the only major occurrence of large Red Cedar in New South Wales. As such it could also be said that the stream has some historical significance in that it represents the last example of an environment that was a major focus of attention in the early development of many of the river valleys of New South Wales. The stands of dry rainforest along Washpool Creek are also of considerable interest as dry rainforest in general is poorly conserved in existing reserves and riparian dry rainforest may not be reserved at all.

The lowland subtropical rainforest along Coombadjha Creek appears to be most significant because of its extent and the absence of Black Booyong which is usually a major species in forests of this type.

Besides these more specific values the nature conservation value of these streams lies in their length, the minimal disturbance of a range of forest types over this length, and the interplay of ecological factors peculiar to the riparian environment including reliable moisture availability, fire protection and the existence of permanent light breaks through otherwise closed forest due to the stream channel. Significant lengths of undisturbed riparian corridor traversing a range of forest types would be required for the thorough investigation of the influence of these factors on forest development.

The final major aspect of any comparative assessment of these four streams is their recreational value. One of the objectives of the wild river concept is to provide a wilderness type experience in a riparian environment. Major features influencing such a recreational experience are environmental quality and the length of the experience. As indicated above it is difficult to make meaningful comparisons of the environmental qualities of these streams, although it has been suggested that Washpool Creek has the highest [illegible] while, together with Clarke's Creek, [illegible] greatest [illegible] wilderness. The other major [illegible] of both the

offers the longest recreational experience with Grady's Creek the shortest. Overall the recreational potential of Washpool Creek is clearly greater than the very substantial values of the other three streams.

An overall assessment of the nature conservation, aesthetic and recreational values of the four rainforested wild rivers in north eastern New South Wales is strongly suggestive of Washpool Creek being the most outstanding of these streams. Not only is it the longest and largest of them, but it also has the highest values for each of the subjective attributes listed in table 5.1. Although still an exceptional stream, Georges River appears to be the fourth ranked of these streams primarily because of disturbance to the stream and its catchment. The attributes of Coombadjha and Grady's Creeks are so dissimilar that no comparative ranking of these streams can be made. Both have exceptional values and must be considered very significant examples of the natural Australian environment.

5.4 A comparison with streams in areas reserved under the National Parks and Wildlife Act

None of the four rainforested wild rivers identified in this study are in areas currently dedicated under the National Parks and Wildlife Act 1974. However there are a number of significant rainforested streams reserved within National Parks in the region. Those which could be considered to be of particular significance are:

1. The tributary creeks of the Bellinger River in New England National Park in particular: Bellinger River, Andersons Creek and Woods Creek.
2. Five Day Creek in New England National Park.
3. Rosewood Creek in Dorrigo National Park.

Each of these streams has substantial nature conservation, aesthetic and recreational values; however, they do not have sufficient attributes to be considered wild rivers. In [illegible] they are either too short, as is Five Day Creek; too

and too small, as are the tributary creeks of the Bellinger over much of their length; or too short and too disturbed, as is Rosewood Creek. Even if such streams did meet the criteria to be classified as wild this would in no way detract from the particular values of the streams described in section 5.3, nor could they be considered to duplicate those particular values. In particular the rainforest along each of these streams is almost wholly subtropical in character, although there is some dry rainforest along Rosewood Creek and some temperate elements in the higher altitude forests in New England National Park. Even the subtropical rainforest along these streams cannot be considered directly comparable with that along any of the four rainforested wild rivers, except that there are some affinities between the subtropical forests in Five Day Creek and Georges River.

Although the range of subtropical rainforests found along streams in the New England-Dorrigo area may be well represented in existing reserves, this in no way affects the conservation significance of the rainforests along the four identified wild rivers. Further those streams in these existing reserves do not duplicate the aesthetic and in particular the recreational values of the rainforested wild rivers. One of the prime objectives of a wild and scenic rivers system is to conserve a range and diversity of streams (Helmen 1981). Even if the reserved streams were considered wild they could not be considered to represent such diversity. In contrast the four wild rivers identified do represent a considerable diversity not only in nature conservation values, but also in aesthetic and recreational attributes.

5.5 Summary

Wild Rivers whose riparian corridors are dominated by rainforest vegetation must be considered as a rare and evidently endangered resource in north eastern New South Wales. Only four have been identified in this study of which two are [illegible] the Dorrigo Area. These two [illegible] the total length of rainforest [illegible]

with its tributaries, clearly stands out as the most substantial and the most valuable. Further it is the largest and longest stream left in the region which has an essentially undisturbed catchment. It is an outstanding vestige of natural Australia. Each of the other three streams have exceptional values making them well worthy of reservation. Rainforested streams in existing areas reserved under the National Parks and Wildlife Act 1974 neither represent the particular values of the four rainforested wild rivers nor do they adequately duplicate any of these values if taken individually.

6. THE IMPACTS OF PROPOSED LOGGING OPERATIONS IN THE WASHPOOL AREA ON THE CONSERVATION VALUES OF WASHPOOL AND COOMBADJHA CREEKS

6.1 Introduction - The Proposed Logging Operations

Some details of the logging operations proposed in the Washpool Area are given in the Environmental Impact Statement. In that statement a proposal is made to reserve a significant area of land as the Willowie Scrub Flora Reserve. In this examination of the impacts of logging in the Washpool Area it is assumed that the exceptional nature conservation and scientific values of the Willowie Scrub are such that it will be reserved irrespective of any modifications that may be made to the logging operations as proposed.

The Forestry Commission's proposals entail a high intensity of logging activity over a period of thirty years. Logging would directly affect 31% of the total Washpool Area, this corresponding to 80% of the available forest resource after reservation of the Willowie Scrub. It is intended to remove a total of 604,000 m^3 of timber from the area, 536,000 m^3 being hardwood and 68,000 m^3 being rainforest timber. Except for a relatively small section of forest in the north east of the area, logging will be heavy, being based on the principle of maximum economic utilisation:

> *"With the exception of stands of irregular age class structure in the Redbank Logging Area in the Casino West Sub-district, the proposed logging operations will remove virtually all merchantable, economically accessible, mature hardwood sawlog trees, except for those in reserves or retained for environmental reasons."* (p.7)

The great majority of rainforest timber will come from the Grafton Sub-district:

> *"The proposed logging of the rainforest areas in the Grafton Sub-district will aim at maximum economic utilisation of logs included in the commitment."* (p.8)

Approximately two-thirds of the catchment of Washpool Creek [illegible] Grafton Sub-district [illegible]

[redacted] the catchment of Washpool Creek [redacted] Desert Creek and Redbank Logging Areas of the Casino West Sub-district.

On the Commission's figures it intends to remove about 10,000 m^3 of rainforest timber and 258,000 m^3 of hardwood timber from the catchment of Washpool Creek, these amounting to 15% and 48% respectively of the total volumes of these timbers to be removed from the Washpool Area. No figures are given for the volumes of timber to be removed from the catchment of Coombadjha Creek. Other catchments affected by the proposals are those of the Timbarra River and Viper, Second and Redbank Creeks.

6.2 Possible impacts of forestry activities on wild river attributes

Any disturbance within the catchment of a wild river can have an impact on the wild attributes of the river, even where that disturbance is some distance from the stream. Such impacts may be negligible, small but acceptable, or unacceptable even if only small in magnitude. The acceptability of any particular impact depends on the magnitude of the impact and the pre-existing condition of the river corridor. The basic objective of wild river management is to maintain the stream in that condition that makes it outstandingly remarkable. The more outstanding, the more natural, the less disturbed is a stream and its catchment, the less is the acceptability of any given disturbance.

Logging operations such as those proposed for the Washpool Area can have a number of substantial impacts on wild river attributes. Such impacts can be direct and immediate such as the disturbance to natural environments in the processes of road construction and tree removal. Others are indirect, usually unintended, impacts subsequent to these processes. Such indirect impacts can include reductions in water quality, increased risk of fire, and the introduction of exotic species.

Direct effects:

1. Visual disturbance - roading and tree removal within the visual corridor of a wild river have substantial impacts on the wild attributes of the riparian corridor. The effects of this type of disturbance can impact on all three major wild river attributes: nature conservation, aesthetic and recreational values. In already disturbed catchments some very limited disturbance to background areas may be acceptable. However middle or foreground disturbance of the type posed by forestry operations would usually preclude a stream from being classified as wild.

2. Access - wild rivers should be inaccessible except by foot or watercraft. Roading which approaches or crosses a stream would usually preclude that section of the stream from being classified as wild.

3. Noise - sensitory perceptions other than visual ones are an important part of the wild river experience. Logging operations such as tree felling and log hauling generate a substantial amount of noise. Where noise from such operations can be heard along the stream corridor the wild river experience will be impaired. Although such noise may be of a temporary or intermittent nature it can have a substantial impact on wild river values.

Indirect effects:

4. Water quality - soil erosion along logging roads, snig tracks and other areas affected by logging can lead to substantial increases in stream turbidity levels, particularly after heavy rain. Water quality is a major feature of the riparian environment and in a wild river should be maintained at the highest possible level.

5. Fire - fire is a natural feature of the Australian environment and both fire frequency and intensity are significant factors affecting the nature and distribution of vegetation communities. Fire activity can have

on fire regimes and thus vegetation communities. Firstly the remnants of felled trees left on the forest floor can lead to a substantial build up of fuel increasing the intensity of any subsequent fire. Secondly, forestry operations are often accompanied by control burn policies leading to an increased frequency of low intensity fires and sometimes to an increased frequency of high intensity fires when control burns become uncontrollable. A third possible effect is due to the increased access to forest areas due to logging roads. This increases the potential for the unauthorised lighting of fires. A fourth effect is that, while such roading encourages and facilitates the suppression of wildfires, it also encourages the rapid construction of further tracks during the course of fighting a fire. The location of such tracks can have serious environmental impacts.

6. The introduction of exotic species - Forestry operations can lead to the introduction or spread of both feral animals and weeds. Disturbed areas along roads and where logging has occurred provide ideal sites for the growth of many weeds. Such sites can then be used as a base for colonisation of natural gaps as they occur in the forest and can act as a seed source for the invasion of stream banks. Forestry roads can also provide easy access for feral animals such as cats, whose activities could reduce the nature conservation values of riparian corridors.

7. Water borne debris - one consequence of upstream use of a river is the downstream movement of various forms of debris including logs and branches from logging operations and a whole range of articles from plastic bottles to car tyres. The existence of road crossings has a substantial effect on the frequency with which this latter group of items could be expected to occur along the stream.

6.3 The likely impacts of [redacted] the wild river values of Washpool and Coombadjha Creek

The discussion in section 6.2 indicates that major forest operations in the catchments of Washpool and Coombadjha Creeks could have very substantial adverse impacts on the wild river values of these streams. In this section each of these impacts will be considered in detail based on the assumption that logging goes ahead as planned.

1. Visual disturbance - Although 20 metre filter strips should be left along most major streams in the area the visual disturbance to the riparian corridors of both Washpool and Coombadjha Creeks will be massive. Well over 60% of the forest in the upper half of the catchment of Washpool catchment will be logged to maximum economic utilisation. Every major stream and virtually all minor streams in this area will be seriously affected. This will result in the almost complete loss of the enclosed riparian landscape typical of the upper catchment streams. The nature conservation, aesthetic and recreational values of the upper catchment will be very seriously impaired. Although much of the logging in the lower half of the catchment will be beyond the visual corridor of the stream, any lengths of visually undisturbed stream remaining after such logging would be too short to be classified as wild. Thus on the basis of visual disturbance alone the Washpool wild river system would no longer exist and no remaining section of Washpool Creek could be called wild.

Logging proposals in the Coombadjha Creek catchment include the extraction of timber from along a 6 km length of the stream. This would cut the wild section in half, neither remaining segment being of sufficient length to be classified as wild. Further, the forest to be logged is largely lowland subtropical rainforest which constitutes one of the major aesthetic and recreational attractions of stream and which is also the feature with the greatest conservation significance.

2. Access - The proposed logging operations require crossings of Eaglehawk, Pi Pi, Washpool, Coldwater and Coombadjha Creeks. Even if no logging was to occur within the visual vicinity of these streams, the existence of such crossings would reduce the length of the Washpool wild river system from 43 to 33 km and the crossing of Coombadjha Creek would be sufficient to bar the stream from being classified as wild.

3. Noise - The impact of noise will depend on background noise at different points along each stream. Where there are significant rapids the impacts of noise will be less severe. However, many stream sections have relatively gentle gradients and the consideration of noise could have a significant bearing on the width of the sensory corridor along these sections.

4. Water quality - A major value of Washpool Creek is its excellent water quality even after heavy rain. The water quality of Coombadjha Creek is excellent at low stream levels but increases significantly after heavy rain. The Commission states that 40% of the areas proposed for logging occur on highly erodible soils:

> *"The subsoil of this type is extremely erodible, forming erosion gullies after heavy rain anywhere on steeper slopes where disturbance has penetrated below the A horizon."* (p.121)

The Commission goes on to say:

> *"The erodible nature of the area, together with the high rainfalls experienced and the steep terrain do indicate a possible soil erosion problem, particularly on roads. Increased soil erosion from this source after logging may lead to some degrade of water quality. The generally small grain size in the B horizon of the erodible soil types may lead to increases in both turbidity and suspended sediment levels in streams for some time during and after rain if erosion from roads becomes a continuing phenomenon."* (p.122)

Given the extent of erosion noticeable along roads constructed in the area in 1979 (Plate 32) and the likelihood that the Commission has underestimated mean rainfall in the area (p.72) it seems highly likely that, despite efforts to control soil erosion, it will be an [illegible] consequence of soil

disturbance and that turbidity levels will indeed rise. This reduction in water quality will adversely affect one of the major aesthetic and recreational values of the Washpool wild river system (Plates 33 and 34). The scientific value of the stream as a major undisturbed catchment will also be lost. Although such increases in turbidity are unlikely to be so substantial as to preclude on their own the classification of Washpool Creek as wild, they will represent a serious impairment of its outstanding values.

The effects on reduced water quality in Coombadjha Creek are likely to be less severe than for Washpool Creek as less of its catchment is to be logged and existing disturbance of the catchment is such that water quality is already affected after rain.

5. Fire - The Washpool Area appears to have had a complex fire history with fire being a major factor affecting the composition and distribution of vegetation types. As such any change to the existing fire regime could have a substantial effect on vegetation communities. It appears very likely that the fire regime will change as a result of logging. The extent of such changes and thus their impacts are difficult to predict. Should the frequency of high intensity fires increase, vegetation communities along the streams could undergo considerable change. If the frequency of low intensity fires was increased some present areas of hardwood forest with a rainforest understorey could revert to forest with an open grassy understorey (Plate 35). This could have an effect on adjacent rainforest communities, some of which will be along streams.

Plate 35. Fire damaged rainforest understorey in Blue Gum-Tallowwood forest, Eaglehawk Creek. A change in fire regimes could lead to the replacement of the rainforest understorey by a grass layer.

6. The introduction of exotic species - It appears quite likely that the disturbance accompanying forestry operations in the area will aid the spread of weeds both in the forest and along the streams. Forest roads could also aid the spread of feral animals into the area. Of particular concern at lower and middle altitudes is the weed Lantana. Lantana is already common along the last few kilometres of the wild river section of Washpool Creek and is so dense as to preclude the last 3 km to the Desert Creek junction from being classified as wild. Heavy infestations of this weed are found in the dry and wet sclerophyll forests to the east of the lower reaches of the stream and it appears likely that it will invade most areas disturbed by logging at lower and middle altitudes.

Coombadjha Creek is at present largely free of weeds for most of its length but the altitude of the lowland subtropical rainforest to be logged along the creek is such as to suggest that Lantana invasion would be highly likely if the forest is heavily disturbed.

A range of other weed species could be able to establish themselves if the upper areas of the catchment were further disturbed. Once established there is a high likelihood of such weeds dispersing downstream as suitable sites occur.

7. Water borne debris - One noticeable feature of Coombadjha Creek is the relatively high frequency of logs in the stream for the first few kilometres of the wild section. Most of these logs have been washed from areas further upstream. An examination of logged areas in the upper part of the catchment suggests that logging may be responsible for much of this debris. There is also a small but significant amount of sawn timber along the stream. With both logging activity and vehicular access to streams in the upper reaches of the Washpool catchment such debris can be expected to become evident along Washpool Creek and its tributaries. Such debris could significantly reduce the aesthetic and recreational values of these streams.

6.4 Summary

Should logging operations in the Washpool Area go ahead as planned the aesthetic, recreational and nature conservation values of Washpool and Coombadjha Creeks will be very seriously affected. After logging neither stream would remain eligible for classification as wild. Some two-thirds of the present remaining length of rainforested wild rivers in north eastern New South Wales would be lost.

The discussion in this section also indicates that disturbance beyond the sensory corridor of a stream can have a number of impacts on stream attributes. This implies the need for compatible catchment management if all wild river values are to be conserved.

7. MODIFICATIONS TO THE PROPOSED FOREST OPERATIONS IN THE WASHPOOL AREA WHICH WOULD MINIMISE OR ELIMINATE THEIR ADVERSE IMPACTS ON THE VALUES OF WASHPOOL AND COOMBADJHA CREEKS

7.1 Introduction

As has been emphasised in section 6, land use both in the immediate vicinity of and in the catchments of wild rivers can have very substantial adverse impacts on wild river values. In the cases of Washpool and Coombadjha Creeks such impacts would be so severe as to preclude their classification as wild rivers. As these streams clearly have outstanding conservation significance (section 5) the impacts of the proposed logging operations on them should be matters of major concern. The objective of this section is to determine how the conservation values of these streams can be preserved through modifications to the proposed logging operations.

Based on the discussion in section 6 the criteria to which any modifications to the proposed logging operations should conform are:

1. no disturbance to the sensitory corridors of the streams
2. the minimisation of any adverse impacts on water quality
3. the minimisation of the risk of significant changes to fire regimes in the area
4. the minimisation of the risk of weed introduction and spread to stream corridors

7.2 Modifications which would retain all existing wild river values

With respect to the Washpool wild river system these criteria demand that all logging and road construction be excluded from the entire catchment of the wild section of Washpool Creek as delineated by the solid red line on Map 1. Only such a policy can hope to preserve the full range of values that make Washpool outstandingly remarkable.

Sugarloaf Road not be built [illegible] be excluded from that area along the proposed road [illegible] on Map 1. Due to existing disturbance of the catchment of Coombadjha Creek it may not be necessary to exclude all logging and roading from its catchment in order to retain all existing values. Providing appropriate soil conservation measures are adopted, logging on low to moderate slopes on ridges in the catchment might be acceptable although some increases in stream turbidity after heavy rain could be expected. As the stream already experiences an increase in turbidity under such conditions the marginal impact of a further increase in turbidity may not be significant, providing such an increase was not large. However some of the areas to be logged off Coombadjha, Maani and Ooroowin Roads extend into very steep topography, often on highly erodible soils. If the risk of increased turbidity is to be minimised, then logging in the catchment should be restricted to low to medium slopes. Further research would be necessary to accurately delineate areas where soil erosion consequent on logging would lead to significant impacts on stream turbidity. The approximate bounds of such areas are shown on Map 1.

7.3 Modifications which would entail a reduction in wild river values

Should it be considered absolutely necessary to build roads or remove timber from the Washpool catchment or to extend logging into the steeper areas of the Coombadjha catchment then adverse impacts on the wild values of the streams cannot be avoided. However, such impacts can be minimised, to some extent at least, through the adoption of policies consistent with the criteria outlined above.

7.3.1 Washpool Creek

If a major, previously undisturbed catchment such as that of Washpool Creek is to be subject to exploitive activity, then a basic principle in the minimisation of the effect of such exploitation on the catchment is for activity to be concentrated in the lower sections of the catchment. In the case of the Washpool catchment if timber is to be extracted then logging should be restricted to those areas in the Redbank and Desert

Creek Logging Areas meeting [redacted] above. Logging of these areas, shown in green with [redacted] hatching on Map 1, would have some impact on turbidity levels along the lower 7 km of the wild section of Washpool Creek. It could also lead to an increased risk of fire and, as much of the areas to be logged must be considered susceptible to invasion by Lantana, there would be a risk of increasing the spread of this weed along the stream corridor. Together these impacts could be quite significant and could substantially affect the values of the lower reaches of the stream. If it is essential to log in the catchment then logging in these lower catchment areas is the maximum possible without seriously impairing the integrity of the Washpool wild river system as a natural asset.

In the event that logging activity in the upper catchment cannot be foregone, significant and probably substantial impacts on the values of the wild river system cannot be avoided. Nevertheless the impact criteria in section 7.1 suggest that the impact of any given amount of logging will be reduced if a number of policies are adopted:

1. intensive field study be carried out to map the sensitory corridors of all streams which have been identified as members of the Washpool wild river system. The whole of this corridor should be included in a protection zone.

2. as a minimum the protection zone should extend to the nearest ridge line or major break in slope on either side of the stream. Where the stream flows through relatively gently undulating terrain the protection zone should extend a minimum of 500 m from either side of the stream.

3. along well defined tributary watercourses, other than those identified as members of the wild river system, protection zones should extend a minimum of 100 m from either side of the stream. Such streams include Weat Gully, Coldwater Creek, Litany Gully and the unnamed stream defining the boundary between compartments 31 and 32 and 31 and 34 in [redacted] Creek Logging Area.

4. All logging and roading should be excluded from these protection zones, even though this might have the effect of making areas not in a protection zone inaccessible for logging activity.

5. all minor watercourses, whether perennial or intermittent should have filter strips extending for a minimum of 20 m from either side of the watercourse. Such filter strips should extend to the headwaters of the watercourse. No felling of trees within or into these filter strips should be allowed. Road crossings would be permitted.

6. logging and roading should be excluded from all areas where the combination of soil type and slope are such as to indicate that significant soil erosion is likely. This will require a detailed study of soil types in the area. Recommendations on the suitability of soil type/slope combinations for logging should be made by an independent authority.

7. detailed consideration should be given to fire management policy so as not to significantly alter the natural fire regime of the area. A particular problem could be the management of logging wastes left in the forest to ensure that the additional fuel on the forest floor does not lead to wildfires of such intensity as to threaten vegetation communities not normally exposed to fire.

8. special provisions should be made to ensure that all of the conditions applying to forestry operations in this area are strictly met. Such provisions might include the payment of substantial deposits.

The orange shaded area on Map 1 corresponds to those areas that Forestry Commission has proposed for logging from which all logging and roading would have to be excluded under the protection zones outlined in policies 1 to 4 above. The pink shading indicates proposed logging areas where policies 5 to 8 [illegible] apply. It should be stressed that any logg[illegible]

shaded areas would seriously affect the integrity of the Washpool wild river system [illegible] avoided if at all possible. Logging in the orange shaded areas would have direct and substantial impacts on the exceptional nature conservation, aesthetic and recreational values of the wild river system. Given these values logging within either the orange or pink areas should be considered unacceptable.

7.3.2 Coombadjha Creek

In section 7.2 it was stated that the Sugarloaf Road logging proposal was totally incompatible with the wild river values of Coombadjha Creek. No modification of this proposal could be considered in any way acceptable. The other suggested changes to the logging proposals along the escarpment to the north west of Coombadjha Creek were fairly minor and given the steep nature of the terrain there can be little doubt that there is a significant potential for serious soil erosion in these areas. Nevertheless, if it is essential to log these areas extreme soil conservation measures appear to be the only appropriate policy if the risk of significant adverse effects on water quality in Coombadjha Creek is to be avoided.

7.4 Summary

A number of modifications to the Forestry Commission's proposed logging operations in the catchments of Washpool and Coombadjha Creeks have been discussed in this section with a view to eliminating or minimising the adverse impacts of the Commission's proposals on the wild river values of the streams. These discussions are summarised in Table 7.1 which includes a column concerned with the effect on the available timber resource of each option considered. The estimates in this column are based on the very scanty data provided in the Environmental Impact Statement and should be viewed as being very approximate. No data on the available timber resource is available for the Coombadjha Creek catchment.

Table 7.1 A SUMMARY OF [illegible] ON WILD RIVER VALUES AND THE AVAILABLE [illegible] RESOURCE OF THE PROPOSED LOGGING SCHEME AND MODIFICATIONS TO IT

	Effect on wild river values	Effect on available timber
Washpool Creek		
Option 1: no logging in the catchment of the wild river section	all outstanding values conserved	reduction of less than 15% in available rainforest timber; reduction of about 40% in available hardwood
Option 2: allow logging in parts of lower catchment (green with pink stripes)	with careful management the essential values of the system would be conserved. Risks of increased turbidity and problems with fire and weed management.	reduction of less than 15% in available rainforest; reduction of about 33% in available hardwood
Option 3: allow logging in both lower and upper sections of catchment with stringent precautions (both pink and green with pink striped areas)	integrity of system lost; values significantly affected; very considerable risk of increased turbidity, fire hazard and weed introduction	reduction of less than 5% in available rainforest; reduction of 20-25% in available hardwood
Existing proposal	would totally negate all existing wild river values; preclude classification as wild	no effect
Coombadjha Creek		
Option 1: no further logging in catchment	would conserve all existing values	no data available
Option 2: allow limited logging on flatter areas	some risk of increased turbidity; with careful management would maintain integrity of stream	no data available
Option 3: allow logging as proposed except for Sugarloaf area	significant risk of increased turbidity leading to some reduction of wild river values	no data available
[illegible] proposal	[illegible] totally negate all [illegible] wild river values; [illegible] classification as	no effect

The comments in Table 7.1 emphasise the total unacceptability of the Commission's proposals as regards the wild river values of Washpool and Coombadjha Creeks. Option 3 for both creeks should also be considered totally unacceptable, but particularly so for the Washpool catchment. This option would totally negate the exceptional value as the last really substantial stream in the north east with an undisturbed catchment. It would also carry with it very high risks of substantial impacts on the other outstanding values of Washpool Creek as the north east's and probably the State's premier rainforested wild river.

Clearly option 1 is the preferred option for both streams conserving all of the values of these two exceptional streams. Option 2 for Coombadjha Creek would be acceptable providing careful erosion control policies were implemented. Option 2 for Washpool Creek might be acceptable but the risk to the values of the lower part of the stream entailed in this option must be weighed against the relatively small volume of timber gained over option 1.

8. CONCLUSIONS

1. The wild and scenic river concept provides an extremely useful framework within which to consider the particular values of rivers and other streams.

2. The particular hydrologic, geomorphic and ecological characteristics of Australian streams imply that increased emphasis should be placed on the river corridor and activities other than on-river travel in Australia than has been the case in other countries.

3. Sixteen wild rivers have been identified in that area of north eastern New South Wales east of the Great Divide. Only two of these rivers have essentially undisturbed catchments. By far the larger of these is Washpool Creek.

4. Of the sixteen wild rivers, ten have riparian corridors dominated by dry sclerophyll forest or woodland. The corridors of another two, the Styx and the Nymboida, contain significant areas of wet sclerophyll forest and rainforest. The corridors of the remaining four streams, Grady's, Washpool, and Coombadjha Creeks and Georges River are dominated by rainforest.

5. The total length of the four rainforested wild rivers is only 90 km, 15% of the length of all wild rivers in the region. Washpool Creek is by far the largest and longest of the rainforested wild rivers.

6. Wild rivers are poorly represented in existing reserves in the region. Only two, the Apsley and the Guy Fawkes, have significant lengths in National Parks. The only reserved rainforested wild river is Grady's Creek which has most of its length reserved within the Grady's Creek Flora Reserve.

7. Each of the four identified rainforested wild rivers has very high nature conservation, aesthetic and recreational values. However, by far the most outstanding of them is Washpool Creek because of its greater size and length,

the diversity of its topographic and vegetative features, its extremely high aesthetic values and the nature conservation significance of its forests and particularly its high frequency of large Red Cedars. Georges River is the least outstanding of the four because of the extensive disturbance to its catchment. Coombadjha and Grady's Creeks are too dissimilar to allow meaningful comparison. Each of these four streams has its own particular values and none can be considered as duplicating the environment of any of the others, rather they complement each other and all four would be very worthy members of a wild and scenic river system.

8. The existence of two of the north east's four remaining rainforested wild rivers in the Washpool Area gives the area a very substantial conservation significance, especially as these two streams account for two-thirds of the total length of all four together.

9. The logging operations proposed by the Forestry Commission of New South Wales for the Washpool Area would totally negate the wild river values of the Washpool wild river system and Coombadjha Creek. Neither would remain eligible for classification as wild after logging.

10. 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.

11. The outstanding wild river values of the streams in the Washpool Area should be recognised in the formulation of policies concerning land use in the area. This has not been the case in the development of plans to [illegible] timber resources of the area.

12. There are a number of possible modifications to the proposed logging operations that would eliminate or minimise the impacts of those operations on wild river values. With respect to the Washpool wild river system the only acceptable modification would be to exclude all logging and roading from the catchment. This is the only means by which the full range of values of this outstanding stream can be conserved. The visual disturbance and risks associated with even limited logging in the catchment could seriously compromise the wild river values of the stream. With respect to Coombadjha Creek some logging on the flatter ridges to the north west of the stream need not be incompatible with its wild river values. However, proposals to log along a 6 km section of the stream are totally unacceptable as this would totally destroy all wild river values of the stream.

13. It is strongly recommended that the whole of the catchment of the Washpool wild river system be reserved so as to conserve what must be considered to be an outstanding example of an environment now almost totally lost. It is also strongly recommended that the valley of Coombadjha Creek, along the wild section of the stream, be reserved because of its very high nature conservation, aesthetic and recreational values.

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SUBMISSION TO THE DIRECTOR OF THE NATIONAL PARKS AND WILDLIFE SERVICE, BY THE WILDERNESS SOCIETY, UNDER SECTION 7(1) OF THE WILDERNESS ACT (1987), FOR THE IDENTIFICATION AND PROTECTION OF THE NORTH WASHPOOL WILDERNESS AREA (DESERT AND MALARA CREEKS)

Prepared for The Wilderness Society, Armidale Branch, by:

David Carr, B.Sc.
Mark Higginbotham
Veronica Hoy
Belinda Nano
James Davies
Mary Flint

30.47

INTRODUCTION TO THE SUBMISSION

The 'Wilderness Act' 1987 represents a new type of ecognition and protection for natural lands in New South Wales. Some opponents believe adequate provision already existed within the 'National Parks and Wildlife Act, 1974', amongst others, to offer equivalent safeguards to our diminishing wilderness regions. The 'Wilderness Act' has broader intentions though; it both originates from, and seeks to foster, the public's growing interest in wilderness. Even its name assists in moving 'wilderness' towards the status it properly deserves.

The authors of this report believe this is the first submission to the Director of the National Parks and Wildlife Service of its kind. Consequently this short introduction is designed to offer possible assistance in understanding the objects of this submission.

It is our opinion that the Director's duties have two phases. The first is to objectively examine the subject land and form an opinion as to whether it is wilderness as defined in Section 6 of the Act. The Director may consider 'relevant' submissions from others in forming this opinion. (Section 6 (2)(c)) We suggest that in light of the objects of the Act -that is Section 3- 'relevant' can only mean contrary or supporting suggestions that specifically relate to Sections 6 (1) (a), (b) and (c). Therefore, for example, a submission that argued against identification or protection on a basis such as the area contains mineral resources, would be irrelevant to the formation of the Director's opinion.

The second phase follows the Director's opinion regarding 'wilderness'. Obviously no action is taken if the area fails to meet the standards of Section 6, but should it do so we suggest the Director is bound to seek the preservation of that wilderness. The duties of the Director are detailed in Section 5, and taken in conjunction with the objects of the Act, the Director must not compromise the wilderness in subsequent action. Section 5 (1) (f), which provides for the Director to act on behalf of the Minister in negotiations for the 'protection, management and use or declaration of existing or proposed wilderness areas", should be read using the 'class rule'. In that case 'use' has an appropriately limited definition and refers to use within the objects of this Act.

In seeking to protect a wilderness the Minister 'may' enter a 'wilderness protection or conservation' agreement. We further suggest that the discretion offered by 'may' should, in all but exceptional circumstances, be exercised in favour of protection, particularly since it is the stated policy of the current government to utilise this Act.

Finally, we suggest, a 'Wilderness Protection Agreement' should be preferred over a "conservation agreement', for it is a more rigid form of protection requiring an Act of Parliament to be revoked- and is therefore more consistent with the Wilderness Act, which seeks the permanent protecion of wilderness.

SECTION 1: WASHPOOL WILDERNESS EXTENSION PROPOSAL

In accordance with Section 7 of the Wilderness Act 1987, the Wilderness Society makes the following draft proposal for the identification (s.6) and declaration (s.8) as wilderness of land in and around the Billilimbra and Washpool State Forests as an extension to the wilderness area (s.57 of National Parks and Wildlife Act) contained within Washpool National Park.

The Wilderness Society asks that the Director of the National Parks and Wildlife Service makes such identification and declaration, taking into account the following recommendations:

1) That the Director adopt as his initial, but non-restricting guidelines for the wilderness study area, the draft wilderness boundaries described in this report and shown on Map 1.

2) That the Director consider the area outlined in this proposal as an extension to the existing wilderness area of Washpool National Park in accordance with section 7(1) of the Wilderness Act 1987.

3) That the area is, together with its plant and animal communities, in a state that has not been substantially modified by humans and their works [s.6(1)(a)part].

4) That certain small segments, namely tracks, while not in a current wilderness state, are capable of being restored to such a state [s.6(1)(a)part].

5) That one small area, which despite development making it not identifiable as restorable wilderness, is needed for the management of the proposed area [s.6(2)(b)].

6) That together with the Washpool National Park wilderness, this area is of sufficient size to make its maintenance in a wilderness state feasible [s.6(2)(b)].

7) That the proposed wilderness area is capable of providing opportunities for solitude and self-reliant recreation.

The Wilderness Society recommends that the Director, after identifying the area as wilderness, should enter negotiations with the Forestry Commission to prepare a Wilderness Protection Agreement under Division 2, sections 10,11,12,13 and 14 of the Wilderness Act 1987.

DESCRIPTION OF PROPOSED WILDERNESS AREA EXTENSION

Location

The Washpool area lies in the NE corner of NSW, to the north of the Gwydir Highway, approximately midway between Grafton and Glen Innes. The area is situated on the Gibraltar Range, part of the Great Dividing Range (see Fig. 1).

The wilderness extension area described in this report, lies to the north of Washpool National Park which is described as follows:

> All that piece or parcel of land containing about 27,715 ha situated in the Shires of Copmanhurst, Tenterfield and Severn, Parishes of Albert, Pleuna, Sistova and Richmond, County of Drake, Parishes of Moogem and Bajimba, County of Clive and being the land reserved as Washpool National Park described in Part 1 of Schedule 2 of the Forestry Revocation and National Park Reservation Act 1983 and Part 1 of Schedule 1 of the Forestry Revocation and National Park Reservation Act 1984 (Adam, 1987).

The wilderness extension area comprises part of Billilimbra State Forest (No. 815) and part of Washpool State Forest (No. 355). It covers the complete catchment area of Desert Creek and the upper catchment of Malara Creek and is bisected by the Gibraltar Range.

The area covers 6,738 ha and in conjunction with the Washpool National Park wilderness comprises 34,453 ha.

Tenure

The entire area of the proposed extension is controlled by the NSW Forestry Commission in two state forests - Billilimbra (No. 815) and Washpool (No. 355) State Forest.

That part of the wilderness area which is the National Park is also part of the NSW Rainforests World Heritage area. As such it is recognised as being of international significance by the World Heritage Commission. The Wilderness Society believes that it is essential that the Desert Creek and upper Malara Creek catchment areas are added to the existing Washpool Wilderness Area, in order to protect the wilderness values of the entire wilderness area.

The Washpool National Park is a gazetted wilderness under section 59 of the National Parks and Wildlife Act, 1974, which will now be covered by Schedule 1(7)(4) of the Miscellaneous Acts (Wilderness) Amendment, 1987.

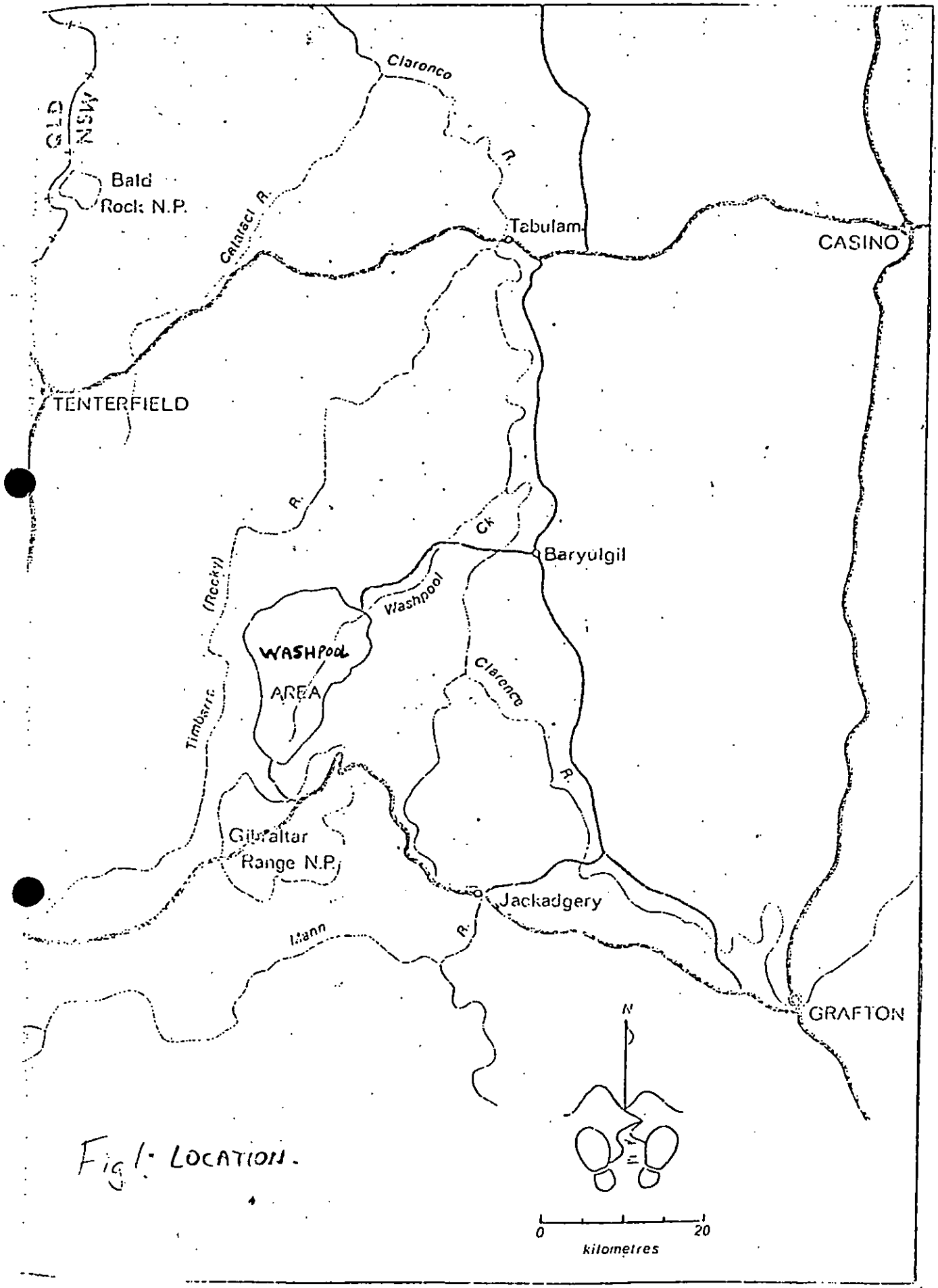


Fig 1- LOCATION.

Maps to be credited.

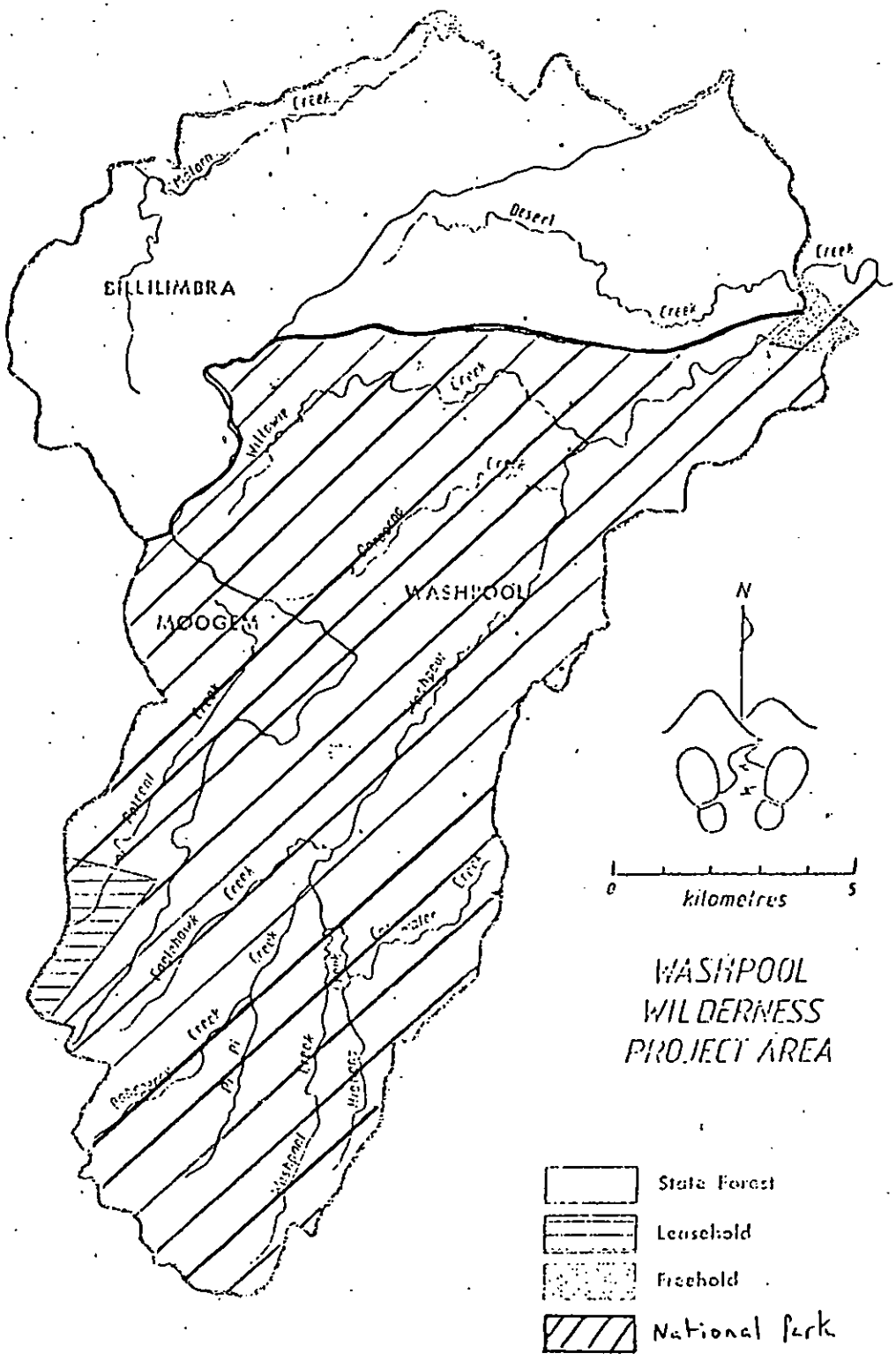

BILLILIMBRA
MOOGEM
WASHPOOL
Creek
Desert
Creek
Creek
Creek
Creek
Creek
Creek
Creek
Creek
Creek
Creek
N
0
kilometres
5
WASHPOOL
WILDERNESS
PROJECT AREA
State Forest
Leasehold
Freehold
National Park

Fig 2 : ~~[illegible]~~. TENURE.

The Wilderness Society recommends that the Desert Creek area and Malara Creek catchment should be declared as wilderness under the Wilderness Act, 1987, to ensure maximum protection of the entire Washpool Wilderness.

ECOLOGICAL AND WILDERNESS STATUS

Topography

The subject area straddles the Gibraltar Range, running north-south and dividing the Desert Creek catchment and the upper Malara Creek catchment. The Range is the dominant topographic feature of the area, rising to 1,175m above sea level at Hayden Trig. At its lowest point, the subject area is less than 200m above sea level at the junction of Desert and Washpool creeks (see Fig. 5). The Desert Creek catchment is bounded in the south by Desert Spur, the northern boundary of the National Park, and in the north-west by the Gibraltar Range. The slopes from Desert Spur to Desert Creek and from the Range into Desert Creek are very steep, occasionally being so steep as to preclude travel, even by foot. The upper headwaters of Malara Creek also contain very steep slopes, in excess of 30^0 (see Fig. 3). The Desert and Malara Creek catchments contain some of the steepest topography in the whole Washpool Wilderness.

Desert Creek drops steeply through a deep valley, which appears quite spectacular from Desert Spur. Its length of 13km makes it the second longest creek in the Washpool system, second only to Washpool Creek itself. In several places Desert Creek drops very steeply through small narrow canyons and passes over the ~~Meuna~~ PLEVNA Falls, a series of three small waterfalls. The gradient of Desert Creek is compared to those of Orooroo, Willowie and Washpool Creeks in Fig. 4.

The lower sections of Desert and Malara Creeks provide easy recreational opportunities due to their low gradient, pebbly beds and terraced banks. However, as the creek gradient increases, the steepness of the banks and the size of the boulders in the creek bed increases. In the upper sections of Malara and Desert Creeks, the creeks cut through basement rocks forming tight gullies with canyons, waterfalls and cascades.

Despite the steep nature of the ridges in the area, most ridge crests are easily accessible to walkers due to the lack of outcropping.

The plateau which occurs near Haydens Trig has gently undulating slopes and makes for pleasant walking, especially as it supports the most developed rainforest forms.

The steep dissected terrain is one of the main factors responsible for the maintenance of this area in wilderness condition, up to the present time.

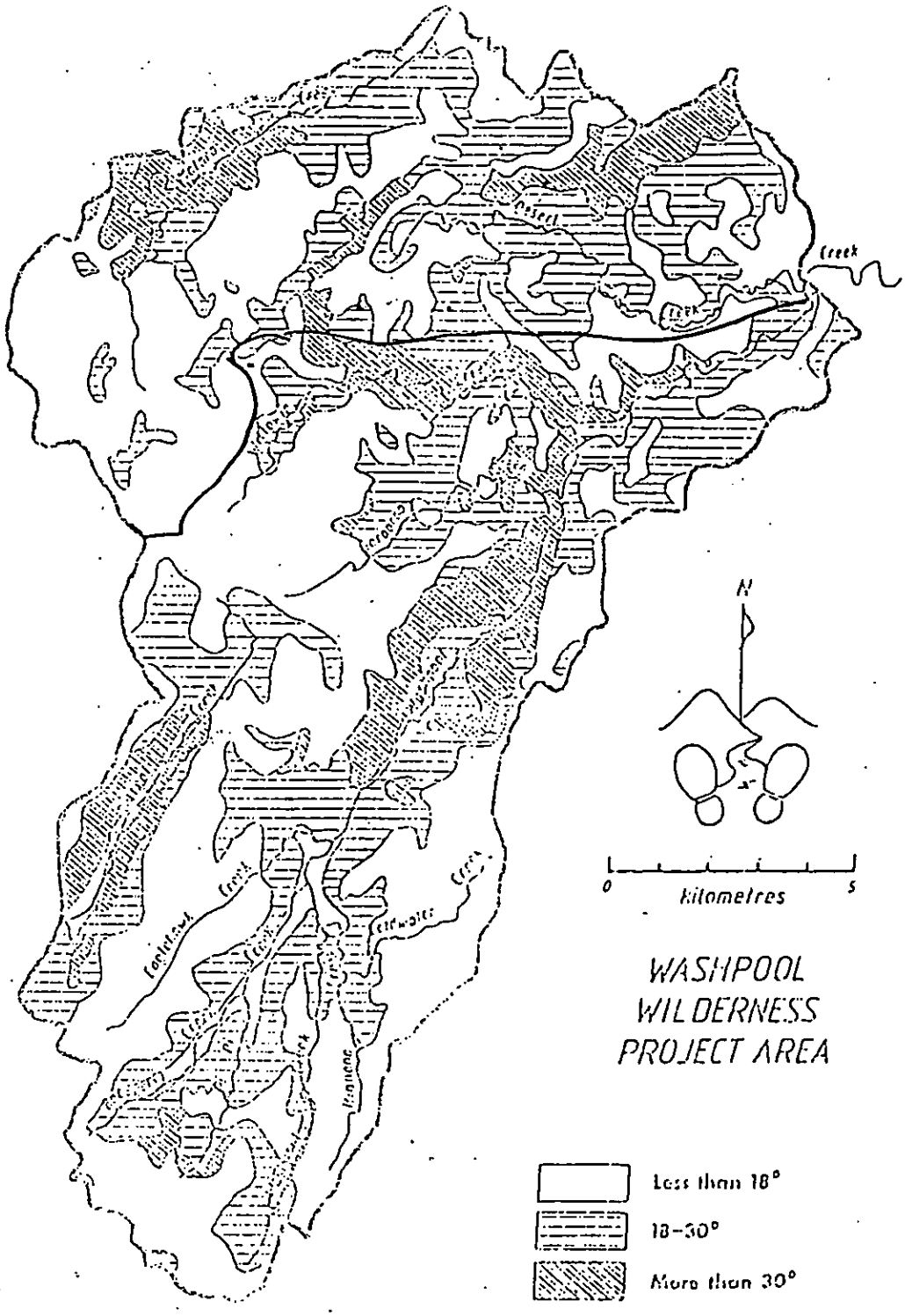
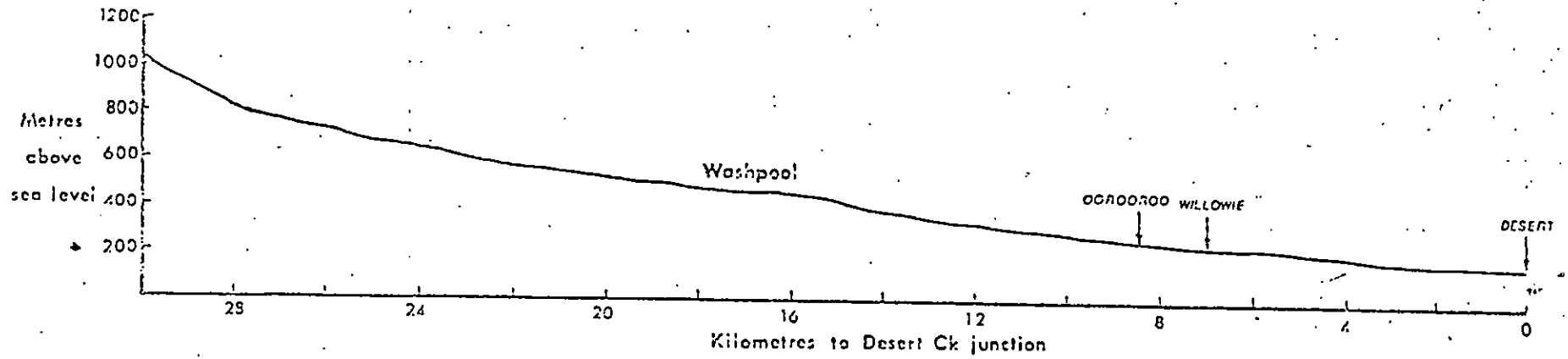


Fig 3. Slope Gradients of Washpool Wilderness.



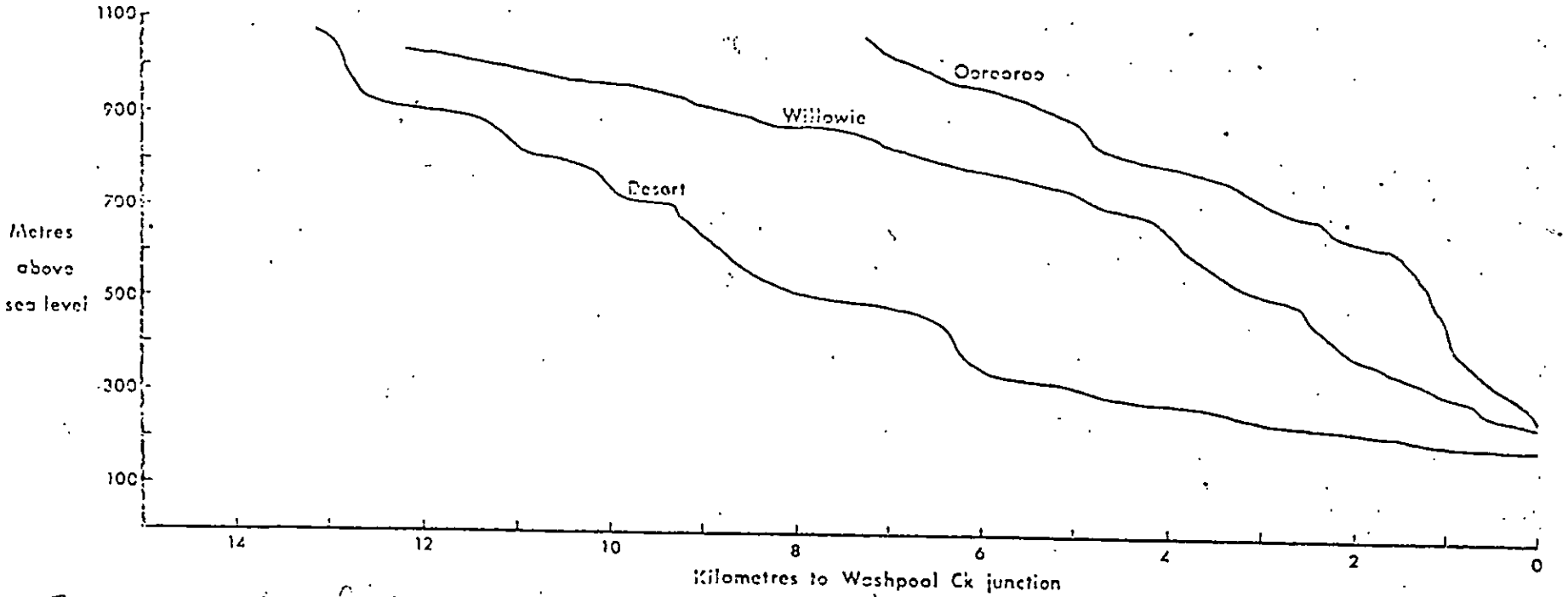


Fig 4: Cradients of Desert, Willowie, Oorroroo, Washpool ck.

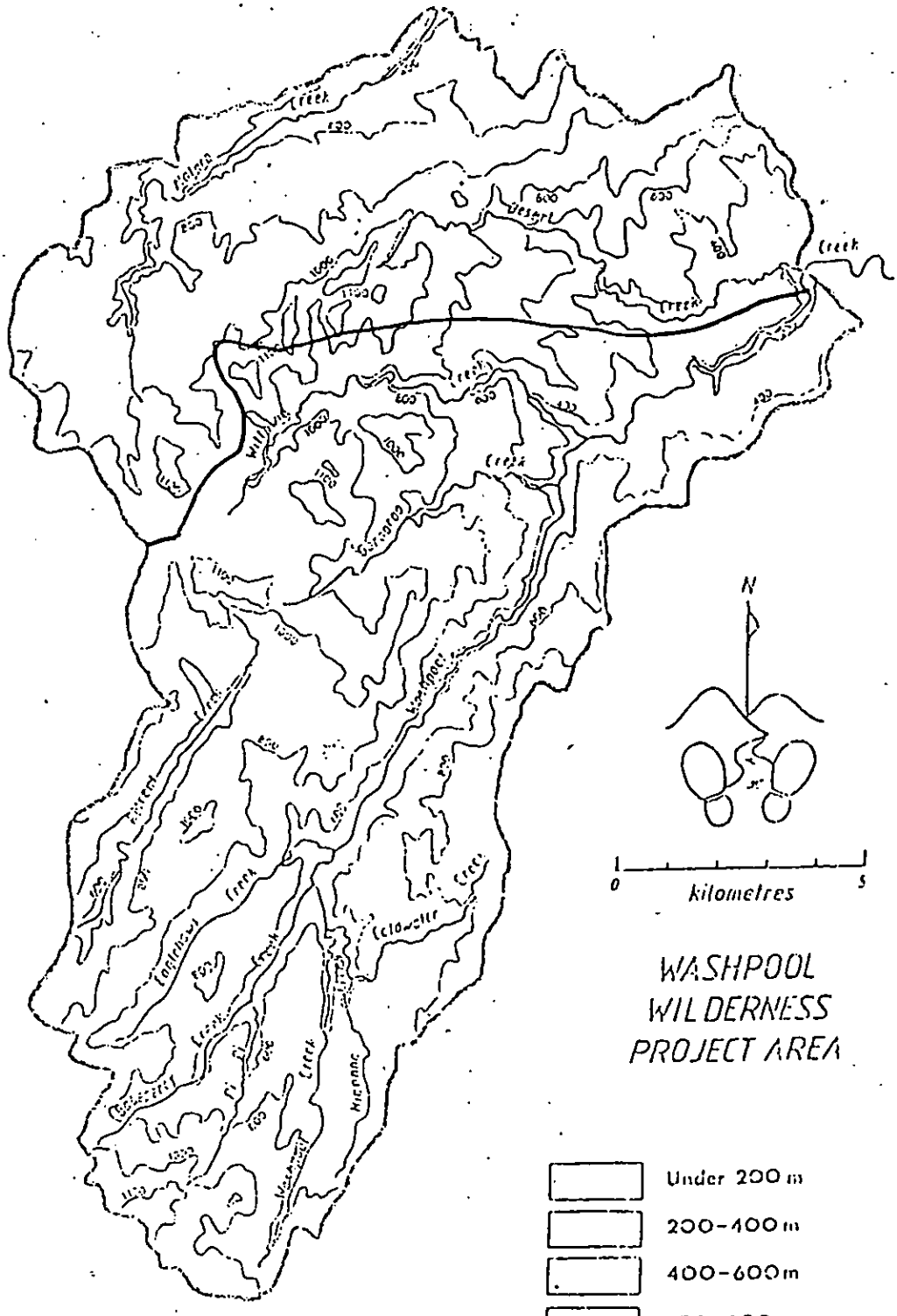


Fig 5: Topography.

Climate

Due to the wilderness nature of the Washpool area, there is little climatic data available within the area, however some information is available from neighbouring regions - the Gibraltar Range National Park headquarters, Glen Innes, Grafton, Tabulam, Drake and Copmanhurst.

Precipitation

	Av. annual (mm)
Drake	1094*
Tabulam	1015*
Copmanhurst	1088*
Grafton	1029**

*NRBC (1980) **Camelback Topographic Sheet 1:25000 9434-3-5 (1987)

Topographic relief in the Washpool area makes it probable that rainfall there is slightly higher than the above values, in the vicinity of 1100-1600 mm/yr. The Forestry Commission Management Plan (1983) quotes estimates of 1050-1425 mm/yr in the Ewingar State Forest to the north of the wilderness area.

Frosts are rare in the area, due to the topography and vegetation cover. However the NRBC (1980) states that frosts may occur more often at the lower end of Washpool Creek. Ice and snow are exceptional.

Temperature

	Jan.	July
Mean daily max. temp.:	28°C	16° C
Mean daily min. temp.:	17°C	2°C

Maximum temperature recorded in the area is 47.5°C and the minimum recorded is -5°C, both from Gibraltar Range National Park headquarters (Fox 1983). The Forestry Commission Management Plan (1983) describes the climate in this area as "warm temperate".

Geology

The southern section of the Washpool wilderness contains a well preserved late Palaeozoic silicic volcanic cauldron - the Coombadjha Volcanic Complex. This complex has been only recently properly mapped, and further work is needed to the northeast of the cauldron to determine the extent of one of the units in the complex.

Regional Geological Setting

The Coombadjha Volcanic Complex is situated in the New England Fold Belt, immediately to the east of the Demon Fault (see Fig. 6), in a sequence of mainly marine sediments of middle to late Palaeozoic age. Parts of the Complex have been intruded by late Permian and early Triassic granitic rock.

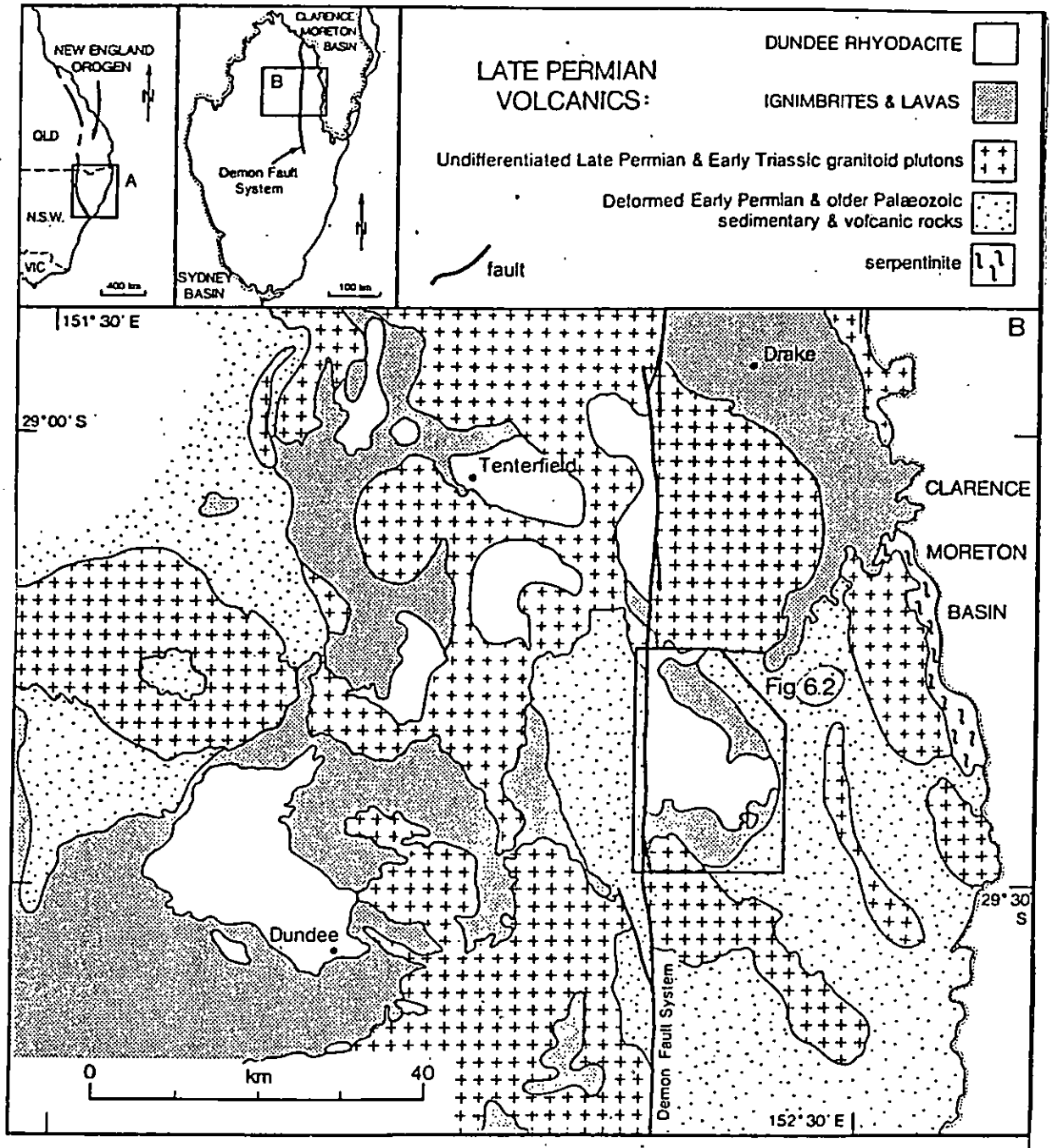


Figure 6.X: Regional geological setting of the Coombadjha Volcanic Complex and Late Permian volcanics of northeastern New South Wales. Modified from Pogson and Hitchins (1973).

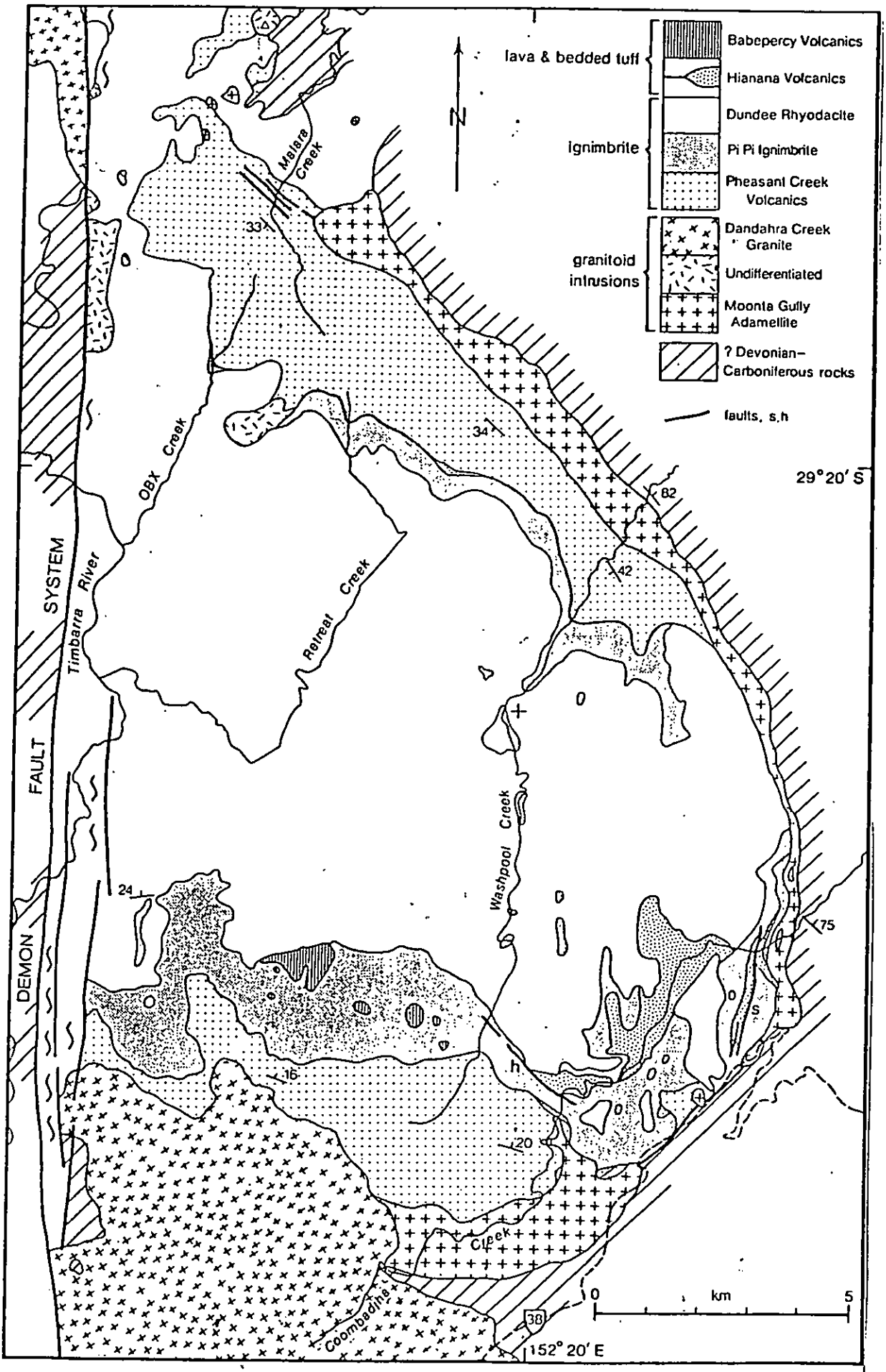


Figure ~~6.7~~ Geological map of the Coombadjha Volcanic Complex. Bedding shown is representative of the structure; ~~more comprehensive data are presented in Figure 6.10.~~ s, Sugarloaf faults; h, Hianana fault.

Geology

The Complex consists of texturally diverse silica-rich volcanic ashes and lavas surrounded by a ring dyke of adamellite, except in the southwest, where the dyke has been truncated by the Demon Fault.

Five volcanic units and one intrusive unit comprise the stratigraphy of the complex. These are briefly outlined below, in order of decreasing age of emplacement.

Pleasant Creek Volcanics: Composed mainly of a welded volcanic glass that is very resistant to weathering. It forms some of the highest ridges in the Washpool area, and is well exposed, showing a maximum thickness of over 1300m.

Hianana Volcanics: Made up of two rock types; (i) a stratified volcanic-derived 'sandstone' resulting from water reworking of erupted material, and (ii) a porphyritic lava (i.e. a fine-grained lava with large feldspar crystals visible). This unit has a maximum thickness of 200m, but most sections through it display a thickness of only 25m.

Pi-pi Ignimbrite: A black welded volcanic glass containing abundant flattened pumice fragments. Maximum thickness only 100m, and only 4 square kilometres of outcrop.

Dundee Rhyodacite: A blue, crystal-rich welded volcanic ash which weathers into rounded tors. These look like granitic boulders and have previously been mapped as a granitic rock. The Dundee Rhyodacite covers an area of 180 square km in the complex, with a maximum thickness of over 500m in the centre and tapering off towards the edges. The extent of this unit to the northeast has not been determined. As shown in Fig. 7, the Dundee Rhyodacite has been mapped in several areas well outside the Coombadjha complex, and may have been deposited as a single sheet covering an area of at least 720 sq km.

Moonta Valley Adamellite: A granitic rock that postdates the volcanics. In plan view, this unit is elliptical and the contact is either vertical or dips steeply outwards. It was emplaced along an elliptical fault, which formed when the volcanic cauldron collapsed. Geochemical data suggest that the Moonta Valley Adamellite and the Dundee Rhyodacite magmas were from the same source.

Other intrusive units such as the Dandahra Creek Granite are significantly younger and unrelated.

History

In the late Permian, nearby volcanoes erupted, depositing the Pleasant Creek Volcanics, Hianana Volcanics, Pi-pi Ignimbrite and Babepercy Volcanics. Then the Coombadjha Volcano became active, and ejected the Dundee Rhyodacite, which is a more voluminous and extensive unit than the previous volcanics. The magma supply was below the volcano and when it was

exhausted the cauldron sagged, then collapsed relatively intact, forming an elliptical, fault-bounded depression/basin. Magma was intruded along the ring fault (the Moonta Valley Adamellite) and is the only sign of post-collapse magmation in the Coombadjha Cauldron. Subsequent erosion has removed a lot of material, with the result that the original thickness of the Dundee Rhyodacite is not known.

As there was no resurgent volcanic activity, the whole cycle of cauldron eruption and collapse probably lasted only a few hundred thousand years. The first four volcanic units were emplaced over several millions of years, as was the post-eruptive Moonta Valley Adamellite.

The Desert and Malara Creek catchments contain the silicic Drake Volcanics (which are related to the volcanics in the Coombadjha complex), the Stanthorpe Adamellite and some marine sediments (Devonian) that were metamorphosed when the Adamellite was emplaced.

The location of the Drake Volcanics correlates fairly closely with the position of the most well developed rainforest area. Volcanic rock strata tend to weather to give soils of high fertility, which provides the most favourable conditions for rainforest development.

Fauna

The wilderness condition of both Washpool National Park and the proposed extension area has provided vital faunal habitat to ensure survival of many species. Due to its intact nature, the Washpool wilderness has ensured that feral animals have been excluded, such as the domestic cat and the fox, which have been responsible for reduction of native animal populations in many areas of Australia.

As a result, most of the animal populations in this area are in a natural state. The diversity of vegetation types support a wide variety of ecotones and ecosystems, capable of supporting a rich variety of fauna, including rare and endangered species. Malara Creek contains dry open forest habitats with a broad altitudinal sequence, with a predominantly north-western aspect, while Desert Creek provides a significant altitudinal sequence of predominantly moist forest types including rainforest.

~~Among the animals living in the area, the most notable species are the Eastern Native Cat (*Dasyurus viverrinus*) and the Parma Wallaby (*Macropus parma*). Both these animals have been classified as rare. Two other animals found in the area which have suffered from habitat reduction are the Potoroo (*Potorous tridactylus*) and Rufous Bettong (*Aepyprymnus rufescens*).~~ During reconnaissance walks in the Desert Creek area, Wilderness Society members have reported sightings of potoroos, tiger quolls, echidnas, antechinus and other mammals. A ~~complete~~ mammal list is provided in appendix 1.

Both the open and closed forests, with their diverse understorey strata, provide a wide variety of habitats for many bird species. A survey of birds occurring in this region was carried out by Holmes (1980) which included several sites in the Malara and Desert Creek catchments. From this, a list has been compiled of bird species which occur in Washpool and Billilimbra State Forests; those which cover Desert and Malara Creek wilderness (see appendices 2a and 2b).

This and other reports have found that the Washpool wilderness is the geographic limit for many species. As an example it forms the northwestern limit of the Superb Lyrebird (*Menura nova-hollandiae*) and the southern limit of the Albert Lyrebird (*Menura alberti*). The area is the northern limit of the Olive Whistler (*Pachycephala olivacea*), and the western limit of the Powerful Owl (*Ninox strenua*) which has been recorded in the Malara Creek catchment. Glossy Black Cockatoos were observed in *Casuarina* trees in the lower part of Desert Creek during Wilderness Society walks in this area.

There is a diverse herpetofauna in the Washpool wilderness which seems to be more prevalent in the dry open forests of the Malara Creek catchment than in the moist forests of Desert Creek and Washpool National Park.

In all, 9 amphibian species in 2 families and 18 reptile species in 9 families were reported ~~by (NPWS)~~ to occur in the Washpool and Billilimbra State Forests. This report on the herpetofauna is the only study of the reptiles and amphibians in the area. The author states that the survey was subjective and only considered abundance of species. Therefore it is likely that more reptile and amphibian species than those listed in Appendix 3 occur in the Washpool wilderness, especially in the Malara Creek catchment.

A reduction in wilderness quality would have significant effects on the herpetofauna, as the author states: "The study revealed in non-quantitative terms that a logged area (Ewingar State Forest) contained fewer reptiles and amphibian species than uncut areas. Burning, whether it be infrequent and intense or regular low-level control, adversely affected reptile populations." (NPWS 1981).

A similar lack of information is available for the invertebrate populations of these areas. However, the diversity of the habitat types is likely to indicate a similar varied invertebrate population.

Although most of the faunal populations in this area are protected with the Washpool National Park, it must be remembered that they have survived in a natural state until this time only due to the undisturbed nature of the *entire* Washpool wilderness, which includes not only the arbitrary boundaries of the entire National Park, but the areas proposed in this document, i.e. Desert and Malara Creek catchments.

Until recently the entire Ewingar forests were of wilderness quality. It is unknown what detrimental effects the gradual

decrease in size and quality of this wilderness area would have on its undisturbed fauna. Therefore it is imperative that as large an area of wilderness as still remains should be given the highest protection, to ensure that the fauna of the Washpool wilderness remains in its natural, undisturbed state.

Vegetation

(Note: Scientific names for species referred to in this section are listed in appendix 4).

The vegetation of the Washpool area, including the Desert and Malara Creek catchments, is one of its primary features. The area features a wide variety of plant communities offering habitat for many animal species. Two of the major features of this area's vegetation are the warm temperate rainforests and the interaction between different rainforest types and between rainforest and sclerophyll forest.

The rainforests include pure Coachwood (warm temperate) rainforests, and warm temperate rainforests with a mixture of dominant species. Subtropical rainforest also occurs in pure stands and there are many examples of this rainforest type intergrading with warm temperate types to form intermediate rainforest complexes. Rainforest also intergrades with wet sclerophyll forest in this area to form plant communities ranging from pure rainforest with *Eucalyptus* emergents to wet sclerophyll forest with a rainforest understorey. As such these latter forest types represent important seral stages between wet sclerophyll forest and pure rainforest and are important to the study of forest dynamics in relation to soil type, climate and fire patterns.

The most valuable vegetation unit in the area is undoubtedly the Willowie Scrub. This is a large area of rainforest which occurs in the Washpool. It is the largest Coachwood forest in the world. It is also reported to be the largest remaining stand of any rainforest in New South Wales. The Willowie Scrub covers parts of the catchments of Willowie, Oorooroo, Malara and Desert Creeks. It is continuous with the rainforests of Desert and Malara Creeks and as such it is not wholly protected. The entire area of the Willowie Scrub is not adequately safeguarded from outside influences unless it is completely protected in a wilderness condition.

Specifically, the vegetation of the Desert Creek catchment is made of a broad altitudinal sequence of forest types and includes open dry sclerophyll forest, wet sclerophyll forest with a grassy understorey, wet sclerophyll forest with a rainforest understorey and rainforest, predominantly of the warm temperate type.

Malara Creek contains rainforest of both subtropical and warm temperate types, wet sclerophyll forest and large areas of dry open sclerophyll forest typical of the western edge of the Washpool area. Wet and dry scrub also occur in both areas.

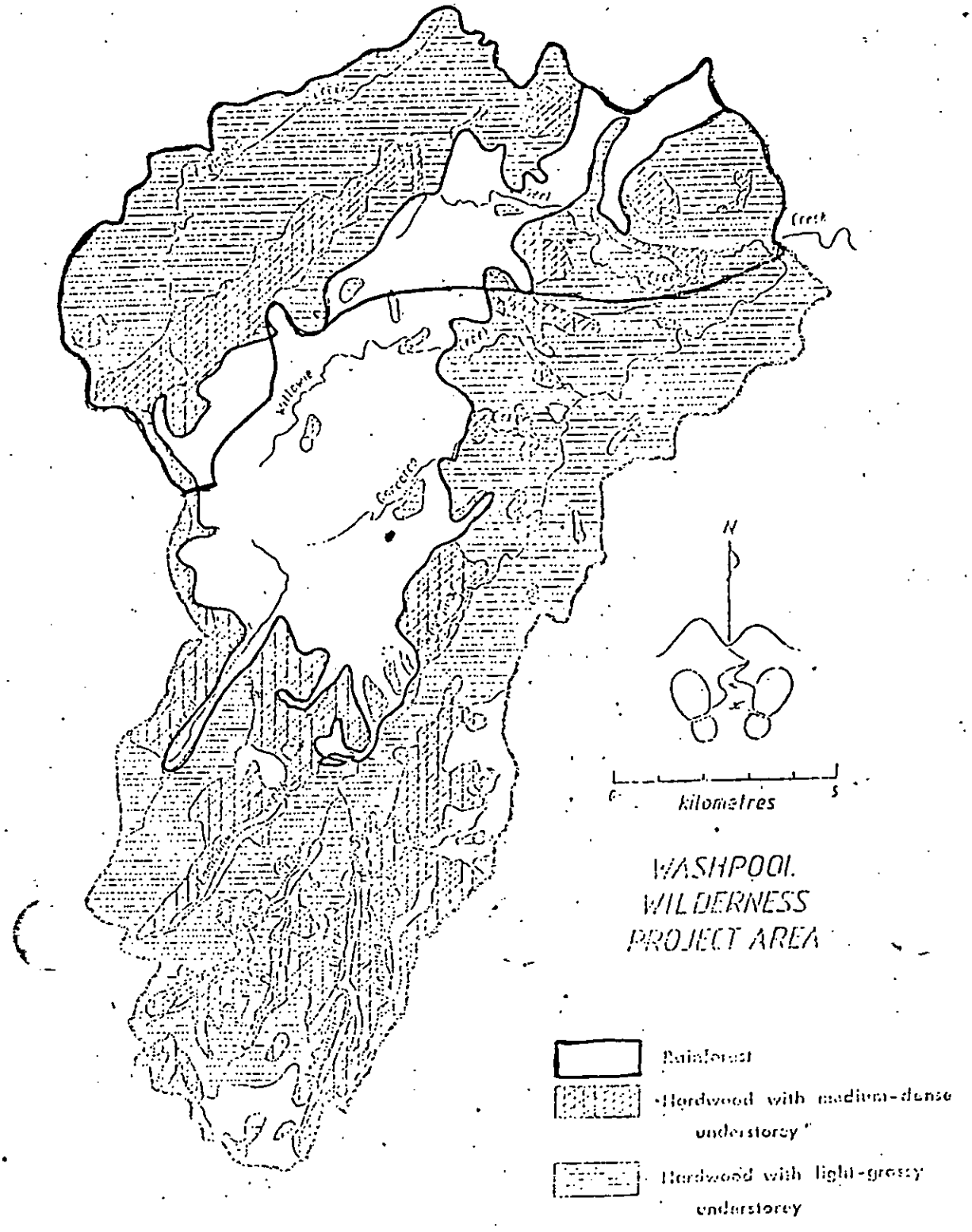


Fig 8: Vegetation Types.

All the forests in these areas are in an undisturbed natural wilderness condition, reflecting the fact that natural processes are the key factor in their development. The exception is Compartment 94 of Washpool State Forest (Desert Creek), which is recommended for inclusion for management purposes (see section 3 - Management).

According to Floyd (1978), the main forest types of the area, all of which occur in the Desert and Malara Creek catchments can be classified into seven broad vegetation types. These vary from the forest types of Baur (1965), due to the lack of clear definition in the intergraded forest stands. The forest types of Floyd are:

1. Subtropical rainforest
2. Warm temperate rainforest in 2 main associations:
   a) Coachwood-Yellow Carabeen
   b) Coachwood-Corkwood-Crabapple-Callicoma
3. Wet Scrub
4. Dry Scrub
5. Wet Sclerophyll Forest
   Tallowwood-Blue Gum-Brush Box association
6. Wet Sclerophyll Forest
   New England Blackbutt type
7. Dry Sclerophyll Forest

Each type is briefly described as follows, with appropriate species lists contained in Appendix 4.

1. Subtropical Rainforest

This rainforest is of very limited occurrence in the area. It occurs as patches throughout the area, and as a small area on undulating land at the head of Malara Creek. It is generally confined to sheltered sites and is usually impoverished due to soil type and altitude. The dominant tree species are Rosewood and Yellow Carabeen.

2. Warm Temperate Rainforest

The family Cunoniaceae dominates this type, which is found on less fertile soils. It comprises the majority of the Willowie Scrub.

a) The Coachwood-Yellow Carabeen association is an intermediate type between the Coachwood-Crabapple-Corkwood association and the subtropical Rosewood-Yellow Carabeen association. It occurs in the creeks and gullies of the Willowie Scrub. It is a diverse forest type which occasionally includes Rosewood and other subtropical species. It represents growing conditions slightly superior to those required by the Coachwood-Corkwood-Crabapple association but which are not adequate for subtropical rainforest development.

b)The Coachwood-Crabapple-Corkwood association is the most common rainforest type in the Washpool area. It is this type which represents the pure warm temperate rainforest type, although variation does occur within the type. Floyd (1978)

reports that Coachwood is usually the dominant species although this varies amongst four other species of the Cunoniaceae family. He describes a site in Billilimbra State Forest where Coachwood is completely replaced by other species.

This forest type is of value in an ecological and aesthetic sense, as it forms closed communities of great diversity. At the top of Desert Spur Trail, a pure stand of Coachwood forest occurs which joins both the Willowie Scrub and the warm temperate forests of the upper Desert Creek catchment. Other pure stands extend to the upper limits of Malara Creek.

Apart from the Cunoniaceae elements (Coachwood, Crabapple, Callicoma and Corkwood), other common tree species in this forest type include Brown Possumwood, Prickly Ash, Sassafras and figs (*Ficus* spp.).

Both types of warm temperate rainforest are prone to cyclone damage in some exposed areas. This usually leads to a largely cleared area with water nettle and raspberry vine covering it and providing shelter for forest regeneration. Even-aged Coachwood stands in the area represent sites where this has occurred in the past.

The pure Coachwood stands appear to be the climax form of this type, while those containing Crabapple or Callicoma are at an earlier stage of development.

3. Wet Scrub

This vegetation type occurs near Haydens Trig and in several other parts of the proposed area in small patches. The dominant species are usually Oval Mint-bush and Lemon-scented Tea-tree which grow up to 6m tall. Below these shrubs, a broad variety of shrubs grow, some of rainforest habit and others of a more sclerophyllous nature.

Some examples of this type exist in the area with a senescent overstorey of Green Wattle, which Floyd suggests may be a regeneration stage after fire. Undisturbed examples of this vegetation type display climax stage characteristics.

4. Dry Scrub

Some of the north facing steep slopes of the Desert Creek catchment contain dry scrub. The vegetation type ranges from depauperate dry rainforest to simple shrub communities. One association includes Dwarf Cypress Pine, Lemon-scented Tea-tree and Grey Myrtle, which occurs on thin soiled sites.

Where soil is better developed, the vegetation contains more dry rainforest species such as Sweet Pittosporum, Rusty Fig, Shatterwood, Silky Oak and Pink Bloodwood, with occasional occurrences of small Red Cedar. Fox (1983) reports that both wet and dry scrubs are normally restricted to steep rocky outcrops at high elevations, which concurs with our observations.

5. Wet Sclerophyll Forest (Tallowwood-Sydney Blue Gum-Brush Box association)

This vegetation type is beautifully developed in both the Desert and Malara Creek catchments, with tall forests of this type occurring on the higher slopes. Floyd has recognised three forms of this association. The first occurs in fire prone sites and has an understorey of Bladey Grass, Kangaroo Grass and Bracken Fern. In this type there is little litter build up due to higher fire frequency. Brush Box is infrequent in this type.

At a higher altitude, with higher rainfall and lower fire frequency, many pioneer rainforest species form the understorey. These form a thick shrub layer which is often impenetrable to walkers. Some of the species which occur here are Cabbage Palm, Bolwarra, Scentless Rosewood, Water Gum and Tree Heath, with some lower storey species such as Prickly Tree-fern, palm lilies, Orange Thorn and Maidenhair Fern.

Where soil is deeper and fire is absent, this shrub layer often develops into pure rainforest with Brush Box occurring as a dominant species with a few emergent tallowwoods and blue gums. This type occurs near the junction of the Ewingar trail and the Desert Creek, with tall Brush Box over a 15m rainforest. High on the Desert Spur trail this type intergrades with rainforest and with pure stands of Blue Gum to form a varied altitudinal forest sequence.

6. Wet Sclerophyll Forest (New England Blackbutt association)

This forest type is very similar to the Blue Gum-Tallowwood association in structure, except that New England Blackbutt is the sole dominant tree. It occurs at higher altitude and is associated with poorer soils of high quartz content. There are some fine examples of this forest type in the Malara Creek catchment, where the grassy understorey is suddenly replaced by pioneer rainforest species in a clearly defined ecotone.

A common shrub in this type is the Tree Heath, which is often seen with a dense covering of epiphytes. Other common shrubs are the Giant Grass-tree and White Banksia.

7. Dry Sclerophyll Forest

This type is common on the lower slopes of both catchments and reaches optimal development near the junction of Desert Spur and Ewingar trails.

It is usually made up of White Mahogany, Small Fruited Grey Gum and Grey Ironbark, with common understorey species being Giant Grass-tree, Twisted Burrawang and *Bursaria* sp. It occurs mainly on shallow stony soil, at lower altitudes and is more fire prone due to the very open forest structure.

From our observations this forest type appears to be favoured by larger mammals such as the Eastern Grey Kangaroo, Common Wallaroo and Red-necked Wallaby.

The region of Desert and Malara Creeks appears to contain the best developed forests of this type within the Washpool wilderness.

Overall, the forests of this area represent a wide variety of types with well developed forms. The variety and the intergrading of forest types makes the area particularly significant. The Desert and Malara Creek catchments contain representation of all of Washpool's main forest types, but most significantly contain further extensions to the Willowie Scrub rainforests. The forests of this area are in wilderness condition, and as such have developed to their current state due to natural influences.

It is important that the whole wilderness be allowed to remain in its current state, to preserve the full extent of the outstanding Willowie Scrub, which is the largest rainforest remaining in New South Wales.

History of Land Use

The land of the Washpool wilderness, including the extension area proposed here, belongs to the Bundjalung and Jukambal Aborigines. They were dispossessed in the ~~1940s~~ 1840s by white men exploring the Upper Clarence for grazing land.

Among the graziers was Edward Ogilvy of Yulgilbar, who kidnapped an aboriginal boy and learnt the Bundjalung language from him. He and other settlers were less harsh in their oppression of the traditional owners, than those settlers who massacred and poisoned large numbers of aborigines ~~for sheep stealing.~~ Most of the aboriginal people were resettled at the Mann River settlement and then to Baryulgil and Tabulam where they live as mixed populations to this day.

Molybdenum and alluvial tin were mined in some of the creeks of the region and antimony was explored for. During the days of the Rocky River goldfields, the Malara Creek area was a popular area for extraction of alluvial gold. A small township existed on the lower reaches of the creek (ref...).

Apart from some small forays into the area by cedar-getters such as Bill Haydon over the years, the Washpool wilderness remained undisturbed until it came to the attention of the Forestry Commission in the 1970s. They pushed roads into the area including the Desert Spur and Ewingar Trails in the subject area. Most of the Washpool was proposed for logging and only saved by a concerted effort ~~from~~ by concerned citizens.

The NSW Government Rainforest Decision of 1982 protected most of the Washpool wilderness in Washpool National Park. Desert and Malara Creeks were not included in the National Park as a compromise to timber interests in the region. Another part of

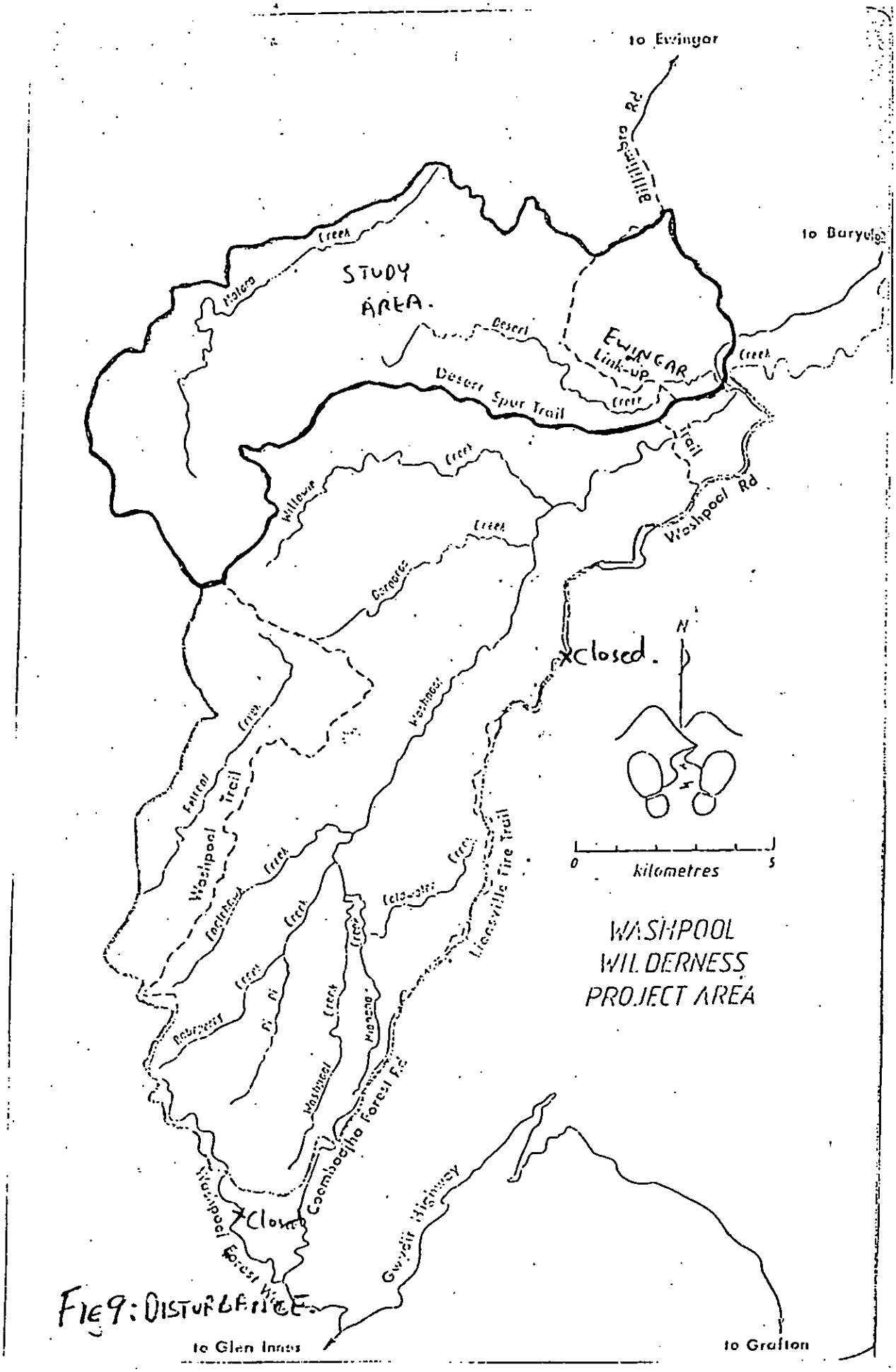
the wilderness area, also left out, was Redbank Creek catchment, an area containing well developed Spotted Gum (*Eucalyptus maculata*) forest which has since been heavily logged for timber.

In 1984, the Washpool National Park was added to the World Heritage list as part of the NSW Rainforests World Heritage Area.

Since the creation of Washpool National Park in 1982, Malara Creek upper catchment has remained undisturbed. Part of the Desert Creek catchment was logged in 1987, and recently Ewingar Trail was reopened after partially revegetating.

Climatic change. Add before land use?

The climatic change predicted for the near future makes necessary the conservation of larger areas than were needed under more stable conditions, to preserve as much biological diversity as possible. The rise in temperature and the changing rainfall patterns will affect frequency of flowering and fruiting which alters the range required by fauna dependent on these foods. The vegetation associations themselves will need to shift in latitude and/or altitude within a few decades (New Scientist October 1988)



WASHPOOL WILDERNESS PROJECT AREA

FIG 9: DISTURBANCE

SECTION 2: THE IDENTIFICATION OF WASHPOOL AS WILDERNESS

Introduction

Section 6 of the Wilderness Act sets out for the Director conditions needed to identify an area as wilderness. The Wilderness Society considers that the areas of the Desert and Malara Creek catchments proposed comply with all parts (a, b and c) of section 6(1).

Human Impact

The area being proposed as wilderness, including its plant and animal communities, has had very little human impact or modifications. Areas where impacts have occurred are the Desert Spur and Ewingar fire trails and Compartment 94 of the Washpool State Forest. These fire trails are easily capable of being restored to the state of their undisturbed surroundings (see Management Section). Compartment 94 of the Washpool State Forest has been logged by Big River Timbers for rainforest timber. It has been included in the boundary of this proposal as it will be essential for the proper management of the entire wilderness areas (see section 6(2)(b) of the Wilderness Act.

These areas of human impact are very small and easily overshadowed by the quality and size of the whole Washpool area considered in this proposal.

Size [section 6(1)(b)]: The area of this proposed extension area is approximately 7,000ha. When added to the current Washpool National Park wilderness area, the total area of wilderness will be 34,700ha. It is widely accepted that a larger area of land is easier to manage as wilderness. The area proposed here will provide substantial protection to the wilderness areas of Washpool National Park (including the Willowie Scrub Coachwood forests) against fire, feral animals and noxious weeds. Because of the size and value of the adjoining wilderness area in the National Park, the area proposed will be able to be maintained feasibly in its current wilderness state [s.6(1)(b)].

Wilderness Quality

The outstanding feature and primary reason for preservation of the Desert and Malara Creek catchments is their value as wilderness. In conjunction with Washpool National Park, these areas form the largest rainforested wilderness area in NSW. With their undisturbed nature, these catchments are an integral part of the varied ecosystems of the Washpool wilderness. Despite the current difference in land tenure, the National Park and the State Forests are closely linked in a biogeographical sense. It is impossible to separate the protected portion from the Desert and Malara Creek catchments on ecological grounds.

The Washpool wilderness is large enough to ensure the survival of its plant and animal communities in an undisturbed state,

with a spread of approximately 40,000ha. Any reductions in the size of this wilderness reduces the wilderness quality and remoteness of the remaining portion and directly reduces the chances of the area providing sustainable plant and animal populations into the future.

With Australia having destroyed the greater majority of its wilderness estate since white settlement, it is imperative that all of the remaining wilderness areas be preserved in their most viable form. Therefore The Wilderness Society believes that Desert and Malara Creek catchments should be protected in order that the whole of the Washpool wilderness has the best possible chance of surviving intact for the reference, scientific and recreational needs of future generations.

The wilderness nature of the Desert and Malara Creek catchments is a result of the dominance of the areas fate by natural systems, with little interference from humans. This is evidenced by the wide range of undisturbed plant communities in the area, ranging from shrubland to pure rainforest. In many forests in the North Coast region the forest appears undisturbed but in many cases, grazing has destroyed the herb and low shrub layers or logging has removed many of the older habitat trees.

Desert and Malara Creek forests show none of this disturbance. Here it is possible to see and study intact ecosystems. Each vital aspect of the complex forest ecosystem is visible here. There has been no logging to remove older trees and to open canopies, with associated imbalances in light penetration. The herb and shrub layers are natural due to the lack of grazing and to the natural fire regimes. The small carnivore population is viable and undisturbed as a result of no competition from introduced predators such as cats or foxes. The populations of their prey species therefore stay in natural dynamic equilibrium with those of their native predators.

The soil remains undisturbed, with its structure and composition wholly dependent on the natural balance between bedrock decay, addition of organic matter and natural erosion factors. The waters of Desert and Malara Creeks contain nothing which is not meant to be there; no runoff from diesel spills, no chemical fertilizer or pesticide and no excess silt from man made erosion. In all, the structure, dynamics and composition of the area remain unaltered by any human activities.

Upon entering this area, a person is immediately given the impression that nature is the master here. There is no sound of modern man. All that disturbs the air is the calls of the birds, the wind in the canopy and the passage of water in the creeks. The sound of chainsaws, vehicles, generators, people or radios does not penetrate this or any other part of the Washpool wilderness.

Apart from the two four wheel drive tracks, the area is inaccessible except by foot. The steep, well defined ridges and the creek beds become the natural pathways for visitors and animal inhabitants alike. Once these tracks are revegetated, the possibility of the roar of motorbikes or of the escaped campfire, lessening the wilderness quality, will be minimized.

Visual disturbance from structures outside the area is negligible. From most of the area the only view possible is of the interior structure of the forest. Occasional views through the trees on ridges in Desert Creek catchment show a sea of green luxuriance in the Washpool National Park. Only from the highest ridges, on the top of Gibraltar Range, which separates Malara and Desert Creek catchments, is it possible to view cleared agricultural land in the distant northwest.

The presence of exotic weeds is one of the few disturbances in this area, although this is virtually non-existent away from the current tracks. Lantana occurs on the lower reaches of Desert Spur trail, but within one kilometre of the track's origin it is non-existent. A small grove of lantana also occurs at about 400m a.m.s.l. on the Ewingar trail, but is negligible in size compared to the wilderness. No other exotic weeds disturb the area, even in the cyclone-damaged rainforest patches which occur on some of the higher slopes of Desert Creek catchment.

The remoteness of the area from any major development precludes any airborne debris or pollution from entering. As the stream catchments are wholly within the wilderness, no water borne debris enters the area either.

The catchments of Malara and Desert Creeks play a vital role in the maintenance of wilderness values in the Willowie Scrub. The rainforest covered areas of these catchments ensure that the Willowie Scrub is of sufficient size to ensure maintenance of viable gene pools and populations in both animal and plant communities. They also provide protection from fire which may originate in forestry operations in the Ewingar State Forest, or the agricultural lands to the west. The maintenance of natural fire regimes in the area is vital to ensure that natural processes continue undisturbed in the Willowie Scrub.

Logging in Desert Creek valley would increase the chance of noxious weed invasion. Opening up the Desert Spur trail for logging operations would decrease the remoteness of the Willowie Scrub, with a concurrent increase in accessibility, noise disturbance and water quality. Any damage to the balance in the ecosystems of Desert and Malara Creeks will also increase the opportunities for feral animal invasion of Washpool National Park.

With a total length of 13km, 10km of which is in an undisturbed condition, Desert Creek can be classified as a wild river according to Helman's definition:

> "A river that traverses or whose catchment is essentially a natural area that has had only minimal disturbance, does not have pondages or other water control structures, and where vehicle access is precluded or strictly limited."

Desert Creek is a permanent stream, with some sections which are only accessible to hardy adventurers with appropriate canyoning equipment. Its rainforested margins and steep valley sides provide a wild river experience for any visitor. The water quality is also exceptionally high due to the undisturbed nature of the catchment.

Desert and Malara Creek catchments have very high wilderness values and are essential to the maintenance of wilderness quality in the Washpool National Park. These catchments are an integral part of the Washpool wilderness and their protection will ensure the viability of one of Australia's largest and most significant rainforest wilderness areas.

Opportunities for Solitude and Recreation

The extension of the Washpool wilderness will provide the perfect environment for many recreational activities. The wilderness quality of the area and natural features such as creeks and ridges offer great new wilderness experiences to everyone from the intrepid explorer to the solitude seeker.

The value of wilderness is difficult to describe; there is just nothing like experiencing wilderness - the wind in the canopy, the moist, earthy smells, the feeling that maybe you are the first person to ever be there. Wilderness is great, stimulating and refreshing the mind and inspiring poets, artists, musicians and dreamers. It offers the chance for peace and solitude like no other place can. As it stands, the Washpool area is one of the few places left where a person can view a panorama of forested mountains and valleys unscarred by human hands. Such wilderness is a beautiful contrast to our stark urban environment. People need places such as Washpool where they can retreat from the pace of society.

A trip to the Desert and Malara Creek regions can involve any number of activities such as walking, rock scrambling, abseiling, canyoning and swimming. Walking is perhaps best catered for.

The absence of roads and the size of the area enhance the wilderness quality of Washpool and offer a challenge to the bushwalker. It is possible to walk for several days without coming in contact with other people or signs of civilization. The walker has to rely solely on his/her own resourcefulness and bush skills. To really understand the meaning of wilderness, Washpool is perfect for walking in solitude. The solitary walker is challenged to meet nature on its own terms. No other environment can offer such a challenge.

The creeks in the Washpool wilderness are diverse and beautiful. They provide natural routes and a great

environment for walking in. They range from gentle, clear streams to the narrower canyon sections where the water passes rapidly over rocks and sharp drops. Here the walker may have to resort to a bit of rock hopping or swimming. Except for some of the steeper places, there are a lot of unexposed areas which make good campsites, and there is an abundant supply of clean drinking water.

The vegetation lining the banks of the creeks also offers many beautiful variations. Desert Creek arises in lush rainforest where palms and ferns enclose the watercourse with a dim, green veil. The impressive buttressing of the Yellow Carabeen highlights the surrounding forest. From rainforest to open forest, the creek passes through stands of Coachwood, Blue Gum, Tallowwood, Brush Box and New England Blackbutt. Walking through these areas is generally good but can be a bit more challenging through wet sclerophyll forest, where rainforest regeneration makes progress slow. The reward is, however, well worth the effort.

Malara Creek also boasts some beautiful stands of Blue Gum. The long, straight, branch-free trunks of these trees make an impressive sight. One tree found in the upper reaches of Malara Creek has a diameter at breast height of at least 3 metres.

For those seeking a greater challenge, Desert Creek contains some steep and interesting gullies which are ideal for canyoning. Canyoning requires a combination of abseiling, rock climbing, sliding, swimming, walking and boulder hopping, depending on the terrain. Waterfalls range up to about 20 metres. Smooth, rounded rocks provide great abseiling conditions. The beautiful clear pools reward the canyoner or walker with an often well deserved swim.

Getting to these creeks can involve ridge-walking. Most of the ridges aren't too steep but require some effort. The lack of landmarks demands careful navigation by the walker and enhances the challenge this wilderness offers.

The interesting geology, flora and fauna attract many people to this area, especially photographers who are enthralled by the scenic variety. The early morning birdlife provides a dawn chorus which would thrill any naturalist.

Whilst wilderness offers great opportunities for solitude and retreat, the walker can also gain a lot from interactions with other members of a walking party. Having to work together as a team to achieve something develops new skills, builds confidence and self-reliance and is also lots of fun.

The recreational opportunities offered by Desert and Malara Creek catchments and the rest of the Washpool wilderness are boundless. The Washpool provides the environment for adventure, excitement and challenge, solitude and self-development, peace and inspiration. Washpool in its entirety has more than our urban environment can ever hope to offer.

SECTION 3: MANAGEMENT

Management of the Washpool wilderness area should be undertaken in accordance with section 9 of the Wilderness Act, and should ensure the protection of the wilderness values of the area.

Section 9(a) of the Act provides for the restoration and protection of the unmodified state of the area and its plant and animal communities. There are two areas of major wilderness incursion in the Malara/Desert Creek area. These incursions are: (i) a number of vehicular access roads; (ii) serious noxious weed (lantana) infestations in disturbed areas around the boundaries of the area, in and around Compartment 94, where logging has taken place, and along roadsides in the area.

The restoration of wilderness value of roaded areas can be achieved by ripping and closing off roads to allow natural regeneration and possibly by undertaking revegetation.

Eradication of all lantana in the area as well as the ongoing prevention of further invasion is necessary to restore and protect the unmodified state of the area. As such eradication must be achieved without causing any harmful effects in surrounding plant and animal communities, the use of herbicide control agents would not be appropriate. Physical control measures such as ripping and revegetation would be more suitable.

After initial restoration measures had been carried out, ongoing management of the area would involve the monitoring and control of incursions and the restriction of human activities in the context of section 9(parts b and c) of the Act.

CONCLUSION

The Washpool wilderness can be considered in two ways. Firstly in an ecological sense, it is a wilderness of outstanding value containing the largest warm temperate rainforest on earth. This rainforest continuously extends to the catchments of Willowie, Oorooroo, Washpool, Desert, Malara and Retreat Creeks. It is an area of approximately 40,00ha. The area contains a wide variety of community types which grade into each other over the full range of the wilderness. It is possible to have superb wilderness experiences in the entire area, with continuous wilderness journeys of up to 10 days a possibility. Opportunities for solitude exist anywhere within its boundaries.

Secondly, the area can be considered in a political sense. In this sense it is composed of a wilderness National Park of 27,715ha and parts of two State Forests. The National Park is protected by an Act of Parliament from any disturbance. It is recognised as being of international significance as part of the NSW Rainforests World Heritage Area, for its ecological and wilderness values. Across an arbitrary line, the State Forests of Billilimbra and Washpool containing the Desert and Malara Creek catchments of the wilderness, are set aside for logging. Their wilderness values are proposed to be destroyed forever in order to provide a small amount of timber for a few years. Even though timber is a renewable resource, wilderness is essentially non-renewable.

Washpool wilderness is too valuable to be considered on political grounds. It must be protected in its ecological entirety and recognized as a large single bioregion in an undisturbed state, not as a partially protected, partially exploitable resource.

APPENDIX 1
MAMMAL SPECIES OCCURRING IN WASHPOOL NATIONAL PARK AND ADJOINING AREAS

Family Ornithorhynchidae	
Ornithorynchus anatinus	Platypus
Family Tachyglossidae	
Tachyglossus aculeatus	Echidna
Family Dasyuridae	
Dasyurus maculatus	Spotted-tailed Quoll
~~*D. viverrinus*~~	~~Eastern Native Cat~~
Phascogale tapoatafa	Brush-tailed Phascogale
Antechinus flavipes	Yellow-footed Antechinus
A. stuartii	Brown Antechinus
A. swainsonii	Dusky Antechinus
Sminthopsis murina	Common Dunnart
Planigale maculata	Common Planigale
Family Peramelidae	
Isoodon macrourus	Northern Brown Bandicoot
Perameles nasuta	Long-nosed Bandicoot
Family Phascolarctidae	
Phascolarctos cinereus	Koala
Family Vombatidae	
Vombatus ursinus	Common Wombat
Family Petauridae	
Pseudocheirus peregrinus	Common Ringtail Possum
Petauroides volans	Greater Glider
Petaurus australis	Yellow-bellied Glider
P. breviceps	Sugar Glider
Family Phalangeridae	
Trichosurus vulpecula	Common Brushtail Possum
T. caninus	Mountain Brushtail Possum
Family Burramydae	
Cercartetus nanus	Eastern Pygmy-possum
Acrobates pygmaeus	Feathertail Glider
Family Potoroidae	
Potorous tridactylus	Long-nosed Potoroo
Aepyprymnus rufescens	Rufous Bettong
Family Macropodidae	
Petrogale penicillata	Brush-tailed Rock-wallaby
Thylogale stigmatica	Red-legged Pademelon
T. thetis	Red-necked Pademelon
Macropus parma	Parma Wallaby
M. parryi	Whiptail Wallaby
M. rufogriseus	Red-necked Wallaby
M. giganteus	Eastern Grey Kangaroo

APPENDIX I cont'd

M. robustus	Common Wallaroo
Wallabia bicolor	Swamp Wallaby
Family Pteropodidae	
Pteropus poliocephalus	Grey-headed Flying Fox
Family Rhinolophidae	
Rhinolophus megaphyllus	Eastern Horesehoe Bat
Family Molossidae	
Mormopterus norfolkensis	Eastern Little Mastiff Bat
Family Vespertilionidae	
Nyctophilus gouldi	Gould's Long-eared Bat
Miniopterus schreibersii	Common Bent-wing Bat
Chalinolobus gouldii	Gould's Wattled Bat
C. morio	Chocolate Wattled Bat
Myotis adversus	Large-footed Mouse-eared Bat
Nycticeius rueppelli	Greater Broad-nosed Bat
N. orion	Eastern Broad-nosed Bat
Eptesicus regulus	King River Eptesicus
E. vulturnus	Little Forest Eptesicus
E. sagittula	Large Forest Eptesicus
Family Muridae	
Hydromys chrysogaster	Water Rat
Melomys cervinipes	Fawn-footed Melomys
Pseudomys novaehollandiae	New Holland Mouse
Rattus fuscipes	Bush Rat

Sources: Adam (1987), McLean (1986)

RECORDED APPENDIX 2a AND WASHPOOL

BIRDS ~~OCCURRING~~ IN BILLILIMBA STATE FORESTS

Species	Habitat								Other Areas of Occurrence				
	ST	WT	WSC	WSO	UDS	LDS	S	F	W	E	G	D	M
Brown Goshawk	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Grey Goshawk	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Wedge Tailed Eagle	✓	✓	✓	✓	✓	✓	✓	✓					
Australian Brush Turkey	✓	✓	✓		✓	✓			✓		✓		
White-headed Pigeon	✓	✓	✓						✓		✓		
Brown Cuckoo-dove	✓	✓	✓	✓		✓			✓		✓		
Wonga Pigeon	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	
Yellow-tailed Black Cockatoo	✓	✓	✓	✓	✓	✓			✓		✓		●
Rainbow Lorikeet	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓
Australian King Parrot	✓	✓	✓	✓	✓	✓			✓		✓		
Crimson Rosella	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Australian Owlet Nightjar	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Laughing Kookaburra	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
Noisy Pitta	✓	✓	✓						✓		✓		
Superb Lyrebird	✓	✓	✓	✓	✓		✓		✓		✓		✓
White's Thrush	✓	✓	✓	✓	✓	✓	✓		✓		✓		
Eastern Yellow Robin	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Pale Yellow Robin	✓	✓	✓						✓	✓	✓	✓	
Crested Shrike Tit	✓	✓	✓	✓	✓	✓			✓	✓	✓		
Golden Whistler	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Grey Shrike-Thrush	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Grey Fantail	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Logrunner	✓	✓	✓		✓				✓	✓	✓		✓
Eastern Whipbird	✓	✓	✓		✓		✓		✓		✓		
Large-billed Scrubwren	✓	✓	✓						✓	✓	✓		✓
Yellow-throated Scrubwren	✓	✓	✓						✓	✓	✓		✓
Brown Gerygone	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		●
Brown Thornbill	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Yellow Thornbill	✓	✓	✓		✓	✓	✓		✓		✓		✓
Striated Thornbill		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
White-browed Scrubwren	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Varied Sitella			✓	✓	✓	✓			✓		✓		
White-throated Treecreeper	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Red-browed Treecreeper			✓	✓	✓	✓			✓		✓	✓	✓
Lewins Honeyeater	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Yellow-faced Honeyeater		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
White-naped Honeyeater			✓	✓	✓	✓	✓		✓		✓	✓	✓
Eastern Spinebill	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Mistletoebird	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
Spotted Pardalote			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Silvereye	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
Satin Bowerbird	✓	✓	✓	✓	✓	✓			✓		✓		✓
Paradise Riflebird	✓	✓	✓	✓					✓		✓		
Pied Currawong	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Green Catbird	✓	✓	✓						✓		✓		
New Holland Honeyeater		✓	✓	✓	✓			✓	✓		✓		

APPENDIX 2b

RECORDED BIRDS OCCURRING IN WASHPOOL AND EWINGAR STATE FORESTS BUT NOT BILLILIMBRA STATE FOREST

Species	Habitat									Other Areas of Occurrence				
	A	ST	WT	WSC	WSO	UDS	LDS	S	F	W	E	G	D	M
Pacific Baza		✓	✓	✓	✓	✓	✓			✓		✓		
Peregrine Falcon		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Brown Falcon						✓	✓	✓	✓	✓		✓		
Painted Button Quail						✓	✓			✓		✓		
Wompoo Fruit Dove		✓	✓	✓						✓	✓	✓		
Topknot Pigeon		✓	✓	✓			✓			✓	✓	✓		
Glossy Black Cockatoo				✓	✓	✓	✓			✓		✓		
Sulphur-crested Cockatoo		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	
Little Lorikeet				✓	✓	✓	✓			✓		✓		
Brush Cuckoo		✓	✓	✓	✓	✓	✓	✓		✓		✓		
Fan-tailed Cuckoo		✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	
Shining Bronze Cuckoo		✓	✓	✓	✓	✓	✓			✓		✓		✓
Powerful Owl		✓	✓	✓	✓	✓	✓			✓		✓		
Southern Boobook		✓	✓	✓	✓	✓	✓	✓		✓		✓		
Tawny Frogmouth		✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
White-throated Needletail		✓	✓	✓	✓	✓	✓	✓		✓		✓		
Sacred Kingfisher				✓	✓	✓	✓			✓		✓		✓
Rufous Scrub Bird		✓	✓	✓							✓	✓		
Welcome Swallow	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		
Black-faced Cuckoo Shrike				✓	✓	✓	✓			✓		✓		✓
White-bellied Cuckoo Shrike					✓	✓				✓		✓		
Cicada Bird		✓	✓	✓	✓	✓	✓			✓		✓		
Varied Triller		✓	✓	✓						✓		✓		
Rose Robin		✓	✓	✓	✓	✓	✓	✓				✓		✓
Scarlet Robin					✓	✓	✓			✓		✓		✓
Jacky Winter						✓	✓			✓		✓		
Rufous Whistler					✓	✓	✓			✓		✓	✓	✓
Black-faced Monarch		✓	✓	✓	✓	✓	✓	✓		✓		✓		✓
Speckled Monarch		✓		✓						✓				
Leaden Flycatcher				✓	✓	✓	✓	✓		✓		✓		✓
Rufous Fantail		✓	✓	✓	✓	✓	✓	✓		✓		✓		
Willie Wagtail						✓	✓		✓	✓		✓		
Superb Fairy Wren				✓		✓	✓			✓		✓		
Variegated Fairy Wren				✓	✓	✓	✓			✓		✓		
Red-backed Fairy Wren							✓			✓		✓		
Weebill							✓			✓				
White-throated Gerygone					✓	✓	✓			✓				
Buff-rumped Thornbill						✓	✓			✓		✓		
Little Wattlebird		✓	✓	✓	✓	✓	✓			✓		✓	✓	
Noisy Friarbird				✓	✓	✓	✓			✓		✓	✓	✓
Bell Miner				✓			✓			✓	✓	✓	✓	
Scarlet Honeyeater		✓	✓	✓	✓	✓	✓			✓		✓	✓	
Striated Pardalote		✓	✓	✓	✓	✓	✓			✓				
Red-browed Firetail		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
Olive-backed Oriole				✓	✓	✓	✓			✓		✓		
Figbird		✓		✓						✓				
Spangled Drongo		✓	✓	✓		✓	✓		✓	✓		✓		
Regent Bowerbird		✓		✓			✓			✓		✓		
White-winged Chough							✓			✓				
Dusky Woodswallow						✓	✓		✓		✓	✓		
Grey Butcherbird					✓	✓	✓	✓						
Australian Raven		✓	✓	✓	✓	✓	✓		✓	✓		✓		
Torresian Crow						✓	✓		✓	✓		✓		

36

APPENDIX 3
HERPETOFAUNA OF GIBRALTAR RANGES

Species	Family	Habitat	Area
Reptiles			
Emydura signata	Chelidae	Aquatic	W
Phyllurus cornutus	Gekkonidae	WS	W
Physignathus leseurii	Agamidae	LD, A	W
Varanus varius	Varanidae	LD	W
Egernia saxatilis	Scincidae	WS	W
Lampropholis chellengeri	"	WS, ST, WT	W, B
Saiphos equalis	"	WT, WS	W
Sphenomorphus murrayi	"	ST, WT, WS	W, B
S. quoyi	"	WT	W
S. scutirostrum	"	WS, UD, LD	B, W
Typhlina nigrescens	Typhlopidae	UD	W
Hordia spilotes variegata	Boidae	WT	W
Dendrelaphus punctulatus	Colubridae	WT	W
Cacophis squamulosus	Elapidae	WT	W
Cryptophis nigrescens	"	LD	W
Demansia psammophis	"	UD	W
Hemiaspis singata	"	WT, WS	W
Pseudechis porphyriacus	"	WS	W
Amphibians			
Assa darlingtoni	Leptodactyllidae	ST, WT	W
Kyarranus loveridgei	"	ST, WT	W
Lechriodus fletcheri	"	ST, WT	W
Mixophyes iteatus	"	WT	W
Pseudophryne coriacea	"	UD	W
Litoria fallax	Hylidae	LD	W
L. latapalmata	"	LD	W
L. lesueuri	"	WT, LD	W
L. peroni	"	LD	W

APPENDIX 4
PLANT SPECIES OF THE WILLOWIE SCRUB

1. Subtropical Rainforest

Trees		
Moraceae	*Ficus watkinsiana*	Strangler Fig
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree
Proteaceae	*Orites excelsa*	Prickly Ash
Monimiaceae	*Daphnandra micrantha*	Channel-leaf
Socketwood		
	Doryphora sassafras	Sassafras
Lauraceae	*Cryptocarya erythroxylon*	Pigeonberry Ash
	C. obovata	Pepperberry
	Litsea reticulata	Bolly Gum
Cunoniaceae	*Ackama paniculata*	Corkwood
	Schizomeria ovata	Crabapple
Escalloniaceae	*Cuttsia viburnea*	Elderberry
	Polyosma cunninghamii	Featherwood
Rutaceae	*Acronychia pubescens*	Hairy Acronychia
	Bosistea euodiiformis	Bonewood
	Euedia microcecca	White Euodia
Meliaceae	*Dysoxylum fraseranum*	Rosewood
Euphorbiaceae	*Daloghia lucida*	Brush Bloodwood
Icacinaceae	*Citronella moorei*	Soapy Box
	Pennantia cunninghamii	Brown Beech
Sapindaceae	*Diploglottis australis*	Tamarind
Rhamnaceae	*Emmenosperma alphitonioides*	Yellow Ash
Elaeocarpaceae	*Sloanea woollsii*	Yellow Carabeen
Sterculiaceae	*Brachychiton acerifolium*	Flame Tree
Myrtaceae	*Rhodamnia trinervia*	Brush Turpentine
	Syzygium crebrinerve	Purple Cherry
	S. francisii	Giant Water Gum
Ebonaceae	*Diospyros pentamera*	Grey Persimmon
Boraginaceae	*Ehretia acuminata*	Koda
Verbenaceae	*Emolina leichhardtii*	White Beech
Shrubs		
Elaeocarpaceae	*Aristotelia australasica*	Wine Berry
Herbs		
Athyriaceae	*Athyrium australe*	Australe Lady-fern
Pteridaceae	*Pteris umbrosa*	Jungle Brake
Vines		
Smilacaceae	*Ripogonum album*	White Supplejack
	R. fawcettianum	Small Heart-leaved Supplejack
Ranunculaceae	*Clematis glycinoides*	Erect Clematis
Monimiaceae	*Palmeria scandens*	Anchor Vine
Rosaceae	*Rubus hillii*	Queensland Bramble
	R. moorei	Greenleaf Bramble
Vitaceae	*Cissus hypoglauca*	White-leaved
Watervine		
Epiphytes		
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern

2a. Warm Temperate Rainforest (Coachwood-Yellow Carabeen association)

Trees		
Palmae	*Archontophoenix cunninghamiana*	Bangalow Palm

	Livistona australis	Cabbage Palm
Moraceae	*Ficus watkinsiana*	Strangler Fig
Proteaceae	*Orites excelsa*	Prickly Ash
Monimiaceae	*Doryphora sassafras*	Sassafras
Lauraceae	*Cryptocarya erythroxylon*	Pigeonberry Ash
	C. meisneriana	Thick-leaved Laurel
	C. obovata	Pepperberry
Cunoniaceae	*Ackama paniculata*	Corkwood
	Callicoma serratifolia	Callicoma
	Ceratopetalum apetalum	Coachwood
	Schizomeria ovata	Crabapple
Escalloniaceae	*Anopterus macleayanus*	Tasmanian Laurel
	Polyosma cunninghamii	Featherwood
	Quintinia sieberi	Brown Possumwood
	Q. verdonii	Grey Possumwood
Pittosporaceae	*Hymenosporum flavum*	Native Frangipani
Rutaceae	*Bosistoa euodiiformis*	Bonewood
Meliaceae	*Didymocheton rufum*	Hairy Rosewood
Icacinaceae	*Pennantia cunninghamii*	Brown Beech
Elaeocarpaceae	*Sloanea woollsii*	Yellow Carabeen
Sterculiaceae	*Brachychiton acerifolium*	Flame Tree
Myrtaceae	*Syzygium coolminianum*	Blue Cherry
	S. corynanthum	Sour Cherry
	S. crebrinerbe	Purple Cherry
Alangiaceae	*Alangium villosum*	Black Muskheart
Shrubs		
Cyatheaceae	*Cyathea leichhardtiana*	Prickly Tree-fern
Palmae	*Linospadix monostachyus*	Midginbil
Herbs		
Xanthorrhoeaceae	*Lomandra spicata*	Jungle Mat-rush
Vines		
Oleandraceae	*Arthropteris beckleri*	Climbing Fishbone Fern
Polypodiaceae	*Microsorium scandens*	Fragrant Fern
Epiphytes		
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Gesneriaceae	*Fieldia australis*	Fieldia

2b. Warm Temperate Rainforest (Coachwood-Crabapple-Corkwood Association

Trees		
Moraceae	*Ficus coronata*	Creek Sandpaper Fig
	F. obliqua	Small-leaved Fig
	F. watkinsiana	Strangler Fig
Proteaceae	*Banksia integrifolia*	White Banksia
	Orites excelsa	Prickly Ash
	Stenocarpus salignus	Scrub Beefwood
Monimiaceae	*Doryphora sassafras*	Sassafras
	Hedycarya angustifolia	Australian Mulberry
Lauraceae	*Cinnamomum oliveri*	Olivers Sassafras
	C. virens	Red-bark Sassafras
	Cryptocarya foveolata	Mountain Walnut
	C. glaucescens	Jackwood
	C. meisneriana	Thick-leaved Laurel
	Endiandra muelleri	Muellers Walnut
	Litsea reticulata	Bolly Gum
Cunoniaceae	*Ackama paniculata*	Corkwood
	Callicoma serratifolia	Callicoma
	Ceratopetalum apetalum	Coachwood
	Schizomeria ovata	Crabapple

Escalloniaceae	*Anopterus macleayanus*	Tasmanian Laurel
	Cuttsia viburnea	Elderberry
	Polyosma cunninghamii	Featherwood
	Quintinia sieberi	Brown Possumwood
	Q. verdonii	Grey Possumwood
Rutaceae	*Acronychia pubescens*	Hairy Acronychia
	Bosistea euodiiformis	Bonewood
	Euodia micrococca	White Euodia
Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Sapindaceae	*Diploglottis australis*	Tamarind
	Guioa semiglauca	Guioa
Icacinaceae	*Pennantia cunninghamii*	Brown Beech
Elaeocarpaceae	*Elaeocarpus kirtonii*	Silver Quandong
	Sloanea woollsii	Yellow Carabeen
Flacourtiaceae	*Scolopia braunii*	Flintwood
Myrtaceae	*Acmena smithii*	Lilly Pilly
	Eucalyptus microcorys	Tallowwood
	Syzygium crebrinerve	Sour Cherry
	S. crebrinerve	Purple Cherry
	S. paniculatum	Brush Cherry
	Tristania laurina	Water Gum
Myrsinaceae	*Rapanea howittiana*	Howitts Nuttonwood
Ebenaceae	*Diospyros pentamera*	Grey Persimmon
Boraginaceae	*Ehretia acuminata*	Koda
Shrubs		
Cyatheaceae	*Cyathea leichhardtiana*	Prickly Tree-fern
Dicksoniaceae	*Dicksonia antarctica*	Soft Tree-fern
Osmundaceae	*Todea barbara*	King Fern
Palmae	*Linospadix monostachyus*	Midginbil
Winteraceae	*Tasmannia insipida*	Tasteless Pepper Bush
Monimiaceae	*Wilkiea huegeliana*	Wilkiea
Pittosporaceae	*Citriobatus pauciflorus*	Orange Thorn
Euphorbiaceae	*Phyllanthus suberenulatus*	
Elaeocarpaceae	*Aristotelia australasica*	Wine Berry
Oleaceae	*Notelaea venosa*	Veined Mock-olive
Herbs		
Aspidiaceae	*Arachniodes aristata*	Shield Fern
	Lastreopsis acuminata	Shiny Shield Fern
Blechnaceae	*Blechnum nudum*	Fishbone Water-fern
	B. patersonii	Strap Water-fern
	B. wattsii	Hard Water-fern
Gleicheniaceae	*Sticherus flabellatus*	Shiny Fan Fern
Xanthorrhoeaceae	*Lomandra spicata*	Jungle Mat-rush
Orchidaceae	*Calanthe triplicata*	Christmas Orchid
		Smooth Nettle
Labiatae	*Plectranthus graveolens*	Sticky Cockspur
Flower		
Vines		
Polypodiaceae	*Microsorium scandens*	Fragrant Fern
Monimiaceae	*Palmeria scandens*	Anchor Vine
Vitaceae	*Cissus hypoglauca*	White-leaved
Watervine		
Araliaceae	*Cephalaralia cephalobotrys*	Climbing Panax
Epiphytes		
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
	A. flaccidum	Weeping Spleenwort
Polypodiaceae	*Dictymia brownii*	Strap-fern
	Platycerium bifurcatum	Elk Horn Fern
Orchidaceae	*Dendrobium gracilicaule*	Spotted Orchid

	D. pugioniformum	Dagger Orchid
	D. tenuissimum	Slender Pencil Orchid
	D. teretifolium	Pencil Orchid
	Liparis reflexa	Rock Orchid
	Sarcochilus falcatus	Orange Blossom Orchid
Piperaceae	*Peperomia leptostachya*	Slender Pepper Plant
Gesneriaceae	*Fieldia australis*	Fieldia

3. Wet Scrub

Trees and Tall Shrubs

Lauraceae	*Litsea reticulata*	Bolly Gum
Pittosporaceae	*Bursaria spinosa*	Sweet Bursaria
	Pittosporum undulatum	Sweet Pittosporum
Mimosaceae	*Acacia falciformis*	Downy Hickory Wattle
	A. irrorata	Green Wattle
	A. obtusifolia	Blunt-leaft Mountain Wattle
Euphorbiaceae	*Baloghia lucida*	Brush Bloodwood
Elaeocarpaceae	*Elaeocarpus reticulatus*	Lily-of-the-Valley Tree
Myrtaceae	*Eucalyptus andrewsii ssp. campanulata*	New England Blackbutt
	E. notabilis	Blue Mountain Red Mahogany
	Leptospermum petersonii	Lemon-scented Tea-tree
	Rhodamnia trinervia	Brush Turpentine
	Lophostemon confertus	Brush Box
	L. laurina	Water Gum
Oleaceae	*Notelaea venosa*	Veined Mock-olive
Labiatae	*Prostanthera ovalifolia*	Oval Mint-bush
Compositae	*Cassinia longifolia*	Shiny Cassinia

Medium and Small Shrubs

~~Liliaceae~~ Agavaceae	*Cordyline sp. nov.*	Palm Lily
Lauraceae	*Cryptocarya meissneriana*	Thick-leaved Laurel
Pittosporaceae	*Citriobatus pauciflorus*	Orange Thorn
Rutaceae	*Acronychia oblongifolia*	White Lilly Pilly
	Asterolasia correifolia	Brown Star-bush
	Correa lawrenciana	Mountain Correa
	Phebalium elatius ssp. beckleri	Tall Phebalium
Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Haloragiaceae	*Haloragis alata*	Raspwort
Ebenaceae	*Diospyros australis*	Yellow Persimmon
Symplocaceae	*Symplocos thwaitensii*	Buff Hazelwood
Compositae	*Olearia elliptica*	Sticky Daisy-bush

Herbs

Araceae	*Gymnostachys anceps*	Settlers Flax
Liliaceae	*Dianella caerulea*	Rough Flax-lily
Stylidiaceae	*Stylidium laricifolium*	Giant Trigger-plant

Vines

Vitaceae	*Cissus antarctica*	Simple Water Vine
Apocynaceae	*Parsonsia induplicata*	Thin-leaved Silkpad

4. Dry Scrub

Trees and Tall Shrubs

Cupressaceae	*Callitris monticola*	Dwarf Cypress Pine
Moraceae	*Ficus rubiginosa*	Rusty Fig

Proteaceae	*Grevillia robusta*	Silky Oak
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Rutaceae	*Euodia micrococca*	White Euodia
Meliaceae	*Toona australis*	Red Cedar
Euphorbiaceae	*Claoxylon australe*	Brittlewood
	Drypetes australasica	Yellow Tulip
	Mallotus philippensis	Orange Kamala
Anacardiaceae	*Euroschinus falcata*	Chinamans Cedar
Celastraceae	*Elaeodendron australe*	Red Oliver-Berry
Sapindaceae	*Diploglottis australis*	Tamarind
	Guioa semiglauca	Guioa
	Jagera pseudorhus	Foam Bark
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle
	B. sciadophora	Shatterwood
	Eucalyptus intermedia	Pink Bloodwood
tree	*Leptospermum petersonii*	Lemon-scented Tea-
Araliaceae	*Polyscias elegans*	Celerywood
Rubiaceae	*Canthium odoratum*	Native Coffee
	Hodgkinsonia ovataflora	Golden Ash
Medium and Small Shrubs		
Apocynaceae	*Alyxia ruscifolia*	Chain Fruit
Herbs		
Sinopteridaceae	*Pellaca paradoxa*	Large-leaved Sickle Fern
Labiatae	*Plectranthus graveolens*	Sticky Cockspur
Flower Vines		
Moraceae	*Maclura cochinchinensis*	Cock-spur Thorn
Vitaceae	*Cissus antarctica*	Simple Watervine
	Tetrastigma nitens	Shiny-leaved Grape
Epiphytes		
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt-fern

5. Wet Sclerophyll Forest (Blue Gum-Tallowwood-Brush Box association)

Tall Trees		
Myrtaceae	*Eucalyptus microcorys*	Tallowwood
	E. saligna	Blue Gum
	Lophostemon confertus	Brush Box
Medium and Small Trees		
Palmae	*Archontophoenix cunninghamiana*	Bangalow Palm
	Livistona australis	Cabbage Palm
Proteaceae	*Orites excelsa*	Prickly Ash
Eupomatiaceae	*Eupomatia laurina*	Bolwarra
Monimiaceae	*Doryphora sassafras*	Sassafras
Lauraceae	*Cinnamomum oliveri*	Olivers Sassafras
	Cryptocarya erythroxylon	Pigeonberry Ash
	C. glaucescens	Jackwood
	C. meisgnerana	Thick-leaved Laurel
	C. rigida	Rose Maple
	Endiandra sieberi	Hard Corkwood
	Neolitsea dealbata	White Bolly Gum
Escalloniaceae	*Anopterus macleayanus*	Tasmanian Laurel
	Polyosma cunninghamii	Featherwood
Cunoniaceae	*Ackama paniculata*	Corkwood
	Callicoma serratifolia	Callicoma

	Ceratopetalum apetalum	Coachwood
	Schizomeria ovata	Crabapple
Mimosaceae	*Acacia melanoxylon*	Blackwood
Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Icacinaceae	*Pennantia cunninghamii*	Brown Beech
Sapindaceae	*Guioa semiglauca*	Guioa
Elaeocarpaceae	*Elaeocarpus reticulatus*	Lily-of-the-Valley Tree
Sterculiaceae	Brachychiton acerifolium	Flame Tree
Flacourtiaceae	Scolopia braunii	Flintwood
Myrtaceae	Syzygium coolminianum	Blue Cherry
	Tristania laurina	Water Gum
Araliaceae	Polyscias elegans	Celerywood
Epacridaceae	Trochocarpa laurina	Tree Heath
Ebenaceae	Diosphyros pentamera	Grey Persimmon
Shrubs		
Cyatheaceae	Cyathea leichhardtiana	Prickly Tree-fern
Palmae	Linospadix monostachyus	Midginbil
~~Liliaceae~~	Cordyline stricta	Erect Palm Lily
	C. terminalis	Broad Palm Lily
Winteraceae	Tasmannia insipida	Tasteless Pepper Bush
Monimiaceae	Wilkiea huegeliana	Wilkiea
Pittosporaceae	Citriobatus pauciflorus	Orange Thorn
Euphorbiaceae	Croton verreauxii	Green Native Cascarilla
Myrtaceae	Archirhodomyrtus beckleri	Rose Myrtle
Ebenaceae	Diospyros australis	Yellow Persimmon
Rubiaceae	Psychotria loniceroides	Hairy Psychotria
Herbs		
Adiantaceae	Adiantum formosum	Giant Maidenhair Fern
	A. hispidulum	Rough Maidenhair Fern
Blechnaceae	Blechnum cartilagineum	Gristle Fern
Araceae	Gymnostachys anceps	Settlers Flax
Vines		
Monimiaceae	Palmeria scandens	Anchor Vine
Vitaceae	Cissus antarctica	Simple Watervine
Araliaceae	Cephalaralia cephalobotrys	Climbing Panax
Bignoniaceae	Pandorea pandorana	Wonga Vine
Rubiaceae	Morinda jasminoides	Jasmine Morinda
Epiphytes		
Polypodiaceae	Platycerium bifurcatum	Elk Horn Fern

6. Wet Sclerophyll Forest (New England Blckbutt-Tallowwood association)

Tall Trees		
Myrtaceae	Eucalyptus andrewsii ssp. campanulata	New England Blackbutt
	E. microcorys	Tallowwood
Medium and Small Trees		
Proteaceae	Banksia integrifolia	White Banksia
Lauraceae	Cryptocarya rigida	Rose Maple
Cunoniaceae	Ackama paniculata	Corkwood
	Ceratopetalum apetalum	Coachwood

Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum
Elaeocarpaceae	Elaeocarpus reticulatus	Lily-of-the-Valley Tree
Myrtaceae	~~Rhodomyrtus~~ Archirhodomyrtus beckleri	Rose Myrtle

CUNONIACEAE.	Schizomeria ovata	Crabapple
Myrtaceae	Tristania laurina	Water Gum
Epacridaceae	Trochocarpa laurina	Tree Heath
Bold type > Shrubs		
Xanthorrhoeaceae	Xanthorrhoea ~~australis~~ glauca	Giant Grass Tree
Proteaceae	Lomatia silaifolia	Wild Parsley
Winteraceae	Tasmannia insipida	Tasteless Pepper Bush

Epacridaceae	Acrotriche divaricata	Green Cluster Heath
	Leucopogon lanceolatus	Lance Beard-heath
Bold type not underlined > Herbs		
Dicksoniaceae	Culcita dubia	False Bracken
Epiphytes (mostly *on Tree Heath)*		
Aspleniaceae	*Asplenium australasicum*	Birds Nest Fern
Polypodiaceae	*Platycerium bifurcatum*	Elk Horn Fern
	Pyrrosia rupestris	Rock Felt Fern
Orchidaceae	*Bulbophyllum aurantiacum*	
	B. crassulifolium	Stonecrop Orchid
	Dendrobium gracilicaule	Spotted Orchid
	D. tenuissimum	Slender Pencil Orchid

7. DRY SCLEROPHYLL FOREST-MAIN SPECIES.

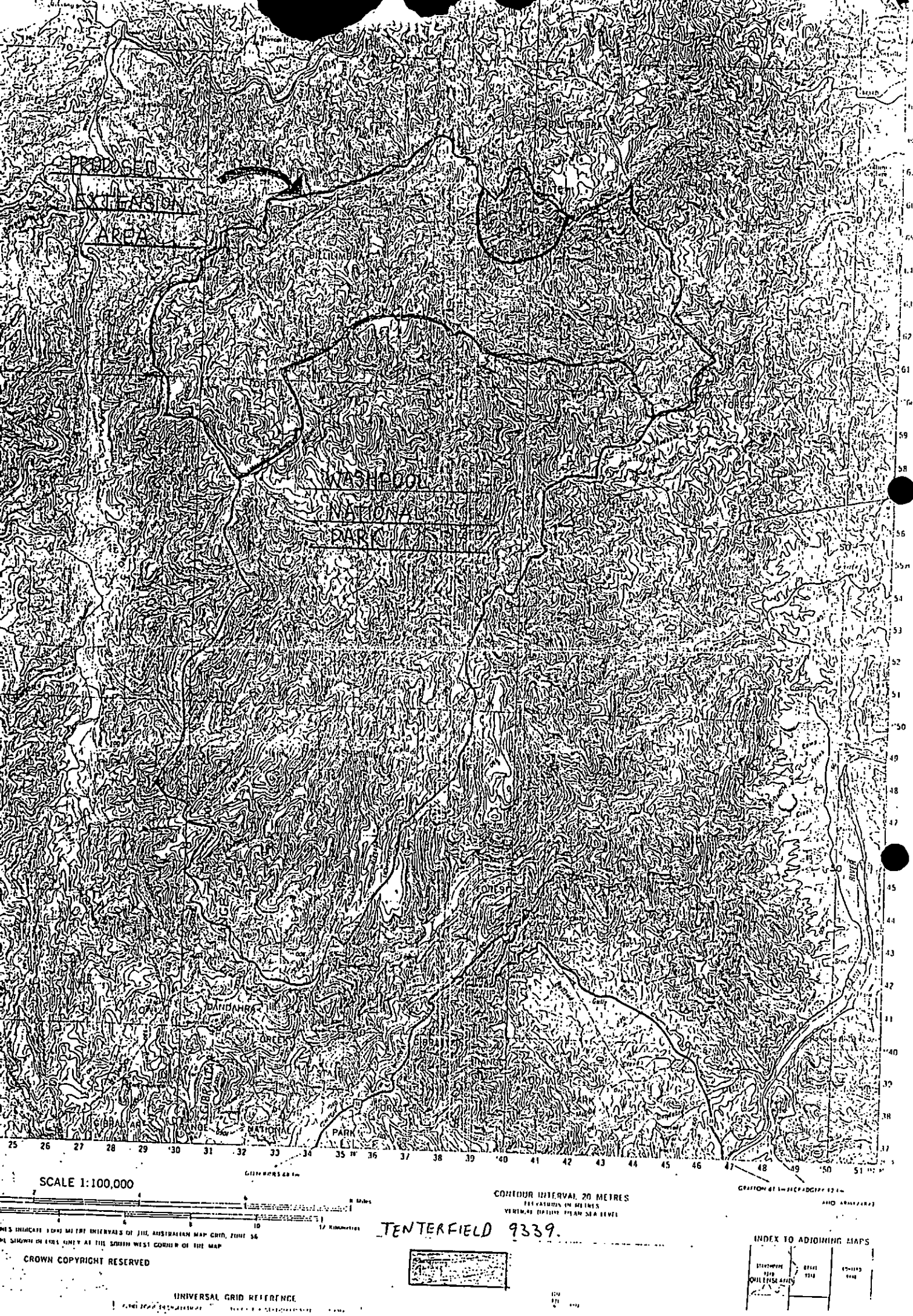
Bold type not underlined >

TREES:

Eucalyptus umbra	White Mahogany
Eucalyptus propinqua	Small-fruited Grey Gum
Eucalyptus siderophloia	Grey Ironbark

SHRUBS:

Casuarina littoralis	Forest Oak
Xanthorrheae ~~australis~~ glauca	Giant Grass Tree
Macrozamia fawcetti	Twisted Burrawang.
Bursaria sp	-


PROPOSED
EXTENSION
AREA
WASHPOOL
NATIONAL
PARK
BILLILIMBRA
FOREST
DANDAHRA
CREEK
GIBRALTAR
RANGE
NATIONAL
PARK
RIVER
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SCALE 1:100,000
CONTOUR INTERVAL 20 METRES
TENTERFIELD 9339.
INDEX TO ADJOINING MAPS
CROWN COPYRIGHT RESERVED
UNIVERSAL GRID REFERENCE

PROPOSED EXTENSION AREA

WASHPOOL NATIONAL PARK

BILLILIMBRA

STATE FOREST

WASHPOOL

DANDAHRA CREEK

GIBRALTAR RANGE NATIONAL PARK

SCALE 1:100,000

2 4 6 8 Miles

4 6 8 10 12 Kilometres

LINES INDICATE 1,000 METRE INTERVALS OF THE AUSTRALIAN MAP GRID, ZONE 56

ARE SHOWN IN FULL ONLY AT THE SOUTH WEST CORNER OF THE MAP

CROWN COPYRIGHT RESERVED

CONTOUR INTERVAL 20 METRES

ELEVATIONS IN METRES

VERTICAL DATUM, MEAN SEA LEVEL

TENTERFIELD 9339.

UNIVERSAL GRID REFERENCE

INDEX TO ADJOINING MAPS

STANTHORPE 9240 QUEENSLAND

DRAKE 9340

TOWALLUM 9440

GREENMOUNTAINS 68 km

GRAFTON 61 km JACKADGERY 12 km

AMD/ARMY/4842

To Forest Alliance
Dear Andrew

Please find enclosed a copy of a submission sent to the Forestry Commission in Dorrigo. Hope we can manage to save Ch-Leundi etc

Yours sincerely
Julie McLeod

Shepherds Rd
Dorrigo 2453

27/2/91

1·81

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THE SOCIAL AND ECONOMIC IMPACT

OF

THE WASHPOOL TIMBER RESOURCE

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A SUMMARY OF FINDINGS OF A REPORT BY:

DR. JAMES C. KABLE, B.E., M.S., B.Econ., Ph.D., F.A.I.M.,

HEAD, DEPARTMENT OF MANAGEMENT,
QUEENSLAND INSTITUTE OF TECHNOLOGY

and

R.J. GREEN (Lt. Col., R.L.),

EXECUTIVE DIRECTOR, CLARENCE DEVELOPMENT CORPORATION

Grafton,
New South Wales,
January, 1981

The findings in this section of the summary relate to the impact of the Washpool Timber Resource as affecting the Grafton district.

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1. The economic and social conditions attaching to the Grafton timber industry fully meet the criteria for full protection of the industry - within the context of conflicts of interest - as enunciated by Mr. Neville Wran, Premier of New South Wales, when the Premier officially opened the 1980 Australian Timber Industry Stabilisation Conference.

2. In terms of employment, the Grafton timber industry represents approximately 64% of the manufacturing base of the district. A significant loss of raw material will downgrade the district's manufacturing base, and this would adversely affect other sectors.

3. The timber industry in the Grafton district is responsible for generating about 1,270 jobs, about $29 million per annum in overall revenue, and approximately $12 million per annum in employee spending power.

4. Approximately 3,800 persons are financially dependent on the timber industry. The majority of these people live in the Grafton district. As the City of Grafton has a population slightly in excess of 17,000 people, continuance of a high level of timber processing is both economically and socially critical to the district.

5. 70% of the timber industry workforce and its industry linkages are reliant on their wages to pay off loans on a house, car and/or furniture.

   85% of spouses of married employees do not have fulltime work.

   In the Grafton employment district, approximately 1,100 persons are registered as unemployed, with access to 45 vacancies listed as unfilled (September, 1980).

   58% of millworkers consider themselves unsuited for other forms of work.

   Average unemployment benefit payments would amount to about $80 per week less than average take home pay of the workforce dependent on the Grafton timber industry.

   > Hence, any significant reduction in log supplies would cause serious economic hardship for the families of workers who are retrenched as a result of the reductions.

6. The Forestry Commission proposes to reduce net log quotas to the three main Grafton Crown sawmills by 46% during the period 1981-86. This reduction applies to log supply from the Grafton Management Area, and the proposal assumes that sawlogs from the Washpool forests will be available.

   Taking into account quotas allocated to two of the three sawmills from Crown forests outside the Grafton Management Area, the overall reduction in Crown log supply to the three sawmills amounts to 37% of 1980 Crown log input levels.

   This quota reduction will result in the loss of about 120 jobs, and $3.88 million per annum in overall revenue. Both figures include the multiplier effects in the community.

These planned quota cuts render the timber industry particularly sensitive to any further substantial reduction in log supply. In that context, access to the Washpool resources on the scale proposed by the Forestry Commission, is critical. The implications extend to the district at large, not merely to the timber industry.

7. The timber resources of the Washpool group of State Forests represent 45% of available sawlog supply for the three Grafton Crown sawmills in the period 1981-2010, and is the only source of supply of the brushwood logs needed by the veneer mill, Big River Timbers, of Grafton.

   In isolation from the quota cuts, the loss of these Washpool resources will result in a loss of at least 240 jobs, and at least $5.2 million per annum in revenue. Both figures include the multiplier effects in the community.

8. Should Washpool sawlogs be available to the three Crown sawmills as proposed by the Forestry Commission, but the brushwood logs needed by the veneer mill not be available to it, then, including the effects of the announced quota cuts on the three sawmills, there will be a loss of about 275 jobs and approximately $7 million per annum in revenue. Both figures include the multiplier effects that will be experienced in the community.

9. Should there be no logging whatsoever in the Washpool forests, the cumulative effects - including quota reductions - will result in:-

   (a) a loss of between 330 and 400 jobs.

   (b) a loss of over $9 million per annum in revenue. This figure, as with jobs, includes multiplier effects in the community.

   (c) a loss of production at pole treatment works in the district.

10. Given the situation at (9) above, the following results also will be experienced:-

   (a) the prospective retrenchments would include approximately 200 workers who, in their view, are unsuited for other work.

   (b) including dependants, about 1,100 persons would be directly affected by the loss of jobs incurred by the breadwinners.

   (c) there will be a general lowering of property values in the district, because:-

      (i) between 200 and 250 homes would then be occupied by retrenched workers who own those homes, with about 61% mortgaged.

      (ii) contractual obligations in respect of home loans, and loans on cars and furniture, would be expected by the lender to be met.

      (iii) alternative job opportunities in the district are scarce.

      An excessive number of homes therefore can be expected to be placed on the market - over and above the normal volume - creating a buyers' market.

(d) overall unemployment in the Grafton district will increase by approximately 33% - from an official September 1980 registration of 1,111, to some 1,475 persons.

(e) adult male unemployment will increase by about 65% - from an official October 1980 registration of 528 persons, to some 870.

(f) due to the nature of timber haulage operations and the distribution pattern of Grafton produced timber products, the general community in the Grafton and Clarence districts, and to some extent in the North Coast district, will have to pay more for food, building materials, lubricating oil, fertiliser, stockfeed and miscellaneous items.

Reduced mill output, amounting to less than half the former levels, therefore would be adverse to the interests of the rural sector and the Clarence community generally.

(g) the prospective retrenchments could affect 600 to 700 individual memberships of various community organisations, particularly if families have to leave the district to find other work; and this would adversely affect their contribution to the aims and operations of the organisations.

11. Loss of the Washpool resources combined with the quota cuts will mean a 57% reduction in output of the three Crown sawmills, and closure of the veneer factory. This will result in increased costs of home building, and will disadvantage a wide range of private sector and Governmental customers of the Grafton timber industry.

12. There is no viable alternative source of supply to replace the sawlog and veneer resources contained in the Washpool forests.

13. Closure of the Washpool is already adversely affecting plant performance, as these forests are the only source of supply of logs of suitable size and specie mix needed by the Grafton sawmills.

14. The industry and its immediate linkages have more than $18 million invested in plant and equipment needed to harvest, process, and deliver finished products to market - a conservative estimate based on actual respondent advice only.

These investments and development of markets are based on an assumption of continuing supplies of logs of suitable size and specie mix, in terms of agreement between successive State Governments and the industry within the framework of long term planning to meet the timber needs of the community.

There is a moral and commercial obligation on the authorities to protect private sector investment in the future of the Grafton district, including small business owners whose savings are at risk.

15. The operations of the Grafton/Clarence timber industry at the present time result in the Commonwealth Government receiving approximately $7.2 million per annum in various tax forms, of which almost $3 million is returned to the NSW Government.

Additionally, the NSW Government receives further revenue direct from the industry and its linkages.

1979 Forestry Commission accounts indicate a profit from forestry operations in the Grafton district, taking into account royalty payments only. The above-mentioned revenues are additional to Forestry Commission accounting.

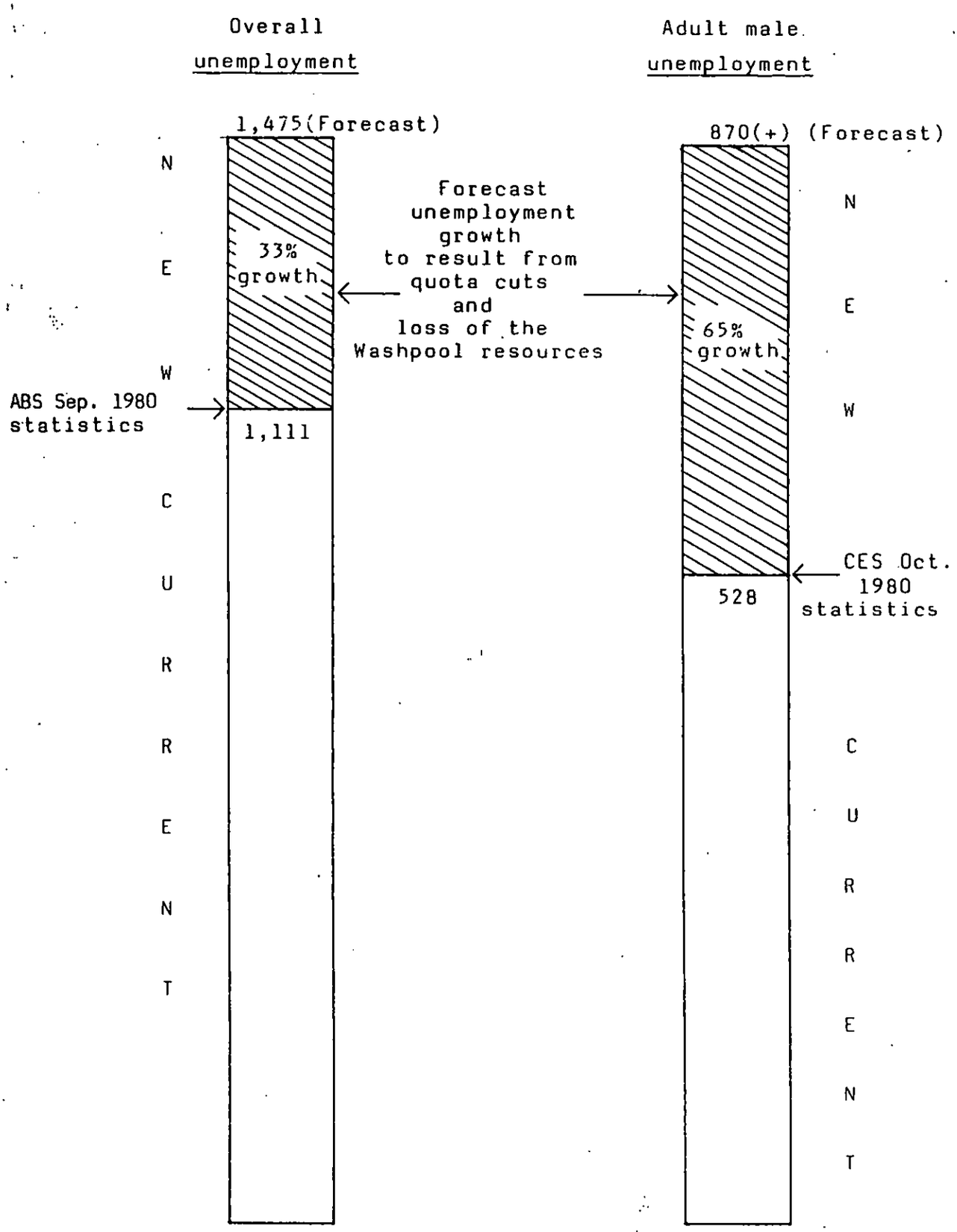
16. There is no evidence that output from the Crown indigenous mills in the Grafton area has declined, or that the mills have effected retrenchments due to declining resources or to the introduction of mechanisation.

There is clear evidence that the Grafton timber industry is growing in terms of demand for its products, and related revenue.

17. On a national basis, the Grafton timber industry occupies a significant, even foremost, place, in supplying hardwood products, veneer, poles and sleepers, to the community. The virtual dismantling of this industry - which is implicit given loss of the Washpool resources in addition to announced quota cuts - would be harmful to the community generally, as timber production in this country already is inadequate to meet the growing demand.

UNEMPLOYMENT DATA GRAFTON DISTRICT

OFFICIAL STATISTICS AND SURVEY FORECAST



ABS = Australian Bureau of Statistics

CES = Commonwealth Employment Service

THE SOCIO-ECONOMIC VALUES OF THE WASHPOOL TIMBER RESOURCE

OVERALL ASPECTS

The foregoing section of this summary deals with the social and economic impact of the Washpool timber resources on the Grafton district. However, two sawmills at Casino and a planing mill at Kyogle, within the Casino West Management Area, are also heavily dependent on the Washpool State Forests for their raw material.

Because of the significance of the resource to their operations, the Casino based sawmills commissioned a study by Dr. J.C. Kable, whose assignment was to report on the social and economic effects on the Casino district of the loss of the Washpool resources to the sawmilling industry in the Casino district.

The relevant report has been prepared by Dr. Kable. Following is a summary of the overall values of the Washpool timber resources to the Grafton and Casino districts, together with a summary of the combined social and economic consequences should the Washpool resources not be made available to the timber industry.

The values include job and economic multiplier effects generated by the timber industry in the community.

. . . . . .

1. The Grafton and Casino timber industry is responsible for the generation of approximately 1,620 jobs.

2. Including dependants of the timber industry related workforce, approximately 5,060 men, women and children are financially sustained by the industry in both districts.

   The combined population of the City of Grafton, and Casino district, is a little more than 28,000. Hence, continuance of timber processing at traditional levels is socially and economically critical to the region.

   The number of people financially dependent on the industry represents approximately 18% of the combined population.

3. The industry in both areas is responsible for generating approximately:

   (a) $38 million per annum in revenue, of which the Crown mills surveyed in both studies generate about $28.3 million.

   (b) $15.5 million per annum in employee spending power.

   (c) $9.4 million per annum in tax etc. revenue to the Commonwealth Government, of which some $3.8 million per annum is returned to the New South Wales Government, which also receives other revenue direct from the industry and its employees.

4. If the Washpool resources are not made available to the industry in both districts, the cumulative effects - including announced quota cuts in the Grafton district - will include:-

   (a) the loss of approximately 515 jobs, as a conservative estimate.

(b) a loss of about $13 million per annum in overall revenue, which includes revenue accruing to sectors other than the timber industry itself.

5. Excluding the value of timber stocks, Grafton and Casino based Crown licensees, logging contractors, timber hauliers, machinery dealers and repairers, fuel suppliers, and sawmill equipment suppliers and engineers, have invested more than $30 million in plant and equipment needed to service timber operations (replacement value).

The reported investment should be regarded as conservative, as it quantifies only those respondents to the surveys.

In the last decade, the seven Crown licensees at both locations have spent $13.5 million on plant and equipment on the understanding of an ongoing commitment by Government in regard to continuity of a stable log supply.

The social survey of the timber industry workforce at Casino elicited evidence similar in nature to the social conditions attaching to the Grafton timber industry workforce. Examples are:-

		Grafton	Casino
(a)	percentage of employees who are married	66%	63%
(b)	percentage of employees whose spouses do not have full time work	78%	87%
(c)	percentage of employees who rely on their wages to pay off loans on a home, car, and/or furniture	67%	60%
(d)	percentage who own their own homes or are paying off a home loan	47%	57%
(e)	percentage of workers who state a preference to remain in their own district, if they lose their jobs	90%	97%
(f)	percentage of mill employees who consider themselves unsuited for other work	58%	57%

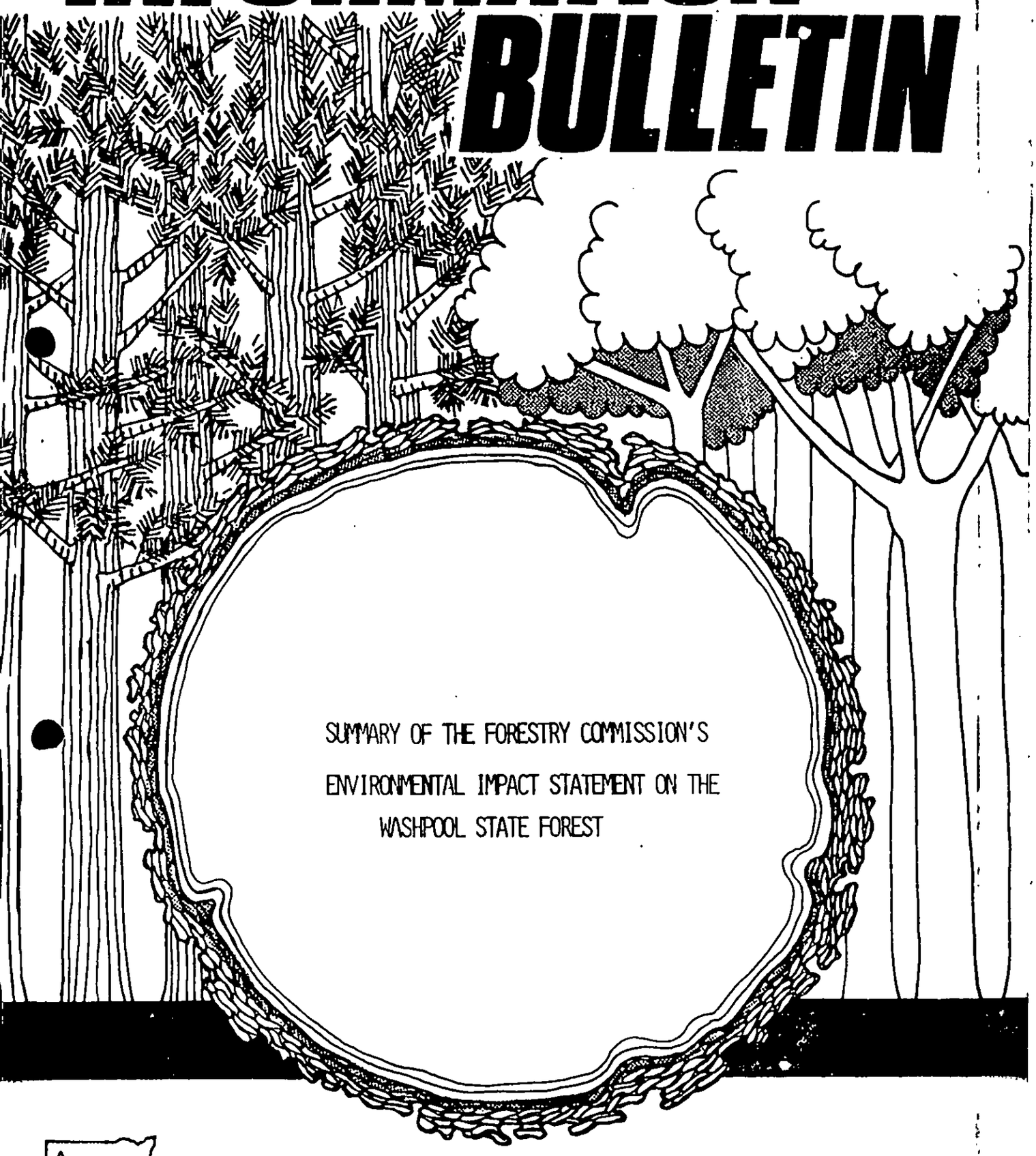
In summary, it can be stated with authority that if the Washpool timber resource planned by the Forestry Commission to be available to the Grafton and Casino timber industry, is not made available, there will be serious social and economic effects in the Grafton/Casino region. These effects will extend not merely to the 1,500 or more workers and dependants directly and immediately affected by the resultant retrenchments, nor only to Crown mill management, but also to the industry infrastructure and to the community in general.

Additionally, there will be a loss of revenue to the three levels of Government, and, until such time as the prospective retrenchments find alternative employment - a remote prospect regionally, given high unemployment levels and few existing job opportunities - there will be a further unemployment dollar burden on the community amounting to approximately $2½ million per annum.

ASSOCIATED COUNTRY SAWMILLERS

INFORMATION BULLETIN

NUMBER 1



SUMMARY OF THE FORESTRY COMMISSION'S ENVIRONMENTAL IMPACT STATEMENT ON THE WASHPOOL STATE FOREST

A C S

24th Floor St Martins Tower, Cnr. Market & York Streets, Sydney. Phone 02 290 1877.

ASSOCIATED COUNTRY SAWMILLERS
OF NEW SOUTH WALES
24th Floor, St. Martins Tower, Cnr. Market & York Streets, Sydney

POSTAL ADDRESS: P.O. BOX Q145, QUEEN VICTORIA BUILDINGS, SYDNEY 2000
TELEPHONE: 02 - 290.1877 TELEX: 25036 TELEGRAMS: "ASCOSAWMIL," SYDNEY

SUMMARY OF WASHPOOL ENVIRONMENTAL IMPACT STATEMENT.

INTRODUCTION:

The Washpool E.I.S was prepared by the Forestry Commission of N.S.W. in accordance with the requirements of the new Environmental Planning and Assessment Leglislation which came into operation on 1st September, 1980. The Washpool area contains large volumes of hardwood timber as well as a smaller amount of brushwood (rainforest). As such it is of vital importance at a local and State level for maintenance of supply of native timber, and progression towards the Commission's stated aim of sustained yield production from these forests.

AREA OF FOREST INVOLVED.

Three major groups of forest are represented in the area. Rainforest(largely of the warm-temperate type) occupies 10,342 hectares (24%), moist hardwood (tallowood, Sydney blue gum and brush box) 7,431 hectares (17%) and dry hardwood (blackbutt, grey and spotted gum, and iron bark) 17,977 hectares (42%). The remaining 7,533 hectares (17%) consists of miscellaneous, generally non-commercial areas which have not been classified. The inclusion of 3,912 hectares of rainforest in Flora Reserves (outlined below) means that only 6,430 hectares of rainforest are in areas which may be subject to logging. It is clear, therefore, that the issue cannot be classified as a rainforest issue. Most of the forest of the Washpool area is in virgin condition with only 1,807 hectares (4%) having been logged previously.

The forest areas come under the control of both the Grafton (in the South) and Casino West (in the North) Forestry districts.

AREAS PROPOSED TO BE LOGGED.

A total of 15,697 hectares of the Washpool is available for logging (after Reserves and physically inaccessible areas are deducted), representing 36% of the total. Of this only a maximum of 13,495 hectares (31% of the total) will be logged because of the Commission's policy of phasing out general purpose rainforest logging. Only one mill, Big River Timbers of Grafton, will be using brushwood (rainforest) timbers from the area. This company has a fixed commitment of 68,000cubic metres which, if the Washpool is logged, will be completed in about 1990.

RESERVES.

There are three main reserves in the Washpool area. The largest, Willowie Scrub Flora Reserve, is 5,572 hectares in area. 70% of this is true rainforest. The Washpool Granites Reserve (790 hectares) contains chiefly dry hardwood while Redbank Reserve (112 hectares) has both rainforest and dry hardwood. The Washpool area is adjoined by a substantial National Park (Gibraltar Range) of 17,273 hectares, containing rainforest, moist and dry hardwoods, and heath communities.

SOCIO-ECONOMIC IMPORTANCE.

It has been estimated that in excess of 60% of the Grafton district's employment is dependent on the timber industry. If the Washpool is not allowed to be logged it will result in the loss of approximately 250 jobs in direct timber industries

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over 11 years. Given a multiplier factor of 2.2 up to 550 jobs in timber and related industries could go in 11 years. In addition to this the areas of forest remaining for logging will be reduced, resulting in more intensive harvesting with little hope of maintaining a healthy industry while achieving sustained yield production.

***

The Washpool issue is not primarily a rainforest issue. The rainforest component is relatively small and, in the long term, of much less significance to the industry than the hardwood component.

The timber industry is convinced that our native forests can be managed wisely for the interests of the vast majority of Australians We believe that the government should support its designated professional body, the Forestry Commission, in its proposals to log the Washpool area according to environmentally responsible pratice. In this way the natural resource can be put to best use for the good of our community.

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ASSOCIATED COUNTRY SAWMILLERS
OF NEW SOUTH WALES

WASHPOOL FACT SHEET

Areas of Forest Involoved - (ha)	Rainforest	10,342
	Moist hardwood	7,431
	Dry hardwood	17,977
	Other	7,533
	TOTAL	43,283
Areas to be logged (ha) (percent of total in parentheses)	Rainforest	1,546 (4%)
	Moist hardwood	4,728 (11%)
	Dry hardwood	6,916 (16%)
	Other	305 (1%)
	TOTAL	13,495 (32%)
Areas to be reserved (ha)	Rainforest	3,912
	Moist hardwood	692
	Dry hardwood	1,861
	Other	9
	TOTAL	6,474
Timber volumes to be logged (m^3 nett quota)	Rainforest	67,862
	Moist hardwood	338,816
	Dry hardwood	197,323
	TOTAL	604,001
Direct monetary analysis $	Total royalties	7,156,711
	Roading costs	1,171,700
	Marketing costs	1,789,177
	Nett gain to Crown	4,195,834
	Estimated sawn timber value	44,660,300
Employment (Grafton) 1979/80	Mill workers (Crown)	224
	Field operators (Crown)	54
	Private mills (total)	204
	Other activities	64
	Forestry Commission	23
	TOTAL	569

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ASSOCIATED COUNTRY SAWMILLERS
OF NEW SOUTH WALES
RICHMOND / TWEED / CLARENCE BRANCH
Telephone : Casino 62 1330 *P.O. Box 123, Casino, 2470*
CIVIC BUILDINGS, WALKER STREET, CASINO, N.S.W. 2470

13th August, 1981.

Dear Sir/Madam,

The attached summary is of two Socio-Economic Surveys carried out by Dr. James C. Kable, Head of the Department of Management, Queensland Institute of Technology, and Mr. R. J. Green, Executive Director of the Clarence Development Corporation, on the impact of the timber resources available to the Grafton and Casino timber industry.

You can see from the Summary that the social and economic impact of the reduction or the denial of this resource to the industry would be devastating.

Our reason for forwarding this Summary and the other enclosures to you is to seek your support in lobbying Local and State Government. We intend to impress on members of the Government, the Opposition and endorsed candidates for the forthcoming State election, the need for a speedy decision in favour of the industry, so that the industry can proceed to log the Washpool State Forest in accordance with the Environmental Impact Statement prepared by the Forestry Commission.

Yours faithfully,

T. F. EVANS.
Chairman
Richmond/Tweed/Clarence Branch
Associated Country Sawmillers of N.S.W.

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May/June, 1981

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prologue

WASHPOOL EIS MINISTER ORDERS REVIEW

On 17th March, the Minister for Planning and Environment, Mr Eric Bedford announced that he had ordered "an independent review of the Forestry Commission's proposal to undertake logging of the Washpool rainforest on the North Coast."

Mr Bedford said that the Department of Environment and Planning would undertake the review of the Commission's environmental impact statement on the Washpool.

Mr Bedford said the review would be undertaken by the Department under Section 113(5) of the Environmental Planning and Assessment Act.

In accordance with the provisions of the Act, there would be no decision by the Forestry Commission on the matter until the Commission had received a report from the Department and considered any recommendations it contained.

The review of the EIS will be undertaken by a small unit to be established in the Department's head office in Sydney.

This unit will be supported by assistance and expert advice from other bodies, including the universities and other Government instrumentalities, Mr Bedford said.

Washpool EIS

The closing date for submissions for the Washpool EIS was March 2nd, 1981 and the ACS submission was one of many which supported the logging of Washpool.

In the interests of better communication within the Association, the summary of the submission is set out in full below:

Summary

Associated Country Sawmillers (ACS) strongly favours logging of the Washpool area.

The main points of agreement with the Forestry Commission Environmental Impact Statement (EIS) are the description of the physical and biological environment and proposals for flora reserves.

The main points of disagreement are:

1. The EIS does not place sufficient emphasis on the benefits of multiple use forestry.

2. There is no justification for the blanket limitation of logging to slopes less than 30 degrees.

3. The volumes of timber in "unloggable" areas are considerable and should not be excluded from logging.

4. Areas for brushwood logging should be increased and intensity decreased. More effort should be put into a more integrated operation between brushwood and hardwood.

5. The "hinterland" classification of the area is not accepted by the Association. Therefore, more intensive silvicultural treatment should be carried out after logging.

6. Estimates of private property timber volumes are disputed. A more realistic figure is one-sixth the value given in the EIS.

7. Previously logged areas should be included in the proposed logging schedule because of the considerable length of the cutting cycle.

8. The Association believes that to prematurely establish the final roading pattern may seriously influence the efficient utilisation of available timber.

9. The Association disagrees that "if logging proceeds about 80 jobs are expected to be lost". Big River Timbers should not be considered as liable to close after its commitment is met. Technological and other changes will ensure its future life after that time.

10. The socio-economic impact of not logging has been understated in the EIS.

In conclusion, the ACS submission proposes "that a larger area be logged and that the 30 degree slope limitation be replaced by a more specific prescription dependent on local conditions. Logging under this proposal would increase the yields ensuring future supplies of timber from the washpool.

Specific silvicultural operations should be implemented following logging to ensure adequate regeneration for future cutting cycles. The brushwood and hardwood logging should be integrated wherever brushwood occurs in the understorey, or in stands closely associated with hard woods. Previously logged areas should be included in future logging plans."

Above: The Hon. E. Bedford M.P., Minister for Planning and Environment. Below: Washpool: East from Commbadja Road

IN THIS ISSUE
Prologue Guest this issue Hon. Don Dac Min. for Industrial Development and Decentralisation (page 3); Royalty Report and Stop Press (page 6); LEAF ladies, back page

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Washpool EIS. Information Sheet. Willowie Scrub.

The Willowie Scrub covers an area of 5,700 hectares, of which approximately 3,000 hectares are rainforest. Because of its steep terrain and remote location it has not been logged, except for some selective logging by early timber getters along Washpool Creek. It encompasses a wide range of vegetative species associations representative of the Washpool forest area, and has been described as the largest virgin rainforest of New South Wales.

The rainforest, according to A.Floyd, Willowie Scrub vegetation survey, June 1978, consists of mostly warm temperate rainforest. There are some areas of subtropical rainforest, but these are restricted by soil fertility, altitude and exposure. Other vegetative associations listed in the above survey are wet scrub, dry scrub, wet sclerophyll forest, and a few small patches of dry sclerophyll forest. In conclusion, it is stated in the above survey, to be "a valuable reference area for future study of warm temperate rainforest in New South Wales ... exceptional in the range of gradations to subtropical rainforest on the one hand and to wet sclerophyll forest on the other".

The Willowie Scrub has been suggested recently by Helman, Jones, Pigram and Smith, Wilderness in Australia, 1976, as the central part of their Washpool Wilderness Area.

The Washpool EIS proposes a Willowie Scrub Flora Reserve, covering 5,700 hectares, of which 3,000 hectares are rainforest, in acknowledgement of its varied composition and its being one of the largest remaining undisturbed rainforest areas in New South Wales. p.92.

It proposes an area that is to be 9 km by 8 km, and free from major indentations. p.136. It discusses wilderness values of the proposed Willowie Scrub Flora Reserve. p.135.

However it also spells out limitations of the proposed reserve:

1. "There will be some roading in the peripheral zones of the Willowie Scrub Flora Reserve." p.23.
   "It is considered that from within such a zone, views of logged sites and roading on adjoining land represent an impediment to the fulfillment of a satisfying experience of landscape." p.135.
2. It would appear from Map 9 accompanying the EIS, outlining the proposed logging operations, that the Willowie Scrub Flora Reserve will be logged fairly extensively on all boundaries. Two exceptions are given: p.143.
   (i) a corridor of vegetation between the Willowie Scrub and unlogged country in Retreat Creek.
   (ii) the rainforest to the west of the Willowie Scrub Flora Reserve is not to be logged.
   However the latter only excludes the pockets of rainforest from logging and Map 9 indicates that the large areas of wet sclerophyll forest to the west of the Reserve are proposed for logging.
3. If the surrounding wet sclerophyll forest areas are logged, as Map 9 indicates, protection for flora and fauna of the rainforest is considerably diminished, especially in view of the slow

regeneration of the moist hardwood forest that is suggested in the EIS, p.142. The desireability of rainforest reservations being accompanied by surrounding sclerophyll forests that are undisturbed is discussed in the National Parks and Wildlife Service's publication, Rainforests, 1977, p.102. These buffers act as protection from wind for the rainforest, and provide a rich habitat mix for wildlife. Two examples that are cited in the latter publication are:

(i) B.Harden states that mammals in temperate rainforest often occur in greater abundance in the wet sclerophyll forest. p.80.

(ii) H.Cogger states that rainforest reptiles are often found in adjacent non-rainforest habitats, although still dependent on the adjacent rainforest. p.63.

4. It is important that reserves guarantee the retention of biological diversity. Studies have shown that reserves surrounded by an altered habitat resemble an island from the point of view of species restricted to natural habitats (D.Lunney, Island studies and the selection of parks and reserves. N.P.W.S.). vIn considering the impact of the proposed logging on the wildlife, the EIS admits that "some problems of conservation may exist for animals with particular habitat requirements, small distributions and large home ranges, but lacking occurrence and abundance data, it is impossible to make statements about them". It would appear that such data collection is imperative before logging roads are constructed in peripheral zones of the Willowie Scrub Flora Reserve, and logging in the associated areas commenced.

It is apparent that the Forestry Commission intends to manage the proposed Willowie Scrub Flora Reserve, and with the revocation of the Grady's Creek Flora Reserve in the Wiangaree State Forest for logging, freshly in mind, the permanence of what is considered to be an exceptional scientific reference area in the Washpool forests could be seen to be questionable.

If you are concerned about these limitations of the proposed Willowie Scrub Flora Reserve, please write to the Premier, The Hon.N.Wran, Parliament House, Sydney, NSW. 2000.

Clarence Valley Branch of the
National Parks Association of NSW,
P.O. Box 425,
Grafton. NSW. 2460.
February, 1981.

Washpool EIS. Information Sheet 2. Obvious Inadequacies in the EIS.

As a study designed to assess the impact of logging operations on a sensitive wilderness area, the EIS on Washpool is inadequate in several major areas.

By its own admission, important research by the Forestry Commission has not been carried out in the fields of soils, vegetation, hydrology, mammals, birds, invertebrates, reptiles and amphibians and archaeological sites.

When each of these sections is studied carefully it is not difficult to find evidence which shows how little research has actually been done.

The following direct quotes illustrate this point : -

A. Soils

"As no detailed soil mapping has been carried out in this area, the comments are of a general nature presenting trends." p.69.

"Disturbance and compaction of soil surface and loss of vegetation cover during logging leave the surface in a potentially erodible state. If slopes are steep and rainfall intensities high, soil erosion may result on these disturbed areas when the underlying soils are naturally erodible."

"Soil types are variable in the Washpool area. While detailed investigations of the soils have not been made, there is evidence that some soil types are highly erodible."

"These readily erodible soils occur over 45% of the Washpool area. 40% of these areas proposed for logging are on the highly erodible soil type." p.121.

B. Vegetation

"The State Forests in the Washpool area were typed for management purposes in 1960 and 1961 from aerial photography flown in 1959, in association with field checks." p.27.

"It is not proposed to retype the areas to the standard forest types now in use, as it is considered that because of the large areas, the cost and time involved to retype the area would not be warranted by any gain in precision." p. 27.

"The report of Mr A. Floyd is the only report on the area and he restricted his investigations to the proposed Willowie Scrub Flora Reserve." (The EIS has failed to use Mr Floyd's second report, "Rainforests of Gibralter Range National Park and Southern Section, Washpool State Forest. 1980.")

"Without further study it is impossible to determine mechanisms for the distribution of forest types and vegetation associations. It is most likely from investigation elsewhere that soils are a major determinant."p.89

C. Wildlife

"It is considered that some problems of conservation may exist for animals with particular habitat requirements, small distributions and large home ranges, but, lacking occurrence and abundance data, it is impossible to make accurate statements about them. In any event the effects would not be evident until some time after logging and, as the forest recovers, they will be reduced. As the proposed logging operations will extend over 30 years the effects should be distributed in both area and time scale." p.144.

D: Mammals

"The mammal fauna of Washpool has not been surveyed. However an extensive trapping programme for small mammals has been undertaken over the past 4 years within similar forest types some 93 kms south of the Washpool area. The list of mammals provided in Appendix I3, is a composite of a variety of sources. It is an extensive list of 56 species which is reasonably possible for this locality." p.93.

E. Reptiles and Amphibians

"A list of reptiles and amphibians which could be expected to occur in the Washpool Area is attached." p.97.

"Mammals and birds are the only fauna considered, as no site data is available for reptiles and amphibians." p.144.

F. Invertebrates

"Invertebrates have not been surveyed in the Washpool area.." p.97.

G. Birds

"Standard texts (Readers Digest - Complete Book of Australian Birds; Busby and Davies (1977)) were used to prepare a list of all possible bird species. The RAOU Bird Atlas Scheme was requested to provide data for two g[redacted] squarea which covered the area. Using this information each species has been listed as a positive sighting and/or as breeding. No estimate of abundance is given." p.95.

"The thirteen rainforest birds include the Albert Lyrebird, the Eastern Bristlebird and Rufous Scrub-bird both of which, because of their rarity, have very restrictive, though unknown needs." p.97.

H. Archaeological Sites

"No systematic survey for sites has ever been carried out and the Washpool area has never been the subject of any detailed anthropological investigations." p.99.

I. Research

"The (Forestry) Commission has not carried out any specific field experimental research within the Washpoolarea, although some projects have b[redacted] conducted to the south, in Cangi State Forest and to the north in the Ewingar group of forests." p.106.

Man's logging of this great forest must bring about change in its ecological system. The statements in the EIS on the natural environment indicate that we are not sure, even now after the compilation of the EIS, what those changes will be.

The Forestry Commission recommends that logging proceed. If it disturbs you that such a recommendation can be made when the natural environment as it is has not even been described in an adequate way, then write to the Premier, Mr N. Wran, State Office Block, Macquarie St, Sydney.NSW.2000.

Clarence Valley Branch of the
National Parks Association of NSW,
P.O. Box 425,
GRAFTON NSW 2460.
February, 1981.

Washpool EIS. Information Sheet 3. Logging and Rainforests.

The timber industry claims that logging of rainforests is only an extension of natural processes such as cyclone damage and normal tree death.

Logging differs from these natural events by : -

+ affecting a much greater area and therefore a greater number of trees;

+ the construction of roads, snigging tracks, culverts etc, that dissect natural habitats;

+ the selection of certain ages and species of trees and thereby simplifying the structure of the forest;

+ the removal of logs that contain essential minerals recycled under natural conditions and provide habitats for invertebrates, reptiles, ferns, fungi, mosses and some vertebrates;

+ the potential introduction of weeds, exotic animals and fungal diseases.

A consideration of the mineral cycle in rainforests is essential in understanding the disturbance of logging. In rainforests, unlike most vegetated areas, minerals are primarily stored in the living plants and the leaf litter with only a small amount being stored in the soil. The complete removal of trees from the forest as logs robs the forest of some essential minerals.

The time involved in rainforest regeneration is also of great importance. The Forestry Commission, in its "Background Paper on Rainforest Logging" states that "something between one and two centuries appeared likely before the regrowth stands resulting from heavy logging in coachwood would again produce sawlogs."

Other researchers placed the figure at about 300 years for a Warm Temperate Rainforest (Coachwood type) to regain something like its original structure.

The preservation of all the remaining rainforest in NSW is essential if we consider the following : -

+ The area of rainforest in NSW has been reduced by 70% from about 1 million ha to 300,000 ha.

+ Rainforests in northern NSW contain over 40 species of rare and endangered plants; as well, they contain over 50 plant species which are poorly known and have restricted distribution.

+ Rainforests in NSW are important faunal habitats. For the whole of Australia, about 20% of all animals found in rainforests are found nowhere else. Rainforest fauna is thus particularly vulnerable to the present onslought.

+ About 40% of NSW rainforests are State Forest, 10% are vacant crown land, and 16% are private property. Thus well over half is under potential threat.

+ Only about 16% of NSW rainforests are in National Parks.

+ Eight sawmills in the north of the State use rainforest timbers. Under the current plans of the NSW Forestry Commission half the mills will no longer be able to use rainforests as a source of logs by the mid 1980s, and NSW rainforests will have been logged out by the mid 1990s. Not only will most of the remaining public rainforests be lost but

so will many jobs.

+ Alternative employment could be created by introducing reforestation schemes.

+ financial aid could be provided to mills with rainforest quotas to enable them to quickly replace rainforest logs with regrowth hardwood timber from outside the rainforest areas.

If you are concerned about the remaining rainforests in NSW please write the the Premier, the Hon. N. Wran, State Office Block, Macquarie St, Sydney.NSW. 2000, asking him to halt rainforest logging now and to place the remaining rainforests in National Parks or equivalent reserves.

If you would like further information or would like to make a donation to the rainforest campaign contact one of the following groups : -

Clarence Valley Branch of the National Parks Assaciation of NSW, P.O. Box 425, Grafton. NSW. 2000.

Australian Conservation Foundation NSW Liason Officer, Total Environment Centre, 18 Argyle St, Sydney.NSW.2000.

The National Trust, Observatory Hill,Sydney.NSW.2000.

The Rainforest Action Centre, c/- The Total Environment Centre, 18 Argyle St. Sydney.NSW.2000.

The National Parks Association of NSW,399 Pitt St,Sydney.NSW.2000.

Clarence Valley Branch of the NPA of NSW. February, 1981.

Washpool EIS. Information Sheet 4. Wildlife.

A number of inadaquacies and errors are apparent in the wildlife section of the EIS. The major inadequacy lies in the lack of an adequate preliminary survey of the Washpool area. This must place severe limitations on the value of any attempted assessment of the impact of logging.

The EIS states : -

+ " The mammal fauna of Washpool has not been surveyed." p. 93.

+ " Invertebrates have not been surveyed in the Washpool area." p.97.

+ " It is considered that some problems of conservation may exist for animals with particular habitat requirements, small distributions and large home ranges, but, lacking occurrence and abundance data, it is impossible to make accurate statements about them." p.144.

+ "... no site data is available for reptiles and amphibians." p.144.

The bird list for the area was compiled from textbooks and records from the Atlas of Australian Birds. A number of errors are included and illustrate a poor understanding of the distribution of NSW birds. It is unlikely that the Double-eyed fig-parrot, Yellow-eyed Cuckoo-Shrike or Black-breasted Button-quail occur in the Washpool area. The Alberts Lyrebird is not known to occur in the area and its southern limit is the Blackwall Range near Meerschaum Vale - 29° S (G. Holmes personal comment). The Brush Turkey, Rufous Scrub-bird, Pale-Yellow Robin and Logrunner (Spine-tailed Chowchilla) are not rainforest dependant. The Washpool does notrepresent the limit of distribution of the Red-crowned Fruit Dove, Superb Lyrebird, Powerful Owl, Azure Kingfisher and Olive Whistler.

The bird list also includes many wetland species that would never occur in the Washpool area. However a few wetland species such as the little Pied Cormorant and White-faced Heron would probably visit the creeks of the area.

The mammal list is compiled from 15 sites some more than 200-300 km from the area and of different vegetation types. Only 14 of the 56 species listed as possible for the area have actually been recorded in the Washpool. The EIS does not clearly reference the sources of information or authors on mammals other than listing the areas concerned and citing 3 authors out of 15.

The mammal list should have included the Yellow-bellied Sheath-tailed Bat, White-striped Free-tailed Bat, Tasmanian Pipistrelle, Large-footed Myotis, Chocolate Bat, Eastern Broad-nosed Bat and Gould's Long-eared Bat. The Pygmy Antechinus (Marsupial Mouse) and Greater Long-eared Bat should be omitted.

The above are a selection of the inadequacies and errors contained in the Wildlife section of the Washpool EIS, there are many more. The EIS recommends that logging proceed, despite the inadequate knowledge of the area's natural environment. If you are concerned about this please write to the Premier, The Hon. N. Wran, Parliament House,Sydney.NSW.2000, or send a submission on the EIS to the Forestry Commission, 95-99 York St, Sydney.NSW.2000.

Feb.1981.

Clarence Valley Branch of the NPA of NSW,P.O.Box 425,Grafton.NSW.2460.

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WASHPOOL ENVIRONMENTAL IMPACT STATEMENT

SOILS, HYDROLOGY AND NUTRIENT CYCLE

30.50

SUMMARY

(1) Soils

(i) Logging of hardwood and brushwood is proposed to "maximum economic utilization". This logging will often approach clear felling in intensity in rainforest leaving a "variable, generally low percentage of upper canopy - 5-15%."

(ii) Logging will be on steep slopes up to 30°.

(iii) Over 40% of the area proposed for logging has soils desribed by the E.I.S. as extremely erodible.

(iv) Much of the remainder of the area proposed for logging has soils described as "eroding readily when disturbed on steeper slopes".

(v) The E.I.S. says that "the problem will be accentuated by the high rainfall totals and intensities experienced."

(vi) The Forestry Commission proposes that its Standard Erosion Mitigation conditions and adequate roading practices will "minimize" erosion from logging and roading. How minimal is "minimize"?

(vii) The certainty is that a logging and roading operation of this type on very steep slopes and highly erodible soils, with high rainfall totals and intensity (at times cyclonic) must lead to significant erosion, no matter how much "minimizing" is done.

(viii) Such an operation is contrary to the Forestry Act itself, which unequivocally charges the Forestry Commission "To preserve and improve, in accordance with good forestry practice, the soil resources and water catchment capabilities of Crown-timber Lands."

The E.I.S. by its own admission, indicates that this logging operation will not preserve or improve the soil resources or catchment capabilities of the Washpool.

On these grounds alone, the logging operation should not proceed, as it completely negates the charter given to the Forestry Commission by the Parliament.

(2) Hydrology

(i) The Washpool is an above average source of water per unit area for the Clarence River.

(ii) Precipitation is in excess of 1700 mm annually.

(iii) The area is subject to high intensity, long duration rainfall.

(iv) The E.I.S. admits that logging may lead to sedimentation of the lower reaches of larger streams outside the forests. It is highly likely that this will in fact occur.

(v) The Forestry Commission justifies its roading as reducing fires because of improved access. However it may well be that improved access results in more fires, as access for incendiarists is improved too.

(vi) Should a wildfire occur after logging its effect is likely to be much more severe because logging will disrupt or remove natural vegetation, fire barriers, and logging debris may well carry hot fires in moist forest types which will normally never burn. The effect of such a fire on logged warm temperate rainforest could well be catastrophic.

(3) Nutrient Cycle

(i) The Washpool rainforest is largely warm temperate.

(ii) Warm temperate rainforest occupies sites which are cooler and where the soils are less fertile.

(iii) Much of the Washpool soils are old and heavily weathered. (E.I.S. p.69).

(iv) Rainforest does not necessarily indicate high soil fertility, since the favourable moisture and temperature conditions that are primarily responsible for the vegetation bulk and complexity are likewise prime causes of advanced weathering and leaching of underlying substrate that gives rise to the soils.

(v) Removal of rainforest from the highly fertile krasnozem soils of the Big Scrub and the Dorrigo Plateau has seen a considerable decline in soil fertility.

(vi) Loss of nutrients from the relatively poorer soils of Washpool, in the removal of logs, may make it impossible for the climax warm temperate rainforest to re-establish itself, over its 200-800 year regeneration cycle.

(1) SOILS

(i) Topography and Slope

The topography of the Washpool area is variable. There is "a pattern of ridge tops and plateaus with generally gentle slopes, separated in many instances by the very steep gorges of the main streams." Those areas excluded from logging are mainly decided on the criterion of steep slopes (E.I.S. p.66).

The E.I.S. (p.23) describes areas not to be logged as those areas having slopes exceeding 30° or areas which cannot be economically roaded. They amount to an area of 19,305 ha or 45% of the Washpool area.

A look at the map that delineates the area to be logged shows that this area is not discrete but in fact is distributed throughout the Washpool area (with the exception of the Willowie Scrub). Logging will affect all the Washpool forests therefore, since no area left unlogged will be large enough to remain unaffected. Consequences of this piecemeal logging will be major visual disturbances; possible dieback due to destruction or partial destruction of the canopy in the logged areas, and reduced buffer zone in the unlogged areas; increased fire hazard due to the opening up of the rainforest areas thus increasing its susceptibility to fire.

(ii) Soil Types and Erosion

Soil type is dependent on soil parent materials which in this area are primarily controlled by the geological formation (E.I.S. p.66). There has been very little study done on the Washpool area. Geological mapping "is of relatively poor accuracy and hence the units should be interpreted broadly." (E.I.S. p.68).

Similarly, "no detailed soil mapping has been carried out in this area, the comments are of a general nature presenting trends." (E.I.S. p.69).

There are four soil types described:

(1) Red Earths - derived from granitic parent materials and are considered "relatively fertile". These support "lower carrying rainforest and wet sclerophyll vegetation."

(2) Red Podzolic Soils - Also derived from granitic parent material and also intermediate volcanics and metamorphic material,

but of relatively low fertility. There are found on mid and upper slopes and support wet sclerophyll dominated by eucalypt, or dry sclerophyll forest type depending on fertility and moisture availability.

(3) Brown Earths - derived from metamorphic rock and some intermediate rocks. Fertility may be sufficiently high to support poor rainforest but usually wet sclerophyll dominated by brush box.

(4) Yellow Podzolic Soils - Same parent material as red podzolics but generally nutritionally poor and would carry perdominently dry sclerophyll and occasionally wet sclerophyll forests.

Parent materials are predominantly instrumental in determining erodibility of soil types. Wallis and Willem (1963) ranked parent materials in the following order after extensiv[redacted] work:-

(1) Erodible parent material: granite, quartz diorite, granodiorite, Cenozoic non-marine sediments, schist.

(2) Intermediate: diorite, a variety of metamorphic rock.

(3) Non-erodible: Cenozoic marine, basalt and gabbro, pre-Cenozoic marine sediments, peridotire and serpentine and andesite.

Woodridge (1964) also found that soils derived from acid igneous rock were especially erodible.

An inspection of Map 6, despite its admitted lack of detail, show that a very large percentage of the area is of very [redacted] erodible soils (as underlined in the above classification). The E.I.S. (p.121) admits "while detailed investigations of the soil have not been made, there is evidence that some soil types are highly erodible."

Some acid red earths "appear to be relatively stable and resistant to erosion, although they have a tendency to slip and slump when wet. Previous logging on the Drake Volcanic soils does not appear to have caused much erosion, although slumping of road batters and areas adjacent to old logging and snig tracks is still occurring on a minor scale." (E.I.S. p.121).

Soils derived from Permian rocks (granite parent material) are "much more erodible. There are extensive erosion gullies in cleared land outside the forest." (E.I.S. p.121).

There is however a very large area of Permian granite-granodiorite derived soils which has a subsoil of "extremely erodible nature, forming erosion gullies after heavy rain. These readily erodible soils occur over 45% of the Washpool

area. 40% of these soils proposed for logging are on the highly erodible soil type." (E.I.S. p.121).

Moreover, the E.I.S. admits "this particular Permian material appears to be much more extensive than indicated on the geological map." (E.I.S. p.121). Therefore, it may be expected that 40% is an underestimation.

Stumpage appraisal for both Hardwood and Brushwood sawlogs for the Washpool, in Appendix 7 of the E.I.S., indicate soil erosion class is extreme.

In the E.I.S., therefore, a picture is presented of logging (and sometimes extremely heavy logging as in the case of "maximum economic utilization") on large areas of soils which are extremely vulnerable to erosion.

Other authorities show concern over soil erosion due to logging. Colley (1976) states "The basic cause of soil erosion is reduction of vegetative cover. Any reduction causes increased water run-off. Run-off is maximized when bare ground is exposed, as occurs in construction of roads and the clearing of logging tracks, loading dumps and snig tracks. Wheel tracks in the mud become gutters. Erosion accelerates rapidly with rainfall intensity and steepness of slope."

The State Pollution Control Commission in its 'Report on Rainforests' states "Logging involves the construction of roads, log dumps, snig tracks and the creation of gaps in the forest canopy by removal of trees. Bare soil usually is more susceptible to erosion than undisturbed soil. It is recognised that measures are adopted to minimize the soil erosion associated with logging but at the same time, if there is heavy rain soon after the soil has been exposed, some erosion appears likely to occur."

The likelihood of heavy rain in the Washpool is very high. "In the Washpool the problem will be accentuated by the high rainfall totals and intensities experienced." (E.I.S. p.122)

"Some of the soils on which rainforest grows are prone to bulk slumping so that this is an ever present risk. However, it is probably a small one in a well-managed forest, particularly where selective logging is undertaken." (S.P.C.C. Report, p.33).

Large areas of the Washpool, however, are to be subjected to "maximum economic utilization" logging which is very heavy in many cases leaving only 5-15% of the forest canopy.

There is very little work done on the effects of rainforest logging on soil erosion in Australia. However, Gilmour (1971) found that snig tracks in a rainforest logging operation he

investigated covered 21% of the logging area. They "remain erosion hazards for many years because topsoil has been removed and vegetation does not establish readily on the less fertile subsoil."

(iii) Erosion Mitigation

The E.I.S., in fact, outlines special measures to ensure road stability involving road location, road design and construction, road-line clearing and debris disposal, earthworks and works stabilization and site regeneration.

It states (p.121) "erosion within the logging compartments is likely to be minimal on gentle topography, even on this soil type (i.e. soils derived from Permian granite-granodiorite). Provided the standard erosion mitigation conditions are strictly enforced, erosion will be minimized in the logged area, even on steeper slopes."

However, the E.I.S. goes on to say "Commission experience in erodible soil types in other areas of New South Wales, such as Eden, has resulted in additional roading measures being undertaken to minimize roads and subsequent sediment supply to streams. In Washpool the problem will be accentuated by higher rainfall totals and intensities experienced." (p.121)

In view of the fact that a large area of the soils is very erodible and that little if any research has been done on the erosion problems in the Washpool it is open to question whether the erosion mitigation measures will be sufficient. (Extrapolating results from work and experience in other areas such as Eden is of doubtful value because of different local conditions in climate, soils, topography etc.)

The whole question of erosion hinges on the statement "provided the standard erosion mitigation conditions are strictly enforced." (including any extra measures proposed.)

The Soil Conservation Service of N.S.W. polices severe tree preservation limits on private lands with above 18° slope. (Soil Conservation Act, 1938). It has no juristriction whatever over the Forestry Commission. The Forestry Commission may log on slopes as steep as it wishes, although economic considerations and road construction in the Washpool put a limit of approximately 30° on logging operations. The Forestry Commission must police its own soil erosion mitigation measures and the fact that it is answerable to no other body leaves the situation wide open for potential abuse.

Logging operations in nearby Cangi State Forest give a clear indication that standard erosion mitigation conditions have not

necessarily be "strictly enforced" to date with steep snig tracks, undrained, borrow pits and minor roads crossing dry stream beds without any drainage. There is an apparent discrepancy between the standard erosion mitigation conditions of Appendix 1 of the E.I.S., and the sample harvesting plan for compartments 26, 27 and 28 in Appendix 3.

The harvesting conditions say:

"Snig tracks on extreme erosion class soils shall not exceed 25° and on other soils should exceed 25° only where specified."

The harvesting plan however permits snig tracks with grades over 25° subject to the approval of the supervising foreman or forester.

The erosion conditions say "Tractors shall not enter the filter strip to remove logs." The harvesting plan provides for tractors to enter the filter strip with the approval of the supervising foreman or forester.

How well are the standard erosion mitigation conditions being implemented now, and is there any guarantee that they will be more strictly enforced in the Washpool?

Under the Forestry Act, 1916, it is the responsibility of the Forestry Commission "to preserve and improve the soil resources and water catchment capabilities of crown timber lands." It is arguable that this cannot be achieved by heavily logging large areas of the rainforest on highly erodible soils for maximum economic utilization.

There is in fact no binding clause in the E.I.S. as far as the Forestry Commission is concerned. Section 6.2.4.1 - 2 describe the special measures for road constructions and other works but most provisions are to be used "as far as practicable." Hence for example:-

..."So far as practicable and aesthetically acceptable roads will be located along ridge-lines."

..."Roads will be designed to follow the natural land surface as closely as possible, consistent with the requirements for functional effectiveness and acceptable safety standards."

..."Road designs will seek to achieve, as far as practicable, a localized balance of cuts and fills."

..."Roadline clearing generally, will be limited to a band extending to about one metre beyond the limits of construction." Coombadjha Road, which is already constructed into the Washpool area, has bands greatly in excess of one metre in many places. Is this an example of how the Forestry

Commission will adhere to its own provisions? There is already a considerable amount of erosion and slipping of batters.

..."Natural regeneration from the surrounding forest will dramatically reduce the visual impact of the clearing debris during the first two years. Further development of this regeneration, plus decay of the debris, will eventually eliminate its impact within 3-5 years." It has been a point at issue that regeneration of warm temperate rainforest in particular is very slow and so any natural regeneration along road verges is likely to be af a rather depauperate and "weedy" nature.

..."The borrow pits will be located so far as practicable to minimize its visual obtrusiveness."

..."Gravel quarries, like wise, will be located as remotely as practicable from natural watercourses and, so far as possible screened from view from the road."

..."Where it is necessary to establish vegetation "preference will be given, so far as it proves practicable and economic to use indigenous species."

..."Any borrow pit which may have been used will be rehabilitated as soon as practicable after the completion of construction of the relevant road section."

..."Gravel quarries, when they are no longer required, will be rehabilitated as far as possible by shaping and revegetation."

..."So far as they can be successfully used preference will be given to local species in any rehabilitation plantings. Note that this statement does not stipulate that the species logged will be the species that will be planted.

Most of the above are laudible intentions in themselves but they are not binding and there is no provision to see that they are carried out. Each statement carries with it an 'escape clause' (i.e. such phrases as "so far as practicable") which can always be used to argue that any future omissions simply could not be carried out for practical or economic reasons. Since the Forestry Commission does not have to answer to any other body for its actions it actually has a 'carte blanche' to do as it pleases. To accept that all stipulated measures will be adhered to in practice has to be a simple act of faith - a faith that has never been particularly well deserved in the past.

In an area such as the Washpool with its very fragile soils, steep slopes, high intensity and long duration rainfall it is simply too risky to allow logging (especially heavy logging to be expected with maximum economic utilization) to proceed. This is doubly so when it is considered that very little

work has been done on the soils of the Washpool area.

(2) HYDROLOGY

(i) Water Quality

The Washpool area is of great importance as part of the catchment for the Clarence River. With a runoff : rainfall ratio of 0,46 (1972-1980) "the Washpool area is clearly an above average source of water per unit area for the Clarence River." (E.I.S. p.70)

Hydrological data is available for the Washpool Creek (Appendix 9) but no work has been carried out on the other creeks. It would be desirable to have more information available on other water courses in the Washpool if only to provide baseline data so that it will be possible in future to establish whether logging has had any effect on the hydrology and water quality of the Washpool forest creeks. There is no chemical data available at all and once again baseline information is vital if it is considered desirable to determine whether logging results in loss of nutrients into the streams, via erosion and consequent sediments being lost to the streams.

Despite the fact that downstream uses of the Clarence River water are limited, future uses are bound to increase and there has been no indication in the E.I.S. of this. Logging in the Washpool is proposed for the next 30 years.

(ii) Precipitation

Precipitation has not been recorded at all for the Washpool area and figures that are considered are for the Ewingar State Forest and for Gibraltar Range National Park. Isohyets produced on Map 7 (E.I.S. p.73) are estimates only and the E.I.S. admits that "isohyets ... may underestimate annual rainfall totals at least at the higher elevations." "Significant parts of the Washpool area, including much of the area to be logged, have annual rainfalls in excess of 1700 mm." Indeed the increase could be considerable since Gibraltar Range National Park Headquarters had an annual average of 2450 mm (1965-1979).

"The Washpool Area is subject to cyclonic activity from time to time in the summer and autumn months, at which time the area receives high intensity - long duration rainfalls and gale force winds (E.I.S. p.74). However, rainfall intensity-duration information is not available for the Washpool area and is extrapolated from data obtained at Gibraltar Range National Park. Despite the lack of real data it is still conceded that "intensities for the longer rainfall duration may occur more frequently in the Washpool area than expected in this part of N.S.W."

(iii) Impact of Logging on Water Yield

The E.I.S. on page 120 states "An increase in water yield generally accompanies logging of an area as a consequence of reduced evapotranspiration." However the "rapid forest regrowth in all forest types in the Washpool Area will ensure that any increase is short lived."

There is dispute about the fact : warm temperate rainforest (large areas of which will be logged to maximum economic utilization) does not regenerate fast and hence water yield in some logged areas may in fact remain increased for a considerable time.

The E.I.S. (p.120) goes on to say "It is distinctly possible that the young regrowth forest may transpire more water for a time than the old forest it has replaced, leading to reduced water yield in comparison to pre-logging."

Some authorities dispute this claim:

Boughton (1970) states "Changes from deep rooting trees to shallow rooting grasses (or regrowth) usually results in less utilization of water by plants and more run-off or groundwater recharge ... When native eucalypt forest is cleared to establish pine plantations, the immature pine forest uses less water and produces more run-off for some years until the trees mature... There seems to be no detectable differences between mature forests of different species other than those attributable to differences in root depth."

The State Pollution Control Commission in its 'Report on Rainforests' (p.34) also states "Although rainforest logging is expected to increase both total runoff and rate of run-off areas logged are usually relatively small in proportion to total river catchments and any effect would probably be localised."

Nevertheless, the effect could well be larger than usual in the Washpool areas because of the high rainfall : runoff ratio.

Moreover, it should be remembered that while water yield increases in logged areas and then gradually decreases as vegetation becomes re-established, other areas are being progressively logged in the same catchment area and hence an increase in water yield may be continued over a considerable length of time.

(iv) Impact of Logging on Water Quality

The E.I.S. 9p.122) admits that two factors in particular will affect water quality. One is "Soil erosion on roads and disturbed areas can increase suspended sediment concentrations

and turbidity levels in streams, leading to a degradation of aquatic habitat in the streams generally and sedimentation where the bed slope is reduced sufficiently." Secondly, "...Severe wildfires in Australia have resulted in increases in dissolved load of streams."

However, the E.I.S. disputes that either of these factors will have much effect on the Washpool Area. ("The proposed Washpool logging will have minimal impact on most of these water quality parameters") Impact will be reduced by the conditions laid out in the Standard Erosion Mitigation procedures.

On the other hand, also on p.122, the E.I.S. does admit that sediment levels into the streams could occur: "The erodible nature of the area, together with the high rainfalls experienced and the steep terrain do indicate a possible soil erosion problem particularly on roads. Increased soil erosion from this source aftre logging may lead to some degrade of water quality. The generally small grain size in the B horizon of the erodible soil types may lead to increases in both turbidity and suspended sediment levels in streams for some time during and after rain if erosion from roads becomes a continuing phenomenon. This may lead to sedimentation of the lower reaches of the larger streams outside the forest, poor domestic quality for farms drawing water from Washpool Creek, and a generally degraded aquatic environment. These adverse effects on water quality will be kept to a minimum by adequate roading practices."

It is highly likely, given the very erodible nature of many of the Washpool soils and the steep country to be roaded and logged, that sedimentation of the lower reaches of the larger streams outside the Forest will occur. It would be surprising if it did not occur. No doubt the Commission will attempt to "minimize" these "adverse effects", but the reality of the situation is that they will still occur as the E.I.S. itself forecasts.

It is also possible that erosion from roads will not be the sole source of sediment into creeks. The State Pollution Control Commission in its 'Report on Rainforests' (p.33) states: "Soil disturbance may result in an increase in suspended sediment which is too fine to be deposited in the drainage system or filter strips. This sediment could be carried downstream and adversely affect water quality."

From this the inference can be drawn that filter strips alongside streams, roads and steep slopes may not be enough to retain fine sediments under conditions of high rainfall. Even though the S.P.C.C. states that this effect could be insignificant, it is not necessarily so under the extreme soil and climatic conditions in the Washpool area.

Boughton (1970) in discussing work done on turbidity says: "Soil type and the amount and type of cover were identied as the prime factors in determining turbidity. Soils formed on granodiorite and volcanics were stated to be readily dispersible in water and more prone to release turbid water either as surface flow or seepage than soils on other rocks..."

Care would have to be taken to monitor the levels of silt and sediment in creeks after logging. Hynes (1973) states that the concentrations of inert silt or clay should not often exceed 80 mg l^{-1} in a river system, otherwise significant damage to fish and other organisms may occur. Concentrations considerably greater than this may be expected frequently in streams draining areas that have been heavily logged.

Referring to the problem of fire the E.I.S. (p.122) states despite the above admission on the possible siltation of streams from erosion:"The logging proposed for the Washpool Area will not result in any measurable change in the dissolved load of streams. Only large scale wildfire is likely to have this effect and the risk of such fires should be reduced by the improved access provided by a network of logging roads."

Although roads so give increased access into the forest for fire fighting and fire prevention work, on the other hand increased roading gives increased access to the public and so there is a greater risk of people causing accidental and deliberate fires.

The Grafton Plan of Management (p.19) states: "The most dangerous and damaging fires have resulted from incendarism, escapes from burning off on nearby private property and irresponsible burning off on leases."

The E.I.S. indicates (p.105) that the chance of wildfire, through much of the Washpool left untouched, is slight. "On the plateau the mosaic of moist hardwood types and rainforest types restricts fires except in the worst of seasons."

Rainforest in its unlogged state is rarely subject to wildfire, but once it is opened up and much of the canopy is removed it becomes increasingly susceptible. This is substantiated in the Washpool Area where logging took place in rainforest along the Coombadjha Road during the sixties, followed soon after by an intensive bushfire. Recovery has been particularly slow.

The risk of wildfire after roading and logging of the Washpool could well be higher due to clearing and logging of naturally fire-excluding moist forest types, presence of large amounts pf logging debris on the ground and improved access for

incendarists and graziers wishing to improve grazing for range grazed cattle.

Should a wildfire occur during logging, damage caused to logged warm temperate rainforest could well be catastrophic. The chances of unlogged warm temperate rainforest being damaged by wildfire are, as the E.I.S. indicates, slight.

Boughton (1970) states: "It is beyond doubt that intensive burning increases erosion and many studies suggest increased runoff as well... The amount of runoff and erosion following any burning also depends on the timing and pattern of rainfall which follows."

It is therefore very possible that there is a considerable chance of increased fire risk due to logging and roading. Wildfire together with heavy rains that are common and the erodibility of the soil would increase turbidity of surrounding creeks.

(3) NUTRIENT CYCLING

The Washpool E.I.S. does not deal with the cycling of nutrients in rainforests at all. This is a key matter which could determine the success of regeneration. Very little work has been done on nutrient cycling in rainforests on a worldwide basis. It is a very complex subject, yet what little is known seems to indicate that it is a very fragile process that is easily disturbed.

Charley and Richards (1977) in the N.S.W. National Parks and Wildlife Service publication on 'Rainforests' point out: "The luxuriance one associates with rainforests should not be taken as an indicator of high soil fertility since the favourable moisture and temperature conditions that are primarily responsible for the vegetative bulk and complexity are likewise prime causes of advanced weathering and leaching of underlying substrate that gives rise to soils."

The Washpool rainforests are primarily warm temperate rainforests which "occurs in the same geographical areas as subtropical rainforest but....occupies sites which are cooler and where the soils are less fertile." (S.P.C.C.'Report on Rainforests',p.8).

When ecosystems are developing there is a continuous repetition of the mineral uptake - utilization - decomposition cycle which gradually leads to an accumulation of nutrients and minerals in the leaf litter, upper soil surface and the biomass of the vegetation. This is particularly so where soil is poor and the biomass and forest floor subsystems become more

significant storehouses of essential elements and lighter and more conservative cycling of minerals is then to be expected.

If heavy logging of trees occurs there is a considerable amount of nutrients removed as logs. Even though the uneconomic parts of the trees (upper limbs, branches, twigs, leaves etc.) are to be left on the forest floor, according to the Forestry Commission, yet there will still be a significant removal of nutrients. Another source of nutrient loss will be any removal of topsoil by erosion. This is a great risk in the Washpool area because of the erodibility of many of the soils. Removal of the richer topsoil would leave the already heavily weathered subsoil.

Claims by some senior members of the Forestry Commission (Grafton Examiner, 30/1/1981) that parent rock is rapidly breaking down, particularly when forming the red earths, to provide renewed nutrients is not necessarily true. Much of this soil type is already old and heavily weathered (E.I.S.p.69) and as already stated <u>these soils are not particularly fertile in the first place since they support warm temperate rainforest rather than subtropical rainforest</u>.

It is generally recognised that removal of the vast tracts of rainforest on the Northern coast of N.S.W. has led to a great reduction of soil fertility. "Extensive areas of krasnozems (red earths) occur in northern N.S.W. at Lismore and Dorrigo, where summer rainfall is heavy. Both of these areas formerly carried heavy forest and are now closely settled, especially for dairying. However, yields have decreased seriously since about 1930, especially at Dorrigo, apparently <u>on account of chemical poverty</u>." (Leeper, 1961)

This decrease in fertility has occurred in areas that previously supported subtropical rainforest where soils are generally accepted to be more fertile. How much more likely is the reduction of soil fertility and available nutrients likely to be when the soil is originally less fertile, as in the case of the Washpool?

Loss of nutrients by the removal of biomass (as logs), by soil erosion and by possible leaching of soil could well create conditions where it would be more difficult to establish a rainforest of the <u>same size and composition</u> as before logging, because of a diminished nutrient supply. Regeneration may occur readily but there is no way that it can be known if final coachwood dominated warm temperate rainforest will attain its original form since coachwood has been estimated to take a minimum of 200 years to reach its mature stage.

The very fact that so little is known about nutrient

cycling in rainforests is a strong argument that more research is needed to know exactly what is happening to the rainforest ecosystem when it is logged. Certainly exploitation of the remaining rainforests in N.S.W. should be halted while we still have the opportunity to study and assess this unique and diminishing ecosystem.

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If you are concenmed about the logging proposals in the Washpool, please write to the Premier, The Hon. N. Wran, Parliament House, Sydney, N.S.W. 2000

Clarence Valley Branch of
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P.O. Box 425,
Grafton, N.S.W. Feb. 1981.

BACKGROUND ON EMPLOYMENT - WASHPOOL ISSUE

30.51

Contrary to the many assurances of sawmill management that logging of State Forests in the Grafton Forestry Sub-District was on a sustained yield basis, the Grafton Management Plan (I980), states on page 22:

> "The long term sustained yield capacity of the State Forests of the area is expected to be less than the present rate of cut...On present estimates of the net quota sawlog volume available from the completion of harvesting in the unlogged stands, a substantial reduction in the rate of quota supply will therefore be necessary during the first cutting cycle, to ensure supply until the beginning of the second cutting cycle."

On page 28, the Management Plan states:

> "Following its most recent assessment of resources the Commission advised these companies in June I980, that quotas would be reduced by 25% from the commencement of the I98I/82 quota year and subject to updated yield determinations at the time forehadowed a further reduction from I985/86."

The Daily Examiner on 5th August, I980 indicates that this further reduction will be in the order of 28%, making a total reduction in quota supplies by I986 in the order of 50%.

This means that by I986 Grafton Crown sawmillers will be cutting half the timber they now cut in the Grafton Forestry Sub-District. This reduction has nothing to do with "conservation" pressures, or whether or not the Washpool will be logged, but is an inevitable outcome of an industry overcutting its resource.

The implications for employment in the Clarence Valley are serious. The Washpool EIS presents no clear picture of the employment question but it does state on page I48:

> "If logging (of the Washpool) proceeds, about I50 jobs will still be lost over the eleven year period, with the greatest impact coming in about I990/9I when about 80 jobs are expected to be lost."

(I990/9I is the expected completion time for Big River Timbers' rainforest timber allocation. They currently employ 7I people.)

That the Forestry Commission was well aware of the inevitability of the decline of the Grafton timber resource is clearly indicated in the I978 report of the Department of Decentralisation, entitled "Regional Development and Employment Prospects", which states on pages I55 and I56 (from Forestry Commission data):

> "The (Forwood) Conference advocated National nett self sufficiency in wood products being attained around the year 20I0. The most logical way for N.S.W. to implement this strategy is by the use of fast growing conifers."

"Expected yields from tableland Pinus radiata softwood plantations are very high by standards of NSW hardwood forestry. Such plantations are large and concentrated in a few areas to take advantage of economies of scale and to encourage large industries able to efficiently utilise products of various sizes."

"At the same time as these softwood projects are increasing, the output yields from many established hardwood sources on the North Coast are expected to decline."

"The Forwood Regions of Coffs Harbour (which includes the Grafton Forestry Sub-District) and Wauchope are expected to be particularly affected. In 1972/73 sawlog production from the Coffs Harbour Forwood Region was 419052 cubic metres, while the year 2000 it is expected to decline to 175000 cubic metres."

"The State-wide trend, operative until the turn of the century suggests a relocation in forest production and employment away from traditional hardwood areas, especially the North Coast, and into Pinus radiata plantation sites, especially Tumut, Bathurst/Oberon and Walcha/Nundle."

"Sustained yield from stable industry supplies has long been a conceptual aim which has been achieved in only a few areas on the North Coast. Such sustained yield would overall be significantly lower than 1973/74 levels."

The impact of these past policies is now starting to be felt in the Clarence Valley. This Branch is concerned that the ailing sawmill industry will, in its death-throes, take with it the last of our rainforests and our big trees, greatly reducing this Regions future options for diversifying employment into a tourist industry based on this very resource. That such an option is viable and attractive to communities such as ours is well demonstrated in nearby South-East Queensland, which retained Lamington National Park unlogged, in the face of overwhelming pressures to both log the plateau, and to clear it for settlement. Lamington National Park today is a significant contributor to the Regional economy which it generates.

There is no doubt that Lamington National Park is worth far more to the community of South-East Queensland left unlogged and developed for tourism than had it been logged many years ago. This Branch believes that an unlogged Washpool will be worth far more to the Clarence Valley, developed in a similar manner to Lamington National Park, as a tourist-based generator of employment, rather than logged now, in the short term, in an attempt to stave off an inevitable decline of the sawmilling industry.

Information Sheet produced by the Clarence Valley Branch of the National Parks Association of NSW.

AN ANALYSIS OF PROPOSED LOGGING OF THE WASHPOOL RAINFORESTS

Rainforest is a dense community of moisture loving trees, mainly of broad-leaved evergreen species. Generally numerous species of trees are present, with the tree crowns tending to be arranged in several layers. The community also contains life-forms such as vines, epiphytes, palms, buttressed stems and stranglers. (Ref. Forestry Commission E.I.S.)

Subtropical Rainforests can be regarded as a latitudinal variant of true tropical rainforest with a floristic composition of Indo-Malayan affinities. This type is confined to basaltic or rich alluvial soils under high rainfall conditions, north of the Hastings River. Three storeys of trees are present. Many species are strongly buttressed and vines and epiphytes are common. (Ref. Forestry Commission Research Note No 9 - Silvicultural Practices in Rainforests of Northern N.S.W. - G.N. Baur).

Warm Temperate Rainforest is characterised by two distinct tree storeys, the upper one forming a continuous canppy. Buttressing is rare. North of the Hastings, warm temperate rainforest is confined to relatively poor soils under high rainfall conditions (Research Note No. 9).

Washpool Rainforest - Although the bulk of the Washpool rainforest is warm temperate rainforest, restricted fragments of true subtropical rainforest are found along streams and sheltered south to east facing slopes. A form of rainforest intermediate between warm temperate and subtropical rainforest also occurs fairly extensively in the Washpool. This is the Coachwood - Yellow Carabeen association, which occurs where growing conditions are better than those required for the typical Coachwood - Crabapple - Corkwood association of the warm temperate rainforest, but which are inadequate for subtropical rainforest. Hence the presence of a few subtropical species such as Yellow Carabeen and Bangalow Palm, in a predominantly warm temperate rainforest. This rainforest association is described by Floyd as "predominantly warm temperate in affinity", and is placed by him in the warm temperate rainforest alliance.

Forestry Commission Typing (Refer pages 27, 28 of the E.I.S.) Forestry Commission typing of the Washpool is based on a forest-type map prepared in 1962. Although the sclerophyll forest types are accurately shown, the rainforest classification is not necessarily ecologically reliable.

The 1962 rainforest typing was based on the predominance of Coachwood and other commercial timber species. Type "A" containing more than 30% Basal Area of Coachwood, is a high quality warm temperate Coachwood rainforest, and is classified correctly in the E.I.S. as type 11, "warm temperate rainforest".

Type "C" included all rainforest with a Basal Area of less than 30% Coachwood, and has been classified in the E.I.S. as

type 2/3 "subtropical rainforest".

In fact this classification includes considerable areas of warm temperate rainforest where species other than Coachwood assume dominance, the intermediate Coachwood - Yellow Carabeen association which links both the subtropical and warm temperate alliances, but which is predominantly warm temperate in affinity, and fragments of true subtropical rainforest. Hence the statement by the Forestry Commission on page 87 of the E.I.S. "... much of the area types as subtropical rainforest is in fact predominantly warm temperate rainforest."

The ecological classification of rainforest in the Washpool is complex and has been complicated by the direct conversion by the Forestry Commission of a rainforest classification based on logging needs into a pseudo-ecological classification. The E.I.S. thus gives the impression that much of the rainforest resource of the Washpool is sub tropical rainforest, when it is in fact "predominantly warm temperate in affinity."

1. Casino West Management Area

Subtropical rainforest will be logged selectively and warm temperate rainforest will be logged "very selectively" at an intensity low enough to allow the continued maintenance of the rainforest structure, to provide timber for specialty use.

2. Grafton Management Area

1546 hectares of rainforest will be logged to provide 67,862 m^3 of timber to Big River Timbers, the remainder of a 187,000 m^3 nett "total terminating allocation" granted by the Forestry Commission to Big River Timbers in 1960.

914 hectares of rainforest available for logging will not be logged at this time.

1344 hectares of rainforest are classified as inaccessible and 3445 hectares are reserved. (3415 of these in the proposed Willowie Scrub Flora Reserve).

Once the 1546 hectares of rainforest has been logged to meet the Big River Timbers Commitment, the remaining 914 hectares will be available for selective logging for specialty purposes. There is no guarantee that such logging would not be large scale or reasonably intensive, particularly should the Forestry Commission decide to issue a "Total Terminating Allocation" of rainforest timbers to say, an export furniture factory, for specialty purposes. In other words, there is a commitment by the Forestry Commission to continue logging rainforests indefinitely. On cessation of the Big River Timbers operation, rainforest logging of the Washpool will not cease.

Effect of Logging on Rainforest

The Forestry Commission is reticent in its E.I.S. on the intensity of the proposed Big River Timbers logging operation, and it is difficult to obtain a clear impression of the logging intensity or the condition of the rainforest after logging.

This reticence is justified - the logging will be heavy and its effect on the vulnerable warm temperate rainforest will be catastrophic.

Several sections of the E.I.S. hint at the logging intensity. Pages 8, 12, 13 describe how the logging operation will obtain its timber "from the smallest area practicable, so that large areas of rainforest will remain in an unlogged condition when general purpose rainforest logging operations cease."

(In case it is assumed this means rainforest logging will stop on cessation of Big River Timbers operations, remember that other sections of the E.I.S. make it clear that all unlogged rainforest areas available for logging and not reserved will be available for "selective logging for specialty purposes.")

The rest of the E.I.S. is similarly discreet. Relevant quotes are:

p.129: "The logging operation which will have the most visual impact is that proposed for the rainforest areas. Directly after substantial disturbance it is also the forest type which will depart the most from its visual character."

p. 131: "It may take many years to restore the order of structural diversity - especially so for a forest of slower growing species like Coachwood, in which case also the impact on forest structure will be most intense."

p. 136: "The rainforest areas however may take many years to reach a comparable stage - possibly up to 100 years for larger harvesting areas."

p. 136: "This return to a like structure will take a long time and the heavier the logging the longer the time of recovery."

p. 137 (Subtropical rainforest) Experience elsewhere i.e. in Wiangaree State Forests over 20 years has shown that rainforests of subtropical affinity do not commonly exhibit a high degree of post-logging dieback and that regeneration is ample.... The recovery of forests of this type following logging can thus be expected to proceed slowly, but, by and large without difficulty."

p.138: (Warm Temperate Rainforest). Because there is a high proportion of merchantable trees, logging can be expected to be heavy, leaving only a sparse remnant overstorey of non-commercial species. Post logging dieback of the remnant as is typical of this type can be expected to occur."

p. 139: "Of the three rainforest types to be logged in Washpool State Forest the Coachwood type will be the most vulnerable to logging damage. This is due to the heavier logging this type will sustain and the susceptibility of this type to post logging dieback."

p.139: "The logging impact on the subtropical rainforest type will be low."

As stated previously the Forestry Commission has translated the original typing of 1962, Type "C", which included all commercial rainforest with a basal area of less than 30% Coachwood into "subtropical rainforest" Type 2/3. However only part of this typing is in fact true subtropical rainforest, the bulk of it being either warm temperate rainforest with a species other than Coachwood dominant, or the intermediate Coachwood - Yellow Carabeen association which links the subtropical and warm temperate alliances but which is predominantly warm temperate in affinity.

The E.I.S. acknowledges this on page 87 where it states "much of the area typed as subtropical rainforest is in fact predominantly warm temperate rainforest."

Knowing that this type is predominantly warm temperate rainforest, and can be expected to be severely damaged by logging, how can the Forestry Commission on pages 137 and 138 of the E.I.S. blandly equate its logging with that of true subtropical rainforest in the Wiangaree State Forest, and state that "experience elsewhere, e.g. Wiangaree S.F. over 20 years, has shown that rainforests of subtropical affinity do not commonly exhibit a high degree of post-logging dieback. However this rainforest is described by Floyd as predominantly warm temperate in affinity, not subtropical. It can be expected to react to logging as does warm temperate rainforest. (Except for the small patches of true subtropical rainforest).

The E.I.S. states on p. 139 that the logging impact on the subtropical rainforest will be low and no particular impediment is seen to its recovery - this is not correct. The logging impact on much of this "subtropical rainforest" can be expected to be severe and post-logging dieback can be expected to impede its recovery.

It is also misleading to equate the selective logging of subtropical rainforest in the Casino Forestry District with the virtual clear-felling of the Washpool warm temperate rainforest. Baur writes in Research Note No. 9 (Forestry Commission of N.S.W.) "Dieback occurs in subtropical rainforest at altitudes above 1000 feet and may attain serious proportions in heavily logged stands above 2500 feet." In its baciground paper on Rainforest

Management in the Macpherson Ranges, the Forestry Commission describes the selective logging (which retains a 50% canopy cover) as leaving the rainforest in a healthy and viable condition. "The retention of so much canopy prevents dieback that is often experienced in rainforests after heavy logging.... The stand is left in such a condition that it can readily be managed for the production of rainforest timbers on into the future."

These statements are not true of the proposed heavy logging of the Washpool rainforests.

The only description in the E.I.S. of the impact of the proposed logging on the warm temperate rainforest is that on p.138: "Because of the high proportion of merchantable trees, logging can be expected to be heavy, leaving only a sparse remnant overstorey of non-commercial trees. Post logging dieback of this remnant, as is typical of this type, can be expected to occur."

The E.I.S. gives little information on either the impact of the logging on the rainforest or any alternative logging options. Alternative selective logging options are dismissed with the bald statement on page 13 "In this location it is not a valid alternative to selectively log the rainforest under the 50%canopy retention system generally used in the Casino District". And yet it is possible to selectively log warm temperate rainforest. A hint is given of this possibility on page 20 of the E.I.S. when rainforest logging on cessation of Big River Timber's general purpose logging is described as "at an intensity low enough to maintain rainforest structure."

The Forestry Commission rejects (p. 159) the option of a lighter logging over a larger area of rainforest to meet its Big River Timbers commitment because it prefers to see the smallest area of rainforest logged as is possible for "general purpose logging". It is however quite happy for the rainforest which remains unlogged when Big River Timbers finish, to be selectively logged for "specialty timbers".

Since the E.I.S. gives little information on the impact of logging on warm temperate rainforest, let us turn to Forestry Commission publications for advice.

Research Note No. 9 : Silvicultural Practices in Rainforests of Northern N.S.W. G.N. Baur.

*"There has been a general tendency to log these stands very heavily, sometimes with the aim of subsequent conversion to plantation and at other times with no apparent thought for the future".

*"Coachwood and its associates have a generally slow growth rate..... Growth analysis suggests a period of about

220 years for the average Coachwood to grow from 2 to 20 inches."

*"After logging operations many of the remaining trees, which in the virgin state appeared healthy and vigorous, develop crown dieback. This is apparently an exposure effect caused by altering the micro-climate. With very heavy logging the dieback becomes severe and may cause appreciable tree mortality, but at more moderate intensities of logging the trees will usually firm up their crowns from the centre and ultimately remake a closed canopy. At the Dorrigo centre dieback tends to be serious when more than about 40% of the basal area is removed by logging."

*"Some type of selection silviculture system seems necessary. To avoid severe dieback it is necessary that no more than 40% of the basal area be removed during the felling cycle."

*"The regrowth requires costly treatment and even with this cannot be expected to produce merchantable timber within a century and probably for much longer."

In his book "The Ecological Basis of Rainforest Management" Baur makes the following points:

*"All but the lightest degrees of logging however lead to crown dieback developing in the remaining stems, presumably as an exposure reaction in these more climatically extreme rainforest communities. The dieback manifests itself as a gradual loss of crown starting from the tips of the twigs; its intensity increases with the degree of canopy opening, and in areas of heavy logging it may lead to the death of most of the remaining trees, though in lightly logged areas the affected trees usually recover."

*"It has been found that the basal area of a virgin Coachwood stand can be reduced by about 40% without dieback becoming critical."

*"Coachwood is so vulnerable to exposure that the only possible form of silviculture, if immature stems are not to be wasted, is a selective system."

*"Because forest services have to operate on a budget there is a tendency for them to regard their revenue-making operations from the sale of timber and other products as their prime responsibility. However in the long range view, the value of the indirect benefits of rainforest may well far outweigh the immediate gain obtained from exploitation. Some of the indirect benefits can well be obtained from forest managed also for major production but in certain areas the indirect benefits - flora, fauna, water and recreation - will need more restrictive management practices if they are to be attained, and it is of the utmost importance that forest services should be kept ever

mindful of their responsibilities in this regard."

*"In Chapter 7 the major uses of rainforest were discussed and it was concluded that in most cases the indirect benefits of rainforest, for the preservation of flora and fauna, for watershed protection and possibly for recreation must take precedence over the management of areas purely for timber production. The policy should therefore give first consideration to reserving and managing adequate areas for these purposes, before considering those areas where the primary aim will be to supply forest products."

*"Rainforests can be managed naturally to produce timber at a profit, though the production is relatively inefficient.... Such managed stands will be impoverished shadows of the virgin primeval stands. For the reasons discussed earlier in this report it therefore becomes imperative that adequate areas of virgin rainforest in all parts of the world should be reserved to provide the most important indirect benefits of preserving the type and its constituent flora and fauna and of providing recreation areas for increasingly urbanised populations."

*"Rainforest is of value to man through both its direct and indirect benefits. Although most attention has been paid to the direct benefit of the production of timber, in the long range view the indirect benefits are probably likely to be of greater significance."

Institute of Foresters of Australia - N.S.W. Division.

Draft Policy on Management of Rainforest in N.S.W.

This draft policy, of the N.S.W. Division of the corporate body of professional foresters in Australia, is relevant in looking at the Forestry Commission proposals for logging the Washpool rainforests. Relevant statements are:

1. "The Institute considers that wherever practicable remaining rainforest in N.S.W. should be managed so as to maintain or restore its intrinsic rainforest structure." (The Forestry Commission logging proposal will destroy the intrinsic structure of the Washpool rainforest.)

2. "The time spans involved in recovery (for warm temperate rainforest) after heavy logging will be long in relation to the length of human generations or lifetimes. For example, the shortest estimate is 200 years for full recovery of warm temperate rainforest from heavy logging. Such time spans are difficult to comprehend by the population at large. They also mean that the recovering rainforest is vulnerable for long periods to destructive agencies such as wildfire or domination by a previously unknown

weed. Available evidence also indicates that time of recovery after logging is proportional to logging intensity. The lighter the logging in any stand, the quicker the recovery to "normal" stocking and structure.

3. "Silvicultural methods employed in rainforest management should aim primarily at the retention of rainforest structure."

4. "The Institute is aware that the immediate reduction of rainforest logging to sustained yield levels will mean the virtual elimination of the present industry based on rainforest... The financial costs of implementing these principles will be considerable, but the Institute considers that the community at large should willingly meet these costs, to be provided out of general taxation revenue..... Nevertheless, it is clear that major disruption is inevitable. To continue on the present course will only provide a temporary respite and may well exacerbate the ultimate problem. It is better to grasp the nettle now. The other side of the coin is that later generations will be disadvantaged if the present generation continues to condone mismanagement of the remaining rainforest resource."

5. "The Institute considers that present management of N.S.W. rainforests does not conform with sound economic principles. Some of the industry costs are externalised, but not readily quantifiable. For example, the reduction of ultimate timber yield and aesthetic attraction inherent in present management are real costs which are not charged to the industry."

6. "It is also fairly clear that royalty levels in State Forests do not cover current costs of supervision and management."

7. "The Institute also points out that the conservation values of a rainforest logged in future under a conservative management regime will be much improved compared with the present situation."

Floyd's Reports.

Page 89 of the E.I.S. says "The report of Mr. A. Floyd is the only report on the area and he restricted his investigations to the proposed Willowie Scrub Flora Reserve." In fact Floyd wrote a second report, on the remainder of the southern section of Washpool State Forest, as well as Gibraltar Range National Park. This report was prepared in August 1980 and should have been utilised in the E.I.S. preparation.

Climate

The E.I.S. makes it clear that the Washpool is subject to extreme temperatures, with a mean annual extreme minimum temperature in the order of -5°C and an absolute minimum in the

order of -11°C. The E.I.S. also records significant snowfalls as lying on the ground for several days, in the adjoining Gibraltar Range N.P. in 1966, 1968, 1970, 1974, 1976 and 1978, and indicates that the Washpool can expect similar falls.

The Washpool warm temperate rainforests have evolved in situ over many thousands of years, and have, through their closed canopy, a natural resistance to frosts and snow. Damage associated with heavy logging can be expected to render the rainforest vulnerable to damage from either snow or frost. Maximum damage can be anticipated in times of climatic extreme. Recovery of the rainforest from heavy logging is 200+ years, so it will be vulnerable to damage for a long period of time.

Baur refers to this problem in "The Ecological Basis of Rainforest Management", where he says:

"The minimum temperatures can also produce profound effects on the course of secondary succession in rainforest outside the tropics by their influence on the microclimate, and this is of considerable significance in the management of rainforest areas in such sites. The development of frost hollows where clearing for plantations is carried out is an example that has been experienced in subtropical and warm temperate rainforest areas of N.S.W."

Indigenous Forest Policy

The Forestry Commission proposal for "heavy" logging of the Washpool rainforest even contravenes its own indigenous Forest policy, which says such things as:

*"Where a continuing indigenous forest is envisaged the long term viability of natural ecosystems should be safe-guarded by appropriate constraints on all uses." (The Grafton Management Plan describes the rainforest after logging as "A variable generally low percentage of the upper canppy (5-15%) remains after logging." This is virtual clearfelling of a beautiful, scarce and delicate resource. How does such treatment equate with "safeguarding the long term viability of the rainforest ecosystem"?)

*"The short term impact of wood production activities on other roles of the forest should be ameliorated by appropriate constraints and remedial treatment." (What constraints ameliorate the impact of wood production activities on the Washpool rainforests?)

*"Silvicultural systems and treatment should aim at maintaining a forest comprising a diversity of natural species and age classes, with a future productive capacity as well as a potential in other roles." (The proposed Washpool rainforest logging negates a future productive capacity and potential in

other roles as well as eliminates the natural diversity of age classes and species.)

*"Only where there is a clear practical and economic case should intense timber production in native forests be allowed to seriously pre-empt other forest use options. In most other circumstances the many uses of the indigenous forests should be interwoven to favour all, retaining the forest in as natural a condition as possible." (These fine words are just not matched with the reality of the Forestry Commission's past and present destruction of the Cangi rainforest and its proposed destruction of much of the Washpool rainforest.)

SUMMARY

1. The E.I.S. says little on the intensity of the proposed Big Rivers Timbers rainforest logging operation and its impact on the rainforest. This is a major deficiency of the E.I.S.

2. The E.I.S. classifies much of the Washpool rainforest as subtropical rainforest, and then says it will withstand heavy logging as does subtropical rainforest in the Border Ranges. This is incorrect because, as stated at one stage in the E.I.S., "Much of the area types as subtropical rainforest is in fact predominantly warm temperate rainforest." The deliberate distortion of classifying warm temperate rainforest, or rainforest predominantly warm temperate in affinity as subtropical is quite outrageous.

3. Logging of the Washpool rainforest will continue after the cessation of the Big River Timbers operation in 1991, as a selective logging for specialty purposes. Such logging could well be extensive and quite intensive, especially should the Forestry Commission decide to issue another 30 year "Total Terminating Allocation" to say, a "specialty" export furniture factory - Think of the employment such a project would create!

4. The rainforest logging will leave an upper canopy of 5-15%, and is described blandly in the E.I.S. as "heavy". Such a logging intensity rivals that of many "clearfelling" operations.

5. The time span involved in recovery of the Washpool rainforest from this intensity of logging will be long in relation to the length of human generations or lifetimes. The shortest estimate for full recovery is 200 years, and this is decidedly optimistic. Other estimates go as high as 800 years.

6. The recovering rainforest will be vulnerable for many years to destruction or severe damage during extreme climatic events which are known to occur regularly in the area, such as snow, extreme cold and frosts.

7. The E.I.S. has ignored Floyd's second report on the Washpool rainforest, written in August 1980.

8. The logged rainforest will be an "impoverished shadow of the virgin primeval stands."

9. The N.S.W. Division of the Institute of Foresters of Australia states in its draft policy on the management of rainforest in N.S.W., that silvicultural methods employed in rainforest management should aim primarily at the retention of rainforest structure.

10. The virtual clearfelling of the Washpool rainforest is in clear contravention of the Forestry Commission's own Indigenous Forest Policy which aims to safe-guard the long term viability of natural ecosystems.

Clarence Valley Branch

National Parks Association

of N.S.W.

The Dome Mountain area encompasses one of the most environmentally significant areas of unlogged old-growth secondary rainforest (moist hardwood) remaining on the far north coast of N.S.W. The Forestry Commission considers that the 'heavy selective' logging of the area will not significantly affect the environment.

The Forestry Commission has consistently refused to undertake any faunal surveys in the area or prepare an Environmental Impact Statement. As the proposed roading, logging and burning of the forests in the Dome Mountain Area will undoubtably have a significant impact on the environment, the Focal Peak Region Flora and Fauna Society now has no option but to pursue legal avenues.

Due to the impending commencement of roading at any moment and the planned extraction of 6,160 m^3 gross of timber from the area this calendar year, immediate action is required.

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June 1988.

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THE DOME MOUNTAIN AREA

prepared by D. Pugh.

The Dome Mountain area encompasses some 2,870 ha of forested public lands comprising the headwaters of Capeen and Duck Creeks on the south-western slopes of the Richmond Range in the Focal Peak region of far north-east N.S.W. Dome Mountain caps a series of basalt plateaus and shelves which rim the heads of the valleys. The rich soils, high rainfall, southerly aspect and inaccessability have resulted in extensive stands of well-developed old-growth forests within which diverse fauna abound.

The Dome Mountain area is particularly significant because:

- it supports over 1,000 ha. of unlogged old-growth eucalypt and Brush Box stands.
- it represents the majority of well-developed unlogged 'hardwoods' in the Urbenville Management Area, and by far the largest single stand remaining on the Richmond Range. Most of the 'hardwood' stands in the National Parks and State Forests of the adjacent Mt. Warning region have been logged and there are similarly no unlogged stands as extensive.
- it is the most important refuge for fauna dependent upon mature eucalypts and tree-hollows remaining in the region and may be the only one large enough to maintain genetic viability of some species.
- it supports one of the largest and most westerly populations of the threatened Marbled Frogmouth remaining in N.S.W.
- a total of 10 species of animals listed in Schedule 12 of the National Parks and Wildlife Act as endangered fauna have been observed in the area. Unusually large populations of Alberts Lyrebirds, Southern Angle Headed Dragons and Koalas have been noted.
- the Double-eyed Fig parrot, listed as in imminent danger of extinction, was observed within the same forest in the adjacent valley in 1984 and can be expected to occur in the Dome Mountain area. A large number of other endangered animals are also expected to inhabit the area.
- many species of plants and animals reach or approach their western limits of distribution within the area.
- the aesthetic appeal of unlogged old-growth forest, the well-developed and extensive palm understorey, the spectacular spur crowned by Dome Mountain, unique perched swamps, and swift creeks in deep sandstone ravines give the area outstanding scenic attributes.

Dome Mountain, at 916 meters altitude, is the loftiest peak on the Richmond Range and represents the junction with the Capeen Range. Dome Mountain is central to a narrow spur jutting out to the west from the extensive Toonumbar plateau, a basalt remnant from the ancient Focal Peak volcano. To the south the spur plummets 200 m. over cliffs and steep rocky slopes to a broad basalt shelf which extends into a small plateau to the west.

Clothing the basalt is complex sub-tropical rainforest, dominated by White Booyong, Black Booyong, Yellow Carrabeen, Strangler Fig and a large variety of co-dominants, with Hoop Pines on more exposed steep slopes and Giant Water Gum on poorly drained sites. Bangalow Palm and Walking-stick Palm dominate the understorey with occasional Cabbage-tree Palms. Lianes and epiphytes are common.

Near the base of the spur are two small swamps, surrounded by rainforest and patches of massive Flooded Gum, they are appealing and unique features of the area.

Capeen Creek, Duck Creek and their many tributaries have eaten deep valleys and narrow ravines into the sandstone underlying the basalt, as they rapidly drop to 400m. The valleys then widen, with extensive terraces, as the creeks level out before leaving the area at 250m.

Below the mature rainforest, extensive stands of secondary rainforest (also termed 'moist hardwood') occur on the edges of the basalt and over most of the lower sandstone country which is subject to occasional wildfire. On the more favourable sites, principally fringing the mature rainforest and in the vicinity of creeks and gullies, Brush Box and Flooded Gum dominate extensive stands. Various other rainforest species are co-dominants, varying from one or a few species on poorer sites to a diverse array on better sites where rainforest succession is well advanced. The understorey is dominated by Bangalow Palms on the wetter sites, which form almost pure stands, overtopped by occasional Blue Quandongs along many creeksides.

On the steeper slopes and drier ridges subject to greater moisture stress and higher fire frequency, Tallowwood and Sydney Blue Gum emerge above a diverse rainforest understorey.

On the driest ridges, particularly at lower altitudes, more open forests of Red Mahogany, White Mahogany and Pink Bloodwood, interspersed with numerous Forest Oaks, dominate a generally sparse rainforest understorey. At the drier extremes Grey Gum and Ironbark begin to take over.

The forests of the Dome Mountain area can be broadly separated into: White and Black Booyong associations 510 ha. (18%), Flooded Gum association 530 ha. (18%), Brush Box association 820 ha.(29%), Sydney Blue Gum-Tallowwood association 710 ha. (25%), and Red and White Mahogany association 300 ha. (10%). An incomplete plant species list for the area is provided in Appendix 1. Similarly, an incomplete faunal list for the area is given in Appendix 2.

CURRENT LAND USE AND MANAGEMENT

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For this report the Dome Mountain Area is considered to encompass compartments 201 to 208 (inclusive) Richmond Range State Forest and compartments 135 and 136 Yabbra State Forest. These are part of the Forestry Commission's Urbenville Management Area. Compartments 201 to 207 are known as the Richmond Range Allocated Area (R.R.A.A.) while compartments 208, 135 and 136 are part of their General Area.

The first extensive logging in the area occurred 1955-7; since then parts of the periphery of the area were logged at various times up until 1983 when the Commission began its present strategy of systematically logging every available hectare of secondary rainforest ('hardwoods') in the area. Over 1,000 hectares of old growth secondary rainforest remains.

Pugh (1982) proposed the creation of the Capeen and Dome Mountain Flora Reserves in the area in 1982, apparently the National Parks and Wildlife Service were independently considering a Dome Mountain reserve at the same time. In May 1986 the National Parks Association of N.S.W. proposed the creation of a Toonumbar National Park which incorporated the Dome Mountain area.

On the 1st of January 1987 the District Forester was informed of the presence in the area of Albert's Lyrebirds, Wompoo Pigeons and the likely presence of Marbled Frogmouths - all endangered fauna. In February and April 1988 the acting District Forester said that the Commission had not undertaken any faunal assessments in the area, nor did they intend to do so. The only faunal records he was aware of for the area were those bird observations made by Glen Holmes - which also included a number of endangered species.

The Dome Mountain Flora Reserve was gazetted on the 28th August 1987 as 340 ha, it incorporates most of the rainforest on the steep and rugged spur around Dome Mountain. It also preserves some 10ha. of the area's extensive Brush Box and Flooded Gum stands.

To date, Dome Road has been reconstructed into a major access road and extended through previously unlogged mature rainforest to link up with an old logging road up the ridge between the two valleys. Most of the accessible higher altitude (above the cliffs) secondary rainforests of the Capeen valley have been logged or re-logged. The Commission has surveyed a road into the lower Capeen valley (Bruce, Northern Star 20.5.1988) and intend to commence roading and logging operations in compartment 201 as soon as weather permits. They will then heavily log every accessible hectare of old-growth forest, and re-log other areas, within the valley over the next 2-3 years.

The regional forester Mr. Bruce (ibid.) claims that the Commission has recently completed a preliminary flora survey and some fauna trapping in compt.201 and would undertake progressive informal surveys of fauna and flora as access roads were constructed. The quota for this year is 6,160 m^3 gross.

Parts of the western side and south-eastern corner of the Duck Creek valley have been logged in the past, recent logging has concentrated on the catchments of two tributaries on the western side of the valley (compt. 207). Once the Commission has finished off the Capeen valley they intend to construct a major access road down a steep cliff and onto a previously inaccessible and extensive creek flat on the western banks of Duck Creek (compt.207) and log the impressive old Brush Box and Flooded Gum at the lowest altitudes in the area.

Then the Commission intends to construct a major access road and

numerous snig tracks through the mature rainforest on the shelf below Dome Mountain to gain access to the remaining old-growth forests on the western side of Duck Creek. Then another major access road will be constructed across Duck Creek or up the Richmond Range and the old-growth forests on the eastern side of the valley heavily logged.

At the proposed cutting rate it seems that there will be little old-growth secondary rainforest left in the Dome Mountain area in 10 years time, aside from the 10 ha. currently reserved, narrow filter strips along creeks and whatever areas prove to be inaccessible.

Details of the Urbenville Management Area (Based on Management Plan for the Urbenville Management Area 1986 and other Commission data)

The State Forests of the Urbenville Management Area encompass 68,491 ha. of which 18,818 ha. (27%) is classified as 'rainforest', 31,050ha. (45%) as 'moist hardwood' and 15,386 ha. (22%) as 'dry hardwood'. For management purposes, the area is divided into three working circles;

(1) Preserved Areas.

This encompasses some 5,800 ha. of Flora Reserves, and cosmetic roadside and ridge strips. The area is comprised of some 4,520 ha. of 'rainforest' and 1,280 ha. of 'hardwoods'. Flora Reserves total 5,030 ha. The area of mature 'hardwoods' remaining in a natural state is in the order of 300 ha.

(2) General Area.

The Commission estimates that this encompasses some 44,083 ha. of 'hardwoods' and 13,728 ha. of 'rainforest'. The condition of the hardwood stands was assessed in 1985 as: 213 ha. remaining in a natural state, 7,646 ha. logged but retaining a low to moderate stand density of old growth trees, 29,667 ha. logged with trees mostly less than 80cm d.b.h.o.b., 5,557 ha. logged and consisting of pole sized, and smaller, regrowth, and 1,000 ha. as steep and of low site quality. It appears that the area of hardwoods may be overstated by some 500 hectares.

The total available volume of timber at 1985 in 'hardwood' areas was estimated at 1,405,935 cubic meters gross. This is broken down into: rainforest species 26,391 (2%), Flooded Gum 50,051 (4%), Brush Box 548,901 (39%), Dunn's White Gum 70,384 (5%), Tallowwood 79,600 (6%), Sydney Blue Gum 186,582 (13%), Red Mahogany 11,072 (1%), White Mahogany 62,331 (4%), Bloodwood 7971 (1%) and other timbers (25%). The available volume for the present cutting cycle (1985-2010) was estimated to be able to supply a yearly gross allocation of: 30,000 m^3 of hardwood quota sawlogs; 6,700 m^3 small (ex-quota) hardwood sawlogs; 21,600 m^3 other ex-quota hardwood sawlogs; 3,000 m^3 poles, piles and girders, 1,000 m^3 rainforest salvage logs. The hardwood quota sawlogs are at present fully allocated, the small hardwood sawlogs "have been harvested" (Forestry Commission 1986), rainforest salvage logs are fully utilized while the other two categories have only a small demand.

Rainforest areas are reserved for speciality purpose logging, for which there is no specific commitment at present. Current operations are limited to the taking of dead or dying trees, and the salvage of trees killed or damaged in roading operations.

(3) The Richmond Range Allocated Area.

Comprised of compartments 201-7 Richmond Range State Forest the R.R.A.A. encompasses some 190 ha. of 'rainforest' and 1,750 ha. of 'hardwoods'. A further 340 ha., mostly rainforest, was gazetted as the Dome Mountain Flora Reserve in 1987.

According to the Commission's available logging history maps for the area some 760 ha. of the central area's 'hardwoods' were logged between 1955 and 1957, primarily for durable 'hardwoods'. It appears that Brush Box and Flooded Gum weren't heavily utilized with logging being most severe in the Red and White Mahogany stands on ridges of easy access. As a rough estimate some 500 ha. may have been logged at that time.

Logging also extended in 78 ha. of 'rainforest', right up on to the spur near Dome Mountain. Logging apparently concentrated on a limited number of prized species.

Between 1962 and 1963 a 72 ha. strip of 'hardwoods' along the eastern boundary of compartment 205 was logged.

While not shown on maps, an additional area of 'hardwoods' in compartment 201, low down on Capeen Creek, has been heavily logged. A rough estimate of extent is 50 ha. Limited 'hardwood' logging also took place at the start of Dome Road.

Dome Road was extended into the rainforest, and past one swamp, in the 1982-83 financial year. The road passed through some of the rainforest logged in 1955-7 but it and numerous snig tracks were also pushed through previously undisturbed stands of mature rainforest.

Logging of 'hardwoods' and 'rainforest salvage logs' began in the 1983-4 financial year but according to the acting District Forester, G.Neville (9.3.1988 pers.comm.) less than 10,000 m^3 have probably been removed to date. A large part of the area logged 1955-7 has been relogged and also some previously unlogged stands.' As a rough estimate this may have involved an additional 50 or so hectares.

It appears that in the order of 1,080 ha. (±100 ha.) of the 'hardwood' stands in the R.R.A.A. remain in a natural condition. Of the 520 ha. of 'rainforest' in the R.R.A.A. and Dome Mountain Flora Reserve some 420 ha. could be considered to be unlogged or not yet converted into a road, 130 or so hectares of this would be within the R.R.A.A. The total area of 'hardwoods' and 'rainforest' (by Commission definition) in the R.R.A.A. and Dome Mountain Flora reserve is in the order of 2,280 ha., of this 1500 ±110 ha.(66%) is unlogged old growth forest.

The Commission estimates a yield of 47 m^3 gross per hectare. They also estimated that there were 2,810 ha. of 'malure and overmature hardwoods' in the R.R.A.A. as at 1985, an apparent overestimation of the area by 1,060 ha. By the simple procedure of multiplying the anticipated yield of 47 m^3 by the inflated total area of hardwoods the Commission estimated a total available yield of 132,000 m^3 gross, which they anticipate will sustain a quota of 5,600 m^3 gross per annum for over 23 years.

Using the actual area of 'hardwoods' of 1,750 ha., with an allowance made for a conservative 20% of the area being unloggable, retained as filter strips, or with very low volumes of timber resultant from previous logging, the total area of loggable hardwoods may only be in the order of 1,400 ha. By multiplying this figure by 47 m^3 gross a total available yield of 65,800 m^3 gross is arrived at, which would sustain an annual quota of 5,600 m^3 gross for less than 12 years.

The Commission's 1977 Urbenville Management Plan estimated on average yield of 15 m^3 gross per hectare from unlogged hardwood forests. The proposed 47 m^3 gross per hectare in the R.R.A.A. is overcutting the forest's natural increment.

It appears that only some 1,500 hectares of the 46,436 ha. of

hardwoods in the Urbenville Management Area remain in an undisturbed natural state. Outside of the Dome Mountain Area the 500 hectares consist of relatively small isolated stands. The remaining 1,000 hectares of old growth 'hardwood' forest in the Dome Mountain area is not only the largest remnant remaining in the Urbenville Management Area but appears to be far larger than any remnants left on the Richmond Range or in the National Parks of the Mt. Warning region.

FAUNAL VALUES OF THE DOME MOUNTAIN AREA

The northern section of the Richmond Range, dominated by Dome Mountain, is an area of special faunal significance. The high annual rainfall and extensive wet forests distributed mainly between 400 and 800 m, together with the area's relatively undisturbed condition make it a refuge for subtropical rainforest fauna of major importance in N.S.W. Generally the area is wetter than the remainder of the Richmond Range and adjacent Tooloom and Koreelah Ranges and has probably functioned as a source area for rainforest and wet sclerophyll forest colonists following drier periods in the past.

Many subtropical rainforest and wet sclerophyll forest-dependent vertebrates, including several endangered species, occur in the area at higher densities than elsewhere in the State. Examples are the Northern Leaf-tailed Gecko *Phyllurus cornutus*, Southern Angleheaded Dragon *Gonocephalus spinipes*, Yellow-bellied Legless Skink *Ophioscincus truncatus*, Wompoo Fruit-dove *Ptilinopus magnificus*, Sooty Owl *Tyto tenebricosa*, Noisy Pitta *Pitta versicolor* and Paradise Riflebird *Ptiloris paradiseus*. The area appears to be one of the strongholds of the threatened Marbled Frogmouth *Podargus ocellatus* in N.S.W. and supports a significant population of the endangered Alberts Lyrebird *Menura alberti* close to the western limit of its distribution. It is also an important breeding area for the migratory Topknot Pigoen *Lopholaimus antarcticus* in the State.

Dome Mountain is at the centre of the N.S.W. distribution of three of the State's rarest birds, the Red Goshawk *Erythrotriorchis radiatus*, Black-breasted Button-quail *Turnix melanogaster* and Double-eyed Fig-parrot *psittaculirostris diopthalma*, all of which have been recorded closeby and are likely to be present. Another endangered bird, the Rufous Scrubbird *Atrichornis rufescens*, could also occur in the area.

The frog fauna is poorly known although the unique rainforest swamps at the base of Dome Mountain contain a population of the newly-described Whirring Tree Frog *Litoria revelata*. The Richmond Range is also one of the few localities in the State where the newly-described Fleays Barred River Frog *Mixophyes fleayi* has been recorded. The area is close to the southern limit of the frog *Philoria kundagungan* and could be important in resolving the relationship and differences between it and the closely-related Loveridges Frog *P.loveridgei*.

Apart from the species previously listed, there is little information on the area's reptiles although it appears to support a diverse group of burrowing species including the skinks *Calyptotis scutirostrum* and the rare *Coeranoscincus reticulatus*.

The mammal fauna is also poorly known although there are unconfirmed sightings of the endangered Parma Wallaby *Macropus parma* which would represent its northern limit of distribution. The Eastern Pygmy Possum *Cercartetus nanus* is another rare marsupial which is likely to be present and the status of the threatened Long-nosed Potoroo *Potorous tridactylus*, of which there are a number of records, requires investigation. Microchiropteran bats are entirely unknown in the area but there is little doubt that it would be important for a number of restricted species.

Of particular importance in the Dome Mountain area are the approximately 1,000 ha. of unlogged so-called 'moist hardwoods'. Composed of mixed stands of subtropical rainforest and wet sclerophyll forest, these are characteristically dominated by species such as Brush Box *Lophostemon confertus*, Flooded Gum *Eucalyptus grandis* and Sydney Blue Gum *E.saligna*. Often such forests exist as well-developed rainforest with scattered sclerophyll emergents and function ecologically as rainforest. With both

sclerophyll and rainforest elements present, they can be faunistically more diverse than either on their own and may have higher productivity. They appear to be particularly important to ground-foraging birds such as the Marbled Frogmouth, Noisy Pitta and Alberts Lyrebird and other vertebrates associated with a moist leaf litter such as the ground-dwelling rainforest frogs and burrowing skinks. To species such as the Sooty Owl, which have both sclerophyll and rainforest requirements, such mixed forests are optimum habitat.

Because of the scarcity of undisturbed moist hardwood habitat in the Urbenville Forestry Management Area and the heavy logging prescription currently applied to this type, it is critical that stands in the Dome Mountain Area receive protection from logging in the future, to function both for fauna conservation and as an area for scientific reference. With the general paucity of information for most vertebrate groups it is also essential that a comprehensive faunal survey of the area be initiated without delay to fully assess the resource.

David Milledge,
Wildlife Ecologist,

20. 3. 1988

SECONDARY RAINFOREST

Some 2,060 ha. of what the Commission terms 'moist hardwood' forests occur in the Dome Mountain area. These types of forest have been variously described as tall-open forest, wet-sclerophyll forest, mixed forest and transition forest. Webb (1988, pers.comm.) suggests that the term secondary rainforest is a more useful and accurate classification, and this classification is adopted in the rest of this report.

Secondary rainforests are considered to have evolved in relatively recent times through man-induced infrequent destructive fires repeatedly eliminating rainforest plants of later successional stages (Smith and Guyer 1983). Webb (cited by Ashton 1981) considers that secondary rainforests are the special product of intense fires on a grand scale. The often sharp boundaries between rainforest and open sclerophyll forests in northern Australia are the result of surface fires of lower intensity causing a gradual attrition of rainforest margins.

Secondary rainforest is a transitional forest within which, in the absence of disturbance, the eucalypts will gradually senesce as the rainforest undergoes a sequence of successional stages until mature rainforest dominates the site. The species composition of the resultant rainforest is largely dependent upon fertility and moisture availability.

Natural disturbance is caused on a limited scale by the death and decay of trees, windthrows and landslips, and on a larger scale by fire and cyclones. Brush Box, Flooded Gum and Tallowwood are able to regenerate in the absence of fire, though wildfires are considered to be the principle natural regenerative agent on a large scale. Turner (1984) found a fire frequency of 325-380 years in a Brush Box stand. Kershaw (1981) notes that under existing man-induced fire regimes secondary rainforest is expanding at the expense of mature rainforest. Open eucalypt forests are similarly expanding at the expense of secondary rainforest.

The overstorey of unlogged secondary rainforest consists of a number of even aged cohorts of trees, each cohort having arisen from a single regeneration event. Turner (1984) noted that stands of Brush Box were of mixed age classes which implied that not all individuals were killed in a fire. By analogy with Mackowski's (1984) results in Blackbutt forests, an unlogged stand of secondary rainforest generally consists of a number of overlapping cohorts, sometimes one cohort occuring within a larger cohort.

The other principle factors influencing the distribution of the various secondary rainforest associations are moisture availability, soil nutrients, aspect and slope (Forestry Commission 1982c, Ellis 1971, Lambert, Turner and Kelly 1983). Ellis (1971) found that above an altitude of 600m. evaporation rates decrease, fog drip increases and mean annual rainfall increases rapidly with increasing altitude. Ellis suggested that these factors could be of major importance in determining the distribution of forest types on ridges while soil factors are probably more important in valley situations.

Ashton (1981) notes that low cloud and fog-drip may add 15-20% to the total precipitation in some mature Mountain Ash forests at altitudes of 600 to 700m., further that the great height of the mature forest may increase orographic rainfall since a rise in altitude of 100m. has been noted to increase annual precipitation by about 150 mm on the Great Dividing Range in Victoria.

Turner and Kelly (1981) found that the White Booyong, Brush Box and Blackbutt associations were broadly delineated by soil parent material, topography and soil morphology. They considered that more precise

differentiation was provided by the soils mineral nutrients, though there was no significant difference between soils supporting White Booyong and Flooded Gum indicating that fire history was probably responsible for the occurrence of Flooded Gum. Their observed differences between Brush Box and Blackbutt soil nutrients may also be largely attributable to fire history (see Fire 1).

Rainforest plants rather than eucalypts are disproportionally responsible for the accumulation of the vast majority of above ground nutrients (Forestry Commission 1982c). Lambert, Turner and Kelly (1983) found that specific elements are accumulated by certain rainforest species and that plant species had a significant effect on some soil nutrients. As the rainforest understorey develops it generally creates a progressively moister microenvironment within which species with higher moisture requirements are better able to grow.

A general progression of dominants occurs in the Dome Mountain area; Sydney Blue Gum dominates on the driest and more fire prone sites, with reducing fire frequency and better site conditions, Tallowwood becomes a co-dominant while Brush Box and other rainforest trees begin to appear in the canopy, eventually Brush Box co-dominates with a variety of other rainforest trees. On some drier and steeper sites Brush Box forms a simple association with Grey Myrtle, while on the most favourable sites, the Brush Box gradually senesce and a complex White Booyong association becomes dominant. Stands of Flooded Gum appear to have similar ecological requirements to Brush Box.

Mackowski (1984) estimated an average life expectancy of 300 years for successful Blackbutt while Turner (1984) found that Brush Box can live for over 1,300 years. The life span of successful Sydney Blue Gum would be in the order of 330 years (Mackowski pers.comm.) while Tallowwood may be around 500 years.

King (1985) notes that mature stands of secondary rainforest with emergent Sydney Blue Gum, Tallowwood and Brush Box generally have a stocking of 40-65 trees/ha.

The rainforest understorey develops in a series of successional stages, the stage of development being related to site conditions and time since disturbance. In the Dome Mountain area, Bangalow Palms are the most obvious and widespread understorey dominant on moister sites, often with Walking Stick Palm and occasional Cabbage-tree Palms. Almost pure stands occur on the more waterlogged soils close to creeks.

THE LIKELY ENVIRONMENTAL IMPACT OF LOGGING THE DOME MOUNTAIN AREA

A forest is the sum of numerous interactions and complex interdependencies that the plants and animals have developed over millions of years of co-evolution. The damage or destruction of each link starts a new chain reaction that spreads throughout the forest.

Knowledge of how the components of a forest function and interrelate is extremely limited. As such the effects of man-induced disturbance to a natural ecosystem are mostly unknown. Enough research into certain aspects has been undertaken to show that the proposed roading, logging and burning of forests in the Dome Mountain area will have a variety of significant adverse impacts upon the environment.

Some consequences of the proposed operations will be:

- a degradation of soil structure and stability
- extensive soil compaction
- an increase in erosion
- altered streamflows
- loss of nutrients
- degradation of aquatic habitats
- a severe reduction in hollow-dependent fauna
- an increase in fauna from more open habitats
- an increase in introduced predators
- a reduction in fauna preferring mature forest, rainforest, a stable microclimate and some specialized food sources
- a reduction in populations of endangered species, with increased risk of elimination of some species
- a possibly significant reduction in genetic variability and viability of some rarer species
- an increase in introduced plants
- a degradation of forest structure
- an increase in pioneer and early successional plants
- a decrease in later successional rainforest plants
- inadequate regeneration on some sites
- an increased chance of the introduction of pathogens
- an altered microclimate
- an increased chance of wildfire

THE IMPACT OF ROADS AND HEAVY MACHINERY

The Forestry Commission plans to construct a number of major permanent access roads over steep and often difficult terrain in the Dome Mountain area. Logging roads and snig tracks together may account for an average of 16% of the logging areas. The steep terrain, major construction works needed for some sections of roads and practice of wet weather logging indicate that roads and the use of heavy machinery will have a significant effect on both the environment within the Dome Mountain area and surrounding rural communities.

Numerous landslips and greatly increased erosion have been noted to have resulted from recently constructed roads and logged forest in the area.

1. Compaction

Compaction of forest soils during logging operations is caused by the weight of machinery, loads and falling trees. The single passage of machinery has been shown to cause major compaction (e.g. Incerti, Clinnick and Willatt 1987) while repeated loadings and logging cycles have been shown to increase compaction effects (e.g. Seymour 1981). Compaction effects have been shown to dramatically increase with soil moisture (e.g. Greacen and Sands 1980) while, to some extent, gravel and organic matter in the soil reduce compaction effects (e.g. Wronski 1984).

Shear stress and wheel slip can increase the compaction effect of static loads by up to 2 and 5 times respectively (Greacen and Sands 1980). Wronski (1984) found that after two or more passes of logging vehicles the full depth of the A horizon of the soil was compacted immediately beneath the wheel tracks and to a lesser extent up to 0.75 m from the edges of the tracks.

Wronski (1984) found that soils covering 23% of an area were visibly compacted or severely disturbed during thinning operations in a karri forest. Incerti *et al* (1987) found that 10% of a logged area of Mountain Ash had significant changes in soil physical properties and saturated hydraulic conductivity was reduced across the entire coupe area.

Van Loon (1966) found that on average 16% of the Sydney Blue Gum - Tallowwood association was tractor disturbed (snig tracks and logging dumps) during logging operations. The Forestry Commission's practice of maximizing soil disturbance in this type can result in disturbance and exposure of up to 70% of the total area (Forestry Commission, 1982a). This practice may therefore result in the majority of the logging area being affected by compaction.

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

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

Soil compaction, resultant from logging, has been shown to significantly:

(i) increase soil density (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al* 1987). Incerti *et al* (1987) found density increases of 27% and 38% on major snig tracks and log landings respectively. Greacen and Sands (1980) report increases in densities of 20-30%.

(ii) reduce infiltration capacity (Langford and O'Shaughnessy 1977, Greacen and Sands 1980, Jakobsen and Moore 1981, Wronski 1984). This can lead to increased surface runoff, loss of water from site, and erosion

(iii) reduce hydraulic conductivity (Jakobsen and Moore 1981, Jakobsen 1983, Wronski 1984, Incerti *et al.* (1987) found that saturated hydraulic conductivity was reduced across an entire logging coupe.

(iv) reduce productivity, this is chiefly attributed to the reduction and restriction of root penetration and growth with increased soil density (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Jakobsen 1983, Wronski (1984). Wronski found that eighteen months after logging, root length density in soil compacted by one or more passes of machinery was only one-sixth of that in undisturbed soil. Jakobsen estimated the productivity of a 32 year old snig track on krasnozem soils at about 20% of the undisturbed area. Greacen and Sands predict a 15% reduction in volume yield due to compaction from tractor logging.

(v) reduce aeration (Greacen and Sands 1980, Jakobsen and Moore 1981, Wronski 1984). This may interfere with the function of soil microorganisms and plant roots.

(vi) reduce nutrient availability and uptake (Greacen and Sands 1980).

(vii) reduce and destroy beneficial soil organisms, for example mycorrhizal fungi (Greacen and Sands 1980) and worms (Jakobsen and Moore 1981).

Wet weather logging has been shown to be very detrimental to soil structure (Greacen and Sands 1980, Seymour 1981, Jakobsen and Moore 1981, Wronski 1984). Greacen and Sands report that one passage of a tractor over wet soil made it almost impermeable to water and the effect was equivalent to four passages over dry soils. As they further note:

> 'Wetter soils are more prone to compaction and the avoidance wherever possible of logging wet soils is probably the most important management practice for prevention or reduction of compaction damage.'

The often poorly drained soils of the Dome Mountain area, as illustrated by the abundance of Bangalow Palms, coupled with the Forestry Commission's practice of allowing wet-weather logging and maximizing tractor disturbance imply that soil compaction will significantly affect the environment of Dome Mountain.

2. Other Effects of Machines

Direct and often complete destruction of soil structure is caused by the tilling or puddling effects of machines (Jakobsen and Moore 1981, Wronski 1984). Wheel ruts are major sources of both runoff and erosion.

Wronski (1984) concluded that where tracks constitute less than 2% of a block area severe rut formation would result in c.8% of the shallow root system being severed. This would further enable easy entry for disease organisms into the roots. He notes that the first pass of a heavy vehicle

kills the understorey vegetation in the track which increases exposure and causes higher temperatures and reduced soil moisture in the top 100 mm of the soil profile during summer.

Other adverse effects of machines include direct destruction of plants and animals, excessive noise levels, pollution, and the transport of weed seeds and diseases.

Logging trucks affect the local population by reducing road safety, and increasing road damage, bridge damage, noise levels, and pollution. Dobinson (1985) notes that road pavement damage increases in relation to the fourth power of axle load and that therefore a truck loaded to the permissable limit will do 14,000 times the damage of an average car to road pavements. He further notes that bridge life depends on the extent of concentrated load by an axle group and the gross weight of the vehicle on the bridge.

The roads and bridges in the Kyogle Shire are deteriorating rapidly and represent the single largest problem the shire faces. There is no doubt that use of rural roads by logging trucks causes significant damage, the resultant damaged roads and bridges are long term problems that the local community has to cope with and (when some of the councils limited funds are available) meet the costs of repairing.

3. Runoff

The reduced infiltration capacity of road surfaces, areas subject to compaction and heavily disturbed soils, combined with reduced canopy interception and transpiration, cause an increase in water runoff following logging.

Bren and Leitch (1985) conclude that the introduction of forest roads could markedly influence both the stormflow and peak flow. On a road with a grade of 2-6% they found that for less than c.10 mm, between 0 and 50% of the rainfall impinging on the road surface leaves as runoff, while for storms the percentage returned as runoff increases and in the largest storm encountered subsurface flow caused 20% more runoff than could be accounted for on the basis of runoff from the road and overland flow. They concluded that the diminution of runoff by simply passing across an infiltrating slope does not appear to be feasible.

Langford and O'Shaughnessy (1977) report increases in streamflows, peak flows and stormflows of 10 to 20% following clearfelling of forests. Streamflows can actually be reduced in the long term by the increased transpiration of the regenerating forest.

4. Erosion

Roads, snig tracks and areas of disturbed soil are the major sources of erosion following logging. Langford and O'Shaughnessy (1977) cite American studies which found that 93% of soil erosion resulted from landslides and mudflows initiated at roads, even though roads and embankments constituted only 6 % of the area. In another study cited clearfelling without roads increased sediment loads from 10 mg/l to 50 mg/l on steep slopes, while the introduction of roads increased it to 320 mg/l.

Langford and O'Shaughnessy cite Gilmour as attributing most sediment as coming from inadequately drained snig tracks and poorly constructed stream crossings. Kriek and O'Shaughnessy are cited as finding significant increases in sediment yields following 'good practice' logging operations in Mountain Ash forests, sediment yields up to 3 times greater than undisturbed forest were recorded and in one case a road embankment slump

increased it to 5 times.

The construction of roads and snig tracks in the steep and often difficult terrain of most of the Dome Mountain area can be expected to cause significant soil erosion. Inspection of the rainforest section of the new Dome Road on 20 May 1988 revealed 3 major landslips, involving the loss of mature trees and large areas of vegetation which completely blocked the road. Numerous smaller slips, associated with the collapse of embankments, were also noted.

5. Effects on Fauna

The easier access and increased sunlight provided by roads enable dispersal and increased populations of mammalian and reptilian predators, and closely related species from more open habitats (Gilmore pers. com.).

The predation of medium-sized ground-dwelling marsupials, such as the Long-nosed Potoroo and Black-striped Wallaby, has been noted to increase as a result of greater access provided by roads for foxes and dingoes (Shields and Kavanagh 1985, Loyn 1985, Forestry Commission 1986). Feral cats, Lace Monitors and various other reptiles appear to be in greater densities near roads on the Capeen Range (pers. obs.). Tyler (1976) suggests that the dispersal of Cane Toads may also be assisted by roads.

Roads have been noted to form an effective barrier for exchanges between populations of small mammals (McIlroy 1978, Barnett, How and Humphreys 1978). Barnett *et al.* (1978) found that roads severely restricted or stopped the movement of small mammals even when the road consisted of a long-unused and partly overgrown track.

Road-kills by vehicles could be significant if species tend to congregate periodically on roads or if the road passes through prime habitat. Rainforest Dragons have been observed to congregate on roads at certain times and Fletchers Frog often uses puddles in roads for breeding (pers.obs.). The construction of the road past one swamp and planned construction past the second swamp at Dome Mountain can be expected to maximize road kills of some frog species.

Changes in the microclimate, predation, and plant species along roads would significantly alter the fauna in the vicinity of roads.

6. Effects on Flora

The altered microclimate, changed soil environment, and disturbance of soil and vegetation along roads allows for the dispersal and proliferation of weeds and species from earlier successional stages (pers.obs., Gilmore pers. com.).

Hopkins, Kikkawa, Graham, Tracey and Webb (1977) point out that the increased densities of early successional pioneer tree species along permanent roads, and their resultant prolific seed, can lead to a limited degradation in the seral status of surrounding rainforest.

The pathogen *Phytophthora cinnamomi* has caused severe dieback of eucalypts in Victoria and Western Australia, and patch dieback of rainforests in Queensland. There is abundant evidence that car tyres and machinery are a major contributor to its rapid dispersal (Gerrettson-Cornell and Dowden 1978, Forests Department of Western Australia 1979, Dawson and Weste 1985). Gerrettson-Cornell and Dowden particularly recommend avoiding any activity that may increase waterlogging of the soil and thus the chance of infection.

7. Other Effects of Roads

The canopy gaps caused by roads, snig tracks and logging generally, cause increased penetration by sunlight, winds, and more extreme temperature fluctuations. Thus the microclimate along and adjacent to roads is significantly altered in the denser forests, with consequent effects on the more sensitive plants and animals.

Shooters, timber and plant (e.g. orchids) poachers, and commercial marijuana growers are active in the region. They mostly rely upon forestry roads and tracks for access.

Roading, logging and fire all combine to cause intial increases in runoff and erosion. This can result in increased flooding and stream bank erosion, and decreases in streamflows in dry periods or over the longer terms from increased transpiration of regrowth. The increased fluctuations in water levels will have direct impacts on aquatic flora and fauna.

Increased erosion will increase turbidity and suspended sediment levels in streams, where stream-bed slopes level out sufficiently there will be extensive sedimentation (Langford and O'Shaughnessy 1977, Forestry Commission 1980, Atkinson 1984). Langford and O'Shaughnessy cite American studies in steep mountain catchments as finding that suspended sediment loads increased 5 to 100 times following logging, the major cause being mass slumping triggered by roads on steep slopes. They also note that ionic concentrations and water temperatures can increase after logging. The Forestry Commission (1980) note that the decomposition of plant material resultant from logging may reduce stream oxygen levels.

The aquatic environment of streams will be degraded by logging and this will undoubtably prove to be unfavourable for a number of aquatic plants and animals. Increased flooding, erosion, sedimentation of streams and degraded water quality will also affect people downstream.

IMPACT OF LOGGING

The secondary rainforests of the Dome Mountain area are planned to be logged on a maximum economic utilization basis and then brought into the 25 year logging cycle of the general area. For the less-accessible secondary rainforests of the Washpool area the Forestry Commission estimated that logging would result in the removal of 60% of the overstorey canopy (Forestry Commission 1982a). While Dunning and Smith (1986) found that in practice normal logging of this type in Mt. Boss State Forest resulted in 75-95% canopy removal.

The only apparent specific constraints on logging are: that mature and overmature trees of value for wildlife habitat (and suitable recruitments) be retained at an average frequency of one per hectare, but preferably in clumps of up to five trees (per 5 ha.); trees identified as being used for feeding by Yellow-bellied Gliders be retained; and that a 10 m strip of undisturbed rainforest understorey be left adjacent to grassy areas as a potential refuge for Black-striped Wallabies (Forestry Commission 1986).

Most of the forests surrounding the Dome Mountain area have been heavily logged or clearfelled and are dominated by young regrowth and weeds. The proposed systematic logging of every available hectare of remaining mature forest will leave no refuge for fauna dependent upon mature forest in the vicinity.

Logging will lead to major changes both in species abundance and forest structure, the more moist the forests the greater the effect and the longer the recovery time (Forestry Commission 1980).

The planned intensive logging will cause significant environmental degradation and adversely affect those animals most reliant upon a stable ecosystem and mature forest.

1. Loss of Hollows

It has been estimated that a total of 399 species of vertebrates use tree-hollows in Australia; 28% of frogs, 28% of reptiles, 17% of birds and 42% of mammals (Ambrose 1982). 142 of these use hollows in tall open-forest.

Dunning and Smith (1986) found that the number of hollow bearing trees (>96 cm.d.b.h.) in secondary rainforest varied from 0.5 per hectare on some logged sites to an average of 16 (8-30) per hectare in mature unlogged forest.

Species of animals dependent upon tree-hollows for denning and nesting are directly affected by the loss of hollow trees in logging operations (Recher, Rohan-Jones and Smith 1980, Forestry Commission 1980, 1981, Mackowski 1984, Dunning and Smith 1986, Smith and Lindenmayer 1988).

Mackowski (1984) dissected 24 trees in a mature Blackbutt forest with a Bladey grass understorey and recorded the average occupancy rate of trees by hollow-dependent fauna for various size classes as: 100-120 cm. d.b.h. 1.14, 120-140 cm. d.b.h. 0.51, 140-160 cm. d.b.h. 2.9, 160 + cm. d.b.h. 2.91. In mature forest with a diverse understorey occupancy rates would be higher due to the higher productivity. Hollows are also variously utilized at different times of the year for nesting so that a single hollow may be utilized by a succession of species (Saunders, Smith and Rowley 1982).

To maintain populations of hollow dependent possums and gliders at a natural level Dunning and Smith (1986) suggest that 3 evenly spaced or 5 randomly spaced self-sustaining potential nest tree clusters are required in

each hectare of logged forest. Mackowski (1984) found that 3 hollow bearing trees per hectare were required and concluded that 0.45 hectares per hectare was needed to provide sufficient hollow trees in perpetuity.

Smith and Lindenmayer (1988) found that the total numbers of possums and gliders per site were significantly related to the number of 0.25 ha. blocks on each site supporting hollow trees and concluded that it is possible that maximum possum and glider density will only be reached when all 0.25 ha. blocks support hollow trees.

They further predicted that the prescription for the retention of a minimum of 15 trees for every 10 ha. clear-felled in Mountain Ash forests would reduce the total number of hollow-dependent possums and gliders to less than one eighth that of unlogged forest. Also that once the number of hollow trees falls below 4.2 per 3 ha. or when less than 1.7 0.25 ha. blocks contain hollow trees they predicted that the average density of Leadbeaters possum would be zero.

The territorial requirements of hollow-dependent fauna needs to be considered when assessing the availability of hollows. Saunders *et al.* (1982) consider that the concentration of hollows in one area may pose behavioural problems for some species. Saunders (1979) notes that White-tailed Cockatoos space their nests out over the available breeding area and for about 15% of the breeding season the female attempts to limit access to trees around her nest site by other females.

Saunders *et al* (1982) found that the smallest tree nested in by Galahs had a cirumference of 0.8 m. and for Corellas and Red-tailed Black Cockatoos it was 1 metre.

Following logging the sudden exposure of large trees to new wind stresses often leads to these trees dying or being thrown by the wind (Recher *et al.* 1980). Saunders (1979) notes that hollows are also lost by sections being broken off, collapse of floors of hollows, the ceiling falling in, being taken over by feral bees, human predation of nestlings, and because hollow trees are particularly susceptible to fire. Recher *et al.* (1980) also note that dead trees appear to be unsuitable to many species of hollow-dependent wildlife.

Mackowski (1984) found that hollows suitable for larger wildlife did not form in Blackbutt trees less than about 200 years old, longevity was estimated at three hundred years. As large hollows only form in trees over 120 cm. d.b.h.o.b. their formation in Sydney Blue Gum would take over 220 years, Tallowwood over 300 years, and Brush Box in the order of 500 years.

2 Other Effects on Fauna

Dependent residents of forest with special adaptations for a stable environment or mature forest requirements can be severely affected by logging operations (Tyndale-Biscoe and Calaby 1975, Milledge 1979, Recher *et al.* 1980, Loyn 1985, Shields and Kavanagh 1985).

Loyn (1985) notes that old trees provide food sources that may be less abundant in forests of younger trees, e.g. nectar, some insects in the bark and foliage, and nectar and fruit of mistletoe. He further states that it appears that old forest is needed to supply a regular abundant supply of insect food.

Recher *et al.* (1980) found significant correlations between canopy height and the number of understorey plant species and bird species diversity. They noted that species which nest in hollows or in the canopy and those which forage on tree trunks or in the canopy are absent from young

logging regeneration.

Loyn (1985) observed that the retention of 14 mature trees per hectare apparently failed to provide habitat for a significant small group of arboreal birds and mammals even up to 70 years after harvesting. Recher *et al.* (1980) found that forest 40-45 years old is too young for some species which depend upon mature forest for refuge, nest sites or foraging.

Animals with high site attachment are often killed in logging operations (Tyndale-Biscoe and Calaby 1975) while any remaining unlogged areas may be fully occupied and unable to support survivors forced out of logged areas.

The Forestry Commission found that in the Hastings Catchment logging had an initially severe impact on amphibians with a recovery in numbers with canopy re-establishment (Shields and Kavanagh 1985).

Vagrant reptiles from more open habitats have been observed to invade logged forests (Shields and Kavanagh 1985, Dunning and Smith 1986). Dunning and Smith (1986) found that selective logging, 33% canopy retention, caused a significant decline in numbers of Challenger's skink.

Birds from more open habitats, often transitory and non-breeding individuals, invade logged forest while birds most dependent upon mature forest decline in numbers or are lost (Pattemore and Kikkawa 1975, Milledge 1979, Recher *et al.* 1980).

McIlroy (1978) considers that forest bird diversity is correlated with plant species diversity and foliage height diversity. Cowley (1971) notes that certain species of birds are specific to certain plants or plant associations, for example the Glossy Black Cockatoo and She-oaks. He considers that the many birds with fairly restricted diets must move to a new area or die should their supply fail.

Many plants rely upon birds for insect control, cross-pollination and/or seed dispersal and an alteration in bird species may initiate an alteration in vegetation.

Dunning and Smith (1986) found that the numbers of Greater Glider, Ringtail Possum and Brown Antechinus declined in approximate proportion to the amount of forest biomass removed, while the Fawn Footed Melomys declined in greater proportion.

Lunney, Cullis and Eby (1987) found that Bush Rats declined in response to logging and that populations did not recover by 10-15 years, they concluded that this demonstrates that animals respond differently to dense ground cover in unlogged and regrowth areas. They also found that logging had no impact on Brown Antechinus, this may indicate that habitat requirements of populations are variable within a species or that the Antechinus is sensitive to the effects of logging only under certain conditions.

Many researchers have concluded that the only sure way of preserving species dependent upon mature forest as habitat is to preserve large areas of mature forest intact (Tyndale-Biscoe and Calaby 1975, Recher *et al.* 1980, Shaw 1983, Loyn 1985, Shields and Kavanagh 1985, Lunney *et al.* 1987). Recher *et al.* note that it is possible that some species dependent upon mature forest which currently occur in buffer strips, reserves and in regenerating forest are derived from animals bred in mature forest. Once the area of mature forest is sufficiently reduced it will no longer be able to maintain these populations.

Shields and Kavanagh (1985) note that the preferred habitats of many species do not include narrow riparian strips or steep unloggable country. Mackowski (1984) notes that in many situations on the north coast of N.S.W. corridor retention in gullies will not maintain suitable habitat for possums and gliders.

Tyndale-Biscoe and Calaby (1975) suggest that an effective population of 1,000 individuals is near to the minimum to ensure the continuance of genetic viability. Dunning and Smith (1986) suggest a minimum population size of 500 and note that it is necessary that each population effectively isolated by vegetation or geographical barriers needs to be maintained at least at this size.

3. Effects on Flora

The eucalypt and Brush Box overstorey of secondary rainforest often arise from a single regeneration event while the rainforest understorey develops in a series of successional stages. Each stage increases nutrient availability and produces a more favourable microclimate for succeeding species. It may take hundreds or thousands of years until a form of mature rainforest is arrived at.

Dunning and Smith (1986) suggest that successional change after logging of secondary rainforest may enhance eucalypt and acacia regeneration to the detriment of rainforest regeneration for at least 25 years after logging.

The 25 year logging cycle proposed for the Dome Mountain area will initiate repeated disturbance which will cause the replacement of the diverse rainforest understorey with weeds and early successional species.

The Forestry Commission (1982a) concluded that about 40 m. is required between 30 metre high eucalypt trees to provide for adequate seed distribution, this requires the retention of 6-8 seed trees per hectare.

Harvesting of seeds by ants and other insects has been observed to be rife (Ashton 1981, van Loon 1966, Forestry Commission 1982a). Ashton noted that more than 60% of the annual seedfall of *Eucalyptus regnans* may be removed, which in the warmer months involves nearly all the full fertile seed.

Poor and inadequate regeneration of eucalypts and Brush Box can often occur in moister areas of secondary rainforest (van Loon 1966, Forestry Commission 1982a, King 1985). Van Loon also noted problems in regenerating steep slopes which the Forestry Commission (1982a) attributed to soil washing away from the roots of young seedlings and excessive drainage of some sites.

Eucalypt and Brush Box regeneration is often poor in the absence of fire (van Loon 1966, Forestry Commission 1982a, King 1985). Van Loon attributed this to the dense nature of the understorey and dense surface litter. King found that 35% of plots that did not receive a post logging burn had no regeneration.

The Forestry Commission (1982a) cite Curtin as finding that in an unburnt block 46% of plots on snig tracks were stocked with regeneration compared to only 5% of those away from tracks. They cite Curtin as finding regeneration height on unburnt blocks was one seventh that of burnt blocks. Compaction can be considered to be one of the causes of this reduced growth. They further note that mechanically cleared sites are usually satisfactory for regeneration establishment, though some unsuitable compacted sites are often present.

Ashton (1981) notes that the poor growth of eucalypt seedlings in mature forest soils has been attributed to phytotoxin from fungus, inhibitory substances from living roots and an inhibition of the nitrifying bacteria by leachate concentration from eucalypt leaves.

King (1985) found that there was no evident relationship between the total regeneration stocking and percentage canopy cover retained.

Hopkins (1981) notes that disturbance of rainforest can result in arrested succession or culminate in a forest type completely unlike the original. Gilmore (pers. com.) considers that it can result in a reduction in floristic diversity of mature-phase rainforest plants.

The development of the rainforest understorey will be affected where eucalypt and Brush Box regeneration is inadequate. The nature and significance of this effect needs to be assessed.

Prolific weed growth is one of the most important factors hindering regrowth of secondary rainforest (van Loon 1966). Numerous exotic weeds have invaded the forests of the Focal Peak region following logging, roading and grazing (Jarman, Johnson, Southwell and Stuart-Dick 1987, Forestry Commission 1986, pers.obs.). Of the numerous weeds that vigorously invade logged forest, lantana and croftons weed are the most prolific in the Dome Mountain area, dominating the understorey of extensive areas of logged secondary rainforest. • Lantana has replaced the rainforest understorey on many sites.

The extensive disturbance caused by logging, particularly when repeated by fire or re-logging, enables introduced species to establish themselves as permanent components of the flora.

4. Effects on the Microclimate

Climatic fluctuations are ameliorated to some extent by the open overstorey of secondary rainforest but more importantly and effectively by the dense canopy of the rainforest understorey. This produces a relatively stable and seasonally predictable microenvironment.

The removal of most of the overstorey during logging and the severe disruption to, or elimination of, the understorey canopy would greatly increase temperature extremes and wind velocities, and decrease relative humidity in the understorey.

Species of animals adapted to more stable environments often have low reproductive capacity (Cowley 1971, Tyndale-Biscoe and Calaby 1975, Barry 1984) and may have comparative longevity and utilize specialized resources (Barry 1984). Such animals may be sensitive to the environmental change associated with logging. Frogs and moisture-requiring invertebrates are likely to be significantly affected.

Many rainforest plants are sensitive to environmental change and may not be able to re-establish populations until earlier successional species have created a suitable microclimate.

The Forestry Commission (1982a) note that frost can damage regeneration and in extreme cases convert forest to grassland once opened up. They state that the risk of frost is greatest on high altitude sites with impeded air drainage, and that Tallowwood is more susceptible than Blue Gum to frost damage.

The sudden exposure of large trees to new wind stresses can result in their dying or being thrown by the wind (Recher *et al.* 1980). The

Forestry Commission (1982a) note that young stands can be damaged by wind squalls.

The opening of the canopy causes increased drying of the understorey which may directly affect a number of species of animals (e.g. frogs) and plants. Dryness and higher ground temperatures would also increase the chance of wildfire occuring.

5. Other Effects of Logging

Reduced transpiration, canopy interception and infiltration capacity of the soil contribute to increased runoff and erosion following logging. Langford and O'Shaughnessy (1977) cite an American study that found that removal of the understorey which accounted for 22% of the basal area increased streamflow by 70 mm. Another American study cited found that clearfelling without roads increased sediment loads fivefold on steep slopes.

Logging can markedly decrease soil stability. Langford and O'Shaughnessy (1977) cite an American study by Swanston as finding that increased saturation of the soil mantle as a result of reduced transpiration and canopy interception can lead to a decrease in effective stress and shear strength and increased seepage forces in the soil, which consequently increases the risk of landslide. Swanston also attributed a marked decrease in soil strength about 3 to 5 years after clearfelling to the decay of root systems. Living tree root systems increase soil tensile strength.

The export of nutrients off-site in log form can be significant. Harwood and Jackson (1975) cite Attiwill as estimating that the bark and harvestable wood of a 51 year old eucalypt forest contained 50, 65 and 54 per cent of the above ground phosphorus, potassium, and calcium respectively.

Eucalypts have the tendency to accumulate specific nutrients, for example high bark calcium in Flooded Gum (Forestry Commission 1982 c), and so the loss of particular nutrients from the ecosystem may be disproportionate. As large quantities of nutrients are stored in eucalypt bark this loss would be less severe if de-barking was carried out on site.

IMPACT OF FIRE

Tree head disposal burning, control burning and wildfire can all have significant effects on the environment. Fire is the most common means employed by the Commission to obtain regeneration of secondary rainforest after logging.

1. Nutrient Loss

Soil nutrients are a major determinant in the delineation of forest communities (Forestry Commission 1982a, Turner and Lambert 1986, Braithwaite 1986). Turner and Lambert consider that differences in soil nutrients lead to variations in distribution of forests, forest productivity and community complexity. They note that even small changes in nutrients can cause subtle changes in species.

Braithwaite (1986) and Barry (1984) consider that site fertility appears to be the major determinant of the distribution and numbers of some animals, the highest densities occuring in the most nutrient rich forests.

Barry (1984) notes that soil infertility acts indirectly to reduce animal abundance by typically stimulating plant chemical defence against herbivory. He cites Neldner as finding that 14 rainforest species had significantly higher mean levels of polyphenols when grown on coarse white sand than when grown on brown loam or krasnozem soil.

Rainforest plants generally have high nutrient requirements. The rainforest understorey of a 27 year old Flooded Gum stand comprised only 9.1% of the total above ground biomass and yet contributed 55%, 59%, 30%, 44% and 69% of the annual net accumulation of aboveground nitrogen, phosphorus, calcium, magnesium and potassium respectively (Forestry Commission 1982 c).

Turner and Kelly (1981) found that the nutrient status of Booyong rainforest and Flooded Gum stands were similarly rich and concluded that the Flooded Gum stands probably represented rapidly developing rainforest after fire disturbance. They noted that soils that had more than about 800 p.p.m. total phosphorus in the surface horizon generally supported Booyong type rainforest.

Lambert, Turner and Kelly (1983) found that individual species of rainforest plants accumulate one or more specific nutrients and directly affect soil nutrient status.

Turner and Lambert (1986) note that young forests have high nutrient demands, almost entirely derived from the soil, which peak at around the time of crown closure. With increasing maturity the forest requires less nutrients from the soil and meet most requirements from redistribution and mineralization of litter nutrients. While nutrient losses following logging on nutrient rich soils may not be limiting for regrowth, nutrient losses can significantly alter reconstructive succession on nutrient poor soils (Hopkins 1981).

Harwood and Jackson (1975) consider that there are three major potential sources of nutrient loss in logging operations; export in the log harvest, losses to the atmosphere on burning, and downslope washing and deep leaching of nutrients mineralized in the ash. Langford and O'Shaughnessy (1977) cite an American study that found some streamflow nutrient concentrations doubled after wildfire.

Fire has been shown to result in large losses of nutrients to the atmosphere. Stewart and Flinn (1985) found that the burning of a clearfelled eucalypt forest resulted in a moderate to high intensity fire which consumed

50% of all debris and resulted in volatilization temperatures for all nutrients being exceeded and further nutrients lost through ash convection. They estimated total loss of nutrients from the debris and top 20 cm of surface soil to be 1.7% phosphorus, 6.5% nitrogen, 17.2% potassium, 19.9% magnesium and 32.8% calcium. Harwood and Jackson (1975) assessed the atmospheric losses of 4 nutrients in an 'unusually cold' slash burn from the above ground fuel following logging of a mixed forest; 50% of the fuel was consumed with resulting atmospheric losses from the burnt fuel of 18%, 17%, 12%, and 29% of phosphorus, potassium, calcium and magnesium respectively.

Fire has been noted to significantly increase soil pH, usually decrease organic carbon, increase exchangable potassium and calcium and increase extractable phosphorus (Stewart and Flinn 1985). Atkinson (1984) points out that nutrients so released in soluble form are readily removed by water. Large quantities of nutrients can be lost following fire, by wind and water transport of ashes and organic matter, and by leaching.

Turner and Kelly (1981) found that the soils of Blackbutt stands, with an average fire frequency of 280 years (Turner 1984), had higher soil pH, higher exchangable calcium, and lower total phosphorus and organic matter than Brush Box stands with a fire frequency of 325-380 years (Turner 1984).

As Ashton (1981) has pointed out, the fertility of soils is likely to be depleted in areas of high rainfall subjected to repeated burning. In terms of ecosystem potential it is a downward spiral.

2. Runoff and Erosion

Wildfires have been noted to result in very significant increases in surface runoff following rainfall (Langford and O'Shaughnessy 1977, Good 1973, Atkinson 1984). Langford and O'Shaughnessy (1977) attribute this to a reduction of the soils infiltration rate caused by high temperatures, and loss of litter and vegetation cover.

McArthur (in Langford and O'Shaughnessy 1977) found that streamflows for a 14,600 ha. area in Western Australia increased by 72% following wildfire. Various recovery periods of one to six years have been reported (e.g. Langford and O'Shaughnessy 1977).

Langford (in Langford and O'Shaughnessy 1977) found that in a Mountain Ash forest, streamflows declined significantly 6 to 15 years after wildfire, with an average 24% decrease of the average pre-fire streamflows per annum 6 years after the fire. This was attributed to increased transpiration of regrowth with streamflow still significantly less 36 years after the fire.

Wildfire can also result in significant erosion. Atkinson (1984) estimated soil losses of 30 to 48 t/ha, over a 10 week period, following a wildfire in Royal National Park. He suggests that for that terrain and climate 20 t/ha may be a more realistic estimate of soil loss following wildfire in an average year. Good (1973) found large increases in water sediment loads following wildfire with extreme erosion potential persisting for many months at one site.

Atkinson (1984) observed that large proportions of ash, charcoal, seeds and other organic matter were transported offsite in initial rain-storms. Langford and O'Shaughnessy (1977) consider that fuel reduction burning consumes organic material leaving lines of weakness in the soil aggregates leading to long term deterioration in soil structure.

3. Effects on Plants

Fire chiefly affects the composition and structure of the understorey, though overstorey trees can also be severely damaged or killed in fires. Rainforest plants are generally very susceptible to fire damage (Gill 1974) while many of the eucalypts associated with secondary rainforest have thin bark, no lignotubers and poor dormant bud development which means that they are also easily killed or damaged by fire (Bridges 1986, Gill 1974).

Ashton (1981) notes that fire results in the replacement of the normal soil microbiological flora by an entirely different one for a period of years.

Frequent low intensity fires (prescribed burns) have been noted to eliminate the shrub layer and allow grasses and ferns to dominate the understorey (McIlroy 1978, Gill 1974). 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).

Floyd (1976) found that both fire intensity and frequency can cause major changes in the understorey vegetation of secondary rainforest, and that the intensity and duration of a fire will determine to a large extent the species composition of the regeneration.

Floyd (1976) and Ashton (1981) note that fires select for more fire-tolerant species. When comparing part of a Blackbutt-Sydney Blue Gum stand burnt 30 years ago and also part logged and burnt 14 years age Floyd (1976) found that the more diverse rainforest understorey was being replaced by quick-maturing, short-lived shrubs overtopped mainly by *Acacia binervata*.

Repetitive burning within the primary non-flowering period of an obligate seed-regenerating species can result in its reduction or complete elimination from a site (Floyd 1976, Ashton 1981). Gill (1974) notes that some eucalypts are sensitive to fire and their regeneration depends on seed held on the tree and shed after the fire, *E.regnans* is then vulnerable to fire until about 15-20 years of age when reproduction begins. Ashton (1981) notes that younger trees are more likely to be damaged or killed by fire than older trees. Secondary insect and fungal attack may follow fire damage (Forestry Commission 1982a).

Fire affects the seed resources of a forest in a variety of ways; all surface seed in burnt areas is killed (Floyd 1976), fire-induced seed falls can be lost by fire-induced erosion (Atkinson (1984) and predation (Forestry Commission 1982a), seed trees are often killed in fires before fullfilling their function (van Loon 1966, Forestry Commission 1982a), seed trees can shed their seed before a fire (Forestry Commission 1982a), and leaf fall following fires can blanket the ground and hinder seed contact with the soil (van Loon 1966, Forestry Commission 1982a).

Van Loon (1966) found that in burnt areas Tallowwood shed the majority of its seed in the first time period after burning. It has also been noted that eucalypt seed germination will not occur if the seed bed is dry and is likely to be inhibited by very low or high temperatures (Forestry Commission 1982a).

Fires create an ash-bed effect which has been observed to stimulate regeneration two to threefold for 2-3 years following fire (Ashton 1981). This has been attributed to enhanced nitrogen and phosphorus availability, nutrients released by dead micro-organisms and most importantly to the

altered microbiological fauna (Ashton 1981).

Fire greatly enhances eucalypt regeneration on less moist sites in logged secondary rainforest (King 1985, Forestry Commission 1982a). However, they have obeserved fire to favour the establishment of Sydney Blue Gum at the expense of Brush Box.

The Forestry Commission (1986) note that while slash burning can result in germination of desirable species it also leads to increased browsing of seedlings and may promote the growth of weeds and vines which in turn inhibit regeneration. Van Loon (1966) found that within 6 months burnt seed beds are generally overgrown with fire weeds and vines, in four out of twelve experimental burns extremely dense stands of wattle completely suppressed Tallowwood germinants. On six sites seeded with Tallowwood 28% of seedlings suffered browsing damage.

Many difficulties are associated with obtaining sufficient regeneration of Tallowwood (van Loon 1966, Forestry Commission 1982a). Sydney Blue Gum has been found to be generally very defective in regrowth stands (van Loon 1966).

The understorey of many logged stands of secondary rainforest in the Urbenville Management Area has been converted to Bladey grass by too frequent burning (pers.obs.). Bladey grass itself promotes a greater fire frequency.

Increasing fire frequency increases the flammability of the forest. Gill (1974) considers that in wetter forests flammabilities tend to decrease as succession proceeds and moisture retention within the forest becomes more effective.. Hopkins (1981) notes that eucalypt regeneration tends to increase the possibility of fires as does the establishment of certain grasses.

4. Effects on Fauna

Fire consumes large quantities of the leaf litter, fallen timber and the understorey vegetation. In extreme conditions most of the foliage can be consumed and most plants damaged or killed. Animals are affected in a variety of ways; killed in fire, loss of food sources, loss of homesites, alteration/degradation of habitat, and increased competition and predation from species preferring more open habitats.

Invertebrates of the soils and surface litter can suffer high mortality rates in fires of even low intensity, with recovery periods of 5-6 years in drier forests (Leonard 1974, Anon 1984). Leonard (1974) observed that invertebrate densities were greatest on damp sites with a dense understorey and noted that recovery of populations is probably related to the recovery of the understorey structure. It may be expected that some of those invertebrates most reliant upon a stable moist environment will be severely reduced/eliminated until regeneration has sufficiently progressed to restore the pre-logging habitat.

Dunning and Smith (1986) found that post-logging burning probably has a more detrimental long term effect than logging, on reptile numbers, mainly due to the destruction of leaf litter and logs. They observed that normal logging practices in a secondary rainforest resulted in a shift from dominance by Murrays Skink and Challengers Skink to dominance by the Eastern Grass Skink.

While no studies have been conducted on the Southern Angle-headed Dragon and Northern Leaf-tailed Gecko, they can be expected to particularly suffer from loss of food sources (litter invertebrates) and degradation of habitat. The detrimental effect of fire on some frog species would also be

very significant.

Birds that live or feed in the understorey are most affected by fuel-reduction burning. Loss of litter and litter invertebrates will directly affect those understorey birds reliant upon invertebrates for food, such as Alberts Lyrebird and Black-breasted Button-quail. Understorey birds will also suffer from loss of nests, nest sites and cover, for some time dense and tangled regrowth may hinder the movements of some larger understorey birds (Cowley 1971).

Reductions, and alterations, in populations of invertebrates, reptiles, frogs and small mammals following fire will also adversely affect the many birds that feed in the understorey but nest in higher strata, for example the Marbled Frogmouth.

The distribution of most birds is correlated with the structure of the vegetation and therefore it is the changes in vegetation structure caused by fire that determine the long-term effects of fire on most birds (Anon 1984).

Small ground mammals have been shown to be more effected by fuel-reduction burning than logging (McIlroy 1978, Anon 1984, Shields and Kavagna 1985, Dunning and Smith 1986, Lunney *et al.* 1987). This is attributed to reduction in the available invertebrates, nesting/refuge sites, and a simplified ground flora (McIlroy 1978, Forestry Commission 1980).

Dunning and Smith (1986) chiefly attributed the post-logging decline of Brown Antechinus in secondary rainforest to the removal of the litter and log layer by burning. Lunney *et al.* (1987) found that fire reduced the numbers of Bush Rat and Brown Antechinus fivefold, though populations quickly recovered. They also found that even a low intensity fire eliminated Dusky Antechinus and that it had not reappeared by 3 years post fire. McIlroy (1978) states that the Yellow-footed Antechinus prefers areas from which fires have been excluded for 40 or more years.

Dunning and Smith (1986) attributed a decline in the Mountain Brushtail Possum and Fawn-footed Melomys on one plot to a post logging burn and concluded that post-logging burning may be as disadvantageous as canopy removal to species which utilize the ground and shrub stratum.

Many researchers have found that the introduced House Mouse can increase to plague proportions following burning of native forests (e.g. Lunney *et al.* 1987).

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BRIEFING ON NORTH COAST WOODCHIP OPERATIONS

30.56

Sawmillers Exports - Newcastle company.

- Owned by Boral (Alan Taylor) 80% Japanese 20%.

1981- Environmental Impact Assessment (E.I.A.) compiled by D.A.S.E.T.T. and relevant State Gov't Depts. and licence was issued for 35000T of sawmill and logging residues for export as woodchips to Japan .

1982- Conditions relaxed to include silvicultural residues (trees not suitable for sawlogs and poles) and freehold land .

1989- Quota increased to 500000T.

This company extracts timber from Milton in southern N.S.W. to the Hastings area in the Mid North coast .

Brisbane Forest Products - Brisbane based company . Ownership?

1989 (Jan.)- E.I.A. completed prior to the issuing of licence this year for the removal of 180000T. per year for the next five years .

- Approval has been granted for a "trial" operation in Northern N.S.W. whereby 5000T. of logging residues will be removed .

: 1000T. from Urbenville Forestry District .

: 1000T. from Murwillumbah " "

: 2000T. from Casino " "

: 10000T from Tenterfield " "

The chips are to be exported to Japan for pulp .We are concerned that operations will undoubtedly be expanded in the North Coast area as was the case with the Sawmillers Exports operations .
We are opposed to the export of cheap woodchips to Japan . Sawmill, logging and silvicultural residues should be made into value-added products such as chipboard, laminated beams etc. in Australia . This would lead to increases in financial returns, employment and most importantly would reduce pressure on our rapidly disappearing native forests .

We intend to lobby the Government to-

: Undertake research into the manufacture of wood products from eucalypts so that value-added products could be produced locally .

: Provide incentives for the establishment of small scale industries to manufacture wood products; and for the establishment of mills to manufacture paper from recycled material and fibre crops .

: Promote the establishment of hardwood plantations on cleared land for future utilisation .

WHAT YOU CAN DO - Write letters opposing woodchip operations on environmental and economic grounds to-

Ian Causely
Minister for Natural Resources
23-33 Bridge St.
SYDNEY N.S.W. 2000

Nick Greiner
Premier
8th Floor State Office Block
Macquarie St.
SYDNEY N.S.W. 2000

Tim Moore
Minister for the Environment
Level 7 Legal and General House
8- 18 Bent St.
SYDNEY N.S.W. 2000

Graham Richardson
Minister for D.A.S.E.T.T.
Parliament House
Canberra A.C.T. 2600

Bob Hawke
Prime Minister
Parliament House
Canberra A.C.T. 2600

For Further Info contact N.E.F.A. 88A Keen St. Lismore 2480 N.S.W.

PERSPECTIVE ON THE NO PULP MILL CAMPAIGN

By Martin Frohlich, C.V.C.C. Liason Officer

The proposed pulp mill is arguably the greatest single threat to the North Coast Environment and accordingly the No Pulp Mill campaign has been the principle activity of the C.V.C.C. since its inception in September last year. It is also arguably the first environment debate to have gained the overwhelming public support of the Clarence community.

The community has endorsed the campaign through the thousands of people who have attended public meetings including those at Grafton, Iluka, Maclean, Minnie Water, Yamba, Coutts Crossing and Coffs Harbour. On these occasions the "No Pulp Mill" message has been voted virtually unanimous support.

The community has responded as never before with a flood of letters to newspapers, participation in radio phone-ins and letters to politicians at all levels of government.

This community response is demonstrated by the over 10,000 signatures on the "No Pulp Mill" petition, and by the July 1989 survey which showed that 77.8% of respondents were opposed to a mill while only 5.6% were in favour.

The success of the no pulp mill campaign to date has probably been due to a number of factors. The credibility of environment groups and their representatives in the Clarence Valley is very good. Also, because issues such as the Wesley Vale mill have been high on the media's agenda, and local coverage has been given to a range of environmental concerns, there is quite a revolution occurring in terms of the community's awareness of the problems confronting us.

Though we have been helped by outside events, including the inept handling of the issue by the Minister for Natural Resources, the N.S.W. Forestry Commission and Daishowa International, the success of the campaign is no accident. It is due in no small part to the dedication and sheer hard work of the many groups and individuals who have been actively involved in organising meetings, seeking information, writing letters, raising funds, and who have not been afraid to speak out. The thousands of dollars which have been donated by the community have also been fundamental to our ability to launch and sustain this campaign.

However, despite all this hard work, we have no assurance that there will be no pulp mill on the North Coast. While politicians are becoming increasingly aware of the resolve of the local community and are better informed as to why the North Coast is totally unsuitable for such an industry, the real battle is still ahead of us. The N.S.W. Government is presently (belatedly) trying to get its development planning into some semblance of order. It is working with the Federal Government to establish effluent guidelines for pulp mills, while the Department of State Development is working feverishly to complete its pulp and paper strategy.

But behind the Government's approach is the inherent, and demonstrably fallacious assumption that Australia needs more pulp mills. The N.S.W. Forestry Commission has embraced this concept for obvious reasons. It has mismanaged our forests to a situation whereby timber produced in N.S.W. will be in decline in terms of both quality and quantity until at least 2010, and therefore sees pulping as a cynical opportunity to maintain or even increase its turnover in the short term.

Both the N.S.W. Government and Daishowa have time-after-time broken their own deadlines and failed to release details of the Company's pre-feasibility study. Added to this the C.S.I.R.O. Report and Minister for Environment Tim Moore have both indicated that lengthy baseline studies will be required before a mill is established. The No Pulp Mill campaign is therefore shaping up to be protracted over a number of years. The strength of community opposition gives some hope that the Government may get cold feet and file it in the too hard drawer, but there is no sign of that at present.

What is certain, is that Daishowa will not have it's mill up and running in 1992 as the company first stated, and not by 1993, as was later claimed. Years are long in the political process and elections at all levels of Government, particularly State, are likely to play a decisive role in the outcome of this campaign. The question of a pulp mill will therefore ultimately become for the community to resolve.

Articles from GROUNDSWELL (Nov. 89), Journal of the Clarence Valley Conservation Coalition Inc.

THAT ELUSIVE FEEDSTOCK - *by Bruce Tucker*

The question always has been - where's the timber coming from? From the time of the first announcement back in August 1988, the Clarence Valley Conservation Coalition was saying that above all else, there was insufficient resource available for the Grafton Pulp mill unless there was to be large scale clear-falling of our forests. The feedstock requirement first announced was only (?) 1.2 million tonnes annually. According to the Chief Commissioner of Forests, Dr Wal Gentle, in an industry intelligence report in September 1988, the timber available for the mill would be about 600,000 tonnes of mixed hardwood and softwood, with the balance of the feedstock being waste paper according to the Minister for Natural Resources, Mr I. Causley. This would mean about 150,000 tonnes of waste being reprocessed annually, a point Mr Causley has confirmed on a number of occasions.

Since then there have been many changes. In February this year, Dr Gentle announced that the proposal had been revised to make it Australia's largest single manufacturing investment increasing it's production output to 400,000 tonnes annually. Subsequently, whilst speaking on local radio, Mr Causley put production at 440,000 tonnes. This meant that the timber requirements were now in the vicinity of 1.6 to 1.8 million tonnes per year. The question was now even more pressing - just where IS all the wood coming from? Daishowa in the meantime announced that it would not be processing any waste paper, but instead would use only virgin eucalypt fibre, which made the question so much more pertinent. It had obviously reached the stage where the Government and/or it's Minister was not able to determine where, how, and what timber resources should be utilized in the community's interest. It was a classical case of the tail wagging the dog. One shudders to think what such a company as Daishowa would do to the local councils if it treats a Minister of the Crown with such disdain.

Undeterred however, the Minister and his Chief Commissioner, announced at two large public meetings held in the area that the feedstock for the mill would be sourced as follows:-

300,000 tonnes of forest waste
300,000 tonnes hardwood thinnings
200,000 tonnes sawmill waste

The balance, now up to a possible 1 million tonnes annually, was to come from private property. The figures sounded suspiciously like guesstimates, based more on a cup of coffee at morning tea time than on research and hard data, and the C.V.C.C. was quickly able to point out the flaws in the claims.

We pointed out that the claim to retrieve forest waste equivalent almost to total sawn timber production was simply impossible, as there was no way in which the material could be processed and transported under present technology. Instead the retrieval was more likely to be in the vicinity of about 50,000 tonnes annually. Hardwood thinnings, whilst they might be able to produce 300,000 tonnes for the first few years, could not sustain that volume beyond 5-7 years because the plantations and extensive regrowth areas necessary for thinnings are simply not there. Similarly, a confidential report from within the sawmill industry itself suggested that less than 100,000 tonnes of sawmill waste was available, and much of that was already tied to present contracts with chip exporters through the port of Newcastle.

But nothing demonstrates the sheer stupidity of the whole proposal better than the suggestion that the balance of the timber required would come from private property. Depending on just who one listened to at any one time, the private property yield was claimed to be as high as 1,000,000 tonnes. This represents up to 55% of the total feedstock required - and not just for one or two years but on into perpetuity.

In no other part of the State does the private property yield exceed 10%, and the state average is just 7.8%. Private property supplies to Eden were just 31,000 tonnes, or 5.2% in 1987/88.

Whilst it became obvious as time went by, that Minister Causley had absolutely no statistical evidence of this huge volume of timber being available, he did in his own inimitable style attempt just one statistical justification. In a local newspaper he is reported as saying that the region had 1.5 million hectares of forests, and that it would take just 1 tonne per hectare per year to provide for the mill.

continued Groundswell 5

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THAT ELUSIVE FEEDSTOCK (continued)

The implication was that this was easily achievable, so what's the problem. Well, the problem is this. In the Grafton Management Plan, 1987, covering the Grafton District Forestry area, we see that for the 65 years up to 1987, the total yield of all forests products, sawlogs, poles, sleepers, fence posts, firewood etc, was calculated at 0.47 cubic metres per hectare per annum. (Note that for all intents and purposes 1 tonne averages 1 cubic metre in hardwood.)

The same report shows that the expected production for the years 1987-2010 has fallen to just 0.31 cubic metres per hectare per annum. It is also interesting to note that projected annual production for that same 23 year period up to 2010 is just 26,000 cubic metres compared to the production average for the 1981-87 period of 44,800 cubic metres and for the 1971-81 period of 57,400 cubic metres. On this basis it seems that there is some validity to the claims of those who say that the sawmilling industry is about to hit a brick wall even without the added liability of a pulp mill. It's no wonder that our sawmillers are getting worried. It is apparent to anyone who takes the trouble to look critically at the feedstock matter, that the Minister's claim that there is ample timber available and that clear-falling will not occur is palpably false.

The fact is that this whole proposal has been badly handled from start to finish. If only half the effort had gone into scientific research that has gone into public relations to promote the scheme, then we would know, scientifically and without reserve, that the feedstock requirement for such a mill never was there.

Harry and Sandra Woods

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C.V.C.C. LIBRARY A PUBLIC ASSET

A lack of information about pulp mills and related issues was initially a problem for the Coalition. Members have therefore gathered authoritative information from a variety of sources. We now hold a collection of over eighty reports and newspaper and journal articles which make up the Coalition's library. Any of this information can be made available to members of the public upon request.

One of the most useful items is a file of all articles and letters to the editor published in the Daily Examiner since the "Red letter day" announcement last year. Other material includes articles on forest wildlife, recycling, pollution, dioxin, and paper manufacturing in Australia and overseas. The Clarence Environment Centre has a copy of the library catalogue and of many of the articles in the C.V.C.C.'s collection. Any person wishing to obtain information from the C.V.C.C. library should contact the Environment Centre or a member of the C.V.C.C. executive.

A TRUE STORY THEFT IN THE COMMUNITY

On the banks of the Volga during the Russian famine in 1921, almost half the people in a refugee community were already dead of starvation. The death rate was rising. Those still surviving had no real prospect of prolonged longevity. In an adjacent field, a lone soldier was guarding a huge mound of sacks full of grain. The white-bearded leader of the community was asked why his people did not overpower this one guard, take over the grain, and relieve their hunger. The dignified old man explained that the sacks contained seed to be planted for the next growing season. "We do not steal from the future," he said. Compare the old man's quiet dignity and wisdom with our own headlong rush to consume the Earth's finite resources. Today the human species is locked into stealing ravenously from the future.

Contemporary well-being is being achieved at the expense of our descendants. We have made satisfaction of today's human aspirations dependent upon massive deprivation for posterity. People of one generation have become indirect and unwitting antagonists of subsequent generations. It needs to be recognised that commonly proposed "solutions" for problems confronting us are actually going to aggravate those problems. Proposed remedies for various parts of our predicament need to be evaluated by asking whether they will intensify the adversary relationship between people living today and people of the next generation and the next.....

(Extracts from "Overshoot" 298 pp by W.R. Catton, 1980, University of Illinois Press.)

PROFESSIONAL FISHERMEN GRAVELY CONCERNED OVER PULP MILL

by Barry Heyen, Manager, Clarence River Fishermen's Co-operative.

First, it is important that readers are aware of the value of the professional fishing industry in this area.

Arguably the short stretch of ocean between Coffs Harbour and Ballina (including the Clarence River), is the most productive in Australia. It is far and away the major supplier of crustacea - King Prawns, School Prawns, Crabs - to the domestic market. Turnover of the five North Coast Co-operatives for the 1989 Financial Year amounted to $27 million with some 700 persons employed full-time. Of the total amount, the Clarence fleet, estuary and ocean contributed $14.5 million, with some 400 persons employed. The point should be made that by far the bulk of this money remained in the district, it was not remitted to Sydney in the form of royalties, nor was it sent offshore in the form of dividends.

And what is the professional fishing industry's attitude to the pulp mill? We are gravely concerned. Indeed if the proposal is for a Kraft system bleaching mill, then we are totally opposed to it.

Pulp mills are notorious throughout the world as polluters of the marine environment, and while generally the problem lies with the bleaching process, we are by no means convinced that a problem does not also exist where unbleached paper is produced. Certainly the condition of the Latrobe River (Victoria) below a non bleaching mill does little to inspire confidence - it varies from black to the colour of tea and is devoid of marine activity. Signs warn against swimming.

The mill proposed for this area will require at least 1,600,000 tonnes of timber to achieve its proposed output. Of this amount, mill proponents claim that forest and other waste will contribute 300,000 tonnes. Even if we accept this, 1,300,000 would still need to be obtained from standing timber, i.e. 65,000 timber jinker loads each year!

There is not the slightest doubt that the rate of siltation of our coastal streams must be gravely aggravated by such a massive increase in activities in the forests. Siltation is already a major pollutant of our coastal streams and we must resist any activity which has the potential to increase its rate.

Having got the material to the plant, it would then be subjected to a chemical process to break down fibres, and washed with copious quantities of water. A similar mill proposed for the N.S.W. South Coast was anticipated to use 64,540,000 litres per day (10,000 gallons per minute). This water is then disposed of into the marine environment. It is black at worst, and at best, the colour of dark tea. Canadian studies have shown the dye to result in colour and taste changes in fish, making them unpalatable.

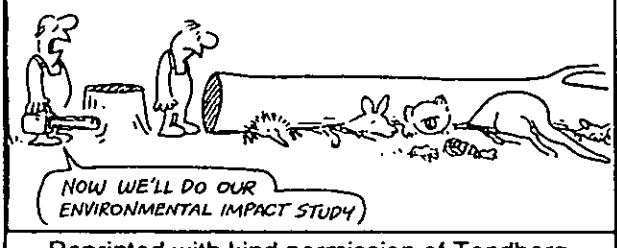
It would contain - who knows what? It may or may not contain Dioxin. If the promoters know, they are certainly not informing us, but even without Dioxin, we would have a major problem.

Overseas studies have identified deformities in marine creatures and loss of underwater vegetation up to ten kilometres from out-falls, with rate of problems increasing the nearer the tests were to the out-fall. It has been suggested that if the mill only produced unbleached paper, then we need not worry about the effluent. Frankly, we are extremely sceptical about this comment.

What do the chimneys discharge? Again, if the promoters of the pulp mill know, we are not being told. We can state with certainty that the plume from a pulp mill in New Zealand, with a similar exhaust system to that proposed for Wesley Vale was photographed by the Royal New Zealand Air Force and shown to extend 200 nautical miles. Is the fall-out likely to harm fisheries? If it caused acid rain, then the answer is yes.

That the effluent contains a number of pollutants there is little argument. A modern mill may reduce the quantity, which presumably would extend the period up to when the problem becomes critical - but very little, if anything, is known about the long term effect of producing paper from hardwood timber.

In conclusion, it seems to us that the North Coast is relatively rich in both economic and lifestyle terms. Existing industries operate satisfactorily - Grazing, Agriculture, Fishing, Apiary and of course, Tourism, to mention just a few. All of these industries will be put at risk to some extent (as will lifestyle), if this obnoxious industry is permitted here. Therefore, on this basis alone, we should hasten slowly.



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Pulp Mill Economics - Who Pays ?

by Stan Mussared

Australia is running an extremely high Current Account Deficit (C.A.D.) of $17.4 billion in 1988-89 and a budget forecast for 1989-90 of $18.5 billion. A pulp mill in Grafton capable of exporting its product would make a contribution to reducing this C.A.D. figure. But, to what extent, and at what total cost to Australians in general, and local people in particular? Any figures on a possible contribution to the C.A.D. given to us by the government or by the mill proponents will need to be examined critically. They should be examined by competent independent studies which consider all aspects, especially the true or total cost of the project - not just private costs to the company but all the many social and environmental costs which will be paid for by the community.

We must look carefully at the extent to which this mill's contribution is based on subsidies, knowing that present economic thinking considers that solutions to our balance of payments problems should not be based on subsidisation. Wesley Vale in Tasmania would have been a recipient of considerable government assistance and in late 1988 Daishowa was provided with a $64.5 m grant for roads and railways for a pulp mill project in Alberta in Canada. Will the situation be any different in the Clarence Valley? To what extent will Daishowa in this area receive assistance from State and/or Federal Governments?

Will Daishowa pay fully for any damage the company may cause to existing infrastructure and for all new developments including the upgrading of facilities, such as Iluka port, which may be needed? Or will local and other Australian taxpayers be asked to assist them to make their profits? It is very important to identify very clearly who benefits and who pays. Will Daishowa pay its full share of taxes or will it use its multi-national corporate power to reduce this obligation? Daishowa is well aware that Australian governments are anxious, perhaps over-anxious, to get export industries established in Australia and as a result may be prepared not only to wrongly offer subsidies but to be less stringent than they should be in the tax field.

Let us not forget two other aspects in relation to the C.A.D. For this project Daishowa will import substantial amounts of capital equipment. Thus, at least in the short term, during the construction phase, the mill will boost our import bill. And in the long term, what of the dividends ? A great deal of money will flow into Australia as foreign investment for this mill.

Always it will be with the intention of maximising profit. Eventually, after the start up phase is completed, dividends will flow out of the country. These are payments out and thus they will increase the Current Account Deficit.

When the proponents of this mill start justifying it by relating it to the C.A.D. (as they will) there are many questions which must immediately arise - questions which will ensure proper scrutiny and debate of the economic issues instead of a placid acceptance (as was the case in the Wesley Vale proposal).

A PHILOSOPHY OF LIFE

Life is founded upon the flow of energy through time and space. Life on Earth is an extended family in which energy flows and all things living are interrelated and depend upon one another. This family of life has many members such as living soils, trees and other plants, animals in the forest, the fish and creatures in the streams and oceans, and all the people of the Earth. The sun, the winds and waves are relatives within the Earth's family.

The streams, the fish, the soils, the forests, and all our other relations on the Earth can live quite well without us. But we cannot live without our relations.

Our valley is the watershed, the natural geographic unit of measurement, and the fish in the rivers are the primary indicator of the quality of life within the watershed. And the quality of life within the watershed determines the health of the oceans and the air. The Earth cares for those who care for the Earth. By first respecting natural cycles, caring for and loving the land and streams, our dreams, our economics and politics will be founded in biological reality, and we shall be a spiritually whole, well-fed and free people.

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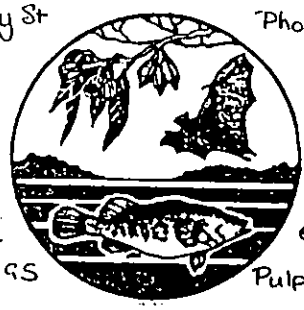
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A TALE OF CARRYING CAPACITY AND PULP MILLS

by John Kelemec, Secretary, C.V.C.C.

There will be a major global end-result of continuing with unbridled industrialisation on a scale and of a type represented by the proposed Clarence pulp mill. A factually accurate explanation of this effect is given below.

The concept of carrying capacity is familiar to most people. It is most readily understood in terms of the number of cows that a given paddock will support. We all know that unimproved pasture will support a certain number of stock for a relatively indefinite period. Provided that sufficient water is available, the carrying capacity in such a case is determined by the type of pasture and how effectively this makes use of sunlight to produce food for the cattle.

We also know that if we improve the pasture by adding fertiliser, tilling the soil, irrigation, etc., then we can increase the carrying capacity. The land will yield even more, as we intensify our management by treating the cattle with chemicals to control parasites and disease, and to promote more rapid growth. We can also provide supplementary feeding and so on, until the carrying capacity of the original unimproved pasture has been increased many times.

These increased carrying capacities have all been achieved by means of using fossil fuels and petrochemicals in many forms, either directly or indirectly. In other words, we have subsidised the stock carried by adding energy which was trapped from the sun millions of years ago and which has been stored underground as coal, oil and gas. This is not an efficient process. As a rule we must increase the amount of the energy subsidy by a factor of the order of 10, to achieve a doubling of yield.

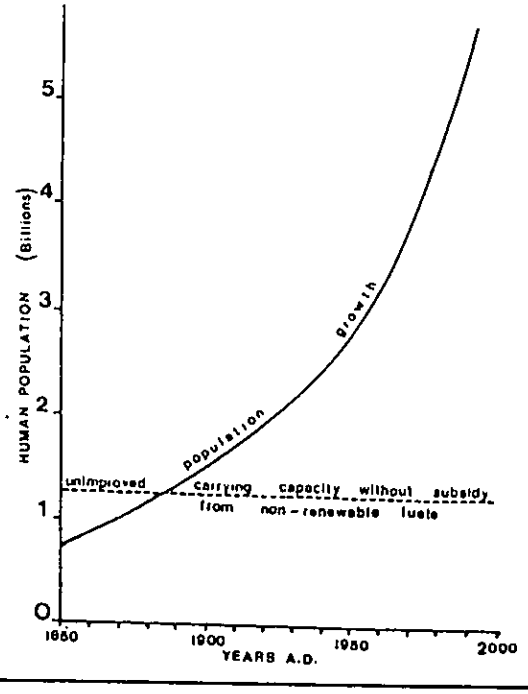
Now, to put this into a human context, consider the Earth as a giant pasture which is largely inhabited by people. We have increased the carrying capacity of the Earth for our species in the same way that we achieve an increase in the number of cows supported by a paddock (and in fact, we largely perform the latter to achieve the former).

By means of energy subsidies to both agriculture and industry, we have artificially increased the number of people which the Earth could otherwise support by about 4 times. This in itself is not a problem whilst the oil, gas and coal reserves hold out. However it is clearly evident that we can in fact expect these reserves to run out. Irrespective of whether we accept the maximum or the minimum estimate, fossil fuel availability is most likely to begin to decline sometime between 2030 and 2050. As these reserves decline there will inevitably be a closely related decline in the Earth's carrying capacity for people.

It is therefore clear that we must immediately curtail the rate at which we subsidise our existence by means of stored (finite) energy sources. It is equally clear that we must curtail our global population growth, and even further, bring it back to a level near to the Earth's unimproved carrying capacity. At the same time, we must ensure that the existing baseline level of capacity to support population without energy subsidy must be prevented from being further depressed by pollution and deforestation.

How does this relate to the Clarence pulp mill? Firstly, the mill will require massive energy subsidies to support the type and magnitude of industrial processes involved. It will therefore contribute to an acceleration of the depletion of the Earth's stored fuel reserves. Secondly, through the harvesting of a natural resource and the dispersion of this energy in the form of product, it will contribute to short-term economic growth which will in turn place upward pressure on the tendency for human population growth.

It will simultaneously depress the Earth's baseline carrying capacity for humans and animals alike, through the destruction of forests, siltation and pollution of waterways, and contamination of the air we breath. The net effect then, will be to widen the gap between human population and the unsubsidised, sustainable carrying capacity of the Earth, and to make us increasingly and unnecessarily more reliant on the fuel subsidy. It is undeniable that the duration of such reliance is finite.



PULP MILL THREATENS WILDLIFE

GREG CLANCY - ENVIRONMENTAL CONSULTANT

The establishment of a Pulp Mill on the Clarence River would have nothing but disastrous effects on the forest and river ecosystems and wildlife of the North Coast.

North Coast forests are far more than just a potential timber or woodchip resource. They are the basis of many complex ecosystems whose structures date back thousands of years. The forests are primarily eucalypt dominated open forests with areas of closed rainforest. The Clarence River, considered by some uninformed people as nothing more than an agricultural and urban drain, is in reality the essential basis of much of the natural life of the valley.

Many plants and animals depend on the forests for their survival. There are hundreds of plant species from the giant Red Cedars, Brush Box and Sydney Blue Gums, down to the smallest of herbs. Many rare and threatened plants occur including the Square-fruited Ironbark and Steel Box. Sixty five species of mammal, 173 species of bird, 65 reptile and 25 amphibian species inhabit North Coast forests and woodlands. Of these, 29 birds, 13 mammals and 7 reptiles are officially classified as endangered under the National Parks and Wildlife Act. The Koala, Long-nosed Potoroo, Eastern Pygmy Possum and Brush-tailed Phascogale are among them. One frog species occurring in these forests is protected under the Act. The waters of the Clarence River provide essential habitats for many fish and invertebrate organisms as well as the endangered Platypus and the Water Rat. Reptiles are also adapted to feeding on and around the riverbank including the Eastern Water Dragon and the Water Skink.

The forest ecosystems are in a delicate balance with soils, plants and animals all depending upon each other. Any disturbance, no matter how slight, will bring about changes to the system. Logging causes major changes but clearfelling for woodchipping causes devastation. Species that are particularly threatened are those that require climax forests with ancient trees containing many hollows. These include the possums and gliders, bats and hollow nesting birds such as owls, kingfishers, cockatoos and parrots.

Originally, large trees with hollows were left untouched in logging operations but modern technology now permits their use as woodchips. The "thinnings" proposed to be made available to the Clarence Mill are to come initially from the Candole State Forest.

This forest contains a large population of the rare Yellow-bellied Glider Petaurus australis. Concern has been expressed about the effects that logging in this area will have on this species. Clear felling for woodchips will have, by far, a greater impact on these gliders.

The Koala, already threatened by disease, will also suffer from clearfelling of its forest habitat. Many bat species such as the endangered Large-footed Myotis and the rare Great Pipistrelle, will suffer as a result of intensive logging of their habitat. Intensive forestry operations in Tasmania are already threatening the survival of the Wedge-tailed Eagle and the Grey Goshawk for instance.

Pollution of the Clarence River by discharges from the pulp mill will directly threaten the rich stocks of fish and prawns in the estuary and all life depending upon them. Migratory wading birds that travel from as far away as Alaska and Siberia will have their food resources eliminated or polluted.

Estuarine areas of the river are vegetated with mangroves and sea grass beds which are essential sources of nutrients and habitat for fish and other aquatic organisms. Five species of mangrove occur here with one being at its Southern limit of distribution. These systems would all be at risk from contamination of the river and siltation from increased logging activity.

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A SHOT IN THE ARM FOR GRAFTON RECYCLING

The future looks bright for those citizens who would like to find an easily accessible collection point for depositing bottles, steel cans (those used for pet food, fruit, vegs., etc.) and P.E.T. bottles (cordial with black bottoms). If all goes well, and Antoinette Perry convenor of the Clarence Valley Recycling Group is keeping her fingers crossed, Grafton should have two such sites in the near future.

Queensland Glass Manufacturers Co. manager Mr. Col Burns has given a fairly definite indication that his company will give Grafton four of their Bottle Banks, which normally cost approximately $860 and hold 750kg of glass. Bananacoast Recyclers of Coffs Harbour have indicated a willingness to come to Grafton to empty these collectors and will also provide cages for the P.E.T. bottles and cans.

Sites chosen for placement of the bins are Shoppingworld carpark and possibly the Cambridge Street entrance to the South Grafton Infants School on Armidale Road. Both areas will be accessable 24 hours per day. When the centres have been established it it hoped to have bins placed in other areas of the Clarence Valley.

A strong advertising campaign will be needed to encourage citizens to "do the right thing" and deposit only suitable materials in the bins, and not drop rubbish around them. Proper and extensive use of the receptacles will keep Grafton tidy and boost the flagging morale of those who've been longing for somewhere handy to deposit material they don't want to waste.

ECONOMICS FROM THE DARK AGES

Economists are almost universally urban intellectuals who understand little of rural ways. They easily come to regard the land, and all that lives and grows upon it, as nothing more than another factor of production. Hence it seems to them no loss, but indeed a gain, to turn all the world's farming into highyield agri-industry, to depopulate the rural areas, and to crowd the cities to the point of chronic breakdown and crisis. Since they inherit their conception of work from the darkest days of early industrialisation, they find it impossible to believe that labor might ever be a freely-chosen, nonexploitive, and creative value in its own right. Hence, it seems to them self-evident that work must be eliminated in favor of machines or cybernated systems. Worst of all, since their world view is a cultural by-product of industrialism, they automatically endorse the ecological stupidity of industrial man and his love affair with the terrible simplicities of quantification. (continued)

They thus overlook or distort the incommensurable qualities of life, especially Schumacher's holy trinity of "health, beauty, and permanence".

(From T. Roszac's introduction to "Small is Beautiful" by Schumacher.)

A REAL TRUCKING PROBLEM

by John Vukovich

Daishowa is currently using a tactic (commonly used by developers) whereby they publish very little of their intentions so that the community will not have enough information to mount a convincing campaign of opposition. From the few statements which have been made, it appears that the proposed pulp mill near Grafton will require 1.6 - 1.8 million tonnes of eucalypt feedstock per year to produce about 440,000 tonnes of pulp.

If the feedstock is delivered to the mill by trucks carrying an average of 25 tonnes per trip, there will be 64,000 truck loads per year or 175 per day, plus return trips. Similarly, if the pulp is trucked out at 25 tonnes a trip, that will require about 44 trucks per day plus return trips. So, without considering the large amount of other traffic which would be generated by a huge mill, the transportation of feedstock and product alone would require over 400 trucks through the gates per day, every day.

The North Coast region is renowned for having some of the worst roads and bridges in the State of N.S.W. At the present time in this region, some Shires are converting bitumenised roads back to gravel because money is unavailable for maintenance. The extra heavy traffic generated by the mill could well make many of the roads impassable to normal cars, especially in wet weather. Inevitably there would be more accidents causing deaths and injuries to other road users as well as to livestock and wildlife. Some residents would be badly affected by noise, dust and fume pollution.

Tourists would tend to detour around the region because of the degraded roads but the local population would just have to put up with the deteriorating transport system.

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WOODCHIPPING - NORTH EAST NEW SOUTH WALES

The need for proper environmental assessment and protection

D R A F T R E P O R T

INTRODUCTION

North east New South Wales is one of the most biologically diverse parts of Australia and yet its forests are amongst the least studied and protected in Australia. 10% of its remaining forests are on National Parks or other reserves, 47% on State Forest or other Crown land and under the control of the Forestry Commission, while 43% is on private lands.

Logging and associated activities in the available 90% of forests are causing:

30.58

- degradation of soil structure and stability
- extensive soil compaction
- an increase in erosion
- altered streamflows
- sedimentation of streams
- degradation of water supply
- loss of nutrients
- a severe reduction in hollow-dependent fauna
- an increase in fauna from more open habitats
- an increase in introduced predators
- a reduction in fauna preferring mature forest, rainforest, a stable microclimate and some specialised food sources
- a reduction in populations of endangered species, with increased risk of extinctions
- an increase in introduced plants
- a degradation of forest structure
- an increase in pioneer and early successional plants
- an increase in fire-adapted plants
- a decrease in later successional rainforest plants
- inadequate regeneration on some sites

- an altered microclimate in wetter forests

- an increased chance of wildfire

Forests are still being cleared for plantations, pasture, crops and developments. Rainforests are continuing to be degraded and restricted. Most of the remaining few percent of loggable oldgrowth eucalypt forests will be gone within a few years. Various species are precariously close to extinction. And yet we do not know nearly enough about our forests or what is being done to them.

In 1981, export woodchipping from north east New South Wales was allowed to commence by the State and Federal Governments and has since expanded to total an annual quota of 680,000 tonnes available from northern New South Wales and southern Queensland for export through the ports of Newcastle and Brisbane.

Two companies are involved: Sawmillers Exports Pty Ltd (500,000 tonnes) and Brisbane Forest Products (180,000 tonnes). Allowable woodchip sources are sawmill residues, logging residues and silvicultural residues, available from public and private lands. Brisbane Forest Products is currently only allowed sawmill and logging residues from Crown lands. Sawmillers Exports were allowed clearing residues on one occasion, though this source is generally not considered acceptable.

The Minister for the Arts, Sports, the Environment, Tourism, and Territories, Senator Richardson, stated (letter 2 Jan. 1990);

> "It is Commonwealth Government policy not to issue any licences for the export of forest products unless the forests concerned are managed on a sustained yield basis, the forest types are adequately conserved and the project has been subjected to environmental impact analysis."

Only 12 of the 19 Forestry Commission Management Area's on the North Coast are "on estimated sustained yield for sawlog production" (Curtin et. al. 1987), the rest are overcutting.

The National Parks and Wildlife Service (1990) consider at least 25 eucalypt associations in north east N.S.W. "likely to be most affected by increased logging" are inadequately conserved. Floyd (1987) considers that 22 of the 43 rainforest suballiances in N.S.W. are inadequately reserved. Oldgrowth forests on moderate to high fertility soils are very inadequately conserved.

Only one Environmental Impact Study has ever been done for these operations, by W D Scott & Co Pty Ltd (1977) for the export of 350,000 tonnes of woodchips derived from sawmill wastes through the port of Newcastle. No assessment of the impact of removing forest residues or clearing residues from Crown or private forests or the nature of north east New South Wales' forests, nor an adequate assessment of the impact of truck transport, in the absence of rail, of pulpwood were made.

In allowing the export of woodchips obtained from forest residues and private forests, in the manner practiced, the responsible Ministers have apparently failed to fulfil their responsibilities under State and Federal environmental protection laws, as well as Government policy. They have also apparently not given due consideration to various comments and recommendations made in the EIS, by a Federal Department, Senate Standing Committee, and State Commission.

It is thus recommended that the Federal Government suspend the use of forest residues until a Commission of Inquiry has been established and fully investigated and assessed the use of such residues from both Crown and private forests.

Dailan Pugh
North East Forest Alliance
February, 1990

WOODCHIPPING - NORTH EAST NEW SOUTH WALES

The need for proper environmental assessment and protection

D R A F T R E P O R T

INTRODUCTION

1. The Natural Environment
2. Adequacy of the north east NSW reserve system
3. The Resource
4. Management of State Forests and other Crown Lands
5. Management of Private Forests
6. History of Export Woodchipping on the North Coast
7. The role of woodchipping in increasing felling
8. The impact of logging on soils and hydrology
9. The impact of logging on flora
10. The impact of logging on fertility
11. The impact of logging on fauna
12. The impact of logging on streams
13. The cumulative impact of utilising logging and silvicultural residues
14. The impact of heavy vehicles
15. Failure of the Federal Minister and Department to fulfil the requirements of the Environmental Protection (Impact of Proposals) Act, 1974

References

Compiled by Dailan Pugh
for North East Forest Alliance

February, 1990

1. THE NATURAL ENVIRONMENT

North east New South Wales is one of the most biologically diverse regions in Australia. Together with south east Queensland, it encompasses the evolutionary hub of the wet sub-tropics as well as the McPherson Macleay Overlap - where Australia's temperate and tropical flora and fauna intermingle. As such, it has a high proportion of endemic species and species at their limits of distribution.

The McPherson Macleay overlap floristic region is particularly rich with some 761 genera of which about 10.6% are endemic (Martin 1984). In common with the limited wet tropics in north Queensland, the region also has the highest densities of bird, marsupial, frog and non-ctenotus skink species in Australia (Pianka and Schall, 1984).

Forests are estimated to cover 5,393,000 hectares of north east New South Wales (Table 2). The North Coast region encompasses 3,642,000 hectares of forests which can be broadly separated into rainforest (12%), secondary rainforest (10%) and open forest (78%) (Table 1).

The rainforest can be delineated as five principle forms: cool temperatue, warm temperate, sub-tropical, dry (monsoonal) and secondary. On favourable sites in drier and more fire prone areas, the rainforests become more restricted to gully heads, creeks and sites that offer some protection from fire.

Brush Box (Lophostemon confertus) is one of a suite of rainforest species able to grow on poorer soils and with a degree of fire resistance. It often occurs on rainforest margins and in stands where most other large rainforest trees have been either eliminated by fire or do not have as high a tolerance of adverse site conditions.

Secondary rainforest is typified by a variably developed rainforest understorey, dominated by cohorts of eucalypts - for example, Flooded Gum, Dunn's White Gum, Tallowwood and Sydney Blue Gum. A variety of other eucalypts and Turpentine dominate some stands, with rainforest species co-dominants in more advanced stands.

With high fire frequency, the rainforest understorey becomes sparse and is often replaced by the most fire tolerant species, such as brakens. The eucalypts generally grow as a series of overlapping cohorts where regeneration events have occurred after fire. They thus tend to be dominated by even aged groups of eucalypts.

These dynamic forests represent rainforest regenerating after fire or rainforest expanding through a fire ecotone. In the absence of logging and fire disturbance, they will develop into mature rainforest.

TABLE 1.
Breakdown of North Coast Forests (Coffs Harbour, Port Macquarie and Newcastle Forestry Regions). These figures are based upon those given by Curtin et al (1987) for June 1986 but have been adjusted to attempt to reflect a more ecological classification by including Brush Box with rainforest (as determined by extrapolation of available data supplied in various Management Plans). As no broad ecological survey, taking into account now heavily degraded forests, has been undertaken, these figures only indicate the true situation.

Hectares x 1,000, (%)

	National Parks and Other Reserves	State Forest and other Crown Lands	Private Property	Totals
Rainforest	92 (21)	260 (59)	88 (20)	440 (100)
Secondary Rainforest	48 (14)	198 (57)	101 (29)	347 (100)
Open Forest	320 (11)	1,412 (49)	1,131 (40)	2,863 (100)
TOTALS:	460 (13)	1,870 (51)	1,320 (36)	3,650 (100)

The open forests are generally dominated by a variety of eucalypts, with an uneven age structure. Forest Oaks, various Acacias and Grass Trees are common large understorey plants, while the ground stratum is characteristically dominated by grasses or heath.

The understorey of most of these forests has been greatly simplified by grazing and a high fire frequency, so that now large areas are covered with Bladey Grass and Braken. A large proportion of these forests are growing on steep poor country and are consequently of low stature and productivity.

Despite their limited extent, rainforests provide a disproportionate role in maintaining the diversity of the north east's forests. While some animals prefer mature rainforest, most rainforest animals also utilise (at least seasonally) the

secondary rainforests. Secondary rainforests are also the optimum habitat for a variety of species.

The oldgrowth (ie, over 200 years old) eucalypts of the secondary rainforests and open forests are also of immense importance in maintaining the diversity of wildlife in north east NSW. Most possums, gliders, bats, owls, cockatoos, parrots, lorikeets, rosellas, treecreepers and a variety of other species depend upon oldgrowth trees for denning, nesting, abundant food sources and/or foraging substrate.

As large logs on the ground, they continue to provide the same necessities, as well as fire protection, for a different assemblage of species.

A high proportion of the north east's fauna are listed as rare and endangered. Populations of many of these species are under direct threat from roading, logging and burning.

Despite north east NSW being one of the most biologically diverse regions in Australia, it is also one of the least studied forest areas.

There is insufficient information on the distribution, densities and habitat requirements of flora and fauna, and the impact of roading, logging, burning and grazing thereupon, to enable an adequate environmental assessment to be made.

2. ADEQUACY OF THE NORTH EAST NSW RESERVE SYSTEM

Australia's long separation from other continents allowed for the evolution of its unique flora and fauna. The arrival of humans, over 40,000 years ago, who utilised fire to manage the landscape, accelerated the decline of fire sensitive plants (eg, rainforest).

Throughout Australia's past, no event has been more dramatic and overwhelming than the arrival of European settlers with their attendant animals, plants, pests and diseases. With them also came a land use system based upon high disturbance regimes achieved with the aid of tools, machinery, poisons, increased fire frequency and the replacement of native species with introduced species.

> "Virtually the whole continent is in flux because the new impact is open ended and because not all changes instituted earlier have worked throughout the system. It is salutary to realise that the life-span of individuals of many Australian plants is greater than total time since the European arrival, so that plant communities contain abnormal numbers of ageing individuals inherited from before European settlement. In such vegetation, hidden changes have yet to become fully manifest."
>
> (Adamson and Fox, cited by Williams, 1985)

Seventeen mammals, three birds and one species of lizard are known to have become extinct since European settlement and many other species can be termed "the living dead" because their populations and habitats have been reduced to below critical threshholds. Of Australia's 1,600 species of terrestrial vertebrates, nearly 300 (19%) are considered endangered. (Recher and Lim, 1990).

Recher and Lim (1990) predict that there will be continued losses of mammal species, an accelerating loss of bird species paralleling the past dramatic losses of mammals, followed by similar declines of reptiles and amphibians. They note:

> "While the dedication of reserves which meet the minimum population size requirements of species and the control of feral animals are important in reducing the rate of loss of critical ecosystems and their associated fauna, the conservation of Australia's terrestial vertebrates depends on significant changes in land management practices."

The National Parks and Wildlife Service (1990) cite Lunney and Leary as stating;

"If the remaining forest habitats are cleared or intensively logged or managed without detailed knowledge of the resident wildlife, it can be concluded from historical records that further extinctions will be inevitable, particularily of those species that have now become uncommon or rare in the district and are known to be dependent upon the mature forest habitat."

Of north east NSW's forest cover of 5,393,000 hectares, some 10% is on National Parks and other reserves. In the Glen Innes Forestry Region, only 4% of the remaining forests are in reserves, 8% in the Port Macquarie Forestry Region, 11% in the Coffs Harbour Region and 17% in the Newcastle Forestry Region (Table 2). On the north coast, 21% of the remaining rainforests, 14% of secondary rainforest and 11% of open forests are on National Parks or other reserves (Table 1).

TABLE 2.

Forest cover and tenure of north east NSW. Estimates of the Forestry Commission for 1986, with state totals updated to 1989 (New South Wales Pulp and Paper Industry Task Force Report 1989).

	State Forest	Other Crown Land	National Park	Private Lands	Totals
Coffs Harbour	473	145	145	528	1,291
Glen Innes	321	366	71	993	1,751
Port Macquarie	413	112	68	289	882
Newcastle	260	463	246	500	1,469
TOTALS:	1,467	1,083	530	2,310	5,393
STATE TOTALS:	3,347	4,783	2,216	5,285	14,959

At the beginning of 1984, the total area of Flora Reserves and Forest Preserves (reserves within State Forests) on the north

coast was 18,200 hectares in 87 reserves with a mean area of 209 hectares (Curtin et al 1987).

Margules (1988) found that nearly 45% of the total Macleay Valley wetlands is needed to represent all species at least once, and in the South Austraian croplands, almost 70% of all remaining vegetation (which is less than 30% of the original vegetation) is required to be reserved if all vegetation alliances are to be represented at least once.

The National Parks and Wildlife Service (1990) note that:

> "Only a minority of the the many forest types growing on better soils are adequately conserved ... The present reserve system is mainly concentrated on poorer soils derived from sandstone and granites ... There are many plants and animals, including the Koala, that predominantly occur on State Forests and private lands, hence should these areas be logged heavily their future may be threatened."

They further note that "It is clear that higher nutrient 'oldgrowth', and selectively logged forests are under represented in reserves."

Benson (cited by N.P.W.S. 1990) lists thirteen eucalypt forest associations on the north coast and twelve on the Northern Tablelands likely to be affected by logging which are inadequately reserved in National Parks and Wildlife Service reserves and Forestry Commission Flora Reserves.

Floyd (1987) considers that 22 of the 43 rainforest suballiances found in NSW are inadequately, very poorly, or unrepresented in NPWS reserves or Flora Reserves. Also that of the 108 rare and endangered plant species in northern NSW's rainforests, 36 require action to ensure adequate conservation. He further notes:

> "All species, whether rare, endangered or common and secure, should be conserved over their full geographic, edaphic and altitudinal range (preferably by several reserves of each) because all species are important and represent unique genetic material."

The most threatened forests are the eucalypt dominated oldgrowth forests, growing on slopes less than 30°. Larger stands (over 200 hectares) of these oldgrowth forests are estimated to represent between 2% to 4% of the eucalypt dominated forests on slopes less than 30° in the Casino Forestry Region. Of particular importance to wildlife are those oldgrowth forests on moderate to high nutrient soils with good rainfalls.

All animals dependent upon or preferring mature trees (both alive and as large logs) for nesting, denning, hibernation, protection, food sources, foraging substrate, and/or other necessities are threatened with dramatic population declines as the last of the oldgrowth forests are felled and the average

frequency of oldgrowth trees is reduced to below one per hectare throughout State Forests.

As Recher et al (1980) note:

> "There may come a time in the logging cycle when the area of mature forest is reduced to a level where the numbers of animals produced are insufficient to maintain these populations. If this critical point is reached, there would be precipitous decline in species number and abundance, leaving little scope for remedial action."

Mackowski (1987) lists 47 species of birds and 26 mammals that utilise tree hollows in north east NSW. The National Parks and Wildlife Service (1990) lists 20 species of birds and 19 mammals that depend upon hollows for denning or nesting and whose abundance is likely to be reduced by integrated logging in eucalypt forests in eastern NSW.

Shields and Kavanagh (1985) note that because it is not known what level of logging can be undertaken and still retain viable populations of animals, then management for species diversity requires that animal species and numbers are maintained at natural ratios and adequate levels in patches of undisturbed forest.

Continuing habitat fragmentation threatens those species at low densities within narrow habitat requirements and low dispersal ability. Species in each block of forest, effectively isolated by unsuitable habitat and other barriers, must be maintained at a level of genetic fitness (ie, 500 individuals) if that population is to survive without human intervention.

Populations of rarer forest vertebrates in north east NSW which are being potentially threatened by current and proposed logging operations incude Dusky Antechinus, Brush-tailed Phascogale, Yellow-bellied Glider, Koala, Long-nosed Potoroo, Rufous Bettong, Parma Wallaby, Black-striped Wallaby, Golden-tipped Bat, Red Goshawk, Wompoo Pigeon, Coxen's Fig Parrot, Glossy Black Cockatoo, Sooty Owl, Powerful Owl, Masked Owl, Black-breasted Button Quail, Marbled Frogmouth, Rufous Scrub-bird, Eastern Bristlebird, Regent Honeyeater, Crested Shrike-tit, Kreft's Dwarf Crowned Snake, Stephen's Banded Snake, the frog Philoria kundagungan, Northern Leaf-tailed Gecko, Rainforest Dragon, Beech skink and the skink Lampropholis caligula.

Finally, the buildup of atmospheric carbon, the Greenhouse Effect, threatens to cause major environmental change with altered rainfall and temperature regimes along with intensification of climatic extremes. Plants and animals unable to migrate as suitable climatic regimes shift will come under increasing stress, which will be aggravated by habitat degradation, ultra violet radiation (ozone depletion) and pollution.

There can be no doubt that the present forest reserve system in north east NSW is far from adequate to preserve the majority of forest species into our uncertain future.

3. THE RESOURCE

North east NSW encompasses 5,393,000 hectares of forested land, of which 47% is State Forest or other Crown land and under the control of the Forestry Commission, 43% is on private lands and only 10% is on National Parks or other reserves.

Timber production from Crown land in the area in 1987/88 totalled 707,588m^3 net of sawlogs, 60,042m^3 net of round timber, 31,223m^3 of hewn timber and 53,435 tonnes of forest residue pulpwood. Private property produced 277,436m^3 net of sawlogs, 29,865m^3 net of round timber, 8,078m^3 of hewn timber and 44,198 tonnes of pulpwood from forest residues. (Annual Report of the Forestry Commission of NSW, 1987/88) (Table 3).

TABLE 3:

Selected timber yields from north east NSW in 1987/88.
Source: Annual Report of the Forestry Commission of NSW 1987/88

m^3 net x 1,000 and tonnes x 1,000

FORESTRY REGIONS	CROWN LANDS		PRIVATE LANDS	
	Hardwood Sawlogs m^3	Forest Residues t.	Hardwood Sawlogs m^3	Forest Residues t.
Coffs Harbour	240	2.6	128	-
Glen Innes	109	0.3	22	-
Port Macquarie	198	6.7	67	2.5
Newcastle	99	43.9	53	41.7
TOTALS:	646	53.5	270	44.2
STATE TOTALS:	853	1,219.3	346	103.2

Of the 19 Management Areas on the North Coast, at least 7 are harvesting sawlogs above the sustained yield of the forest (Curtin et al 1987) while a number of other Management Areas have virtually been cut out of large sawlogs. Present sawlog yield cannot be maintained and will continue to decline.

Of the approximately 458,000ha of mature and secondary rainforests occurring on State Forests and other Crown lands, on the north coast, the Forestry Commission classes 323,000ha (71%) as moist hardwood.

Brush Box alone represented 12% of the hardwood sawlog yield from the north coast in 1986/87, and is planned to represent up to 40% of the timber cut in some Management Areas. Of the mature rainforests, those stands dominated by Brush Box are logged on a maximum economic utilisation basis, while other stands are logged for veneer or general purposes on a 50% canopy retention basis or for specialty purposes.

As secondary rainforests (wet sclerophyll) tend to be dominated by cohorts of evenly aged species, logging tends towards clearfelling, co-dominant or sub-dominant rainforest species are "salvage" logged. Eucalypt species from these forests represented some 38% of the sawlog cut in 1986/87 from north coast Crown lands.

In the order of 13% of the north east's forests are on slopes over 30° and a further 22% are on slopes from 20° to 30°. The coastal forests are generally on more undulating topography (only 10% of the State Forests of the Casino Management Area being on slopes over 10°) with the Great Escarpment forests on rugged topography (36% of Styx River State Forest is on slopes over 30°) (Sources: various Management Plans).

Variously, the Forestry Commission restricts logging to slopes less than from 25° to 35°, with a limit of 30° most commonly applied. Though as slopes are averaged, parts of allowable logging areas extend onto steeper slopes. Many areas now being logged are on slopes that were too steep to log with available machinery in previous operations.

Mature and oldgrowth Brush Box and eucalypts provide the large sawlog resource. These remain as scattered individuals in logged forest that were left behind (due to better quality then being available), patches on slopes that were too steep and uneconomic to log previously, and in a few isolated stands of difficult access. Such trees are a scarce resource that is rapidly being eliminated.

There are large quantities of small sawlogs, poles and thinnings for which there is a low demand. Poles, thinnings, poor quality sawlogs and "defective" trees are the resource being utilised for

woodchips. These are available in the form of sawmill residues, forest (logging and silvicultural) residues, and clearing residues.

Sawmill Residues: those parts of sawlogs generated as waste in the milling process. Sawdust, bark and some defective timber is unsuitable. The Forestry Commission now considers 1 tonne of woodchips to be obtainable from $3m^3$ gross of sawlogs put through the mill (pers. com.).

Forest Residues are comprised of two types:

Logging Residues: those parts of trees left beghind once sawlogs have been removed, generally composed of larger and straighter timber that can be removed in log form. Also includes trees felled for use as sawlogs, but found to be unsuitable for such when they are on the ground.

Allen Taylor & Co Ltd (1985) state that logging residues represent from 15% to 110% of the volume logged (adopting the figure of 56% in their estimations), of this they expected 22%-30% to be recoverable. The Forestry Commission (pers. com.) now estimate 1.2 tonnes of pulpwood to be available for each m^3 gross of timber harvested.

Silvicultural Residues: trees currently considered unsuitable for sawlogs and for which there is currently no commercial demand, that are removed to make room for potentially more economically valuable trees. This includes many oldgrowth trees and thinnings from regrowth stands.

In thinning operations, yields of up to $150m^3$ gross per hectare are obtained (Forestry Commission, pers. com.).

Clearing Residues (Agricultural/Plantation Residues, also sometimes termed roundwood): timber considered unsuitable for use as sawlogs generated by the clearing of native forests, mostly for plantations or grazing.

Woodchips from such sources are generally not allowable for export, though Sawmillers Exports were allowed to utilise them on one occasion. Forests on Crown lands may be virtually clearfelled for sawlogs and forest residues and then replanted with "suitable" species. The potential also exists for private forests to be logged for sawlogs and forest residues and then cleared and converted to pasture.

The NSW State Development Co-ordinating Committee (1976) estimated that 330,000 tonnes of sawmill residues and 175,000 tonnes of forest residues were available for woodchips in north-eastern NSW. Due to "improved utilisation standards", the Forestry Commission now estimates 122,000 tonnes of sawmill

residues and 972,000 tonnes of forest residues to be available from Crown lands in north-eastern NSW (Table 4).

The National Parks and Wildlife Service (1990) questions these recent figures, stating "it is difficult to believe that this level of resource is available unless the assessment assumes that clearfelling of many of the States forests will occur."

TABLE 4:

Estimated availability of woodchips/pulpwood in north east NSW. Source: NSW Paper and Pulp Industry Task Force Report (1989)

FORESTRY REGIONS	CROWN LANDS H/W Sawmill Residues	CROWN LANDS H/W Forest Residues	CROWN LANDS S/W Residues	PRIVATE PROPERTY H/W Sawmill Residues	PRIVATE PROPERTY H/W Forest Residues	TOTAL
Coffs Harbour		492	52	40	300	
Glen Innes		187				
Port Macquarie		193	49	30	300	
Newcastle		100				
TOTALS:	122	972	101	70	600	1,865
STATE TOTALS:	157	1,697	390	88	700	3,032

Phillips (1988) considers that because young plantation-grown woods are generally less variable, normally pulp more readily , contain less extractives, produce easily bleached pulp with good bonding strength and can be developed after short beating periods, they are more suitable for the pulpwood industry than old-growth pulpwoods.

He considers that, because the quality or cost of young plantation derived pulp is superior to pulp produced from Australian native forests, Australia has been left behind by the rest of the world. He considers that it is time to develop additional pulpwood

resources through plantation establishment with hardwood species most suitable for industry requirements.

A pulp and paper mill established to utilise smallwood and non-timber resources could be of a far smaller size and produce less pollutants than the proposed bleached hardwood kraft mill. Such a mill would largely be confined to the utilisation of silvicultural thinnings, plantation timber and non-timber resources.

4. MANAGEMENT OF STATE FORESTS AND OTHER CROWN LANDS.

Some 2,553,000ha of north east NSW's forests occur on State Forests or other Crown lands where they are managed for timber production. Products include sawlogs, veneer logs, hewn wood, poles and woodchips. These products may be removed in individual operations or in a combined operation (integrated logging).

In general, logging operations consist of road and track construction, logging, pre or post logging burning and when desirable and economically affordable, silvicultural culling (if not removed as pulpwood). Most accessible forests are also utilized for grazing and bee-keeping.

Clear cutting in State Forests on the North Coast has been deliberately employed for over 50 years and is quite widely used (Forestry Commission 25.2.1975). Particularly in forest with a high proportion of oldgrowth trees with high defect (Curtin et al 1987).

Rainforests, without a relatively high proportion of Brush Box, Turpentine and eucalypt dominants, are logged for veneer or "specialty purposes". Other rainforests are logged on a maximum economic utilisation system, combined with deliberate maximum tractor-disturbance to the rainforest understorey and post logging burning to eliminate as much of the rainforest component as possible.

Recent forest treatment has aimed at retaining: clumps of 5 potential wildlife habitat trees per five hectares; 20 metre filter strips on each side of some permanent streams from which trees can be removed provided they are not dropped into creeks and the machinery does not enter the filter strip; some localities of some endangered plants and animals; some localities of significant Aboriginal sites; some seed trees of commercial species; and small trees considered capable of merchantable increment.

The Forestry Commission's desire to silviculturally treat the productive forests to remove all unwanted trees, such as "defective" oldgrowth trees and thinnings from regrowth, has only been partially achieved due to the constraints of available

finances to employ culling crews and the reluctance of sawmills to utilise lower quality sawlogs and small timber.

The Forestry Commission considers an expanded woodchip industry as necessary if it is to fully "treat" all its productive forests.

Fire is a frequently employed management tool by both the Forestry Commission and graziers. It is used: to encourage eucalypt regeneration after logging in the wetter forests; for "hazard reduction", practiced as frequently as every 2 years in "high risk" areas; and by graziers with forest leases and/or adjoining properties to encourage fresh pick, often illegally and sometimes as frequently as annually.

The Forestry Commission's information and policies on wildlife are grossly inadequate. In a number of Management Areas no wildlife records specific to them are available. Where the Forestry Commission does have species lists, they are mostly incomplete and often incorrect. Records are mostly of birds and mammals with few of reptiles and amphibians and virtually none of aquatic fauna and invertebrates.

Most information on the habitat requirements of wildlife in north east NSW's Forestry Commission Management Plans is based on circumstantial observations and is not quantified in any way. As such, there are numerous inadequacies and incorrect conclusions. There has been no realistic attempt to assess or integrate the results of research (even that carried by the Commission's own personnel) on the adverse impacts of roading, logging or fire on animals into management plans and practices.

With few exceptions, the Commission makes no attempt to locate and identify the specific localities where rare and endangered animals occur. Therefore, the territories of endangered species are often logged and burnt. Any real attempt to manage forests for rare and endangered animals must be based upon the delineation of their specific territories and habitat requirements.

Significant Aboriginal sites fare little better. For example, in Washpool State Forest, the Commission gave undertakings that a reputed site near Redbank Creek would be located and recorded with some urgency before logging was undertaken and that further archaelogical surveys would be undertaken in proposed logging areas. (Forestry Commission, 1980).

Logging began in the Redbank area in 1982/83 and has since destroyed the site, while a partially completed road into the Desert Creek area similarily destroyed another significant site in 1989. No attempt was made to identify either site prior to roading or logging.

On Crown lands, logging and snig track construction extends onto slopes from 25° to 35°, most commonly 30°, on a variety of soil types. The application of the Standard Erosion Mitigation Conditions is professed by the Forestry Commission to be adequate to reduce the impact of logging on erosion and water quality to acceptable limits.

The Standard Erosion Mitigation Conditions specify, amongst others, that: minor roads and tracks should be constructed with crossfall drainage; immediately following logging operations, such roads and tracks should be drained by cross banks where necessary; the exits of these banks must allow water to escape readily from the track or road; the surface material is to be replaced on roads and tracks as far as practicable; roads and tracks shall not cross running streams unless a causeway, bridge or pipe culvert designed to transmit peak flows has been provided; topsoil to be returned to logging dumps which shall be revegetated and/or ripped where specified; that a filter strip of existing vegetation shall be retained to extend at least 20 metres on each side of a stream where the catchment area exceeds (at most) 100 hectares; no tree shall be felled into a watercourse within a filter strip; and trees may be felled within a filter strip but tractors shall not enter the filter strip to remove logs.

The Senate Standing Committee on Science and the Environment (1977) notes that it is through harvesting operations that much of the actual environmental damage occurs and it is at this point that most of the environmental protection measures must eventually be applied. They were convinced that a greater emphasis needs to be placed upon development of expertise in the area of forest harvesting as the importance of environmental protection is not properly understood by those whose responsibility it is to carry out the protection work in the forest.

The Committee received a "disturbingly large mass of evidence... which appears to be quite firmly based" regarding the non-observance of harvesting prescriptions, much of it associated with erosion and siltation. They concluded that even where well established prescriptions exist, it is evident that management structures and lines of responsibility for their practical implementation are for the most part either poorly delineated or only partially effective:

> "This matter is considered of such importance by the Committee that it recommends that renewal of existing licences for the export of woodchips be granted only when it can be shown that implementation of the environmental protection measures laid down by forestry authorities, as amended from time to time in the light of new knowledge, is fully effective." (Senate Standing Committee on Science and

the Environment, 1977, pp.226-7).

Commissioner Gentle (1981) stated that the Forestry Commission of NSW could not say that what was happening in the bush was in fact what it said was happening, the field performance was too sloppy. Relating to the then Casino Region, which he emphasised is no worse than anywhere else, he stated "there was no doubt in anyone's mind but that the Standard Erosion Mitigation Conditions were being breached, and seriously, almost all the time". He concluded by admitting that in this respect, the Forestry Commission was breaching the law.

Justice Hemmings (1989) found that "The Standard Erosion Mitigation Conditions imposed on the operations by the Forestry Commission are likely to be unsuitable guidelines for erosion control in the steeper catchments in the Mistake State Forest." He considered that even on soils of poor to moderate erodability, on slopes over 25°, with the conditions conscientiously applied, "it was very doubtful whether they would hold such exposed soils and prevent the formation of gullies and continuing generalised erosion".

The Standard Erosion Mitigation Conditions are still not being fully implemented in north east NSW and the Forestry Commission still refuses to undertake soil surveys prior to roading or to amend the Conditions to reduce potential erosion on steeper sites and less stable soils. Abuses of all the aforementioned Conditions have been observed by, and reported to, the author.

For example, on a recent (25-29 January, 1990) visit to Boorook and Spirabo State Forests (Tenterfield Management Area), the author camped beside permanent streams, alongside Wattle Tree Creek in the latter forest. Logging up to one side of the streams had occurred around 1987 and 1988. In both situations, an approximately 300 metre length of the streams, adjacent to camp, was inspected.

In both State Forests, no filter strip had been retained with 6 trees at Boorook and 3 trees at Spirabo being felled into or across streams (in the latter area across the junction of two major streams in one instance). In both forests, 2 trees next to the stream channel had been deliberately (as evidenced by scarf cuts) felled across the stream. At Boorook, the trunks appeared to be either unsuitable or unrecoverable and were left in the creek. The heads and unwanted parts were left where they fell - often in the streams. Soil damage, occasioned by machinery, adjacent to the streams, was evident and in some places, extensive.

Also in Boorook State Forest, in the head of Gilgurry Creek, three Brush Box within 20 metres of a permanent stream had been felled on a 33° slope and left, as they were, presumably

unrecoverable.

It appears that under Forestry Commission management and over time in the accessible forests: species composition will be simplified or altered to favour commercial species; old growth forests will be eliminated to be replaced by regrowth; large areas of forest will become less productive; the few retained hollow bearing trees will be blown over, burnt out or die and along with them, will go the majority of the surviving hollow-dependent animals; large logs on the ground will become scarcer, as will the fauna dependent upon them; the understorey will increasingly be simplified by burning and grazing, with conversion to such plants as Bladey Grass, brakens and weeds; streams will suffer from increased sedimentation and water quality will continue to decline; and in dry periods, streamflows will decrease due to higher transpiration of growth.

5. MANAGEMENT OF PRIVATE FORESTS.

Private property encompasses some 2,310,000ha (43%) of north east NSW's forested land (Table 1). Though these forests have been generally abused, they still play a significant role in flora and fauna conservation and maintaining the quality of the environment.

While some owners regard their forests as valuable assets, the majority of private forests have only survived because they are on steep slopes, poor country, or are uneconomic to clear. As noted by Bourne Forestry Services Pty Ltd (cited by Allen Taylor & Co Ltd, 1975), "...forest management would hardly rate consideration by most property owners".

It is herein asserted that, even when properly implemented, environmental controls on the logging of Crown lands are inadequate. The principle problem with the utilisation of forest residues from private property is that no adequate statutory controls have been implemented to ensure that even the minimal environmental controls used by the Forestry Commission are applied.

In 1987/88, 97,633 tonnes of forest residue pulpwood was harvested in north east NSW, of this 44,198 tonnes (45%) came from private property.

The State Pollution Control Commission (1975) stated that it:

> "...envisages the possible indiscriminate exploitation of private lands to provide material for woodchips. There are not sufficient statutory powers to ensure the proper environmental management of private lands in respect of soil erosion, protection of visual amenity, faunal habitats and specific plant communities".

further recommending:

> "That no approval be given to the export of woodchips derived from trees felled on private lands, until such time as there are adequate statutory powers to ensure the proper environmental control of tree removal and forest management on private lands."

The Senate Standing Committe on Science and the Environment (1977, p.16), recommended that:

> "Renewal of licences for the export of woodchips be made conditional upon the assurance of means to ensure sufficient regeneration for future requirements, particularily on private land."

Despite the fact that export woodchips derived from forest residues, and in one instance clearing residues, obtained from private poperty was allowed in 1984, the NSW Pulp and Paper Industry Task Force Report (1989) still was recommending that the NSW Government "immediately develop" a code of practice and "regulatory control mechanisms to enforce the code of practice for integrated harvesting on private land".

W D Scott & Co Pty Ltd (1977) note that in the longer-term, woodchipping will make private land-clearing operations somewhat less costly and perhaps more significant.

While no detailed appraisal of NSW's private forests has ever been undertaken, it is salutory to note that in Tasmania, only 25% of private lands are adequately regenerated after logging and that the average annual yield of pulpwood from private lands is anticipated to decline from 1,361,000m^3 (average 1979 to 1982) to 400,000m^3 p.a. sometime after the year 2015, while long term sawlog yields would be minimal. (Commission of Inquiry into the Lemonthyme and Southern Forests, 1988).

The NSW Pulp and Paper Industry Task Force Report (1989) notes that much of the Private Forests of NSW have been logged in an uncontrolled manner for the last 80+ years and that this means that a good percentage of this resource is not in good condition.

6. HISTORY OF EXPORT WOODCHIPPING ON THE NORTH COAST.

During 1974 and 1975, four seperate companies put forward proposals to export woodchips obtained from the North Coast region of NSW. Proponents were Allen Taylor & Co Pty Ltd, Toyomenka (Australia) Pty Ltd, Standard Sawmilling Co Pty Ltd and Sawmillers Woodchips Pty Ltd.

These four proposals were reviewed by the State Pollution Control Commission at an inquiry in October 1975 and assessed by the NSW State Development Co-ordinating Committee in June 1976.

In February, 1977, the four companies agreed to form one consortium, Sawmillers Exports Pty Ltd. The Company proposed to export 350,000 tonnes of woodchips annually through Newcastle. For an initial three year period, only sawmill residues were to be utilised, while transport of woodchips to Newcastle was to be by rail "where economics permit". In subsequent years, it was proposed to also utilise logging, silvicultural and clearing residues.

In July, 1977, the Federal Minister for Environment, Housing and Community Development and the NSW Minister for Planning and Environment agreed that the Company prepare a single Environmental Impact Statement to meet the requirements of both the NSW and Commonwealth Governments.

W D Scott & Co Pty Ltd (1977) prepared the EIS. They only considered the use of sawmill residues, stating that further biological and ecological studies into the use of forest residues should be undertaken prior to their utilisation. No assessment of the proposal on forest ecosystems or private property was made. The assessment of impacts on roads and road uses was largely based on the utilisation of rail transport and was clearly inadequate to assess the impact in the absence of rail transport.

The draft EIS was released for public review and comment from 21 December, 1977 to 23 January, 1978. Considerable comment was received with the major concerns being the effect of the proposal on forests in the area and on the regional road network.

The Company then prepared an addendum responding to the public comment which, together with the draft EIS, constituted the final EIS.

In May 1978, the Office of Environment Protection (OEP) in the Department of Environment, Housing and Community Development, gave their approval to the Company to export 350,000 tonnes of sawmill and logging residues, with the condition that the Company implement "all necessary measures and techniques to safeguard the environment described in the final EIS and on the company using, where economically feasible, rail transport for chips to

Newcastle". Further stating:

> "The OEP would not therefore support any aproval for the Company to use residues, other than sawlog residues, until information adequate to assess the impact is made available." (Conclusion 49).
>
> "...the Company should be informed that any future proposal to utilise forest residues will require a further application for export approval and environmental assessment in accordance with the Environment Protection (Impact of Propsal) Act." (Recommendation 56 b.).

Approval for the export of 350,000 tonnes of sawmill and logging residues was granted to Sawmillers Exports Pty Ltd for 15 years from April, 1981.

In 1984, approval was given for Sawmillers Exports to export woodchips derived from silvicultural residues from Crown lands and forest residues from private property. This was despite the facts that: no environmental assessment of the use of forest residues had been prepared or assessed; no satisfactory statutory controls to protect forests on private property had been enacted; and the changes were not referred to the OEP for assessment in accordance with the Act.

In 1988, Sawmillers Exports' quota was increased from 350,000 tonnes to 500,000 tonnes. Similarly, no adequate environmental assessment of the forest, or the increased impacts on roads and road users, was undertaken. At this time, the OEP, now in the Department of Arts, Sports, Environment, Tourism and Territories (DASETT) ignored its previous advice of May 1978 and raised no objections.

In 1989, export approval was given for 5 years for an entirely new company, Brisbane Forest Products Pty Ltd, to export 180,000 tonnes of sawmill and logging residues from northern NSW and southern Queensland. No EIS was prepared and the public were not informed. The Company has prepared what it terms an EIS though this is not available to the public. No other documented environmental assessment appears to have been made. Nor was this proposal referred to OEP for assessment in accordance with the Act.

In September, 1989, the New South Wales Pulp and Paper Industry Task Force Report recommended the construction of a world scale bleached hardwood kraft pulp and paper mill on the North Coast. The mill would require 1.5-1.8 million tonnes of greenwood to produce approximately 400,000 tonnes of pulp and paper per annum. Apart from an ill-informed discussion, the report makes no assessment of the impact of the proposal upon forests or rural roads.

7. THE ROLE OF WOODCHIPPING IN INCREASING FELLING.

With proposals for pulpwood to represent around half of the timber removed from forests, and up to 150 tonnes per hectare in some operations, there can be no doubt that woodchipping does require the felling of trees that would not otherwise be felled.

Trees to be felled include "defective" oldgrowth and regrowth trees, thinnings from dense regrowth stands, potential (but poor quality) sawlogs not wanted by sawmills, sawlogs improperly assigned for woodchipping and any other trees the Forestry Commission does not want. Any potential sawlogs assigned for woodchips will necessitate the felling of additional trees to meet sawlog quotas.

The Commission of Inquiry into the Lemonthyme and Southern Forests (1988, p.388) noted that Crown Sawmillers, who are guaranteed an allocation, have no incentive to take lower grade logs and seek the highest standard landed at their mills. Further that Crown Sawmillers press contractors employed by pulpwood companies to deliver only high-quality logs; that is, there is a tendency to "cream" the better sawlogs when logging operations are controlled by sawmillers.

The Forestry Commission of NSW (1988, p.18) states that:

> "There is no fixed specifications to separate lower grade sawlogs from pulpwood. Perhaps half would be suitable for sawing into lower value products, depending on the standards acceptable to the purchaser. These standards in turn can vary from time to time according to available markets, processing efficiency and capacity, and the purchaser's assessment of these factors."

The Commission of Inquiry into the Lemonthyme and Southern Forests (1988, pp.387-388) note that Australian Newsprint Mills clearly indicated that there were greater returns to the Company to process Category 1 sawlogs through to pulp and paper than to selling them to sawmillers. Also that APPM stated that returns on low-grade sawlogs were certainly higher if processed as export woodchips.

The Commission received considerable evidence, notably from fallers and contractors, claiming poor sawlog recovery and segregation in the integrated logging operations. In addition, they note that contractors having difficulty meeting pulpwood quotas may give priority to pulpwood recovery, which can lead to loss of sawlogs at the log dump by inappropriate crosscutting, deliberate smashing with machinery and by other means.

As Commissioner Gentle (1981) notes, the timber "which is marginal right now because it is too small, is going to be the Rolls Royce in 10 years time."

The utilisation (as forest residues) of trees felled for use as sawlogs, but found to be too faulty for such when they are on the ground, also increases the number of trees felled. As noted in the Tenterfield Management Plan, Annual Report (1983/84):

> "No culling was carried out because of unavailability of funds, however with the sale of reject logs behind Crown Operations, tree marking has been intensified to remove more trees of doubtful merchantibility."

There are extensive forest stands in north east NSW comprised of regrowth below sawlog size, interspersed with oldgrowth trees or stands which are at present uneconomic to log. Similarly, there are numerous "defective" oldgrowth trees left scattered around in regrowth stands which are uneconomic to cull.

Integrated logging and pulpwood logging of silvicultural residues makes it possible to log these trees. Without pulpwood harvesting, such oldgrowth trees, which are of such vital importance to many animals, would be retained because of financial constraints.

The claim that woodchipping will not lead to the felling of trees which would not otherwise be felled, is not substantiated by practices and policies. There needs to be an immediate assessment to determine to what extent woodchipping has increased felling and the clearing of private lands.

8. THE IMPACT OF LOGGING ON SOILS AND HYDROLOGY.

Roads and vehicle tracks divert and concentrate overland and subsurface water flows, thereby increasing runoff (eg: Bren and Leitch 1985). They and other areas of disturbed soils are also major sources of erosion thereby increasing soil losses, nutrient losses (eg: Richards and Charley 1983), and sediment loads in streams (eg: Langford and O'Shaughnessy 1977).

These losses are particularly severe: when roads and snig tracks are inadequately constructed; when soils are highly erodable or unstable; on steeper slopes and nearer streams; until adequate drainage systems are constructed; where instability of cut and/or fill results in slumpage or excessive erosion; where excessive soil damage is caused by machinery in wet weather; and when contrators fail to fulfil erosion mitigation conditions.

Significant soil compaction is caused by the weight of machinery,

loads and falling trees, wetter soils being most prone to damage (eg: Greacen and Sands 1980).

Soil compaction, resultant from logging, has been observed to significantly: increase soil density; reduce infiltration capacity; reduce productivity; reduce aeration; reduce and destroy beneficial soil organisms; reduce nutrient availability and uptake (eg: Greacen and Sands 1980), and reduce hydraulic conductivity (eg: Incerti et al 1987). Soil compaction may occur down to 50-120cm and soils may take over a hundred years to recover (eg: Jakobsen 1983).

Fire has been noted to cause significant increases in runoff (eg: Langford and O'Shaughnessy 1977) and erosion (eg: Atkinson 1984) and cause deterioration in soil structure (eg: Langford and O'Shaughnessy 1977). Decay of root systems, killed by logging or fire, decreases soil stability (Langford and O'Shaughnessy 1977).

Cattle cause soil copaction while degrading stream banks and wetlands.

9. THE IMPACT OF LOGGING ON FLORA.

Logging, clearfelling, silvicultural treatments and fire cause a reduction in the diversity of species and their natural distribution.

The species composition of the overstorey following logging depends upon a variety of factors such as: which seed trees are retained; which less commercial species are removed for silvicultural reasons; adequacy of regeneration; selection pressures (eg: grazing); competition from introduced species; plantings undertaken; and a variety of chance events.

Generally, the Forestry Commission's management aims at producing a crop of the quickest growing, easiest grown, commercially acceptable species.

Failure of "desirable" regeneration becomes more pronounced in the wetter forests (eg: Forestry Commission 1982 a). In order to obain the desired results in mixed rainforest-eucalypt communities, a policy of maximum disturbance to the understorey (bearing as much soil as possible) during logging is followed up by burning to eliminate as much of the rainforest understorey as possible and produce a receptive seed bed. When these measures fail, as often happens, further clearing and replanting (often with species not originally found on site) are sometimes carried out.

It is in these forests that floristic simplification and

10. THE IMPACT OF LOGGING ON FERTILITY.

Nutrients are a major determinant of the distribution and densities of many plants and animals. Many ecosystems depend on efficient nutrient accumulation, retention and recycling mechanisms and thus, are particularly vulnerable to changes in nutrient status occasioned by disturbances (Raison 1980). Even small changes in nutrients can cause subtle changes in species (Turner and Lambert 1986).

During logging operations, significant nutrient losses occur by: increased transport in overland flow and by leaching, removal in timber - particularly in bark and sapwood, and through losses to the atmosphere on burning (eg: Harwood and Jackson 1975).

Nutrient losses are most apparent in areas of high rainfall subject to repeated disturbance - particularly by fire.

Site fertility is also significantly reduced by the compaction effect of machines.

Plants variously accumulate specific nutrients, rainforest plants being particularly efficient accumulators (eg: Forestry Commission 1982 b). The modification of species composition by logging and burning thereby also alters the nutrient balance and cycles of the forest.

Altered and decreased site fertility can affect the growth, health, defence mechanisms and competitive advantages of plants and thus affect faunal distributions and densities.

11. THE IMPACT OF LOGGING ON FAUNA.

Logging operations cause a reduction in fauna preferring mature forest, rainforest, a stable microclimate and some specialised food sources and habitats. The operations cause an increase in animals from more open habitats and feral species. The impact becomes most alarming when rare or endangered animals are adversely affected, though potentially all animals not preferring regrowth forests are threatened with drastic population declines and extinctions.

The structural and floristic diversity of a forest are important determinants of its faunal composition and diversity. In the eucalypt dominated forests, it is the oldgrowth stands, with low fire frequencies, which provide the greatest diversity of structural and floristic features: a high proportion of large, often hollow bearing trees; a variety of tree sizes and forms; a diverse and complex understorey; and large logs.

alteration can be most pronounced, with the diverse rainforest component often reduced to swathes of Bladey Grass, Braken Fern and seas of Lantana. Where overstorey regeneration is obtained, there is a pronounced shift to the quicker growing, more fire tolerant, eucalypts at the expense of the slower growing eucalypts and Brush Box.

Fire - its intensity, seasonality and frequency - is the most critical factor affecting the species composition of the understorey. Frequent fires favour those plants with adaptive traits (such as ability to sucker, rapid maturity and production of fire resistant seeds and capsules) over plants with susceptible traits.

While Australian forests have a long history of fire disturbance, it appears that the current frequency of fires in north east NSW is far greater than the order laid down prior to European settlement (eg: Turner 1984). As a consequence, the natural grass, heath and rainforest understories of the forests are being drastically simplified, with increasing dominance by such plants as Bladey Grass, Brakens and various Acacias. Increases in fire adapted plants can increase the flammability of the forest.

The Forestry Commission is concerned with the dominant commercial trees and pays scant attention to the overall and natural species composition of the forests. Very little is known of the occurrances and requirements of rare and endangered plants, so that many individuals and populations are being adversely affected by logging operations. In the Urbenville Management Area, the endangered Dunn's White Gum (classified as 3R by Leigh, Boden, and Briggs 1984) is expected to represent 60,392m^3 of the timber yield up to the year 2010 (Forestry Commission 1986).

Exotic plants (weeds) rarely become established in stable plant communities without disturbance and environmental modification (eg: Amor and Piggin 1977). Their abundance usually increases with the intensity and frequency of disturbance. Logging and fire are agents of massive disturbance, while roads create avenues for the proliferation and dispersal of weeds. Cattle and machinery are sources of disturbance and carriers of weed seeds (as well as a variety of other potentially harmful organisms).

Intensively managed forests are dominated by immature even aged trees with a grossly simplified understorey.

Oldgrowth trees provide a number of resources not offered by, or in lesser quantities by, immature trees:

1. **Hollows:** Tree hollows are utilised by some 399 species (25%) of Australian terrestrial vertebrates (Ambrose 1982), and are necessary for most owls, parrots, cockatoos, lorikeets, rosellas, treecreepers, possums, gliders, bats and a variety of other birds, mammals, reptiles and amphibians.

   It takes over 100 years for quick growing eucalypts to develop small hollows and over 200 years to develop the larger hollows required by large animals for denning and nesting - slower growing trees can take proportionally longer.

2. **Food sources:** Mature trees produce more flowers and fruits than immature trees (Ashton 1975) and thus provide far greater quantities of these food sources. Some insects in the bark and foliage and the nectar and fruit of mistletoe have also been noted to be more abundant in mature trees (Loyn 1985).

3. **Other structural features:** such as large trunks for foraging and stable nest platforms.

4. **Large logs:** Large fallen branches and trunks variously provide nest and den sites, predator and fire protection, moist stable environments, insulation, food sources and other necessities for a large proportion of ground dwelling invertebrates, small mammals and reptiles. small logs have lower densities and thus rot and burn more rapidly, while also not being able to meet the requirements of many animals.

Many animals, in particular species of restricted distribution, are dependent upon the protection, stabilised microclimate, food sources and other benefits provided by rainforests. Rainforest degradation by logging, clearance of secondary rainforests and loss of rainforest by fire, are having significant impacts upon dependent species.

The simplification of understories, particuarly by fire, can variously result in: a reduction in palatable plant species for herbivores; loss of nest sites; loss of protection; loss of invertebrate, fruit and seed sources; increased competition from animals from more open habitats and feral animals; and increased predator efficiency.

Roads create an edge effect and act as corridors for the

dispersal of exotic fauna while also increasing predator success and populations (eg: Yahner 1988). Even partly overgrown tracks act as effective barriers for exchanges between populations of some animal species, thereby disrupting gene pools (eg: Barnett et al 1978).

As the aforementioned impacts and numerous others take their toll on particular species, so too their decline impacts on the species to whom they provide benefits or necessities. Numerous such chain reactions have been instigated and it may take many years before we realise what is happening, by which time it may be too late to do anything about it.

Since European settlement, the ranges of many forest animals have declined in greater proportion than the amount of forest cleared. Many species are in decline and numerous populations are approaching critical genetic threshholds beyond which inbreeding will hasten their decline.

Very little research has been undertaken on the distribution, densities and habitat requirements of fauna in north east NSW and even less on the impacts of roading, logging, silvicultural treatments and fire upon them.

12. THE IMPACT OF LOGGING ON STREAMS.

Roading, logging and fire all cause initial increases in runoff and erosion. Roads contributing to such for long periods. This affects streams by: increasing flooding and streambank erosion; increasing turbidity and suspended sediment levels; sedimentation of stream beds; increasing water temperatures; increasing nutrient loads; and decreasing oxygen levels.

Streamflows can decrease during dry periods due to lower soil storage and over the longer term, (from 5 years until forest maturity) by the increased transpiration of regrowth.

The aquatic environment of streams is degraded by logging activities, so that it is less favourable for a number of aquatic plants and animals. The more sensitive and restricted species being particularly vulnerable.

Increased flooding, erosion, sedimentation and degraded water quality will also affect people downstream.

13. THE CUMULATIVE IMPACT OF UTILISING LOGGING AND SILVICULTURAL RESIDUES.

The Department of Primary Industry (pers. com.) claim that the export of woodchips derived from sawmill wastes and other "residue material" has no additional adverse environmental impact above that of routine logging operations.

The Forestry Commission currently expects 972,000 tonnes of woodchips/pulpwood derived from logging and silvicultural residues to be obtainable per annum from Crown land in north east NSW (Table 4). This represents 810,000m^3 gross of timber as compared with a declining hardwood sawlog production which, in 1987/88 represented some 841,000m^3 gross of timber obtained from Crown lands in north east NSW. The total non-pulpwood harvest representing some 1,013,000m^3 gross.

The utilisation of logging and silvicultural residues can therefore be expected to almost double the volume of timber being removed from the forest when fully integrated into logging operations.

The losses of nutrients in timber removal will be proportionally higher because of the greater utilisation of small wood with a higher sapwood, and thus nutrient, content. Significant increases in the degree and extent of compaction, soil disturbance, runoff, erosion, vegetation alteration, habitat degradation and other impacts of logging will occur.

Losses of mature trees and large logs, due to removal as silvicultural and logging residues respectively, will increase dramatically and have a severe adverse impact on dependent fauna. Aquatic fauna and amphibians will also be significantly affected by increased stream degradation.

Recent cases in the Land and Environment Court of NSW (Bailey vs Forestry Commission of NSW, 1989, Barrett vs Forestry Commission of NSW, 1989, and Corkhill vs Forestry Commission of NSW 1990) have proved that the Forestry Commission is in breach of Environment Protection and Assessment Act by not adequately assessing the environment and their impact upon it.

The utilisation of logging and silvicultural residues greatly increases what has already been proven as a significant impact.

Integrated logging is a single activity which must be assessed as a whole and the impact of any part of the operation (eg: utilisation of forest residues) cannot be divorced from the overall operation. As such, the impacts of roading, machinery, logging and burning need to be assessed along with the utilisation of forest residues.

14. IMPACT OF HEAVY VEHICLES.

Logging trucks affect the local population by reducing road safety and increasing road damage, bridge damage, noise levels and pollution. There are currently export licences for 680,000 tonnes of woodchips per annum from northern NSW and southern Queensland. Without allowing for waste, this represents at least 34,000 20 tonne truck loads, or 68,000 truck movements, though the use of B-Double trucks carrying 40 tonne loads is becomng more widespread.

Dobinson (1985) notes that road pavement damage increases in relation to the fourth power of axle load and that therefore a truck loaded to the permissable limit will do 14,000, the damage of an average car to road pavements. He further notes that bridge life depends on the extent of concentrated load by an axle group and the gross weight of the vehicle on the bridge.

Numerous instances of logging trucks being overloaded have been observed and reported in north east NSW. Overloading significantly increases the impact reported by Dobinson.

Trucks are used to move the forest residues from the forest to centralised woodchip mills and woodchips produced from sawmill waste to the central stockpile.

On usually quiet and poor quality rural roads, the increased truck movements during logging operations significantly increases bridge and road damage which Local Councils have to meet the costs of repairing. The State Pollution Control Commission (1975) noted that "Several submissions, in particular from local councils, commented on the damage to secondary roads by heavy woodchip vehicles. Experience in Tasmania is said to show that the damage is not trivial".

The Department of Environment, Housing and Community Development (1978), in giving its approval for the export of 350,000 tonnes p.a. of woodchips through the port of Newcastle, recommended that the approval be conditional "on the Company using, where economically feasible, rail transport for chips to Newcastle". Rail transport has not been utilised.

Many rural roads have rough surfaces (necessitating avoiding pot holes and ruts) and are narrow and winding. Logging trucks greatly decrease road safety and give rise in many rural communities to real fears of accidents occurring.

There has to date been no adequate assessment of the impact of logging trucks on roads, bridges, Local Council finances and road safety in northern NSW. Such impacts need to be determined so that means of alleviating problems and compensating councils for damage incurred can be determined.

15. FAILURE OF THE FEDERAL MINISTER AND DEPARTMENT TO FULFIL THE REQUIREMENTS OF THE ENVIRONMENTAL PROTECTION (IMPACT OF PROPOSALS) ACT, 1974.

The EIS (W D Scott & Co Pty Ltd, 1977) was deficient (in the terms of Schedule 4.1) in describing and assessing the environmental impacts of utilising forest residues, increasing road usage by heavy vehicles and utilising pulpwood from private property.

The Department of Environment, Housing and Community Development (1978) noted that "...the EIS does not contain sufficient information to properly assess the impacts of the use of forest residues" but considered that the restrictions sought by the Senate Standing Committee on Science and the Environment (1977) would be met by "...the proposed NSW Government statutory controls on use of forest wastes from private lands and by the undertaking given by the Company to complete further biological studies before seeking to use residues other than sawmill wastes".

The Department concluded by recommending that "...the Company should be informed that any future proposal to utilise forest residues will require a further application for export approval and environmental assessment in accordance with the Environmental Protection (Impact of Proposals) Act".

The Act states (8,b.) that the Minister is responsible "...for ensuring that any final environmental impact statement..., and any suggestions or recommendations made in accordance with those procedures, are taken into account".

Schedule 10.1.1 notes that "...the Department may at anytime... review and assess all or any of the environmental aspects of the proposed action, inquding... the effectiveness of any safeguards or standards... the accuracy of any forecasts of the environmental effects..."

In granting and amending the Sawmillers Exports and Brisbane Forest Products export woodchip licences to variously include forest residues, silvicultural residues and such residues from private lands, the Department and the Minister appear to have failed to take into account:

1. The substantial effect on the community of increased heavy vehicle damage to road surfaces and their effect on road safety, without the utilisation of rail transport. Particularly the impact of the 7,500 extra truckloads (of 20 tonnes each), which is 15,000 truck movements, as allowed by Sawmillers Export licence increase of 150,000 tonnes in 1988 and the 9,000 extra truck loads (passing through Brisbane)

as allowed by the issuing of Brisbane Forest Products licence of 180,000 tonnes in 1989.

2. The significant environmental impact that the removal of logging residues and silvicultural residues does have on a forest ecosystem. Particularly as the three year study, proposed in the EIS, into the environmental impact of utilising forest residues was not done. Sawmillers Exports was allowed to utilise logging residues in 1981 and silvicultural residues in 1984. Similarly, Brisbane Forest Products were allowed to utilise 50,000 tonnes of logging residues, on a trial basis, in 1989. No adequate environmental assessment on the utilisation of forest residues on the North Coast has apparently ever been undertaken.

3. That no comprehensive assessment of the nature of the North Coast forests and the impact of logging operations upon them, has been undertaken. Of particular concern is the role of intensified (integrated) logging in the endangering, or further endangering, of species of flora and fauna.

4. The role of intensified harvesting, on private property, in degrading the environment and increasing forest clearance. Particularly as there are still not adequate statutory powers to ensure the proper environmental management of private lands in respect of soil erosion, protection of visual amenity, faunal habitats and specific plant communities. Despite this, Sawmillers Exports was given approval to utilise forest residues from private land in 1984 and in one instance, approval was also given for the utilisation of clearing residues.

As the utilisation of forest residues can have a significant impact upon the environment their use should be suspended and a Commission of inquiry (as allowed for in the Act) be established by the Minister to fully assess the nature of the environment, the impacts of the utilisation of forest residues upon it, the impact of woodchipping on private forests and their clearence, and the impact of logging vehicles upon roads, bridges, and road safety (particularily in rural areas).

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North Coast Woodchip Proposals.

25/2/75

Attitude of Forestry Commission of N.S.W.

30.59

Although woodchips - a stage in the production of paper pulp - are ultimately a product of trees growing in forests, the Forestry Commission of N.S.W. is not a prime initiator in the various proposals to establish a woodchip export project on the North Coast. Nonetheless, the Forestry Commission has received many requests for information about these proposals, and about the Commission's attitude to these.

This statement has been prepared in answer to these queries.

The current proposals

At the time of writing, three proposals have been made public for the export of woodchips from the North Coast. These are:

1. From Allen Taylor & Co. Pty. Ltd. and C. Itoh & Co., for shipment of 350 000 tonnes a year from Coffs Harbour.
2. From Toyomenka (Australia) Pty. Ltd., for shipment of 300 000 tonnes a year, ultimately from Iluka.
3. From Standard Sawmilling Co. Pty. Ltd., for shipment through Brisbane of chips coming mainly from southeastern Queensland, but including some supplies from the far North Coast of N.S.W.

In addition it is known that there is at least one other proposal currently being formulated.

Apart from the Brisbane scheme, all proposals envisage exports in the order of 300 000 to 400 000 tonnes a year, and all would be seeking to utilise the same raw material resource, which would seem capable of supporting one only project of the size envisaged.

In brief, the available raw material for woodchips on the North Coast would allow the establishment of only a single export project. As all proposals are competing, in part or in total, for the use of the same, limited resource, the total volume available for export could only be in the order of 400 000 tonnes, and not the 1.4 million tonnes publicised in some quarters.

The Raw Material

Woodchips, as the name implies, are merely small pieces of wood in a form that can be readily transported in bulk carriers. Log billets, offcuts from sawmills and other suitable material can be fed into either mobile or static "chippers" and converted to this state.

There are two main sources for the wood used to produce chips. They can come directly from trees growing in the forest, or they can come from the waste material produced when cylindrical logs are converted to rectangular pieces of timber in sawmills.

Existing woodchip projects in Australia depend primarily on material obtained directly from the forest, though this may be supplemented by substantial volumes of sawmill waste. The woodchip project operating on the far South Coast of N.S.W. is of this type,

and its story is told in the Forestry Commission booklet, "Woodchips from Eden."

By contrast, the proposals put forward for the North Coast would rely primarily, if not entirely, on the use of sawmill waste. When sawn timber is produced in a sawmill, something in the order of a third to a half of the original log is "wasted" - as sawdust and as slabbage, offcuts and similar material. Sometimes this "waste" can be utilised as a valuable energy source for the mill, but most often it poses a considerable problem to the sawmiller in its disposal and ends up by being burnt - usually at appreciable cost and with more than a little resultant, albeit generally harmless, air pollution.

Whilst the sawdust is unsuitable as a source of paper pulp, the other sawmill waste is generally quite suitable, and it is this material that is proposed for use as the basis of the North Coast woodchip export proposals. Mills would either install static chippers or, in the case of smaller mills, stockpile their waste for processing by the periodic visit of a mobile chipper, and then have the woodchips transported to some central shipping point. As an indication of the volumes of mill residue available, an estimate by the Forestry Commission, based on the measured input of sawlogs into the district's mills, suggested that about 450 000 tonnes of mill residue is generated each year by sawmills within 320 km (200 miles) road distance of Coffs Harbour, though not all of this would be suitable or available for conversion to woodchips.

Besides this basic reliance on the use of sawmill residue, most of the woodchip proposals mention the use also of "forest residue."

Forest Residue

Forest residue is not a term that has in the past been used by the Forestry Commission, but its meaning is nonetheless fairly clear. As far as State Forests are concerned, it would include:

1. Logging waste: the faulty butts and larger limbs and tops, left in the forest when a tree is felled and the sawlog removed. Also, trees felled as sawlogs, but found to be too faulty for such use when on the ground (such trees are known as "reject trees").

2. Plantation clearing residue: the Forestry Commission has been establishing eucalypt plantations on the North Coast for the past 35 years, and it intends ultimately to extend these to an area of about 12 000 ha in the Kempsey-Coffs Harbour region. It is establishing these at the rate of 600 ha a year, scattered over a large number of sites. The clearing operations, to prepare these sites for planting, result in the loss of some stems that are unsuitable for sawlogs, but that could be used for woodchips.

3. Silvicultural residue: in the silvicultural treatment of State Forests (to improve the vigour and health of the timber stands), certain trees are often destroyed. These are malformed or defective trees that are clearly unsuitable for current commercial use, e.g. as sawlogs, poles or sleepers, and that lack the capacity to become merchantable stems in the future. In some cases such trees could be suitable for use as woodchips.

4. Regrowth thinnings: As a result of regeneration treatments carried out by the Forestry Commission over many decades of careful husbandry of the region's forests, there are numerous stands of advanced regeneration present in North Coast State Forests. These contain small trees, unsuitable yet for use as sawlogs because of small size or the timber quality problems inherent to many young eucalypts. A thinning of such stands to remove the poorer trees and favour the better ones, would be to the long term advantage of the forest, and would speed up the production of sawlogs from the remaining trees. The trees removed would be suitable for woodchips.

All of these four categories of forest residue could under some circumstances be obtained from the State Forests for use in woodchips.

Provisoes on Use of Forest Residue

However, there are several important provisoes to the use of this material.

The first of these is economic. The Forestry Commission has considerable doubts about the economic feasibility of removing most logging waste and probably any silvicultural residue. It can see no major problems to the use of the limited volumes of plantation clearing residue available each year. It would strongly welcome the use of regrowth thinnings, but fears that the type of operation needed to extract the thinnings economically could be unacceptable environmentally, or alternatively that the cost of thinning in a manner that does not cause excessive damage to the remaining stand would be greater than the value of the thinnings as woodchips.

The second proviso relates to existing commitments from the State Forests. Unlike the Eden area, where there was an extensive forest area largely uncommitted to existing industries, on the North Coast the production of timber from State Forests is committed very largely to the supply of sawlogs to an important and well established sawmilling industry. For nearly 60 years management of these State Forests by the Forestry Commission has aimed at maintaining, and where practicable increasing, this supply, and this remains the Commission's aim for the next 60 years, and more. Whilst, as outlined above, there is still a substantial volume of wood unsuitable for sawlog production, but potentially suitable for use in woodchips, available from State Forests on the North Coast, the first responsibility of the Forestry Commission is to maintain log supplies for existing industries. The Forestry Commission would not permit the woodchip industry or any other similar industry to prejudice the supply of logs, now and in the future, from State Forests to the Commission's most important customers, the State's sawmilling industry.

The third proviso is environmental. The Forestry Commission is well aware of the important role of North Coast State Forests in forming an attractive landscape background, in providing an increasingly widely used recreational resource, in protecting stream catchments and in maintaining habitat for a rich variety of native wildlife. All these values can be maintained in forests managed for timber production - as indeed is the case with vast areas of State Forest on the North Coast and elsewhere in N.S.W. at present - but the more intensive the operations aimed at timber getting become, the more difficult it is fully to maintain the provision of all or some of these other benefits. In the context of the North Coast State Forests, the Forestry Commission considers that these other benefits

are of immense significance to the community generally. The costs of ensuring that these benefits suffer no long term impairment as a result of extracting forest residue for woodchips could in many cases mean that it becomes uneconomic to obtain this residue from the State Forests.

Thus, whilst the Forestry Commission can see many benefits coming from the development of a woodchip industry on the North Coast, it believes that State Forests would directly supply very little of the material used to produce woodchips, and it has refused to make any commitment of supply of material from State Forests for this purpose, although it has informed those proposing woodchip projects that some material, considered desirable for removal from the State Forests on silvicultural grounds, could be available to any organisation in a position to establish a woodchip export industry.

Private Forests

Private forested land could also be a source of material for woodchips, and indeed would almost certainly become so, if only through the sale of material from land being cleared for agricultural or residential development.

The Forestry Commission has no control over logging on private property. However some controls can be exercised through the application of the Soil Conservation Act, the Water Act, and local government tree preservation orders. The Commission does provide an advisory service to landholders seeking to manage areas of forest on their land.

Clearcutting

It has been alleged that the establishment of a woodchip project on the North Coast would result in the widespread clearcutting of the local forests. In this connection several points need to be stressed.

Firstly, clearcutting is not only a well proven method of managing certain types of forest (including many eucalypt stands), but for many of these it is the direct adaptation of the way these forests regenerate in nature (e.g. following destruction of the previous stand by fire or cyclone), and the only practical means of ensuring that these forest communities are perpetuated.

Secondly, there is nothing new in the use of clearcutting in State Forests on the North Coast. It has been deliberately employed for over 40 years in those areas where it represents the appropriate system of silviculture, and an excellent illustration of it is given by two photographs of the identical scene, taken 17 years apart in the very popular State Forests at Bellangry, in the Wauchope area, included in the booklet "Woodchips from Eden."

Clearcutting is not employed in many - or indeed in most - areas of State Forest on the North Coast, but it is nonetheless quite widely used where required by the ecological or silvicultural characteristics of the particular forest stand.

The introduction of a woodchip industry would have no effect on the use of this system on State Forests. Clearcutting would continue to be used where this is silviculturally desirable whether or not a woodchip project were commenced, and the existence of such a project would not result in any extension of clearcutting on the State Forests of the North Coast.

Establishment of a Local Pulp Mill.

In the view of the Forestry Commission, the quantity and quality of material proposed for export as woodchips would not warrant the establishment of a local pulpmill to process the wood to at least the pulp form in Australia. The Commission has made these views known since the matter was first raised in June, 1974.

However, Australian Paper Manufacturers Ltd., through their forestry subsidiary, have for a decade and a half been establishing a substantial area of eucalypt plantation, mostly on repurchased farmland, in the Bellingen-Coffs Harbour area, and as mentioned above the Forestry Commission has also undertaken a eucalypt planting programme in the same general region. The produce from these plantations, supplemented by woodchips from other sources, and particularly from mill residue, could ultimately be sufficient to support a local pulpwood industry on the North Coast, to help supply Australia's growing requirements for paper and other pulp products.

The Forestry Commission eucalypt plantations, intended essentially for pulpwood supply, will ultimately total 12 000 ha in the Kempsey-Coffs Harbour region. By comparison, the present total area of State Forest in these two districts is over 400 000 ha.

The Decision

Three or more groups are interested in the export of woodchips to Japan, and at some stage a decision must be made as to which, if any, of the groups will be permitted to establish the project.

An export licence is required before any company can sell woodchips overseas, and the responsibility for the issue of such a licence rests with the Commonwealth Government. Such a licence is essential for the project to get under way. However the matter is also of vital importance to the N.S.W. Government. For this reason the State has commissioned two investigations, one being carried out by the State Pollution Control Commission into the environmental effects of the industry, and the other by the State Development Co-ordinating Committee, which is examining the economic, social and developmental aspects.

The State Government's attitude, as determined by these two investigations, will obviously carry considerable weight with the Commonwealth in the issue of an export licence.

Local government bodies will also be involved through the necessity to take into account local planning schemes and to obtain Council approval for any constructions carried out.

Conclusion

The Forestry Commission has a limited involvement in the proposals to establish a woodchip export industry on the N.S.W. North Coast:

- The basic source of raw material used will be sawmill residue.
- Although the Forestry Commission would be prepared to provide appropriate forest material for use as woodchips, for economic and environmental reasons it believes that only very limited quantities of such material can be provided from State Forests.

- The Forestry Commission has no responsibility for control over logging operations on private land.

- The final decisions about the establishment of the industry rest with the Commonwealth Government, but with other State instrumentalities and local government bodies also deeply involved.

The Forestry Commission can see considerable benefits accruing from the establishment of a woodchip export project on the North Coast, though it believes that these benefits would be rather marginal so far as the State Forests of the region are concerned.

However the Commission would reiterate the following points:

1. Apart from a small contribution to a scheme exporting from Brisbane, there is scope for only one woodchip project on the North Coast.

2. The Commission does not believe that the availability of woodchips from mill residue and forest residue is sufficient for the economic operation of a local pulp plant.

3. In the long run, wood from Forestry Commission and private eucalypt plantations on the North Coast, supplemented by woodchips from other local sources, could be adequate for the establishment of a local pulp mill.

4. In the management of State Forests on the North Coast, the first responsibility of the Forestry Commission is to maintain the supply of sawlogs to established local industries, while managing the forests to retain their many other important community benefits.

5. Whilst the supply of forest residue from State Forests need not in any way affect the ability of the forests to supply sawlogs, costs associated with the environmentally sound extraction of the residue are likely to result in only very small volumes being available.

6. The Forestry Commission has declined to give any guarantees of supply of forest residue or other material from State Forests for woodchips.

7. Clearcutting has been used as a system for regenerating certain North Coast forests for many decades, and where appropriate to the local forest conditions, it will continue to be so used. The existence or not of a woodchip export project will have no effect on the use of this important and well proven silvicultural system.

The Forestry Commission hopes that comments and opinions about the establishment of a woodchip industry on the North Coast will be considered in the light of the information contained in this statement.

Forestry Commission of N.S.W.

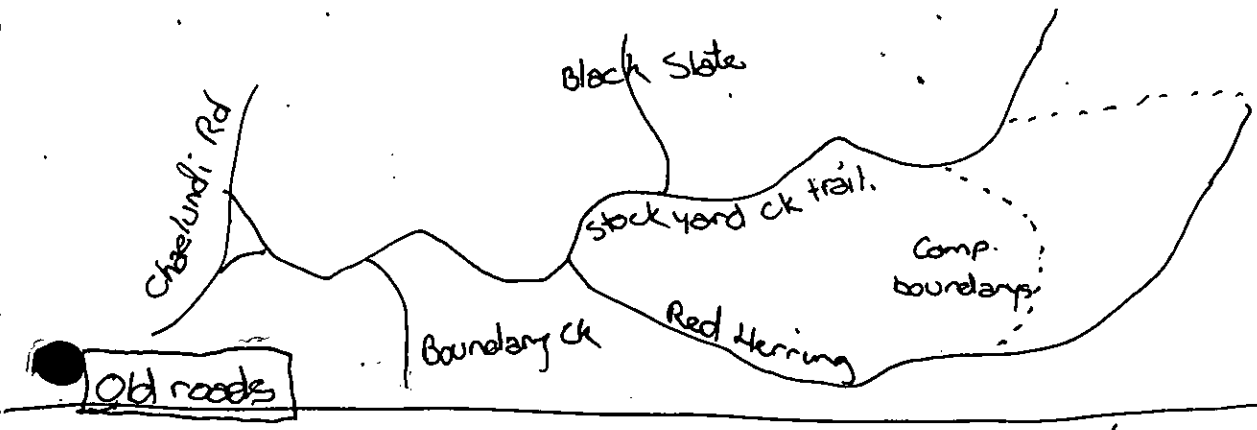
Sydney

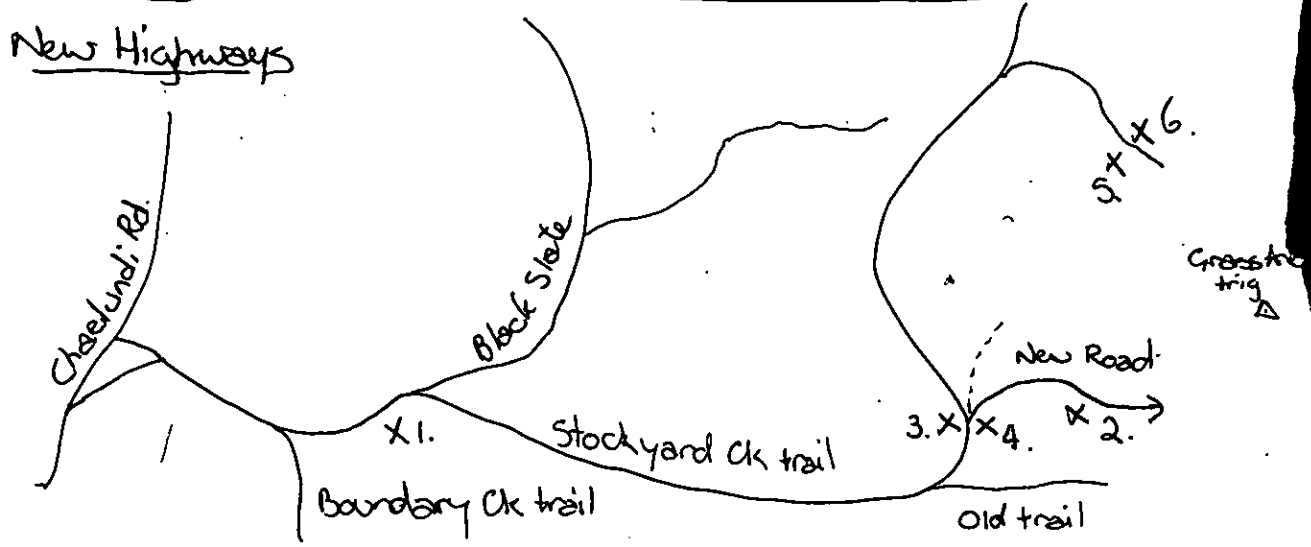
25th February, 1975.

30.60

G'day Andrew,

It appears that from the junction of Red Herring fire trail & Stockyard Ck trail, they've renamed it Black Slate trail up to & down the existing Black Slate trail. Red Herring has become stockyard trail & curves back along compartment boundary to the give access to the old stockyard trail.





Im not too sure exactly where & how but Im pretty sure this is how the roads are now. The numbers & are the photo points shots 3 & 4 fit together showing the new road junction. The sign is pertaining to the old trail (in the centre) & reads: Red Herring Hill 7ks (Grasstree) Trig 15ks Chandlers Ck. 20ks.

If you feel the need to keep the photos, thats cool but if not Ive enclosed a SAE.

Cheers mate!