BARRINGTON WILDERNESS - IT NEEDS YOUR HELP

Public comments on the Service's Draft Plan of Management for Barrington Tops National Park can be made until September 18. By making a submission in support of wilderness management you will be helping protect this beautiful World Heritage area. Here's how:

***Address a letter to:**

THE PLANNING OFFICER
BARRINGTON TOPS PLAN OF MANAGEMENT
PO BOX 270
RAYMOND TERRACE, 2324

*** Head your letter:**

"Submission on Barrington Tops National Park Draft Plan of Management"

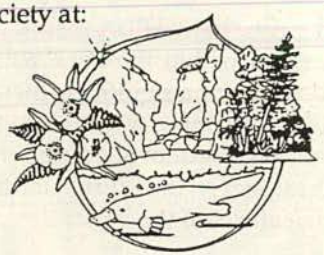
*** Points to make:**

- Express your opposition to a road into the Barrington Plateau;
- Ask that Barrington's wilderness and World Heritage values be protected by declaring the Barrington Plateau as part of the wilderness area, in line with existing studies and guidelines;
- Point out that wilderness management is the best way of helping control Scotch Broom and ensuring the area's unique ecology is not further degraded.

*** Send a similar letter to the NSW Environment Minister, Mr Tim Moore, Parliament House, Sydney, 2000.**

If you would like a copy of The Wilderness Society's Alternative Management Plan for Barrington Tops National Park, contact the Society at:

Hunter Heritage Centre
90 Hunter St
Newcastle, 2300
Ph: (049) 29 4395



I WOULD LIKE TO JOIN THE WILDERNESS SOCIETY

Mr/Ms/Mrs/Miss_____

Address_____

_____Postcode_____

Phone_____(home)_____(work)

Date_____

You can save yourself money - and us administration - by joining for up to three years ahead.

	1 year	2 years	3 years
Concession	$17	–	–
Regular	$28	$53	$75
Household and Organisation	$33	$63	$90
Overseas	$60	$115	$170
Life	$750	–	–
Donation	$_____		
TOTAL	$_____		

Cheque/money order enclosed(please circle)
Please charge $_____ to my Bankcard/Mastercard/Visa
Card number

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Cardholder's name_____

Expiry date_____

Signature_____

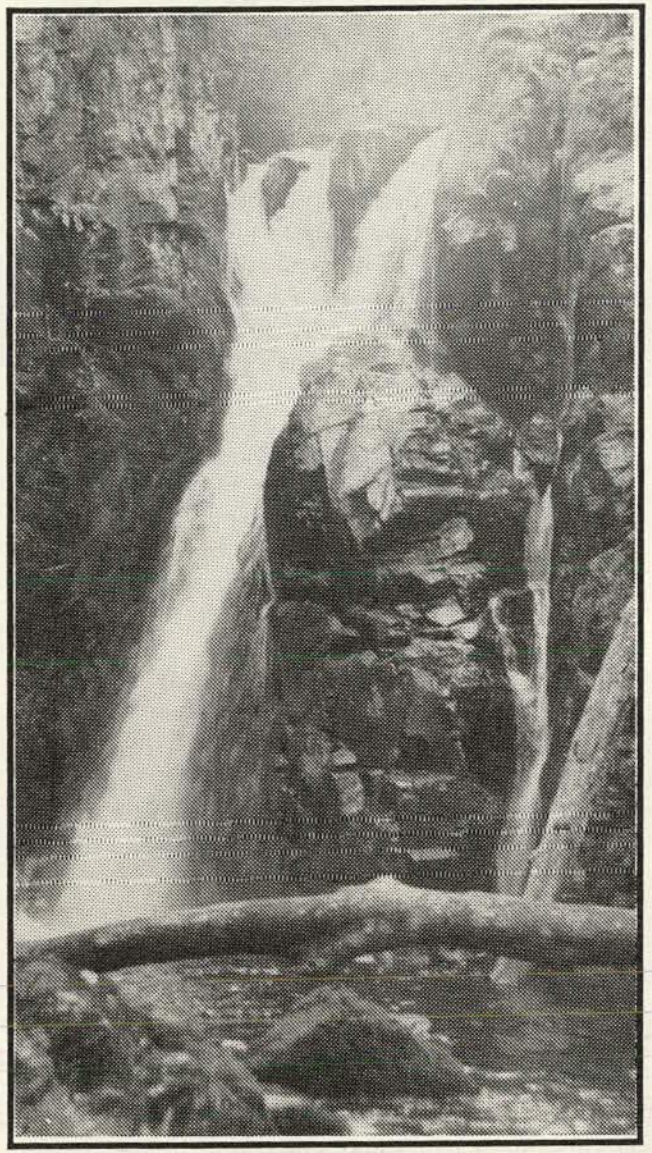
☐ I'd like to be more involved in the work of the Wilderness Society. Please send me more information.

☐ Please send me information on how to include the Wilderness Society in my will. Your request will be treated in the strictest confidence.

Membership corresponds with the financial year (1 July to 30 June). Subscription paid after January will be financial to 30 June the following year.

The Wilderness Society
NEWCASTLE BRANCH
Office & Shop, Hunter Heritage Centre
90 Hunter St, Newcastle, 2300
Phone (049) 294395

BARRINGTON TOPS



WORLD HERITAGE WILDERNESS UNDER THREAT

BARRINGTON TOPS - WORLD HERITAGE WILDERNESS

Barrington Tops is part of only 4% of New South Wales that survives as wilderness. Two-thirds of the Barrington wilderness is in the 39,000 hectare Barrington Tops National Park - one of sixteen National Parks and Nature Reserves which form the NSW Rainforests World Heritage Area.

The Barrington wilderness protects one of the largest areas of rainforest remaining in the State. Its pristine valleys contain lush subtropical rainforests. Cool temperate rainforests of ancient Antarctic Beech (Nothofagus moorei) - a remnant of Australia's past links with the super-continent Gondwana - grow on the higher, mist-shrouded slopes.

The heart of the Barrington wilderness is a basalt plateau rising to over 1,500 metres. The plateau supports a unique system of snow-gum woodlands and sphagnum swamps. This sub-alpine area is the largest ecosystem of its kind north of Kosciusko and is home to rare plant species which occur nowhere else.

A number of rare and endangered animals are also found in the Barrington wilderness. These include the Rufous Scrub Bird (Atrichornis rufescens) and the Hastings River Mouse (Pseudomys oralis), which was thought extinct until rediscovered in the last few years.

THREATENED BY MISMANAGEMENT

Although the Barrington wilderness protects a rich array of wildlife, considerable work remains to be done to fully document it. Current threats could destroy much of its diversity without it ever becoming fully known.

The Barrington wilderness is presently divided between National Park and State Forest. The Forestry Commission have logging plans which would destroy the third of the wilderness which is outside National Park.

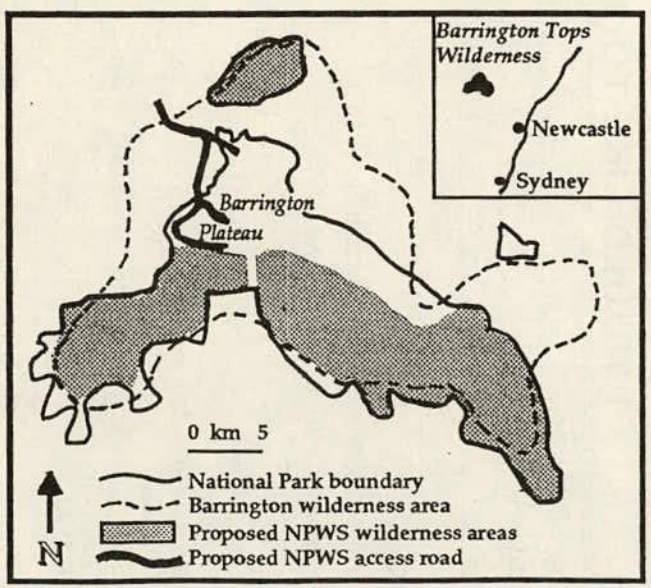
A more immediate threat comes from proposals in a Draft Management Plan for the Park recently released by the National Parks and Wildlife Service.

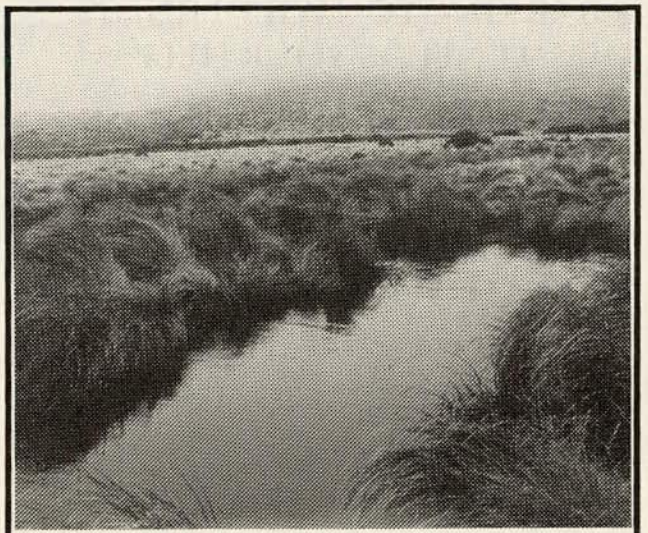
The Service are proposing to split the wilderness into three smaller areas and to construct a damaging access road into the unique sub-alpine environment of the Barrington Plateau.

Managing the Plateau as part of the Barrington wilderness is vital to its overall integrity. Three separate studies have identified it as the core of the wilderness area.

The Service claim the Plateau is too degraded by the introduced weed Scotch Broom (Cytisus scoparius) to be included in the wilderness area. Yet both the NSW Wilderness Act and the Service's own Wilderness Conservation Policy provide for the inclusion of damaged areas where they are important to the integrity of a larger area, or where there is a commitment to them being restored.

The CSIRO is working to find a biological control for Scotch Broom. However, the road would destroy what remains of the Plateau's wilderness value before any control could be implemented.





Sub-alpine Swamp - Barrington Plateau

Disturbance from the road would aid the Broom's spread into new areas and make existing infestations worse, thereby endangering the rare plants and animals that survive in this remnant sub-alpine area. It would also require use of scarce funds which could be better spent on ensuring the Park's natural features are effectively protected.

THERE IS AN ALTERNATIVE

The Wilderness Society have prepared an Alternative Management Plan for Barrington Tops National Park.

The Alternative Plan guarantees access to every environmental setting in the Park without resorting to a damaging road into the heart of the wilderness area. All visitor facilities which are accessible by normal vehicles will be retained and a number of new ones established.

The Alternative Plan ensures that the full extent of wilderness within the Park will be protected while still allowing for a significant increase in the facilities available to visitors. A feature of the Alternative Plan is an extensive system of educational facilities providing information on the World Heritage status and other natural features of the Park.

LAND AND ENVIRONMENT COURT
APPLICATION FOR INJUNCTION

EXPLANATION

The Davis Creek Section of Mount Royal State Forest is one of a number of areas for which the applicant has commissioned field studies and engaged a solicitor to bring an action before the Land and Environment Court in respect of Forestry Commission operations in these areas of concern. Neither the solicitor, who does not live in Sydney, nor the Sydney barrister, have been available to the applicant to assist or advise in the preparation of this application. Work commenced on the eve of Christmas and is to resume today January 2nd a mere few hundred metres from the area of greatest concern. We ask the Court's indulgence with respect to departures from normal forms of presentation and other deficiencies in this application arising from the lack of legal advice and assistance in its preparation.

SUMMARY

Proposed Forestry Commission logging operations in the Davis Creek Section of Mount Royal State Forest will significantly affect an area of high conservation value. Work on the final section of the access road entering the most environmentally sensitive areas resumed after a long break on or about December 20th. At the same time locked gates were erected denying access. Almost all of the area is previously unlogged oldgrowth forest, which is very diverse, ranging from open dry sclerophyll forest with dense casuarina understorey and moist dense hardwood forest, to Messmate-dominated secondary rainforest and cool temperate rainforest and pure stands of Antarctic Beech. The area has been submitted for inclusion in the Barrington Tops National Park because of its unique conservation values. Much of the area is steep, with unstable soils and high rainfall. No flora or fauna surveys have been completed, but it is known that the area contains rare, endangered and vulnerable species. The applicant together with the North-East Forest Alliance, an association of conservaion groups formed in August 1989, is organising and funding expert flora and fauna surveys and a soils investigation.

We submit this application should be granted to enable the surveys to be completed so that we are not prevented from presenting evidence to the court that the EPA Act requires a full Environmental Impact Assessment to be conducted.

CLAIM

1. The proposed logging operations are likely to significantly affect the environment within the meaning of s.112 of the Environmental Planning and Assessment Act, and accordingly the Forestry Commission is required to obtain, examine and consider an environmental impact statement prepared in accordance with that Act before operations commence. The Commission has not done so and is therefore in breach of s.112.

1.1 The area of concern comprises approximately 1000 hectares, of almost entirely unlogged oldgrowth forest.

1.2 The Davis Creek Section was included in the Proposed Additions to Barrington Tops National Park submission by Conservation groups in December 1982, because of its high conservation value. The submission states:

"The area contains a diversity of plant communities including some not represented or poorly represented in the (then existing) Park. Continuous pure stands of rainforest, cool temperate to sub-tropical are found throughout the area including the Big Losy/Mount Cockrow-Davis Creek/Falbrook area.... The cool temperate Antarctic Beech forests within this section are more diverse than the higher altitude Beech forests wfthin the Park. Those at the low altitude of 900m (such as those within the Davis Creek Section - applicant) are of particular scientific interest and are not well represented within the park." (page 17) The groups involved in this submissioon were the National Parks Association of N.S.W., the Nature Conservation Council of N.S.W., the National Trust of Australia (N.S.W.), the Colong Foundation for Wilderness and the Newcastle Flora and Fauna Protection Society.

1.2.1 Justice Hemmings found the fact that part of the area subject of the Jarasius case was considered by the National Parks and Wildlife Service as having environmental significance justifying its inclusion as a park managed by that service was "a relevant matter which should have been taken into consideration by the first respondent (the Forestry Commission)." (page 40). A significant factor in Justice Cripps' finding in the Kivi case was that the area had been proposed for

inclusion in a National Park. We submit that the recommendation by major conservation groups that the Davis Creek Section be included in the Barrington Tops National Park is a relevant matter which the Commission has not adequately considered.

1.2.2. In late 1987 the Australian Heritage Commision's Native Forest Information Kit was accompanied by a media release opposing logging in oldgrowth forest. In September 1989 at the Institute of Foresters Conference, Mr Pat Galvin, Chairman of the Australian Heritage Commisssion, called for an end to logging of oldgrowth forest.

1.3 The Davis Creek operations have been identified as one of several areas of greatest concern by the North-East Forest Alliance, formed in August 1989 by conservation groups covering the State north of Newcastle.

1.4. We submit that facts presented in this application and the affidavits of Roger Tembit and Barrie Griffiths, with the attached statement of Dailan Pugh, together with the photographic evidence, establish that the Davis Creek Section of Mount Royal State Forest is an area containing important and unique conservation values which will be irretrievably lost if the proposed operations continue.

2. The Commission is in breach of s.111 of the Act, in failing to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment" by reason of these logging operations.

2.1 The Mount Royal Management Plan 1988 admits that "there has been no comprehensive floral survey" (page 4), and "no specifc faunal surveys have been done in the Area, and no specific data is available on the relative abundance of species of fauna between the major forest types," and "there is a need for improved documentation of the range and status of species in the area" (page 6). The Commission has not made available the environmental review allegedly prepared.

2.1.1 Justice Hemmings in the Bailey case found that "the Management Plan, as amended, was concerned predominantly with economic factors and the environmental reviews are superficial documents. Such documents were inadequate to enable a full and proper consideration of the likely affects of the activities." (Bailey, page 27). We submit this is so also of the Mount Royal Management Plan, and is likely to be so of the undisclosed environmental review.

2.2. Justice Hemmings noted in the Jarasius case that: "The locality obviously contains some areas likely to be of high conservation value and only survey can identify and determine their environmental attributes. No comprehensive botanical survey has been made or research published on non-commercial species of flora." (page 38). The same remarks apply to the Davis Creek area, which contains great diversity and density of species of both flora and fauna, neither of which have been surveyed or studied.

2.3 In the Bailey case, Justice Hemmings referred to "the potential in this area for rains of high intensity, duration and prevalence on land which has long slopes in the elevated parts of the catchment, and which are potentially readily reactivated, erosion prone drainage systems". This potential exists in the Davis Creek Section. Justice Hemmings found that as a consequence the proposed logging operations "must be likely to pose a substantial threat to landscape stability in the longer term." Justice Hemmings continued:
" I am satisfied that had the Forestry Commission given 'real' consideration to the matter.... it would have had no option but to conclude that in the up river forest where the surface soil was removed and the sub-soil exposed it must be likely to be highly erodable, particularly as a result of logging and tracks on slopes over twenty-five degrees. The Standard Mitigation Conditions imposed on the operations by the Forestry Commisssion are likely to be unsuitable guidelines for erosion control in the steeper catchments..." (pages 24-25). Sixty per cent of the Davis Creek Section as a whole is over 20 degrees slope, and a significant percentage is over 30 degrees slope, the figures by compartments being: compartments 200, 50 per cent over 30 degrees, 201, 12 per cent, and for compartments 202, 203 and 204 approximately 20 per cent is over 30 degrees slope. (see Plan, appendix 4b). Photos one to eight show impacts of the Davis Creek road. We submit that Justice Hemmings' remarks apply also to the Davis Creek area. The applicant has commissioned a soils expert to undertake a study and report on the area.

2.3.1. Roadworks resume today January 2nd with only about

300 yards remaining before the steep gully formed by Cross Creek is reached, after which the road traverses extremely steep slopes as it climbs the escarpment at the head of Cross Creek where the cool temperate rainforest and Antarctic Beech exist. If an immediate injunction is not granted the destruction of this pristine area with associated severe erosion and hillside slip appears certain.

2.4 On May 15th 1989 Barrie Griffiths wrote to the regional forester requesting copies of the environmental review and harvesting plans. The request was refused. An appeal to the Minister Mr Causely against the policy of secrecy with respect to environmental reviews was also unsuccessful.

3. Justice Hemmings has stated that: "'Likely' with respect to significantly affect as it appears in s.112 means only a 'real chance' or "possibility" and not "more probably than not". (Jarasius page 25).

3.1 In the absence of fauna and flora surveys, the claim that the environment will not be significantly affected cannot be supported by evidence.

3.2 The applicant has commissioned a series of surveys of the fauna, flora and soils in the area. A four-day preliminary fauna survey by experts from the University of New England was carried out in November for the applicant. Further time for another visit and to prepare the report is necessary. This survey is being carried out with a permit from the Commission. Application for a permit for a botanical survey to be commenced during January was lodged with the Commission in early December. No reply has yet been received.

3.3 Clear evidence of environmental impacts of the operations can be seen in the roadworks already carried out. Unstable soils have slipped, bladed areas have eroded, pockets of rainforest have been destroyed (for example, over a significant area where the road crosses Davis Creek).

3.4 Work resumed on or about December 20th on the final section of road which enters the most environmentally sensitive and diverse areas, where our survey work has commenced. This area also includes the unique cool temperate rainforest and Antarctic Beech areas featured in the 1982 Submission by major conservation groups.

3.5 Justice Hemmings stated that: "The construction of roads with associated works of drainage, timber clearing, cutting and filling, excavation and retaining walls has an effect on this environment and that effect is significant, particularly if located in or near rainforests, creeks or swamps. The opening of such roads and quarries in the forest is also likely to have a significant effect as a consequence of increased human activity, machinery and vehicles, visual change, fire risk and danger to fauna." (page 27)

3.5.1. Work is scheduled to resume today (Tuesday January 2nd) continuing the road round the swamp shown in photos nine and ten, across the steep slope shown in photo eleven (just above the paperbarks), and twelve, then across the steep gully formed by Cross Creek (photo thirteen), where a bridge is to be constructed. The road is then to loop back, returning to ascend this very steep slope (photos fourteen to seventeen) towards the head of Cross Creek where stands of Antarctic Beech, cool temperate rainforest and Messmate dominated secondary rainforest occur (photos eighteen to twenty-five). The road then appears to descend steeply again to cross Cross Creek near the head of the gully, (photos twenty-six to thirty) before returning across the steep slopes shown in photos thirty-one to thirty-four). From the bottom loop after the first crossing of the creek, a major harvesting road is proposed, which crosses the watercourse shown in photos thirty-five to thirty-seven, which drains from the larger swamp shown in photo thirty-eight. Despite amateur photography, we submit these photos reveal the proposed roads will cause devastating impacts on this environment of swamps, small watercourses and soaks, the major creek gully and rainforest.

3.6 Pockets of rainforest occurring throughout the area will be affected by road construction and logging operations. Buffer zones are necessary for their protection: "From an ecological point of view the buffer zones are very much part of the rainforest" (National Parks and Wildlife Service, Background Paper, Rainforest Policies, 1979 pages 35 & 37.) Towards the head of Cross Creek, rainforest extends almost to the Davis Creek Section boundary on the escarpment shown in photo thirty-nine, beyond which is the cleared grazing country shown in photo

...ty.

3.7. The proposed road's impact on the rainforest pockets along Cross Creek, just a few hundred metres from the bulldozer's present position, can be seen by comparing photos showing sections of road already formed, with photos along the proposed route. (For example, photo six, presumably a culvert site, and photo thirteen, showing Cross Creek gully just below the lower of the two crossings, where a bridge is to be constructed.

3.7 The road under construction by the Commission is close to significant large areas of rainforest in the adjoining National Park, through what should be regarded as a vital buffer zone. The road is downslope of these rainforests which would therefore be at risk during post-logging burning and subsequent regular control burning.

3.8 The Davis Creek section is relatively small in total area; the impact of roads, trails, logging and post-logging burning and treatment will be correspondingly extensive within the Section.

3.9 The Management Plan provides for "broad area fuel reduction in unlogged areas", biennial strip burning, low intensity burning of regeneration areas, and post-logging burning. (Plan, page 36). Of twenty five uncontrolled fires in the Management Area between 1957 and 1986, only five are attributed to lightning, with most of the remainder being escaped 'control burns'. (Plan, Appendix 12). We submit that damage from fire is a likely significant effect of the operations.

3.9.1 Justice Hemmings has found:
"Control burning both pre and post logging is carried out by the first respondent to reduce the impact of wildfire and to facilitate regeneration. However, it is conceded that repeated burning associated with logging, as distinct from wildfire, is likely to cause sheet and gully erosion before regeneration. I am also satisfied that regular burning as distinct from wildfire is likely to affect the diversity of plant and animal communities and their habitat to a significant extent, particularly in the long term. " (page 27).

This is an unlogged area, little is known of its wildlife.

The operations should be halted immediately to allow surveys and studies to be completed before the area is destroyed, and to allow a full Environmental Impact Statement to be "obtained, examined and considered" in respect of the operations.

John Corkhill

Vice-President,
North Coast Environment Council.

Applicant

REFERENCES:

Judgements by Justice Hemmings in the Land & Environment Court -

4/3/88 Jarasius v Forestry Commission of NSW (first of six respondents) (No 40173 of 1987)

31/3/89 Bailey v Forestry Commission of NSW (No 40212 of 1987)

Judgement by Cripps (1982) ELR 0109 Kivi v Forestry Commission

Submission to the Government of NSW on the proposed additions to Barrington Tops National Park, Dec. 1982; National Parks Association, Nature Conservation Council, National Trust, Colong Committee, Newcastle Flora and Fauna Protection Society.

Management Plan of Mount Royal Management Area, Forestry Commission of N.S.W., July 1988

National Parks & Wildlife Service, Background Paper, Rainforest Policies 1979.

ATTACHMENTS

* Statements of Roger Lembit, Dailan Pugh and Barrie Griffiths.
* Photographs numbered one to forty-three.
* Sketch map, Proposed Roading Pattern, Davis Creek Section, Mount Royal State Forest. Supplied by the Forestry Commission.
* Detail from Appendix 4a, Mount Royal Management Plan, Forestry Commission, showing Slope Classes for the Davis Creek Section. Sketch of proposed roading pattern imposed by Griffiths.

Roger Lembit
Environmental Consultant
22 Blue Hills Road
HAZELBROOK NSW 2779

In 1982, whilst employed as Project Officer for the Nature Conservation Council of NSW, I was part of a team which prepared a document entitled 'Submission to the Government of New South Wales on the Proposed Additions to Barrington Tops National Park' (the Submission), published by the National Trust of Australia (NSW).

I am aware that the Forestry Commission of NSW is undertaking roading in the Cross Creek catchment in preparation for logging operations in this area.

The Cross Creek catchment lies within part of an area proposed by the Submission as suitable for inclusion in the Barrington Tops National Park. In the Submission this area is identified as the South-Western Section.

The Submission identifies several reasons for including the Section in the proposed National Park additions. Those which would apply specifically to the Cross Creek area include flora values and catchment values.

The Submission highlights the value of Antarctic Beech forests in the Section as they are more diverse than the higher altitude Beech forests within the Park. The Commission's Forest Type maps of the area show such forests in the Cross Creek catchment.

The Forestry Commission's 'Management Plan for Mount Royal Management Area, 1988' states that the forest types of the Mount Royal area were originally mapped in the Royal Milli Survey of 1961-62. It would appear from the Plan that there has been little, if any, further assessment of the vegetation of the area. In my opinion it is impossible to assess the impact of the operations on the vegetation of the area without more detailed survey than is evident in the Management Plan.

The Forest Type maps show that Messmate forests occur in the Cross Creek catchment. Messmate forests are generally associated with basalt soils where they occur in the central and northern tablelands of NSW. In these regions they are very restricted due to past clearing for agriculture.

The Submission also states that 'Davis and Cross Creeks and the steep western slopes of Mt Cockcrow and Big Losy Mountain ' contribute to the catchment of the proposed Rouchel Brook Dam'. Roading and logging in the catchment may have detrimental impacts on these catchment values through increasing siltation and destablisation of slopes.

It is my opinion that the roading operations being carried out would be likely to significantly affect the flora and catchment values of the Cross Creek area.

Roger Lembit B.Sc.Agr.
2nd January, 1990.

Roger Lembit

P.O. Box 7
Bonalbo, N.S.W. 2470
December 29th 1989

I have recently been commissioned by the applicant to investigate significant areas of forests in North-East NSW. This has involved a detailed study of all available Forestry Commission Management Plans for the north coast region of NSW, contacts with a large number of people interested in forests, and field investigations. A wildlife consultant, Mr H. Hines from the University of New England, was also employed to undertake preliminary faunal surveys of the identified areas. To date, only relatively small areas of old-growth forests have been found, the Commission is already preparing Environmental Impact Assessments for three of these areas (Dome Mountain, Ben Hall's Gap and Blackbutt Plateau); a court action has been initiated over another (North Washpool), while the remaining five areas already have roads being constructed within them or have been surveyed for roads.

The most alarming aspects revealed by these surveys were the severely restricted distribution of remnant old-growth forests, and the Commission's intention to degrade the few remaining stands of loggable old-growth forest they control as quickly as possible.

Of particular concern is the scarcity of old-growth dry sclerophyll forests. The Davis Creek Section of Mount Royal State Forest (compartments 200-204) appears to be one of the most significant old-growth dry sclerophyll forests remaining in northern NSW. A preliminary faunal survey revealed a diverse fauna with good densities of arboreal mammals. The presence of Yellow-bellied Gliders, Koalas and Broad-toothed rats (awaiting confirmation) are some of the species recorded which will be significantly affected by the proposed operations.

I have no doubt that the Davis Creek Section is of immense environmental significance for its old-growth eucalypt forests, untouched cool-temperate rainforests, Messmate dominated secondary rainforests, swamps and soaks, diverse fauna and for numerous other reasons. A detailed report is being prepared, though it will not be ready for some time. Given the present urgency of the situation it is imperative that an injunction be granted to allow the area's environmental attributes to be properly and thoroughly assessed.

D.H.

In the Land and Environment Court of New South Wales

No 40002 of 1990

JOHN CORKHILL

Applicant

FORESTRY COMMISSION OF NEW SOUTH WALES

Respondent

APPLICATION
CLASS 1

Full name of applicant: John Corkhill

Address 1 Oliver Place, Lismore N.S.W. 2480

Occupation Environmentalist

The applicant claims the following relief.

1. A declaration that the Respondent has failed to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment in respect of the proposed general logging, burning and road activity as it is required to do under s.111 of the Environmental Planning and Assessment Act 1979 (NSW) in the Davis Creek section of the Mount Royal State Forest No. 297.

2. A declaration that no valid Environmental Impact Statement has been prepared in accordance with Part V, and in particular s.112, of the Environmental Planning and Assessment Act in respect of the proposed logging, burning and roading activity in the Davis Creek section of the Mount Royal State Forest No. 297.

3. An order that the Respondent by itself, its servants, agents and contractors be restrained from carrying out the general logging activity until such time as it has complied with Part V of the Environmental Planning and Assessment Act.

The applicant also claims by way of interlocutory relief.

1. An order that pending the further order of the Honourable Court the Respondent its servants agents and contractors be restrained from carrying out any preparation for or construction of a road being the main access road to the Davis Creek section of the Mount Royal State Forest.

2. An order that pending the further order of the Honourable Court the Respondent its servants agents and contractors be restrained from carrying out any logging, roading or burning activity in the Davis Creek section of the Mount Royal State Forest.

Date: 3 January 1990

Signed .....

To the Respondent:
Forestry Commission of NSW
95-99 York Street
SYDNEY NSW 2000

A call-over will take place before the Registrar at the time and place specified below.

OR

The hearing of (or the applicant's claim for interlocutory relief in) these proceedings will take place before the Court at the time and place specified below.

If there is no attendance before the Court or the Registrar, as the case may be, by you or your counsel or solicitor or your agent authorised by you in writing, the hearing or call-over may take place and orders may be made in your absence.

Time:

Place:

Signed, Registrar.

Barrie Griffiths
Green Alliance Network
P.O. Box 9 Singleton 2330
October 24th 1990

Col Nicholson, Regional Forester
Forestry Commission of N.S.W.

Re: Environmental Impact Statement - Mt Royal Management Area.

GENERAL COMMENTS

Old growth forests are, as such, areas of high conservation value, and Forestry Commission operations - logging, thinning, roading, burning, grazing - are activities which by their very nature are destructive of the significant values, floral, faunal, aesthetic, of such forests.

Approximately 50% of the forests of north-east N.S.W. have been cleared since settlement, and only about 5% of the original forest cover is currently reserved and protected. (1,p.9) The National Parks and Wildlife Service considers that 54 distinct forest types are inadequately protected under the existing system of reserves. (2,p.19-20) The majority of National Parks have been declared over forests of low productivity on poor soils and steep slopes. The NPWS has concluded that "the reservation of forests growing on moderate to high nutrient soils in N.S.W. is inadequate." (2,p.16) While the NPWS gained some more productive forests as a consequence of the rainforest decision of 1982, the majority of these forests had already been logged or were on slopes too steep to log. 20 species of birds and 19 species of mammals which depend on the tree hollows characteristic of undisturbed forest are likely to be adversely affected by logging in the eucalypt forests of eastern N.S.W. (2, App.2)

National Parks and Nature Reserves do not include all the representative samples of species, forest associations or ecosystems needed to ensure the maintenance of genetic and biological diversity of indigenous flora and fauna and ecological processes. Consequently there are many species, associations and/or ecosystems, on private lands and within State Forests, which are not reserved and protected in perpetuity. An alarmingly high percentage of these are at risk of degradation, fragmentatidn or extinction. (3,2)

The objects of the Forestry Commission under the Forestry Act 1916 include: to conserve the timber on Crown-timber lands to the best advantage of the State; to preserve and improve the soil resources and water catchment capabilities of such lands; to preserve the native flora thereon, and to conserve birds and animals thereon.

I contend that no case can be made that roading, logging and burning activities within the areas under consideration will not result in significant adverse affects on the values of these old growth forest environments. The Commission is undertaking an EIS in order that legal responsibilities are fulfilled regarding proposed operations - responsibilities which have already been breached by commencing these operations.

In these circumstances, my general comment on the proposed EIS is that the studies undertaken should fully and comprehensively examine the total environment of these areas and adjacent lands. The scope and detail of the investigations must not be compromised by the Commission's purpose in relation to the statement of impacts. The Commission has a legal obligation to study the forest environment, and this obligation exists independently of the obligation to undertake an EIS. To quote counsel's advice:
"The obligation to examine the forest environment is quite separate and distinct from the obligation to produce an EIS where activities having significant impact upon the environment are proposed." (4)

SCOPE OF STUDIES

The areas under consideration are rich and diverse in species, yet relatively small in size, and it is likely that relations and interactions with flora and fauna in surrounding lands are significant and complex. This applies also with respect to hydrology and soil sediments. The significance of areas which constitute protective buffers surrounding or adjoining Barrington Tops National Park should also be considered. Accordingly, while the areas themselves need to be intensively examined, studies need to provide information also for the Management Area, for all that forest area existing as an entity isolated by cleared land from other forest areas, for adjoining forest within the National Park, and for the region.

In relation to the EIS based on the studies, this scope is of course a legal requirement. To quote counsel:
"As a matter of law, the relevent environment is the area of land upon which the activities will directly impact and any other land which may suffer indirect impacts from the logging, burning and roading activities." (4)

MATTERS TO BE EXAMINED IN STUDIES

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Without limiting the generality of the foregoing, the studies should include investigation of the following matters.

1. General vegetation survey of dominant, understorey, shrub and ground cover species, noting differences within species in different communities or associations, unusual associations and any rare or vulnerable species.

2. Stand and condition and history of disturbance of all forest types.

3. Populations of species dependent on old growth and high productivity forests, or dependent on such as components of their habitats in areas with old trees, and on productive sites with wet sclerophyll forest.

The following information will need to be gathered or simulated for each forest type, to accomodate the requirements for hollow-dependent fauna species:

(a) The density and crown dimensions and number of hollows of the dominant individuals through to the period of their natural lifespans.

(b) The degree to which these hollows are utilised by various species including arboreal mammals, bats, cockatoos, parrots, lorikeets, tree-creepers, kingfishers, pardalotes and other species. Predictions of the populations of each species within these groups needs to be made.

4. Changes in soil moisture regime in gullies with the conversion of old growth forests to regrowth forests, with the consequent increase in transpiration and reduced dry season soil moisture for a long period of the regrowth stands' life span, and the consequences for vertebrate consumers of detritus-based food chains, such as potoroos, bandicoots, lyrebirds, bush rats, antechinus etc.

5. Predictions of the total populations of the species involved need to be made for the situations of (i) no logging taking place and (ii) for intervals of ten years for a period of two tree lifespans following a specific harvest, or series of harvests.

6. Effects on the species composition and densities of aquatic invertebrates, and other species reliant upon streams, in streams whose catchments will receive suspended particles and solutes from roads and tracks and disturbed soil associated with the logging activities, both over the short term, under various intensities and frequencies of rainfall, and also how the effects vary over the lifespan of the longest-lived forest components.

7. Changes to the reptile populations induced by long-term alterations to the size of canopy gaps and the influence on the periodicity of solar radiation at and near the forest floor.

8. Associated with changes to the structure of the forest is the quantities of dead and down material, its dimensions and rates of decomposition, all variables that influence the equilibrium quantities of various size/decomposition combinations.

9. Information on the reptiles utilising different logs as basking, egg laying or hibernation sites, needs to be determined, to derive predictions of populations, at intervals of a decade, for a period of two tree lifespans.

10. Changes in the incidence of utilisation by non-native species and/or predatory species, as a consequence of road construction and habitat modification, need to be identified. This will entail looking at the increase in populations of rabbits, hares, foxes and cats and their impacts on potential competitors or prey such as potoroos, other small macropods, bandicoots, rodents and carnivorous marsupials. The accumulated impact of these feral species plus native carnivores, which colonise fragmented habitats (including Dingoes, Kookaburras, Tawny Frogmouths, Black snakes, Pied Currawongs), and the consequences for nesting success and mortality of potential prey species or species subject to competition, needs assessment. In this regard, the Tiger Quoll is of particular significance.

11. Survey design and field methods should attempt to identify populations of endangered or rare species known to exist nearby, such as the Hastings River Rat (5,6), and attempt to assess unconfirmed sightings of species in the area - for example, Eastern Native Quoll (7)

12. Population status and habitat requirements of species listed as of special concern, vulnerable or rare should be assessed. Examples would include the Tiger Quoll, Koala, Diamond Python, Glossy Black Cockatoo, Cicadabird, White's Thrush, Crested Shrike-tit, Rufous Fantail, Spotted Quail-thrush, Broad-toothed Rat, Peregrine Falcon, Powerful Owl, Long-nosed Potoroo.

13. The importance of the forest to be logged for migratory fauna and the effect of forestry activities on populations of intra-regional, intra-state and interstate migrants should be evaluated.

14. Predictions should be made of the changes in populations of migratory species including birds and flying foxes, and the consequences for both the forest and the complementary areas the

species seasonally occupy must be made.

15. The damage to fruit-bearing rainforest trees and understorey mesomorphic shrubs and vines will have consequences for fruit-eating fauna, which need to be assessed.

16. As well as predictions of populations for the maintenance of regional and local populations, the essential ecological processes they are involved in facilitating, need to be predicted. These include:

(i) Any alterations to the pollination success and degree of outcrossing of plants.

(ii) The degree to which mycorrhizal fungus spores have their dispersal patterns and germination rates changed.

(iii) Changes to the quantities and spatial distribution of seed dissemination.

(iv) Changes to the rate of litter decomposition, nutrient cycling and humification of organic matter.

(v) Any changes to the rates of herbivory consequent on changes in insectivore populations.

17. The influence on microclimate and availability of growing substrates for vascular epiphytes and biophytes, and their projections of occurrence through time under different management options, including subsequent logging cycles, needs to be assessed.

18. The seral status of rainforests and moist forests has been degraded by roads and other permanent canopy gaps, and weeds have intruded. Quantitative predictions of the species composition, soil seed store and structure of vegetation for a period of time following harvest, equal to the longest-lived componens of the habitat, need to be made.

19. The impacts of repeated harvests on the composition, soil seed store and structure of the forest also need evaluation.

20. Energy and materials budgets for the forest, unlogged and logged, should be compiled, the latter including materials removed from the site in wood, and smoke, solutes or other redistributed particles. This should focus on nutrient elements and Carbon, and should include time estimates for the Carbon compounds to be oxidised to carbon dioxide.

The energy budget should include the energy content of the timber harvested, the energy consumed during harvesting, transporting and milling logs, the energy consumed distributing the product, and a proportion of the lifespan of the machinery times the energy used in its construction and maitenance.

21. Other impacts to be considered are:

(i) impacts on soil structure;

(ii) effectiveness of erosion mitigation works and rehabilitation of disturbed soils;

(iii) these and other impacts of the roadworks already carried out in the Davis Creek Section, and an assessment of erosion mitigation works carried out in connection with those roadworks;

(iv) short and long-term impacts of prescribed burning;

(v) effects of truck movements on road safety, road conditions and the anxiety caused to affected people - for example, implications of tourist road use proposed in the Draft Barrington Tops National Park Management Plan, during the time scale of the proposed operations.

(vi) any archaeological sites and other sites of significance to Aboriginal people.

There needs to be a thorough assessment of the economics of all aspects of the proposed operations, including:

(i) Management: Head Office and District office costs, planning, field costs, EIS costs, legal costs, etc.

(ii) Costs of constructing and maintaining existing and proposed roads used to service the logging operation; (iii) The impact of laden trucks on Council and State roads is significant, and needs to be assessed.

(iv) The losses of nutrients in the timber harvested, to the atmosphere on burning and by increased transport, in overland flow and by leaching, needs to be assessed, and the monetary costs of replacing these lost nutrients should be determined.

(v) The loss in productivity caused by compaction and other soil disturbances needs to be determined along with the costs of replacing eroded soil, and soil restructuring, to return the site to its natural condition.

(vi) The full costs of establishing and maintaining replacement tress of the same species through their achieving the same size as those proposed to be removed.

(vii) Royalties for all classes of timber to be taken need to be detailed, along with all forms of rebates and any other subsidies obtained by the falling contractors, sawmillers or their employees, directly or indirectly, from the Government.

viii) The proposed end uses of all timber taken, along with their State/country of destination, and the direct benefits this provides to the people of N.S.W., should be detailed. Company profits from the use of such timber need to be separately detailed.

CONSULTATION

The forests under consideration here are distinctive in containing rare and possibly endangered species of fauna and a diverse flora with unusual features. Over this summer, the preliminary fauna survey carried out last November is to be followed by a more extended survey, and a vegetation survey and soils assessment will also be undertaken. The experts doing these surveys may wish to contribute some specific comments on the EIS process at an appropriate time. Those persons doing the field work for the EIS, presumably experts in their areas of expertise, would be likely to share with our people an appreciation of values inherent in their fields of study. It would be sensible if the EIS process included discussions with other experts working in the Davis Creek and East Carrowbrook areas.

Yours faithfully,

Barrie Griffiths

OTNOTES

- North East Forest Alliance, Submission to Public Accounts mittee, Enquiry into Forestry Commission of N.S.W. August 1990.
- National Parks and Wildlife Srvice (1990) Submission to the sources Assessment Commission Inquiry into Australia's Forest and imber resources, N.P.W.S., Sydney.
3. Benson, J.S. (1989) Establishing priorites for the conservation of rare or threatened plant associations in New South Wales, in Hicks and Eiser (eds) The Conservation of Threatened Species and their habitats, 1987 Conference Proceedings, Australian Committee for the .C.N., Canberra.
- Robertson, T.F. (1990) Corkill vs Forestry Commission of N.S.W., elundi State Forest, Memorandum of Advice, unpublished.
- Dickman, C.R. and McKechnie, C.A. (1985) A Survey of the Mammals of nt Royal and Barrington Tops, NSW. Australian Zoolpgy 21(6) pp 531-
6. Dickman, C.R. (undated), Search for the Hastings River Rat Pseudomys oralis) at Mt Royal and Barrington Tops: Report to the NSW National Parks and Wildlife Service.
7. There have been unconfirmed sightings by local people and people who visit frequently, including a confident sighting by a staff member of the Australian Museum - pers. comm.

THE WILDERNESS SOCIETY

Office & Shop
90 Hunter Street
Newcastle, 2300
Ph (049) 29 1805

Tuesday, 29th October, 1990.

Attention : Col Nicholson
Regional Forester
Newcastle
Fax: (049) 613 409

Sender : Anthony Too
The Wilderness Society
Newcastle Branch
Ph (040) 294 9395

Dear Mr Nicholson,

The Wilderness Society welcomes the opportunity to comment on the Commission's proposal to prepare an Environmental Impact Statement for proposed logging operations in the Mount Royal Management Area.

The Society is disappointed that the Commission has not withdrawn its proposal to carry out logging in the unlogged sections of the Management Area in Davis and Cross Creeks and Carrow Brook. These are areas of high conservation value in which the public interest would be better served through their dedication as protected areas.

If the Commission is to continue with the proposal, it should be cognizant of the fact that the area's conservation values are sufficiently high that an objective assessment of the activity would conclude that it is likely to have a significant impact on the environment, and that the area's values cannot be maintained under a timber production regime.

We also consider it unlikely that the activity could take place without severely compromising certain sections of the Forestry Act which direct the Commission's responsibilities on matters other than timber production.

With this in mind, we offer the following recommendations on the terms of reference for the EIS.

1. That the EIS be extended to include the whole of the Mount Royal Management Area. This is necessary to ensure that the assessment of environmental impact is consistent with the Commission's planning procedures, which over the long term have impacts on the whole of the Management Area. The term "the area" in the following recommendations refers to the whole of the Management Area, not just that currently proposed for assessment.

2. That the EIS investigate the presence of, and impact upon, conservation values in the area which are contiguous with, and/or commensurate with, the World Heritage values of the adjacent Barrington Tops National Park. This is necessary to meet Australia's obligations under the World Heritage Convention.

3. That the EIS investigate the presence of, and impact upon, conservation values relevant to the Register of the National Estate. This is necessary to ensure that public concern for the protection of National Estate quality forests is taken into consideration and also to reflect the fact that no previous assessment of National Estate values has been conducted in the area.

4. That the EIS investigate the presence of, and impact upon, conservation values in the area which are commensurate with, and/or would enhance, those of the existing Barrington Tops National Park under the criteria of the National Parks and Wildlife Act.

5. That the EIS investigate the presence of, and impact upon, the values of the area as part of a wilderness area which extends into the adjacent National Park. This is necessary to ensure conservation criteria of the Wilderness Act are adequately considered.

6. That the EIS comprehensively investigate the area for the presence of uncommon, rare and endangered species. It should report on the size and extent of their populations, the ecological factors influencing them, and the likely impact of the proposed activity.

7. That the EIS pay particular attention to the populations, distribution within the area, ecological requirements and impacts upon species and associations of species which are at, or near, the limits of their geographical and/or local distributions. This is necessary to ensure long term changes in species evolution and distribution are considered, particularly with respect to climatic change (natural or otherwise).

8. That the EIS comprehensively investigate ecological gradients both within the area and which extend as a continuum into surrounding areas.

9. That the EIS pay particular attention to the assemblages and populations of invertebrate species; to their role in the overall ecology of the area; and to the likely impacts on the invertebrate fauna and the overall environment of the proposed activity.

10. That the EIS comprehensively assess the presence, populations and ecology of fauna species, with particular attention to be paid to:
i) those which utilise either areas of old growth forest and/or isolated mature and senescent trees; and
ii) those which utilise the forest floor.

11. That the EIS comprehensively investigate the effect of the proposed activity on the physical structure of the forest, as well as on the ecological factors which affect forest structure. Particular attention should be paid to the impact of the fire regime and the effects of integrated harvesting as compared to other harvesting techniques.

12. That the EIS report comprehensively on the structure (both physical and chemical) and stability of soils in the area and on their role in the local forest ecology. It should pay particular attention to the conditions of the soil under a timber production regime in the short, medium and long term.

13. That the EIS report on hydrological factors operating within the area, and pay particular attehtion to the impact of the proposed activity on these factors. Comprehensive data should be obtained.

14. That the EIS fully consider variations in the ecological productivity and characteristics of sites within the area, and pay particular attention to differences between low-medium and steep slopes. This should focus on the inadequacy of assigning steep areas as non-logging areas as the major means of environmental protection.

15. That the EIS investigate the potential of the proposed activity to aid the introduction of both exotic species and/or species not native to the area. It should identify both the species and likely vectors.

16. That the EIS should consider the impact of the proposed activity in the context of the overall adequacy or otherwise of the protection of the biota and associations found within the area. It should pay particular attention to any likely reductions in the overall conservation status of species (flora & fauna) recognised as endangered, rare, vulnerable or uncommon.

We look forward to receiving a copy of the completed EIS as well as any other relevant documents when they are ready.

Yours sincerely,

Anthony Too
The Wilderness Society
Newcastle

LAND AND ENVIRONMENT COURT
APPLICATION FOR INJUNCTION

EXPLANATION

The Davis Creek Section of Mount Royal State Forest is one of a number of areas for which the applicant has commissioned field studies and engaged a solicitor to bring an action before the Land and Environment Court in respect of Forestry Commission operations in these areas of concern. Neither the solicitor, who does not live in Sydney, nor the Sydney barrister, have been available to the applicant to assist or advise in the preparation of this application. Work commenced on the eve of Christmas and is to resume today January 2nd a mere few hundred metres from the area of greatest concern. We ask the Court's indulgence with respect to departures from normal forms of presentation and other deficiencies in this application arising from the lack of legal advice and assistance in its preparation.

SUMMARY

Proposed Forestry Commission logging operations in the Davis Creek Section of Mount Royal State Forest will significantly affect an area of high conservation value. Work on the final section of the access road entering the most environmentally sensitive areas resumed after a long break on or about December 20th. At the same time locked gates were erected denying access. Almost all of the area is previously unlogged oldgrowth forest, which is very diverse, ranging from open dry sclerophyll forest with dense casuarina understorey and moist dense hardwood forest, to Messmate-dominated secondary rainforest and cool temperate rainforest and pure stands of Antarctic Beech. The area has been submitted for inclusion in the Barrington Tops National Park because of its unique conservation values. Much of the area is steep, with unstable soils and high rainfall. No flora or fauna surveys have been completed, but it is known that the area contains rare, endangered and vulnerable species. The applicant together with the North-East Forest Alliance, an association of conservaion groups formed in August 1989, is organising and funding expert flora and fauna surveys and a soils investigation.

We submit this application should be granted to enable the surveys to be completed so that we are not prevented from presenting evidence to the court that the EPA Act requires a full Environmental Impact Assessment to be conducted.

CLAIM

1. The proposed logging operations are likely to significantly affect the environment within the meaning of s.112 of the Environmental Planning and Assessment Act, and accordingly the Forestry Commission is required to obtain, examine and consider an environmental impact statement prepared in accordance with that Act before operations commence. The Commission has not done so and is therefore in breach of s.112.

1.1 The area of concern comprises approximately 1000 hectares, of almost entirely unlogged oldgrowth forest.

1.2 The Davis Creek Section was included in the Proposed Additions to Barrington Tops National Park submission by Conservation groups in December 1982, because of its high conservation value. The submission states:

"The area contains a diversity of plant communities including some not represented or poorly represented in the (then existing) Park. Continuous pure stands of rainforest, cool temperate to sub-tropical are found throughout the area including the Big Losy/Mount Cockrow-Davis Creek/Falbrook area.... The cool temperate Antarctic Beech forests within this section are more diverse than the higher altitude Beech forests wrthin the Park. Those at the low altitude of 900m (such as those within the Davis Creek Section - applicant) are of particular scientific interest and are not well represented within the park." (page 17) The groups involved in this submissioon were the National Parks Association of N.S.W., the Nature Conservation Council of N.S.W., the National Trust of Australia (N.S.W.), the Colong Foundation for Wilderness and the Newcastle Flora and Fauna Protection Society.

1.2.1 Justice Hemmings found the fact that part of the area subject of the Jarasius case was considered by the National Parks and Wildlife Service as having environmental significance justifying its inclusion as a park managed by that service was "a relevant matter which should have been taken into consideration by the first respondent (the Forestry Commission)." (page 40). A significant factor in Justice Cripps' finding in the Kivi case was that the area had been proposed for

inclusion in a National Park. We submit that the recommendation by major conservation groups that the Davis Creek Section be included in the Barrington Tops National Park is a relevant matter which the Commission has not adequately considered.

1.2.2. In late 1987 the Australian Heritage Commision's Native Forest Information Kit was accompanied by a media release opposing logging in oldgrowth forest. In September 1989 at the Institute of Foresters Conference, Mr Pat Galvin, Chairman of the Australian Heritage Commisssion, called for an end to logging of oldgrowth forest.

1.3 The Davis Creek operations have been identified as one of several areas of greatest concern by the North-East Forest Alliance, formed in August 1989 by conservation groups covering the State north of Newcastle.

1.4. We submit that facts presented in this application and the affidavits of Roger Tembit and Barrie Griffiths, with the attached statement of Dailan Pugh, together with the photographic evidence, establish that the Davis Creek Section of Mount Royal State Forest is an area containing important and unique conservation values which will be irretrievably lost if the proposed operations continue.

2. The Commission is in breach of s.111 of the Act, in failing to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment" by reason of these logging operations.

2.1 The Mount Royal Management Plan 1988 admits that "there has been no comprehensive floral survey" (page 4), and "no specifc faunal surveys have been done in the Area, and no specific data is available on the relative abundance of species of fauna between the major forest types," and "there is a need for improved documentation of the range and status of species in the area" (page 6). The Commission has not made available the environmental review allegedly prepared.

2.1.1 Justice Hemmings in the Bailey case found that "the Management Plan, as amended, was concerned predominantly with economic factors and the environmental reviews are superficial documents. Such documents were inadequate to enable a full and proper consideration of the likely affects of the activities." (Bailey, page 27). We submit this is so also of the Mount Royal Management Plan, and is likely to be so of the undisclosed environmental review.

2.2. Justice Hemmings noted in the Jarasius case that: "The locality obviously contains some areas likely to be of high conservation value and only survey can identify and determine their environmental attributes. No comprehensive botanical survey has been made or research published on non-commercial species of flora." (page 38). The same remarks apply to the Davis Creek area, which contains great diversity and density of species of both flora and fauna, neither of which have been surveyed or studied.

2.3 In the Bailey case, Justice Hemmings referred to "the potential in this area for rains of high intensity, duration and prevalence on land which has long slopes in the elevated parts of the catchment, and which are potentially readily reactivated, erosion prone drainage systems". This potential exists in the Davis Creek Section. Justice Hemmings found that as a consequence the proposed logging operations "must be likely to pose a substantial threat to landscape stability in the longer term." Justice Hemmings continued:
" I am satisfied that had the Forestry Commission given 'real' consideration to the matter.... it would have had no option but to conclude that in the up river forest where the surface soil was removed and the sub-soil exposed it must be likely to be highly erodable, particularly as a result of logging and tracks on slopes over twenty-five degrees. The Standard Mitigation Conditions imposed on the operations by the Forestry Commisssion are likely to be unsuitable guidelines for erosion control in the steeper catchments..." (pages 24-25). Sixty per cent of the Davis Creek Section as a whole is over 20 degrees slope, and a significant percentage is over 30 degrees slope, the figures by compartments being: compartments 200, 50 per cent over 30 degrees, 201, 12 per cent, and for compartments 202, 203 and 204 approximately 20 per cent is over 30 degrees slope. (see Plan, appendix 4b). Photos one to eight show impacts of the Davis Creek road. We submit that Justice Hemmings' remarks apply also to the Davis Creek area. The applicant has commissioned a soils expert to undertake a study and report on the area.

2.3.1. Roadworks resume today January 2nd with only about

300 yards remaining before the steep gully formed by Cross Creek is reached, after which the road traverses extremely steep slopes as it climbs the escarpment at the head of Cross Creek where the cool temperate rainforest and Antarctic Beech exist. If an immediate injunction is not granted the destruction of this pristine area with associated severe erosion and hillside slip appears certain.

2.4 On May 15th 1989 Barrie Griffiths wrote to the regional forester requesting copies of the environmental review and harvesting plans. The request was refused. An appeal to the Minister Mr Causely against the policy of secrecy with respect to environmental reviews was also unsuccessful.

3. Justice Hemmings has stated that: "'Likely' with respect to significantly affect as it appears in s.112 means only a 'real chance' or "possibility" and not "more probably than not". (Jarasius page 25).

3.1 In the absence of fauna and flora surveys, the claim that the environment will not be significantly affected cannot be supported by evidence.

3.2 The applicant has commissioned a series of surveys of the fauna, flora and soils in the area. A four-day preliminary fauna survey by experts from the University of New England was carried out in November for the applicant. Further time for another visit and to prepare the report is necessary. This survey is being carried out with a permit from the Commission. Application for a permit for a botanical survey to be commenced during January was lodged with the Commission in early December. No reply has yet been received.

3.3 Clear evidence of environmental impacts of the operations can be seen in the roadworks already carried out. Unstable soils have slipped, bladed areas have eroded, pockets of rainforest have been destroyed (for example, over a significant area where the road crosses Davis Creek).

3.4 Work resumed on or about December 20th on the final section of road which enters the most environmentally sensitive and diverse areas, where our survey work has commenced. This area also includes the unique cool temperate rainforest and Antarctic Beech areas featured in the 1982 Submission by major conservation groups.

3.5 Justice Hemmings stated that: "The construction of roads with associated works of drainage, timber clearing, cutting and filling, excavation and retaining walls has an effect on this environment and that effect is significant, particularly if located in or near rainforests, creeks or swamps. The opening of such roads and quarries in the forest is also likely to have a significant effect as a consequence of increased human activity, machinery and vehicles, visual change, fire risk and danger to fauna." (page 27)

3.5.1. Work is scheduled to resume today (Tuesday January 2nd) continuing the road round the swamp shown in photos nine and ten, across the steep slope shown in photo eleven (just above the paperbarks), and twelve, then across the steep gully formed by Cross Creek (photo thirteen), where a bridge is to be constructed. The road is then to loop back, returning to ascend this very steep slope (photos fourteen to seventeen) towards the head of Cross Creek where stands of Antarctic Beech, cool temperate rainforest and Messmate dominated secondary rainforest occur (photos eighteen to twenty-five). The road then appears to descend steeply again to cross Cross Creek near the head of the gully, (photos twenty-six to thirty) before returning across the steep slopes shown in photos thirty-one to thirty-four). From the bottom loop after the first crossing of the creek, a major harvesting road is proposed, which crosses the watercourse shown in photos thirty-five to thirty-seven, which drains from the larger swamp shown in photo thirty-eight. Despite amateur photography, we submit these photos reveal the proposed roads will cause devastating impacts on this environment of swamps, small watercourses and soaks, the major creek gully and rainforest.

3.6 Pockets of rainforest occurring throughout the area will be affected by road construction and logging operations. Buffer zones are necessary for their protection: "From an ecological point of view the buffer zones are very much part of the rainforest" (National Parks and Wildlife Service, Background Paper, Rainforest Policies, 1979 pages 35 & 37.) Towards the head of Cross Creek, rainforest extends almost to the Davis Creek Section boundary on the escarpment shown in photo thirty-nine, beyond which is the cleared grazing country shown in photo

ity.

3.7. The proposed road's impact on the rainforest pockets along Cross Creek, just a few hundred metres from the bulldozer's present position, can be seen by comparing photos showing sections of road already formed, with photos along the proposed route. (For example, photo six, presumably a culvert site, and photo thirteen, showing Cross Creek gully just below the lower of the two crossings, where a bridge is to be constructed.

3.7 The road under construction by the Commission is close to significant large areas of rainforest in the adjoining National Park, through what should be regarded as a vital buffer zone. The road is downslope of these rainforests which would therefore be at risk during post-logging burning and subsequent regular control burning.

3.8 The Davis Creek section is relatively small in total area; the impact of roads, trails, logging and post-logging burning and treatment will be correspondingly extensive within the Section.

3.9 The Management Plan provides for "broad area fuel reduction in unlogged areas", biennial strip burning, low intensity burning of regeneration areas, and post-logging burning. (Plan, page 36). Of twenty five uncontrolled fires in the Management Area between 1957 and 1986, only five are attributed to lightning, with most of the remainder being escaped 'control burns'. (Plan, Appendix 12). We submit that damage from fire is a likely significant effect of the operations.

3.9.1 Justice Hemmings has found:
"Control burning both pre and post logging is carried out by the first respondent to reduce the impact of wildfire and to facilitate regeneration. However, it is conceded that repeated burning associated with logging, as distinct from wildfire, is likely to cause sheet and gully erosion before regeneration. I am also satisfied that regular burning as distinct from wildfire is likely to affect the diversity of plant and animal communities and their habitat to a significant extent, particularly in the long term. " (page 27).

This is an unlogged area, little is known of its wildlife. The operations should be halted immediately to allow surveys and studies to be completed before the area is destroyed, and to allow a full Environmental Impact Statement to be "obtained, examined and considered" in respect of the operations.

John Corkhill

Vice-President,
North Coast Environment Council.

Applicant

REFERENCES:

Judgements by Justice Hemmings in the Land & Environment Court -

4/3/88 Jarasius v Forestry Commission of NSW (first of six respondents) (No 40173 of 1987)

31/3/89 Bailey v Forestry Commission of NSW (No 40212 of 1987)

Judgement by Cripps (1982) ELR 0109 Kivi v Forestry Commission

Submission to the Government of NSW on the proposed additions to Barrington Tops National Park, Dec. 1982; National Parks Association, Nature Conservation Council, National Trust, Colong Committee, Newcastle Flora and Fauna Protection Society.

Management Plan of Mount Royal Management Area, Forestry Commission of N.S.W., July 1988

National Parks & Wildlife Service, Background Paper, Rainforest Policies 1979.

ATTACHMENTS

* Statements of Roger Lembit, Dailan Pugh and Barrie Griffiths.
* Photographs numbered one to forty-three.
* Sketch map, Proposed Roading Pattern, Davis Creek Section, Mount Royal State Forest. Supplied by the Forestry Commission.
* Detail from Appendix 4a, Mount Royal Management Plan, Forestry Commission, showing Slope Classes for the Davis Creek Section. Sketch of proposed roading pattern imposed by Griffiths.

Roger Lembit
Environmental Consultant
22 Blue Hills Road
HAZELBROOK NSW 2779

In 1982, whilst employed as Project Officer for the Nature Conservation Council of NSW, I was part of a team which prepared a document entitled 'Submission to the Government of New South Wales on the Proposed Additions to Barrington Tops National Park' (the Submission), published by the National Trust of Australia (NSW).

I am aware that the Forestry Commission of NSW is undertaking roading in the Cross Creek catchment in preparation for logging operations in this area.

The Cross Creek catchment lies within part of an area proposed by the Submission as suitable for inclusion in the Barrington Tops National Park. In the Submission this area is identified as the South-Western Section.

The Submission identifies several reasons for including the Section in the proposed National Park additions. Those which would apply specifically to the Cross Creek area include flora values and catchment values.

The Submission highlights the value of Antarctic Beech forests in the Section as they are more diverse than the higher altitude Beech forests within the Park. The Commission's Forest Type maps of the area show such forests in the Cross Creek catchment.

The Forestry Commission's 'Management Plan for Mount Royal Management Area, 1988' states that the forest types of the Mount Royal area were originally mapped in the Royal Milli Survey of 1961-62. It would appear from the Plan that there has been little, if any, further assessment of the vegetation of the area. In my opinion it is impossible to assess the impact of the operations on the vegetation of the area without more detailed survey than is evident in the Management Plan.

The Forest Type maps show that Messmate forests occur in the Cross Creek catchment. Messmate forests are generally associated with basalt soils where they occur in the central and northern tablelands of NSW. In these regions they are very restricted due to past clearing for agriculture.

The Submission also states that 'Davis and Cross Creeks and the steep western slopes of Mt Cockcrow and Big Losy Mountain contribute to the catchment of the proposed Rouchel Brook Dam'. Roading and logging in the catchment may have detrimental impacts on these catchment values through increasing siltation and destablisation of slopes.

It is my opinion that the roading operations being carried out would be likely to significantly affect the flora and catchment values of the Cross Creek area.

Roger Lembit B.Sc.Agr.
2nd January, 1990.

Roger Lembit

D.Pugh
P.O. Box 7
Bonalbo, N.S.W. 2470
December 29th 1989

I have recently been commissioned by the applicant to investigate significant areas of forests in North-East NSW. This has involved a detailed study of all available Forestry Commission Management Plans for the north coast region of NSW, contacts with a large number of people interested in forests, and field investigations. A wildlife consultant, Mr H. Hines from the University of New England, was also employed to undertake preliminary faunal surveys of the identified areas. To date, only relatively small areas of old-growth forests have been found, the Commission is already preparing Environmental Impact Assessments for three of these areas (Dome Mountain, Ben Hall's Gap and Blackbutt Plateau); a court action has been initiated over another (North Washpool), while the remaining five areas already have roads being constructed within them or have been surveyed for roads.

The most alarming aspects revealed by these surveys were the severely restricted distribution of remnant old-growth forests, and the Commission's intention to degrade the few remaining stands of loggable old-growth forest they control as quickly as possible.

Of particular concern is the scarcity of old-growth dry sclerophyll forests. The Davis Creek Section of Mount Royal State Forest (compartments 200-204) appears to be one of the most significant old-growth dry sclerophyll forests remaining in northern NSW. A preliminary faunal survey revealed a diverse fauna with good densities of arboreal mammals. The presence of Yellow-bellied Gliders, Koalas and Broad-toothed rats (awaiting confirmation) are some of the species recorded which will be significantly affected by the proposed operations.

I have no doubt that the Davis Creek Section is of immense environmental significance for its old-growth eucalypt forests, untouched cool-temperate rainforests, Messmate dominated secondary rainforests, swamps and soaks, diverse fauna and for numerous other reasons. A detailed report is being prepared, though it will not be ready for some time. Given the present urgency of the situation it is imperative that an injunction be granted to allow the area's environmental attributes to be properly and thoroughly assessed.

D.P.

In the Land and Environment
Court of New South Wales

No 40002 of 1990

JOHN CORKHILL

Applicant

FORESTRY COMMISSION
OF NEW SOUTH WALES

Respondent

APPLICATION
CLASS 4

Full name of applicant: John Corkhill

Address: 1 Oliver Place,
Lismore N.S.W. 2480

Occupation Environmentalist

The applicant claims the following relief.

1. A declaration that the Respondent has failed to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment in respect of the proposed general logging, burning and road activity as it is required to do under s.111 of the Environmental Planning and Assessment Act 1979 (NSW) in the Davis Creek section of the Mount Royal State Forest No. 297.

2. A declaration that no valid Environmental Impact Statement has been prepared in accordance with Part V, and in particular s.112, of the Environmental Planning and Assessment Act in respect of the proposed logging, burning and roading activity in the Davis Creek section of the Mount Royal State Forest No. 297.

3. An order that the Respondent by itself, its servants, agents and contractors be restrained from carrying out the general logging activity until such time as it has complied with Part V of the Environmental Planning and Assessment Act.

The applicant also claims by way of interlocutory relief.

1. An order that pending the further order of the Honourable Court the Respondent its servants agents and contractors be restrained from carrying out any preparation for or construction of a road being the main access road to the Davis Creek section of the Mount Royal State Forest.

2. An order that pending the further order of the Honourable Court the Respondent its servants agents and contractors be restrained from carrying out any logging, roading or burning activity in the Davis Creek section of the Mount Royal State Forest.

Date: 3 January 1990

Signed .....

To the Respondent:
Forestry Commission of NSW
95-99 York Street
SYDNEY NSW 2000

A call-over will take place before the Registrar at the time and place specified below.

OR

The hearing of (or the applicant's claim for interlocutory relief in) these proceedings will take place before the Court at the time and place specified below.

If there is no attendance before the Court or the Registrar, as the case may be, by you or your counsel or solicitor or your agent authorised by you in writing, the hearing or call-over may take place and orders may be made in your absence.

Time:

Place:

Signed, Registrar.

Barrie Griffiths
Green Alliance Network
P.O. Box 9 Singleton 2330
October 24th 1990

Col Nicholson, Regional Forester
Forestry Commission of N.S.W.

Re: Environmental Impact Statement - Mt Royal Management Area.

GENERAL COMMENTS

Old growth forests are, as such, areas of high conservation value, and Forestry Commission operations - logging, thinning, roading, burning, grazing - are activities which by their very nature are destructive of the significant values, floral, faunal, aesthetic, of such forests.

Approximately 50% of the forests of north-east N.S.W. have been cleared since settlement, and only about 5% of the original forest cover is currently reserved and protected. (1,p.9) The National Parks and Wildlife Service considers that 54 distinct forest types are inadequately protected under the existing system of reserves. (2,p.19-20) The majority of National Parks have been declared over forests of low productivity on poor soils and steep slopes. The NPWS has concluded that "the reservation of forests growing on moderate to high nutrient soils in N.S.W. is inadequate." (2,p.16) While the NPWS gained some more productive forests as a consequence of the rainforest decision of 1982, the majority of these forests had already been logged or were on slopes too steep to log. 20 species of birds and 19 species of mammals which depend on the tree hollows characteristic of undisturbed forest are likely to be adversely affected by logging in the eucalypt forests of eastern N.S.W. (2, App.2)

National Parks and Nature Reserves do not include all the representative samples of species, forest associations or ecosystems needed to ensure the maintenance of genetic and biological diversity of indigenous flora and fauna and ecological processes. Consequently there are many species, associations and/or ecosystems, on private lands and within State Forests, which are not reserved and protected in perpetuity. An alarmingly high percentage of these are at risk of degradation, fragmentation or extinction. (3,2)

The objects of the Forestry Commission under the Forestry Act 1916 include: to conserve the timber on Crown-timber lands to the best advantage of the State; to preserve and improve the soil resources and water catchment capabilities of such lands; to preserve the native flora thereon, and to conserve birds and animals thereon.

I contend that no case can be made that roading, logging and burning activities within the areas under consideration will not result in significant adverse affects on the values of these old growth forest environments. The Commission is undertaking an EIS in order that legal responsibilities are fulfilled regarding proposed operations - responsibilities which have already been breached by commencing these operations.

In these circumstances, my general comment on the proposed EIS is that the studies undertaken should fully and comprehensively examine the total environment of these areas and adjacent lands. The scope and detail of the investigations must not be compromised by the Commission's purpose in relation to the statement of impacts. The Commission has a legal obligation to study the forest environment, and this obligation exists independently of the obligation to undertake an EIS. To quote counsel's advice:
"The obligation to examine the forest environment is quite separate and distinct from the obligation to produce an EIS where activities having significant impact upon the environment are proposed." (4)

SCOPE OF STUDIES

The areas under consideration are rich and diverse in species, yet relatively small in size, and it is likely that relations and interactions with flora and fauna in surrounding lands are significant and complex. This applies also with respect to hydrology and soil sediments. The significance of areas which constitute protective buffers surrounding or adjoining Barrington Tops National Park should also be considered. Accordingly, while the areas themselves need to be intensively examined, studies need to provide information also for the Management Area, for all that forest area existing as an entity isolated by cleared land from other forest areas, for adjoining forest within the National Park, and for the region.

In relation to the EIS based on the studies, this scope is of course a legal requirement. To quote counsel:
"As a matter of law, the relevent environment is the area of land upon which the activities will directly impact and any other land which may suffer indirect impacts from the logging, burning and roading activities." (4)

MATTERS TO BE EXAMINED IN STUDIES

MATTERS TO BE EXAMINED IN STUDIES

Without limiting the generality of the foregoing, the studies should include investigation of the following matters.

1. General vegetation survey of dominant, understorey, shrub and ground cover species, noting differences within species in different communities or associations, unusual associations and any rare or vulnerable species.

2. Stand and condition and history of disturbance of all forest types.

3. Populations of species dependent on old growth and high productivity forests, or dependent on such as components of their habitats in areas with old trees, and on productive sites with wet sclerophyll forest.

The following information will need to be gathered or simulated for each forest type, to accomodate the requirements for hollow-dependent fauna species:

(a) The density and crown dimensions and number of hollows of the dominant individuals through to the period of their natural lifespans.

(b) The degree to which these hollows are utilised by various species including arboreal mammals, bats, cockatoos, parrots, lorikeets, tree-creepers, kingfishers, pardalotes and other species. Predictions of the populations of each species within these groups needs to be made.

4. Changes in soil moisture regime in gullies with the conversion of old growth forests to regrowth forests, with the consequent increase in transpiration and reduced dry season soil moisture for a long period of the regrowth stands' life span, and the consequences for vertebrate consumers of detritus-based food chains, such as potoroos, bandicoots, lyrebirds, bush rats, antechinus etc.

5. Predictions of the total populations of the species involved need to be made for the situations of (i) no logging taking place and (ii) for intervals of ten years for a period of two tree lifespans following a specific harvest, or series of harvests.

6. Effects on the species composition and densities of aquatic invertebrates, and other species reliant upon streams, in streams whose catchments will receive suspended particles and solutes from roads and tracks and disturbed soil associated with the logging activities, both over the short term, under various intensities and frequencies of rainfall, and also how the effects vary over the lifespan of the longest-lived forest components.

7. Changes to the reptile populations induced by long-term alterations to the size of canopy gaps and the influence on the periodicity of solar radiation at and near the forest floor.

8. Associated with changes to the structure of the forest is the quantities of dead and down material, its dimensions and rates of decomposition, all variables that influence the equilibrium quantities of various size/decomposition combinations.

9. Information on the reptiles utilising different logs as basking, egg laying or hibernation sites, needs to be determined, to derive predictions of populations, at intervals of a decade, for a period of two tree lifespans.

10. Changes in the incidence of utilisation by non-native species and/or predatory species, as a consequence of road construction and habitat modification, need to be identified. This will entail looking at the increase in populations of rabbits, hares, foxes and cats and their impacts on potential competitors or prey such as potoroos, other small macropods, bandicoots, rodents and carnivorous marsupials. The accumulated impact of these feral species plus native carnivores, which colonise fragmented habitats (including Dingoes, Kookaburras, Tawny Frogmouths, Black snakes, Pied Currawongs), and the consequences for nesting success and mortality of potential prey species or species subject to competition, needs assessment. In this regard, the Tiger Quoll is of particular significance.

11. Survey design and field methods should attempt to identify populations of endangered or rare species known to exist nearby, such as the Hastings River Rat (5,6), and attempt to assess unconfirmed sightings of species in the area - for example, Eastern Native Quoll (7)

12. Population status and habitat requirements of species listed as of special concern, vulnerable or rare should be assessed. Examples would include the Tiger Quoll, Koala, Diamond Python, Glossy Black Cockatoo, Cicadabird, White's Thrush, Crested Shrike-tit, Rufous Fantail, Spotted Quail-thrush, Broad-toothed Rat, Peregrine Falcon, Powerful Owl, Long-nosed Potoroo.

13. The importance of the forest to be logged for migratory fauna and the effect of forestry activities on populations of intra-regional, intra-state and interstate migrants should be evaluated.

14. Predictions should be made of the changes in populations of migratory species including birds and flying foxes, and the consequences for both the forest and the complementary areas the

species seasonally occupy must be made.

15. The damage to fruit-bearing rainforest trees and understorey mesomorphic shrubs and vines will have consequences for fruit-eating fauna, which need to be assessed.

16. As well as predictions of populations for the maintenance of regional and local populations, the essential ecological processes they are involved in facilitating, need to be predicted. These include:

(i) Any alterations to the pollination success and degree of outcrossing of plants

(ii) The degree to which mycorrhizal fungus spores have their dispersal patterns and germination rates changed.

(iii) Changes to the quantities and spatial distribution of seed dissemination.

(iv) Changes to the rate of litter decomposition, nutrient cycling and humification of organic matter.

(v) Any changes to the rates of herbivory consequent on changes in insectivore populations.

17. The influence on microclimate and availability of growing substrates for vascular epiphytes and biophytes, and their projections of occurrence through time under different management options, including subsequent logging cycles, needs to be assessed.

18. The seral status of rainforests and moist forests has been degraded by roads and other permanent canopy gaps, and weeds have intruded. Quantitative predictions of the species composition, soil seed store and structure of vegetation for a period of time following harvest, equal to the longest-lived componens of the habitat, need to be made.

19. The impacts of repeated harvests on the composition, soil seed store and structure of the forest also need evaluation.

20. Energy and materials budgets for the forest, unlogged and logged, should be compiled, the latter including materials removed from the site in wood, and smoke, solutes or other redistributed particles. This should focus on nutrient elements and Carbon, and should include time estimates for the Carbon compounds to be oxidised to carbon dioxide.

The energy budget should include the energy content of the timber harvested, the energy consumed during harvesting, transporting and milling logs, the energy consumed distributing the product, and a proportion of the lifespan of the machinery times the energy used in its construction and maitenance.

21. Other impacts to be considered are:

(i) impacts on soil structure;

(ii) effectiveness of erosion mitigation works and rehabilitation of disturbed soils;

(iii) these and other impacts of the roadworks already carried out in the Davis Creek Section, and an assessment of erosion mitigation works carried out in connection with those roadworks;

(iv) short and long-term impacts of prescribed burning;

(v) effects of truck movements on road safety, road conditions and the anxiety caused to affected people - for example, implications of tourist road use proposed in the Draft Barrington Tops National Park Management Plan, during the time scale of the proposed operations.

(vi) any archaeological sites and other sites of significance to Aboriginal people.

There needs to be a thorough assessment of the economics of all aspects of the proposed operations, including:

(i) Management: Head Office and District office costs, planning, field costs, EIS costs, legal costs, etc.

(ii) Costs of constructing and maintaining existing and proposed roads used to service the logging operation; (iii) The impact of laden trucks on Council and State roads is significant, and needs to be assessed.

(iv) The losses of nutrients in the timber harvested, to the atmosphere on burning and by increased transport, in overland flow and by leaching, needs to be assessed, and the monetary costs of replacing these lost nutrients should be determined.

(v) The loss in productivity caused by compaction and other soil disturbances needs to be determined along with the costs of replacing eroded soil, and soil restructuring, to return the site to its natural condition.

(vi) The full costs of establishing and maintaining replacement tress of the same species through their achieving the same size as those proposed to be removed.

(vii) Royalties for all classes of timber to be taken need to be detailed, along with all forms of rebates and any other subsidies obtained by the falling contractors, sawmillers or their employees, directly or indirectly, from the Government.

(viii) The proposed end uses of all timber taken, along with their State/country of destination, and the direct benefits this provides to the people of N.S.W., should be detailed. Company profits from the use of such timber need to be separately detailed.

CONSULTATION

The forests under consideration here are distinctive in containing rare and possibly endangered species of fauna and a diverse flora with unusual features. Over this summer, the preliminary fauna survey carried out last November is to be followed by a more extended survey, and a vegetation survey and soils assessment will also be undertaken. The experts doing these surveys may wish to contribute some specific comments on the EIS process at an appropriate time. Those persons doing the field work for the EIS, presumably experts in their areas of expertise, would be likely to share with our people an appreciation of values inherent in their fields of study. It would be sensible if the EIS process included discussions with other experts working in the Davis Creek and East Carrowbrook areas.

Yours faithfully,

Barrie Griffiths

FOOTNOTES

1. North East Forest Alliance, Submission to Public Accounts Committee, Enquiry into Forestry Commission of N.S.W. August 1990.
2. National Parks and Wildlife Srvice (1990) Submission to the Resources Assessment Commission Inquiry into Australia's Forest and Timber resources, N.P.W.S., Sydney.
3. Benson, J.S. (1989) Establishing priorites for the conservation of rare or threatened plant assocøiations in New South Wales, in Hicks and Eiser (eds) The Conservation of Threatened Species and their Habitats, 1987 Conference Proceedings, Australian Committee for the I.U.C.N., Canberra.
4. Robertson, T.F. (1990) Corkill vs Forestry Commission of N.S.W., Chaelundi State Forest, Memorandum of Advice, unpublished.
5. Dickman, C.R. and McKechnie, C.A. (1985) A Survey of the Mammals of Mount Royal and Barrington Tops, NSW. Australian Zoolpgy 21(6) pp 531-543.
6. Dickman, C.R. (undated), Search for the Hastings River Rat (Pseudomys oralis) at Mt Royal and Barrington Tops: Report to the NSW National Parks and Wildlife Service.
7. There have been unconfirmed sightings by local people and people who visit frequently, including a confident sighting by a staff member of the Australian Museum - pers. comm.

THE WILDERNESS SOCIETY

Office & Shop
90 Hunter Street
Newcastle, 2300

Tuesday, 29th October, 1990.

Attention : Col Nicholson
Regional Forester
Newcastle
Fax: (049) 613 409

Sender : Anthony Too
The Wilderness Society
Newcastle Branch
Ph (040) 294 9395

Dear Mr Nicholson,

The Wilderness Society welcomes the opportunity to comment on the Commission's proposal to prepare an Environmental Impact Statement for proposed logging operations in the Mount Royal Management Area.

The Society is disappointed that the Commission has not withdrawn its proposal to carry out logging in the unlogged sections of the Management Area in Davis and Cross Creeks and Carrow Brook. These are areas of high conservation value in which the public interest would be better served through their dedication as protected areas.

If the Commission is to continue with the proposal, it should be cognizant of the fact that the area's conservation values are sufficiently high that an objective assessment of the activity would conclude that it is likely to have a significant impact on the environment, and that the area's values cannot be maintained under a timber production regime.

We also consider it unlikely that the activity could take place without severely compromising certain sections of the Forestry Act which direct the Commission's responsibilities on matters other than timber production.

With this in mind, we offer the following recommendations on the terms of reference for the EIS.

1. That the EIS be extended to include the whole of the Mount Royal Management Area. This is necessary to ensure that the assessment of environmental impact is consistent with the Commission's planning procedures, which over the long term have impacts on the whole of the Management Area. The term "the area" in the following recommendations refers to the whole of the Management Area, not just that currently proposed for assessment.

2. That the EIS investigate the presence of, and impact upon, conservation values in the area which are contiguous with, and/or commensurate with, the World Heritage values of the adjacent Barrington Tops National Park. This is necessary to meet Australia's obligations under the World Heritage Convention.

3. That the EIS investigate the presence of, and impact upon, conservation values relevant to the Register of the National Estate. This is necessary to ensure that public concern for the protection of National Estate quality forests is taken into consideration and also to reflect the fact that no previous assessment of National Estate values has been conducted in the area.

4. That the EIS investigate the presence of, and impact upon, conservation values in the area which are commensurate with, and/or would enhance, those of the existing Barrington Tops National Park under the criteria of the National Parks and Wildlife Act.

5. That the EIS investigate the presence of, and impact upon, the values of the area as part of a wilderness area which extends into the adjacent National Park. This is necessary to ensure conservation criteria of the Wilderness Act are adequately considered.

6. That the EIS comprehensively investigate the area for the presence of uncommon, rare and endangered species. It should report on the size and extent of their populations, the ecological factors influencing them, and the likely impact of the proposed activity.

7. That the EIS pay particular attention to the populations, distribution within the area, ecological requirements and impacts upon species and associations of species which are at, or near, the limits of their geographical and/or local distributions. This is necessary to ensure long term changes in species evolution and distribution are considered, particularly with respect to climatic change (natural or otherwise).

8. That the EIS comprehensively investigate ecological gradients both within the area and which extend as a continuum into surrounding areas.

9. That the EIS pay particular attention to the assemblages and populations of invertebrate species; to their role in the overall ecology of the area; and to the likely impacts on the invertebrate fauna and the overall environment of the proposed activity.

10. That the EIS comprehensively assess the presence, populations and ecology of fauna species, with particular attention to be paid to:
i) those which utilise either areas of old growth forest and/or isolated mature and senescent trees; and
ii) those which utilise the forest floor.

11. That the EIS comprehensively investigate the effect of the proposed activity on the physical structure of the forest, as well as on the ecological factors which affect forest structure. Particular attention should be paid to the impact of the fire regime and the effects of integrated harvesting as compared to other harvesting techniques.

12. That the EIS report comprehensively on the structure (both physical and chemical) and stability of soils in the area and on their role in the local forest ecology. It should pay particular attention to the conditions of the soil under a timber production regime in the short, medium and long term.

13. That the EIS report on hydrological factors operating within the area, and pay particular attention to the impact of the proposed activity on these factors. Comprehensive data should be obtained.

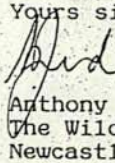
14. That the EIS fully consider variations in the ecological productivity and characteristics of sites within the area, and pay particular attention to differences between low-medium and steep slopes. This should focus on the inadequacy of assigning steep areas as non-logging areas as the major means of environmental protection.

15. That the EIS investigate the potential of the proposed activity to aid the introduction of both exotic species and/or species not native to the area. It should identify both the species and likely vectors.

16. That the EIS should consider the impact of the proposed activity in the context of the overall adequacy or otherwise of the protection of the biota and associations found within the area. It should pay particular attention to any likely reductions in the overall conservation status of species (flora & fauna) recognised as endangered, rare, vulnerable or uncommon.

We look forward to receiving a copy of the completed EIS as well as any other relevant documents when they are ready.

Yours sincerely,



Anthony Too
The Wilderness Society
Newcastle

BIG SCRUB

NORTH-EAST FOREST ALLIANCE
HUNTER REGION

GREEN ALLIANCE NETWORK
FAL BROOK WILDLIFE REFUGE

P.O. Box 9 Singleton 2330 Australia
phone: (065) 77.3105 fax/data: (065) 77.3001 E-mail: peg: ganref

Released: September 29th 1992.

REMAINING HUNTER REGION OLD GROWTH FORESTS THREATENED BY PROPOSED LOGGING.

Remnant old growth forests in **Mt Royal, Gloucester and Chichester State Forests** are all scheduled for logging in the near future. Roading and logging operations in many old growth areas of north-eastern N.S.W. were halted following legal actions by the North East Forest Alliance to compel the Commission to undertake Environmental Impact Assessments (EIS) as required by law. The first of these EISs have now been published, for Wingham and Mt Royal Management Areas, and those for Gloucester and Chichester will be published next month.

A preliminary critique of the Mt Royal EIS follows, together with some comments on the Wingham EIS, and a summary of mismanagement and unsustainable practice in Mt Royal, Gloucester and Chichester Management areas.

RICH AND RARE FAUNA AND FLORA AT MT ROYAL

Surveys undertaken in Mt Royal State Forest for the Enironmental Impact Statement just published reveal highly significant fauna and flora species and associations and confirm an assessment undertaken by the North East Forest Alliance (NEFA) in 1989 which concluded the remnant old growth forests in the area should be given high priority for conservation reserve status.

The EIS however argues that proposed logging operations will have minimal impact on the environment and should proceed.

An EIS must be a 'scientific assessment' and be 'objective in its approach' (**Justice Cripps, Land and Environment Court**); these Forestry Commission assessments are neither - they distort Survey results to justify logging these ancient forests, and they propose 'reserves' which are not reserves at all, and which in any case would be totally inadequate to protect rare and vulnerable species or maintain numbers of more abundant species.

The surveys found a rich diversity of fauna species including a number of Vulnerable and a few highly Endangered species; and rare flora species and associations including old growth dry scherophyll Eucalyptus canaliculata (a Grey Gum) with Eucalyptus eugenoides association with extremely limited occurrence, and supporting high populations of the Vulnerable and Rare Yellow-bellied Glider. The Flora Survey notes a number of other forest associations regarded by Benson (1989) as inadequately conserved.

Vulnerable and Rare fauna species include Hastings River Mouse, Parma Wallaby, Glossy Black Cockatoo, Tiger Quoll, Long-Nosed Potoroo, Rufous Bettong, Koala, Brush-tailed Phascogale and Yellow-bellied Glider.

The Surveys reveal an astonishing variety within the small area of Old Growth in the Davis and Cross Creeks section of the State Forest. Within an area of only about 900 hectares, an altitudinal range from 600 to 1200 metres and differences in soil and aspect and other factors not well understood because of our inadequate knowledge of natural ecosystems, produce a range of communities from the rare dry old growth through untouched moist sclerophyll

forests to pristine cool temperate, temperate, gallery and subtropical rainforests and pure stands of antarctic beech (at its southern and western limit.) High diversity of flora and fauna at Mt Royal is a direct and obvious consequence of the presence of these remnant unlogged areas. Logging simplifies floristic structure and consequently potentially fauna also, with risk of local loss of entire species and a decline in number of some species.

Other factors associated with logging are also known to have major impacts on many species of flora and fauna - for example, cattle grazing, post logging top disposal burning, frequent fuel reduction burns and broadscale burns, roads and snigging tracks.

The Flora and Fauna Survey Reports for Mt Royal both state that "it was very difficult to assess general logging impacts because there are no detailed pre-logging data available". Evidence from other studies and the Mt Royal Survey results themselves suggest an unscientific lack of objectivity in assessing logging impacts. This bias is even more obvious in the EIS itself and in the Fauna Impact Statement.

The Mt Royal EIS was ready for final proofing in November 1991. The Forestry Commission has acknowledged that the main reason for the inordinate delay in publishing it was problems with the Fauna Impact Statement based on the Fauna Survey: Head Office required the FIS to be rewritten (**Regional Forester, pers. comm.**) Obviously the Fauna Survey results present the Commission with formidable problems and the EIS goes to extraordinary lengths to distort the fact that the proposed operations will clearly have very significant adverse effects on such rich fauna populations.

It is quite dishonest for **Forests Minister Mr West (Press Release September 23rd)** to suggest there is no significant difference between logged and unlogged forest as habitat for forest-dependent fauna. Studies in Mt Royal and Wingham State Forests confirm many other findings including findings of the Commission's own researchers, that logging destroys the preferred habitats of arboreal mammals such as Gliders and Koalas.

The Mt Royal Fauna Survey found that 80% of the Yellow-bellied Gliders recorded on the study plots were in unlogged forest. All the Koalas, 60% of the Greater Gliders and 80% of the Brushtail Possums were in unlogged forest, which is only 13% of the State Forest. Furthermore, the logged plots in the Survey were harvested more than 20 years ago, and although heavily logged were not subjected to the integrated sawlog/pulplog operations proposed for these old growth areas. So these previously logged areas are likely to support somewhat higher populations of arboreal mammals than areas to be intensively logged in future integrated logging operations, especially since there are old growth areas nearby. With the loss of this old growth habitat populations of a number of species could be expected to decline. Experts such as Professor Harry Recher and Tony Norton (**Chaelundi evidence**) have dismissed filter strips as quite inadequate to ensure the survival of viable populations of forest dependent fauna.

As for the **Hastings River Mouse**, its presence at Mt Royal adds significantly to the habitat significance of these small remaining ancient forests, which support a number of endangered species. For the Minister to suggest that finding a single individual in a previously logged area is a hopeful sign and shows logging doesn't harm wildlife betrays a callous disregard for wildlife and our native forests. A previous survey trapped 5 individuals near Mt Royal. The Hastings River Mouse may be in danger of local extinction at Mt Royal, and nationally it is one of our most endangered mammals. The largest colony found so far, 20 individuals near Tenterfield, could not be located in follow-up surveys after the Forestry Commission roaded

and burnt the habitat.

Mr West says Parma Wallabies are thriving at Mt Royal. In fact only one individual was recorded. How could the Minister make such an absurd statement?

The EIS proposes various measures including two fauna "reserves" (Koala & Yellow-bellied Glider) resulting in 48% of the Davis Creek catchment being protected from logging. These "safeguard measures" taken together constitute the EIS's justification for concluding the proposed logging operations should proceed despite the significance and extreme fragility of fauna and flora, the vital Hunter Region catchment values, the unstable (slump prone) basaltic soils and the small size of the old growth area remaining within a State Forest which has been grossly overcut and seriously degraded, and which separates the National Park from cleared grazing land, open-cut coal mines, the New England Highway and Liddell and Bayswater power stations.

It is complete nonsense to suggest that these measures are a significant concession to wildlife or that they will protect vital habitat from the affects of logging. Under the Mt Royal Management Plan (MP,1988) 46% of the Davis Creek catchment was to be excluded from logging by the normal management prescriptions (which exclude slopes above 30 degrees, rainforest, retention strips etc - see Plan Appendix 11).

Consequently very little area is added to the total which would be excluded from logging by standard minimal management prescriptions - prescritions which experts (and Land and Environment Court Judges) have criticised as inadequate. Moreover, neither the estimated yield from the Davis Creek catchment nor the sawlog quota for the proposed old growth logging (which is double the figure given in the MP as the sustained yield) have been reduced at all as a consequence of these measures, including the reserves not provided for in the Management Plan.

Most importantly, it would appear these "fauna reserves" are not really reserves at all. They do not appear to have legal status - as gazetted Flora Reserves have, for example. They are simply included in the PMP (Preferred Management Priority) mapping system, and there is no guarantee they may not be logged in the future.

The Wingham EIS is dishonest in the same manner. Of the proposed "Conservation Reserves" in the Wingham Management Area, 75.2% of the area of these is inaccessible because of steep slopes and therefore presumably of "low site quality". (Table 4.8 page 162). Moreover, only 6.2% (400 ha) is Flora Reserve (already existing), the remaining 93.8% being PMP 1.3 (Preserved Native Forest) and therefore not really conservation reserves at all. The EIS says these will be "assessed over time to determine which areas should be gazetted as Flora Reserves" (page 161). There is no commitment to permanent reserves in addition to the existing Flora Reserves of only 400 ha; PMP 1.3 classification can be altered by the Commission at any time and the area logged.

In any case, these so-called "fauna reserves" are ludicrous. The home range of Yellow-bellied Gliders is 30 to 60 hectares. The Davis Creek "Yellow-bellied Glider Reserve" of a miserable 56 ha would perhaps provide habitat for **one family** of up to 4 Gliders (the total Survey count was 43) - an uncertain, vulnerable and probably temporary refuge for one family amidst the surrounding devastation of integrated logging. And **Mr West** talks of mammals thriving - not for long!

This 56 ha area serves dual purpose in the EIS insofar as it overlaps the Eucalpytus canaliculata area temporarily excluded from logging pending an

assessment of areas of reserve in Barrington Tops National Park. However, as Doug Binns (author of the Flora Survey) acknowledges (pers. comm.) Canaliculata is a low elevation species with an extremely limited distribution which is most unlikely to be represented in the Park. So much for these so-called "reserves" as "safeguard measures". The object of the exercise is to have the thing determined, however dishonest the means, by the Planning Minister, for logging to proceed, and thereafter the lack of legal protection means that they can log it anyway - no matter that it's not represented in the Park, they'll find a small, steep, inaccessible oldgrowth patch in Chichester State Forest, and reserve that (Eucalyptus canaliculata only occurs between Gloucester and the Hunter River, and the conservation status of the canaliculata - eugenoides association occurring in Davis Creek is uncertain).

The Koala "reserve" is entirely within very steep country excluded from logging on that basis by routine prescription; no Koalas were found there in the Survey. The area has been chosen because it is excluded from logging anyway, not because it has been assessed as providing the preferred habitat.

Another major dishonesty about these "safegaurd measures" concerns buffer or filter strips. The EIS suggests in a carefully - worded section (4-12) that logging will not occur in these areas: "where no logging machinery is to enter", "trees are not permitted to be felled into the drainage lines in these specified filter strps", "an area 5 metres either side of the drainage line is to be left undisturbed by logging machinery unless otherwise specifically approved". What the EIS carefully does not say, is that logging is permitted within these buffer or filter strips. This is a major deliberate omission since so much is made in the EIS of these filter strips and their value as wildlife refuge and corridors.

The Mt Royal EIS is at pains to stress that the proposed logging operations will not be more intense than previous operations in the area (e.g. 3-11); and that the operations constitute "selective logging" as opposed to the "intensive" logging of the south-east forests (8-20). "The degree of intensity of logging operations would indicate relatively minor disturbance in comparison to more intensive operations and techniques (e.g. clear felling and higher yield harvesting)" (4-15). "Past harvesting practices were more intense than those practised now or expected in the future." (7-16)

Again and again the dishonest attempt to "have it both ways" is evident in these EISs. At a time when worthwhile Survey-based independent expert assessments of the ecology of old growth forest is urgently needed, after decades of almost complete neglect and ignorance of wildlife species and habitat requirements by the Commission, lack of funds for survey and research by the National Parks and Wildlife Service, and decades of wholesale habitat destruction by intensive logging operations far in excess of sustained yield, significant public funds are being expended in these cynical "assessments" which grossly distort the nature of logging operations and their environmental impacts to attempt to justify the Commission's policy of logging remaining old growth as rapidly as possible..

The Mt Royal EIS tries to argue that past logging has been heavy, extensive and intense, that future logging will not be more intense than previously, and that future logging will be "selective" such as to leave "a relatively undisturbed zone" adjoining the Park:

"It is particularly important that the management prescriptions of the Mt Royal Management Area be complementary, as far as practical, to those of the Barrington Tops National Park. Therefore, while selective logging will occur in the management area, the ecology of specific areas should not be disturbed

or degraded. It is particularly important that the management area should continue to act as a relatively undisturbed zone on the southern and western flanks of the Barrington Tops National Park and between the Park and unreserved, developed areas currently being used for grazing and agriculture."

The EIS itself presents substantial evidence that these objectives are incompatible with the proposed logging operations.

What is deliberately disguised is the intensive and destructive nature of the proposed integrated sawlog/pulplog logging, which is intended to achieve "silvicultural" ends by obliterating old growth characteristics in one cutting cycle to rapidly establish even-aged crops (stands) of the commercially favoured species. Integrated harvesting means the contractors save the Commission having to manage the forest by judicious thinning and enrichment planting where necessary, because they trash almost everything in the one operation.

Similarly the **Wingham Fauna Impact Statement** (FIS) implies the proposed operations are "selective logging". This is not true - the Wingham Plan of Management and the EIS itself are explicit that the operations will be intensive integrated sawlog/pulpwood operations.

The Wingham F.I.S. also says that "it is clear that there is increasing evidence of protected (and endangered) fauna being able to survive within a selectvely logged forest."

It is a weak conclusion, to say that some individuals were encountered. In the case of the Yellow-bellied Glider, only one individual was seen in a total of 105 km of road transects, and 5 were heard calling in gullies. (Wingham Fauna Survey Part 1 pages 21, 42). Most importantly, this conclusion begs the question of the impacts resulting from integrated logging operations as opposed to 'selective logging'.

Most of the studies carried out for the Wingham EIS were in areas not logged recently and therefore not logged 'intensively' - only 4 out of 45 plots were in areas described as "high intensity logging -1977 to 1987". (Table 5 Fauna Survey Part 1 page 11). However, this category disappears in discussions of relative population abundance and species richness and comparisons of logged and unlogged forest.

Similarly the **Mount Royal Fauna Survey** included as "logged" a plot within a compartment part of which was lightly and illegally logged long ago, such that this portion is substantially old growth; and it would appear that high numbers of arboreal mammals found there skewed the comparison between logged and unlogged forest types for arboreals; and of 8 plots described in the Fauna Survey as moist, some are described by the author of the Flora Survey as dry (Binns, pers. comm.) Yet "site differences" including presumably moisture are given as more likely determinants of differences between certain plots than logging history.

These EISs do not provide assessments of the impacts of the integrated sawlog/pulplog operations proposed. If the purpose of the EIS and the FIS is to examine the likely impacts of the proposed operations, they have not done so, and are open to challenge on this basis - that is, not merely that they carry out the task inadequately, but that they do not carry it out at all. This is true of both the Wingham and Mt Royal EISs.

The only way to protect now and for the future the Mt Royal habitat of the Yellow-bellied Glider, the Tiger Quoll, the Glossy Black Cockatoo, the Long-Nosed Potoroo, the Hastings River Mouse and other endangered species, and

the rare, beautiful dry sclerophyll forests and undisturbed cool rainforest and antarctic beech, is to preserve what little old growth remains in the Management Area.

The Forestry Commission are proposing to trash these remaining ancient forests in a high-intensity integrated sawlog/pulplog operation for maximum short-term yield. It is obvious the impacts on fauna and flora will be enormous, and for West and this Mt Royal EIS to say otherwise is dishonest, as even their own data, for all its weaknesses and limitations, shows. The same is true of the Wingham EIS.

Publication of EISs for Gloucester and Chichester is due next month. Attached is a summary of mismanagement and unsustainable logging policies for Hunter Region Management Areas - Mt Royal, Gloucester and Chichester.

- Barrie Griffiths, September 1992.

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MISMANAGEMENT OF HUNTER REGION STATE FORESTS.

SUSTAINED YIELD

In 1981 the then NSW Commissioner for Forests Dr Gentle told senior Commission officers:
"The statistics that come out of the Management Planning Division indicate without a doubt that our big management areas are being over-cut... What you should be doing on the quota side is definitely to pull things back towards the sustained yield principle which is really the corner-stone of all forestry at the field management level." (Public Accounts Committee Report, Dec.1990). Nevertheless overcutting continued throughout the eighties, as conceded by then Minister Ian Causely in 1989. The PAC Committee noted "the Commission's continuing failure in 1990 to fully address the need to reduce quctas. In the Committee's view, the entire issue of sustainability and the future of the native forest resource raises very grave doubts about the Commission's ability to plan for the future". (PAC, 1990)....

The Commission routinely overcut native forests in operations showing a net financial loss. Currently whilst the Commission talks about "ecological sustainability" and a "sustainable yield strategy", forests are still being cut at grossly unsustainable levels, and at a loss. The policy seems to be to keep quotas high and cut the old growth as fast as possible, and then reduce quotas towards more sustainable levels from the regrowth.

MOUNT ROYAL MANAGEMENT AREA

The Mount Royal State Forest has been subjected to gross mismanagement by the Forestry Commission in past decades. The Commission's own regulations and guidelines requires: (Quotes are from the Mount Royal Management Plan 1988)

* harvesting yield from forests to be "adjusted to the sustainable capacity of the forest" and operations shall minimise damage to the forest environment; and filter strips along watercourses and sensitive exclusion areas to be observed and erosion mitgation measures implemented;

* that the forest resource be studied and inventoried for its values and characteristics and operations conducted in such manner as to "retain the range of forest types and their ecological viability"; and to "maintain a diverse habitat for viable populations of indigenous wildlife";

* the Commission to "maintain any significant or rare ecological, floral, faunal or other scientific values"; and to "retain trees of value for wildlife habitat" and establish reserves to conserve representative samples of flora and plots to monitor growth rates;

* that measures be taken to "minimise the loss of forest values resulting from wildfire" and "conserve catchment values", and to monitor harvesting operations and market forest products to "maximise financial return to the State" and ensure "harvesting for the highest economic use"; and to "retain a scenic forest environment". Rainforests are to be conserved, harvesting being restricted to "mature trees for specialty use, at an intensity low enough to maintain canopy and rainforest structure and composition".

The Commission is also required to maintain regular records, such as harvesting plans and logging history maps, compartment history maps, fire plans, management plans, annual management and financial reports.

In all these respects, without exception, the Commission has failed to fulfill its obligations in its management of public forests in the Mount Royal area, as in most other management areas.

Prior to legal action by NEFA in 1990 to compel the Commission to comply with the law regarding preparation of an Environmental Impact Statement, the Commission had not surveyed the flora and fauna of Mount Royal State Forest, assessed habitat requirements, or displayed any regard for forest values other than timber resources. There are no forest preservation reserves in the M.A. There were no fauna or flora inventories apart from the Commission's classification of broad forest types; consequently knowledge of the forest environment being subjected to such massive impacts was scant. Operations proceeded without regard for known likely effects of overcutting on wildlife habitat, species composition and diversity, effects on soil (including compaction, erosion, loss of structure, nutrient levels and increased temperature); turbidity and sedimentation of streams. Prescriptions such as 20 metre filter strips (within which selective logging is permitted practice), erosion mitigation measures, retention of habitat trees and "50% canopy retention" were applied, if at all, without assessment of their effectiveness and despite criticism by experts. Often even these inadequate prescriptions were ignored and supervision of operations was minimal or non-existent. Areas of rainforest were destroyed by roading, logging and burning to be replaced by regeneration of commercially favoured species. The forest has been subjected to decades of grazing and frequent burning with no assessment of the effects of these practices.

Harvesting yields from the Mt Royal Management Area (MA) during the thirty-year period from 1950 to 1980 averaged 50,000 cubic metres per decade - 5000 annually. In January 1985 the quota mill closed down, and by 1988 annual yield had fallen virtually to nil.

Commission operations for the period 1982 to 1988 showed a loss, despite considerable subsidies from the public purse. Financial records for the period 1988 to 1992 have not yet been made available, but would show a significant loss, without including the value of subsidies.

Records and monitoring of operations in the M.A. have been woefully inadequate or non-existent over these decades. There was no Management Plan in existence over the period when most harvesting took place (the first draft was prepared in 1984, and the Plan was not finalised until 1988), supervision and monitoring were inadequate, records were lamentable. A perusal of annual management reports for the eighties reveals continuing deficiencies. Commenting on the lack of harvesting plans and controls, the report for 1985-86 states: "The Mount Royal Management Area is a difficult area to afford adequate supervision considering its distant location within the district."

The same Report states that:
"Compartment histories have not been adequately maintained. Permanent Growth Plots have suffered as a result of staff transfers. No measuring or maintenance in established PGPs took place in 1983-4 or 1984-5. During 1985-6 no measuring or maintenance or establishment of PGPs occurred. Priority has been given to Cessnock M.A."

Reports for 1986-87 and 1987-88, 88-89, 89-90 repeat that compartment histories have not been maintained and no work done on Permanent Growth Plots. Despite very little activity in the M.A. the Report for 1988-89 says of growth

information: "Lack of time and resources prevented any work being undertaken".

The Reports for the past three financial years (dated in August, August and January the following year respectively) state that "a financial report will be provided at a later date".

NO MORE LOGS

The Mt Royal Management Plan says that:

"In the 47 years to 1988 total production has been 200,000 cubic metres net including 190,000 of hardwood sawlogs, at an average rate of 4,266 cubic metres net per annum including 4,035 cubic metres hardwood sawlogs." In the 30 years from 1950 to 1980 total production was 150,000 cubic metres, and in the sixties annual production averaged 5,700 cubic metres. The result of this overcutting is that the only mature sawlogs available for harvesting in the M.A. until about year 2040 are in the 654 hectares (net productive area*) of old growth currently in dispute, of which 532 ha are in the Davis Creek Section. This is all the old growth remaining in the M.A., and at the conclusion of the proposed cutting cycle in the old growth, about year 2002, there will be no mature sawlogs until 2040. It is obvious then that harvesting has been well above sustainable levels.

The position is even worse, however, since there is a shortfall in availability even of small sawlogs from thinning, as the Management Plan explains:

"There are no appreciable quantities of advanced regrowth trees now in the 40-100cm dbhob size ranges. Regeneration stands of sizes generally well below 40cm dbhob are present on some 940 ha logged and culled since 1963 and could not be expected to develop sufficiently to sustain a commercial thinning for small sawlogs for at least 10 years, i.e. until about year 2000. A further 1,400 ha has been completely logged and regeneration is well-developed, but at least 20 years away from development to a sufficient size to sustain commercial thinning for small sawlogs, assuming average tree increment to be less than 2cm dbhob per year, i.e. not available until about year 2010. A further 40 years is expected to be required for these stands to reach harvestable maturity for mature sawlogs, i.e. years 2040 (940 ha) and 2050 (1,400 ha)."

The Management Plan then looks at the longer term prospects and estimates that after this period of shortage to year 2040, the 4,400 ha available for long-term production should "give a sustained yield of quota sawlogs of something in the order of 2,000 to 2,500 cubic metres per annum." This is based, as with other estimates in the Plan, on yield figures obtained in Chichester Management Area.

Worth noting also is discussion in several Annual Management Reports for the Chichester M.A. of an option to use the remaining old growth in Mt Royal M.A. to alleviate the critical shortage of sawlogs in the overcut Chichester forests.

CHICHESTER MANAGEMENT AREA

In a 1982 **Report on the Chichester Management Plan,** Paul Scobie wrote:

"The Dungog region has been, and is being, heavily overcut with a serious decline in sawlog availability. The Timber Industry's own planning conference, Forward, estimated in 1974 that sawlog availability in the Dungog region would decline 75% (135,000m3) in the 25 years between 1975 and 2000. (Forward

Panel Report 2, p.50)... It is clear from the Plan that a hiatus is expected in sawlog supply from the area and the Forestry Commission figures show sawlog availability will decline to almost nothing by 2023...

"The volume of timber available from Chichester forests was re-assessed in 1975/76 and it was determined that the sustained yield quota for sawlogs was 15,800m3 net per annum. (Plan, p.25). From 1975 to 1980 the Commission allowed sawlog yields to increase 45%, in full knowledge that the quota was 36% above sustained yield levels, and ex-quota cut was 28% on top of this irresponsibly high quota. The Plan states (p.24):

> The critical consideration, however, is that sufficient area of regrowth stands will NOT have reached maturity by the time the cutting cycle is completed about 2023/24. (My emphasis)...

The Chichester Management Plan states (p.41):

> Harvesting of hardwood forest shall aim at the sale of ALL trees considered to be merchantable."

This very heavy logging of the 90% of the hardwood forests for sawlogs amounts to clearfelling when integrated sawlog/pulpwood logging takes place. The Plan states harvesting of pulpwood may include:

> trees of any species, size or maturity encountered in timber harvesting operations already described in this plan, which are judged to have no present or potential value as sawlogs, poles or piles. (p.43). **(Paul Scobie 1982.)**

Scobie in 1982 saw that

"The clear intention of the NSW Forestry Commission is to develop an integrated sawlog/pulpwood operation in this area, as stated on page 20:

> The virgin forest areas of the Chichester Management Area contain a significant component of overmature, highly defective stems which are totally unsuitable for sawmilling purposes. Following logging much of this material is currently wasted in silvicultural practices such as culling and clearing and consequently would be available profitably to help support a woodchip project without prejudicing sawmill industry committments..

These logging practices are so intensive that forest values other than wood production receive only token consideration." **(Paul Scobie, 1982)**

And indeed integrated logging was introduced in 1983/84, and the following year "saw full integration of sawlog and pulpwood operations being achieved" (Annual Report). Sales of pulpwood, chiefly to Sawmiller's Exports P/L, totalled over 800,000 tonnes during 1983/84 to 1987/88.

The move to integrated sawlog/pulpwood harvesting in Chichester has brought an acceleration of the loss of oldgrowth forest and a significant increase in environmental impact.

Yield analysis of completed compartments shows that between 1976 and 1983 9,604 m3 was cut from 5 recut compartments and 49,065 m3 from 11 virgin compartments. In 1983/84 23,258 m3 of the year's total of 24,337 m3 of quota sawlogs were cut from 298 ha of virgin forests. More recent Management Reports do not give proportions of recut to virgin compartments logged.

The Annual Report for 1982/83 stated that:

" Previous Management reports have expressed some concern with the 1980 Plan's requirement to maintan a suitable overall mix of virgin and previously logged areas. The 1975/76 assessment recognised a resource of 110,000m3 gross of previously logged areas generally available for relogging. The 1982 assessment estimated there was 25,000m3 of this resource available at the commencement of

1982/83."

In that year (1982/83) 52% of the of the area logged was virgin forest, yielding 16911m3 net from 217 ha as against 4460m3 net from 200 ha of previously logged forest.

Throughout the eighties the sawlog quota remained at about double the sustainable figure, so that by 1988 assessed yield indicated that "if the balance is to last until 2039, quota would be 5,818m3 per annum from 1990, i.e. 27.1% of current quota" (Annual Report). As the District Forester said in his bitter Report for 1986/87, "the future holds no ray of hope". Nevertheless the quota remained unchanged for 1988/89. Instead of reducing quotas, various proposals including taking supplies from neighbouring Gloucester & Mount Royal Management Areas, even more intensive integrated logging, and greater concentration of logging in virgin areas, were considered.

Despite continued high volumes and increases of 44 - 48% in royalties in 1983/84, the Management Area lost $717,909 for the four-year period 1982/83 to 1985/86, the only period for which this writer has figures - an average of about $180,000 per annum. (This net loss figure does not include the asset write-off resulting from the Rainforest Decision).

The Chichester Management Plan was due for revision in 1985, extended to 1988, and the new Plan has still not been published.

GLOUCESTER MANAGEMENT AREA.

A similar situation has existed in Gloucester M.A., which includes Barrington Tops and Stewarts Brook State Forests. Net average sawlog production between 1977 and 1984 was 28,884 cubic metres per annum, whereas the sustainable yield figure is 10,000 cubic metres. In addition to this there was a further average net ex-quota cut of 8,566 cubic metres per annum. Thus sawlog production from the M.A. has been many times the sustainable yield. The Management Plan (1984) states that "Sustainable yield could not be expected to be available until towards the end of next century (2070-2090). (p.41)

The Forestry Commission admits that harvesting at this level can only continue until 2005, but the current Gloucester Management Plan (1984) makes no definite plans to reduce production to a sustainable level, and yields were not significantly reduced until 1990/91, and remain well above the sustainable level.

The Commission has continued a policy of grossly unsustainable logging in this Management Area. In 1986/87 quota sawlog yield was 22,838 cubic metres net; in that year Allen Taylor & Company agreed to accept a quota cut-back from 19,380 cubic metres to 16,000 cubic metres, with further reductions planned. The Commission rejected this. In his Annual Report the District Forester commented: "This District is at a loss to why the offer was rejected by Head Office and why further opportunities (for reductions) have gone by the way." In 1987/88 total quota was 22,000 cubic metres, and the Annual Report for the year states that "In order to achieve a yield towards sustainable (10,000 cubic metres p.a. net) annual quotas will need to be reduced substantially from 1989 onwards. This fact is accepted by local industry and it is expected the 1989 quotas will be ... 14,200 net... It can be seen that to eke out the remaining resource until 2020 (when regrowth will contribute about 50% of yield) an annual cut of about 11,300 cubic metres is required from 1989 onward."

Despite this, current figures from the Gloucester Office indicate that approximately 24,500 cubic metres of sawlogs and about 20,000 cubic metres of

other logs were cut last year (1991-92); the Commission says this is about half the previous levels (District Office pers. comm.) - although the figures indicate otherwise.

Current Management Accounts for the Management Area have not been made available to date; the Accounts for 1986/87 and 1987/88 show losses of $218,000 and $172,000 respectively. The Report for 1988 says that a dramatic increase in Head Office overheads contributed significantly to the result.

- Barrie Griffiths, September 1992.

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TO: Ned, NEFA Big Scrub
RE: Interim report on FOI Request, Newcastle Regional Office 8.7.92 & Cessnock District Office 10.7.92, Forestry Commission.

Hi Ned.

As advised in an earlier memo, previous hassles from Head Office regarding the 50% reduction in FOI fees were dropped and advice of this was sent from Head Office on Jan.17th last. In that letter Head Office advised that: harvesting plans were only available for 1984-91; logging history maps - available; fire history maps - available but incomplete; annual management reports - available; fire plan - available; timber production statistics (we asked for "monthly and annual print-outs showing logging volumes, species type, mills and royalties") - available (but not information of a commercial nature) and various other things we asked for - available.

I had discussed procedure with both Col Nicholson & Mike Rowland beforehand by phone, realising some information would be at Regional and some at District Office, offering to attend either office at their convenience; they said Regional Office would be fine; but it turned out most of information was still at District Office. Only Management Reports and EIS survey material was available at Newcastle. Nicholson said commercial information would not be available and I said this was unacceptable. He said he would not give details of roading costs or details of contractual agreements with licencees (however we have copies of licence agreements obtained at the time of the injunction.)

At Cessnock on the Friday District Forester Shaw responded likewise. ~~Forester Steve Shaw repeated~~ that volumes and species types were available but not financial information or details of Mills supplied.

I told both Nicholson & Shaw this was unacceptable. I reminded them that the agreement reached as a result of the injunction included full access to Commission records, and that the agreement had been effected by Order of the Court; I said that we required access to all material including financial details if we were to be able to fully assess and respond to the EIS, that the matter had been subject of Ombudsman and Parliamentary findings critical of the Commission, and that we would obtain the material by subpoena if necessary. All this was relayed by Shaw in phone conversations with Newcastle and Sydney, and in the end we were given access to timber production statistics including royalty rates and values of sales; and we accessed these for the period 1980 to March 1992, in the first instance. I indicated we would require a further visit.

I gather that hitherto denial of access to timber production statistics has been general policy; perhaps in other M.A. also in future this may not be the case, especially if we are insistant.

However, we still do not have revenue and expenditure for the last three years - the Management Reports for 1989 & 1990 state that "A Financial Report will be provided at a later date", and the Report for 1991 makes no reference to revenue or expenditure - so that although we have timber sales revenue for these years, we do not have details of expenditures, which will include legal costs, EIS costs, and roading costs (these were estimated at $157,000 in 1983, budgeted at $204,300 in the Report for 1986/87, and I suspect have to date been well in excess of that).

I am very keen to obtain these figures, which almost certainly will reveal that the proposed operations in the old growth here will show a very significant loss. If it proves possible to get them by pressure in the Ombudsman complaint/PAC recommendation implemented/consultation process, that would be good; otherwise I'll be talking to Tim about subpoena when the time comes.

There are no fire history maps since 1970; fire reports exist for 1986 - 1991.

The timber production statistics are confusing. I'll peg-post an interim analysis. I'm preparing packages for old growth mail-outs to people and groups. I will send draft. Would like to include leaflet (Quoall on cover) with some packages - could you peg-post it so I can print it a bit larger? It's an

excellent summary. Thanks, Barrie. Copy to John.

NORTH-EAST FOREST ALLIANCE
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TO: NEFA AREA CO-ORDINATORS
DRAFT BACKGROUND MATERIAL FOR IMPENDING MOUNT ROYAL EIS.

(NOTE: draft. Material obtained through Freedom of Information Act is incomplete (Management Accounts have been withheld), some of it confusing. Nevertheless the general account given here is well-founded. Further information and comment will be available when the EIS is published - expected this month. More information on Chichester & Gloucester M.A.s including field investigations will be available soon. Meanwhile, comments/corrections welcome.)

UPPER HUNTER OLD GROWTH THREATENED:

THE DAVIS CREEK SECTION OF MOUNT ROYAL STATE FOREST

Mount Royal Management Area comprises 6,694 hectares of the Mount Royal Forest, the remaining 753 hectares of which is within Chichester M.A. The area occupies the south-western slopes of the extremities of Barrington Tops, east of Muswellbrook and about 50km north of Singleton.

Proposed logging operations in Mount Royal State Forest threaten all old growth forest remaining in the Management Area. Most of these ancient forests are in the Davis Creek Section, adjoining the south-western boundary of Barrington Tops National Park, and physically separate from the rest of the State Forest. A Court injunction obtained by the North-East Forest Alliance (NEFA) in January 1990 halted roading operations pending the preparation of an Environmental Impact Statement, as required by law. This EIS is now about to be published, and unless prevented by legal or other action, the operations which will destroy these forests will proceed this year.

Almost all of this Section is previously unlogged old growth forest, which is very diverse, ranging from open dry sclerophyll forest with casuarina understorey, moist dense tall hardwood forest, to Messmate-dominated secondary rainforest and cool temperate rainforest and pure stands of Antarctic Beech. The area has been submitted for inclusion in the Barrington Tops National Park because of its unique conservation values. Much of the area is steep, with unstable soils and high rainfall. No flora or fauna surveys had been conducted prior to the commencement of forestry roading operations; however, it was known that the area contains rare, endangered and vulnerable species.

The Davis Creek Section was included in the **Proposed Additions to Barrington Tops National Park**, Submission by Conservation Groups, in December 1982, because of its high conservation value. The Submission states:

"The area contains a diversity of plant communities including some not represented or poorly represented in the (then existing) Park. Continuous pure stands of rainforest, cool temperate to sub-tropical are found throughout the area including the Big Losy/Mount Cockrow-Davis Creek/Falbrook area.... The cool temperate Antarctic Beech forests within this section are more diverse than the higher altitude Beech forests within the Park. Those at the low altitude of 900m (such as those within the Davis Creek Section - ed) are of particular scientific interest and are not well represented within the park." (page 17)

The groups involved in this Submission were the National Parks

Association of N.S.W., the Nature Conservation Council of N.S.W., the National Trust of Australia (N.S.W.), the Colong Foundation for Wilderness and the Newcastle Flora and Fauna Protection Society.

Sixty per cent of the Davis Creek Section as a whole is over 20 degrees slope, and a significant percentage is over 30 degrees slope, the figures by compartments being: compartments 200, 50 per cent over 30 degrees, 201, 12 per cent, and for compartments 202, 203 and 204 approximately 20 per cent is over 30 degrees slope.

The Davis Creek/Cross Creek area is small, and the impact of these operations will be correspondingly massive, and lead to the destruction of the conservation values for which the area is so valuable. The Section contains endangered, rare and vulnerable species.

FAUNA

The avifauna of the Mt Royal area is rich and diverse. A total of 90 species of birds have been recorded from the Mount Royal State Forest. These include four species of owl, four species of pigeon, four species of cockatoo including the Glossy Black Cockatoo, eight species of honeyeaters, the Peregrine Falcon, Rose Robin and Ground Thrush. Species at the extremity of their distribution include the Noisy Pitta, Regent Bowerbird (soutern limit) and the Pilot Bird (northern limit). Most of the rainforest gullies in the area support pairs of Powerful Owls, according to the E.I.S. Survey.

Species richness of large arboreal marsupials is high, with Greater Gliders the most abundant (total count 133). Other species detected are Ringtail Possum, Yellw-bellied and Sugar Gliders (total count 58) Brushtail Possum, Mountain Brushtail Possum, and Koala (6 occurrences). Small arboreal mammals include Brush-tailed Phascogale, Brown Antechinus, Sugar Glider, Bush Rat and Fawn-footed Melomys. Macropods include Red-necked Pademelon and Red-necked Wallaby (both extremely abundant), Parma Wallaby, Eastern Grey Kangaroo, Common Wallaroo, Swamp Wallaby, Long-Nosed Potoroo and Rufous Bettong. Other species include Echidna, Spotted-tailed Quoll, Northern Brown Bandicoot, Long-Nosed Bandicoot, Common Wombat, Dusky Antechinus, Common Dunnart, Swamp Rat and Hastings River Mouse; seven species of frogs, twenty species of reptiles including Diamond Python. There are also reports of sightings of the Eastern Quoll, but this species has not been confirmed in formal surveys.

The Report of the Fauna Survey, part of the E.I.S., has just been obtained. The general conclusion that fauna would not be significantly affected by logging operations is contradicted by the evidence presented, as shown by the attached graph of data in Section 4.3 of the Report. SEE P. 10.

"Of particular concern is the scarcity of old-growth dry sclerophyll forests. The Davis Creek Section of Mount Royal State Forest (compartments 200-204) appears to be one of the most significant old-growth dry sclerophyll forests remaining in northern NSW... I have no doubt that the Davis Creek Section is of immense environmental significance for its old-growth eucalypt forests, untouched cool-temperate rainforests, Messmate dominated secondary rainforests, swamps and soaks, diverse fauna and for numerous other reasons. "

- Dailan Pugh, NEFA

DEGRADATION OF THE FOREST ENVIRONMENT

The Mount Royal State Forest has been subjected to gross mismanagement by the Forestry Commission in past decades. The Commission's own regulations and guidelines require that harvesting yield from forests shall be "adjusted to

the sustainable capacity of the forest" and operations shall minimise damage to the forest environment; that filter strips along watercourses and sensitive exclusion areas shall be observed and erosion mitgation measures implemented; that the forest resource be studied and inventoried for its values and characteristics and operations conducted in such manner as to "retain the range of forest types and their ecological viability" and to "maintain a diverse habitat for viable populations of indigenous wildlife", and to "maintain any significant or rare ecological, floral, faunal or other scientific values"; to "retain trees of value for wildlife habitat" and establish reserves to conserve representative samples of flora and plots to monitor growth rates; to adopt measures to "minimise the loss of forest values resulting from wildfire" and "conserve catchment values", and to monitor harvesting operations and market forest products to "maximise financial return to the State" and ensure "harvesting for the highest economic use"; and to "retain a scenic forest environment". Rainforests are to be conserved, harvesting being restricted to "mature trees for specialty use, at an intensity low enough to maintain canopy and rainforest structure and composition". (Quotes are from the Mount Royal Management Plan 1988). The Commission is also required to maintain regular records, such as harvesting plans and logging history maps, compartment history maps, fire plans, management plans, annual management and financial reports.

In all these respects the Commission has failed to fulfill its obligations in its management of public forests in the Mount Royal area, as in most other management areas.

Prior to legal action by NEFA in 1990 to compel the Commission to comply with the law regarding preparation of an Environmental Impact Statement, the Commission had not surveyed the flora and fauna of Mount Royal State Forest, assessed habitat requirements, or displayed any regard for forest values other than timber resources. There are no forest preservation reserves in the M.A. There were no fauna or flora inventories apart from the Commission's classification of broad forest types; consequently knowledge of the forest environment being subjected to such massive impacts was scant. Operations proceeded without regard for known likely effects of overcutting on wildlife habitat, species composition and diversity, soil compaction, erosion, turbidity and sedimentation of streams, soil structure, nutrient levels and temperature. Prescriptions such as 20 metre filter strips (within which selective logging is permitted), erosion mitigation measures, retention of habitat trees and "50% canopy retention" were applied, if at all, without assessment of their effectiveness and despite criticism by experts. Often even these inadequate prescriptions were ignored and supervision of operations was minimal or non-existent. Areas of rainforest were destroyed by roading, logging and burning to be replaced by regeneration of commercially favoured species. The forest has been subjected to decades of grazing and frequent burning with no assessment of the effects of these practices.

All these abuses are a matter of public record and the subject of trenchant criticism in court judgements, parliamentary inquiries, expert studies and the media, as features of Forestry Commission practice throughout the State. Such practice makes nonsense of dishonest guidelines and objectives in management plans which profess commitment to sustainable capacity, ecological viability, species diversity, erosion mitigation, and so on.

OVERCUTTING, WASTE, INEFFICIENCY

Harvesting yields from the Management Area (MA) during the thirty-year period from 1950 to 1980 averaged 50,000 cubic metres per decade - 5000 annually. In January 1985 the quota mill closed down, and by 1988 annual yield had fallen to 4 cubic metres (of fencing)! As a result of this massive rate

of overcutting over three decades, Commission operations for the period 1982 to 1988 showed a loss, despite considerable subsidies from the public purse. Financial records for the period 1988 to 1992 have not yet been made available, but would show a significant loss, without including the value of subsidies.

Records and monitoring of operations in the M.A. have been woefully inadequate or non-existent over these decades. There was no Management Plan in existence over the period when most harvesting took place (the first draft was prepared in 1984, and the Plan was not finalised until 1988), supervision and monitoring were inadequate, records were lamentable. A perusal of annual management reports for the eighties reveals continuing deficiencies. Commenting on the lack of harvesting plans and controls, the report for 1985-86 states: "The Mount Royal Management Area is a difficult area to afford adequate supervision considering its distant location within the district. When new parcel sales begin a formalised system of working will include harvesting plans being split into 'sectors', with contractors requiring the supervising foreman's approval before shifting into a new sector. Foremen now fill out a standard checklist every time they visit a bush operation". Progress indeed!

The same Report states that:
"Compartment histories have not been adequately maintained. Permanent Growth Plots have suffered as a result of staff transfers. No measuring or maintenance in established PGPs took place in 1983-4 or 1984-5. During 1985-6 no measuring or maintenance or establishment of PGPs occurred. Priority has been given to Cessnock M.A."
Reports for 1986-87 and 1987-88, 88-89, 89-90 repeat that compartment histories have not been maintained and no work done on Permanent Growth Plots. Despite very little activity in the M.A. the Report for 1988-89 says of growth information: "Lack of time and resources prevented any work being undertaken".

The Reports for the past three financial years (dated in August, August and January the following year respectively) state that "a financial report will be provided at a later date".

It is evident from comments in the annual Management Reports that finalising estimates and allocations of the Davis Creek resource was a major cause of the inordinate delay in finalising the Management Plan after some 6 years or more of prevarication. For example, the Report for 1986-87 says: "Management Plan preparation: The first draft was submitted in December 1984. Since that time there has been much deliberation over the uncommitted resource. At present further work on this preparation has been postponed until resource allocation has been decided." It would also seem that lack of adequate harvesting supervision for the remaining uncommitted quota quality timber meant that operations were suspended. The only sales in the M.A. for 1986-87 were parcel sales to a licencee of 316 cubic metres over a three-week period. The Annual Report commented: "Although further sales could have been negotiated, the proportion of quota quality timber and the low level of supervision that could be afforded meant that operations could not continue."

In other words, there were no quota allocations in the Management Area after the quota mill, Maitland Timber and Hardware, informed the Commission in May 1984 that they required no more logs. Evidently the Commission was unable to sell the tender until 1989 when two licencees took quotas for the old growth. Between May 1984 and December 1989 only parcel sales were made. Parcel sales are sales of timber at a flat rate per cubic metre gross regardless of species or size. This method is especially uneconomic for class one quality sawlogs harvested without adequate supervision.

NO MORE LOGS

The Management Plan says that:
"In the 47 years to 1988 total production has been 200,000 cubic metres net including 190,000 of hardwood sawlogs, at an average rate of 4,266 cubic metres net per annum including 4,035 cubic metres hardwood sawlogs."
In the 30 years from 1950 to 1980 total production was 150,000 cubic metres, and in the sixties annual production averaged 5,700 cubic metres. The result of this overcutting is that the only mature sawlogs available for harvesting in the M.A. until about year 2040 are in the 654 hectares (net productive area*) of old growth currently in dispute, of which 532 ha are in the Davis Creek Section. This is all the old growth remaining in the M.A., and at the conclusion of the proposed cutting cycle in the old growth, about year 2002, there will be no mature sawlogs until 2040. It is obvious then that harvesting has been well above sustainable levels.

The position is even worse, however, since there is a shortfall in availability even of small sawlogs from thinning, as the Management Plan explains:
"There are no appreciable quantities of advanced regrowth trees now in the 40-100cm dbhob size ranges. Regeneration stands of sizes generally well below 40cm dbhob are present on some 940 ha logged and culled since 1963 and could not be expected to develop sufficiently to sustain a commercial thinning for small sawlogs for at least 10 years, i.e. until about year 2000. A further 1,400 ha has been completely logged and regeneration is well-developed, but at least 20 years away from development to a sufficient size to sustain commercial thinning for small sawlogs, assuming average tree increment to be less than 2cm dbhob per year, i.e. not available until about year 2010. A further 40 years is expected to be required for these stands to reach harvestable maturity for mature sawlogs, i.e. years 2040 (940 ha) and 2050 (1,400 ha)."

The Management Plan then looks at the longer term prospects and estimates that after this period of shortage to year 2040, the 4,400 ha available for long-term production should "give a sustained yield of quota sawlogs of something in the order of 2,000 to 2,500 cubic metres per annum." This is based, as with other estimates in the Plan, on yield figures obtained in Chichester Management Area - in this case, 0.5 cubic metres net quota sawlog volume per productive hectare per year.

CHICHESTER MANAGEMENT AREA

Yield estimates, harvesting plans and silvicultural practices used in the Mt Royal M.A. are based on integrated sawlog/pulpwood logging operations carried out in the neighbouring Chichester area, where overcutting over past decades has been most severe.

In a 1982 **Report on the Chichester Management Plan**, Paul Scobie wrote:

"The Dungog region has been, and is being, heavily overcut with a serious decline in sawlog availability. The Timber Industry's own planning conference, Forward, estimated in 1974 that sawlog availability in the Dungog region would decline 75% (135,000m3) in the 25 years between 1975 and 2000. (Forward Panel Report 2, p.50)... It is clear from the Plan that a hiatus is expected in sawlog supply from the area and the Forestry Commission figures show sawlog availability will decline to almost nothing by 2023...

"The volume of timber available from Chichester forests was re-assessed in 1975/76 and it was determined that the sustained yield quota for sawlogs was 15,500m3 net per annum. (Plan, p.25). From 1975 to 1980 the Commission allowed sawlog yields to increase 45%; in full knowledge that the quota was 36% above

sustained yield levels, and ex-quota cut was 28% on top of this irresponsibly high quota. The Plan states (p.24):

> The critical consideration, however, is that sufficient area of regrowth stands will NOT have reached maturity by the time the cutting cycle is completed about 2023/24. (My emphasis)...

The Chichester Management Plan states (p.41):

> Harvesting of hardwood forest shall aim at the sale of ALL trees considered to be merchantable."

This very heavy logging of the 90% of the hardwood forests for sawlogs amounts to clearfelling when integrated sawlog/pulpwood logging takes place. The Plan states harvesting of pulpwood may include:

> trees of any species, size or maturity encountered in timber harvesting operations already described in this plan, which are judged to have no present or potential value as sawlogs, poles or piles. (p.43).

The clear intention of the NSW Forestry Commission is to develop an integrated sawlog/pulpwood operation in this area, as stated on page 20:

> The virgin forest areas of the Chichester Management Area contain a significant component of overmature, highly defective stems which are totally unsuitable for sawmilling purposes. Following logging much of this material is currently wasted in silvicultural practices such as culling and clearing and consequently would be available profitably to help support a woodchip project without prejudicing sawmill industry committments..

These logging practices are so intensive that forest values other than wood production receive only token consideration." (Paul Scobie, 1982)

These practices have continued to the present in all Hunter Region Management Areas.

GLOUCESTER MANAGEMENT AREA.

A similar situation has existed in Gloucester M.A., which includes **Barrington Tops and Stewarts Brook State Forests.** Net average sawlog production between 1977 and 1984 was 28,884 cubic metres per annum, whereas the sustainable yield figure is 10,000 cubic metres. In addition to this there was a further average net ex-quota cut of 8,566 cubic metres per annum. Thus sawlog production from the M.A. has been many times the sustainable yield. The Management Plan (1984) states that "Sustainable yield could not be expected to be available until towards the end of next century (2070-2090). (p.41)

The Forestry Commission admits that harvesting at this level can only continue until 2005, but the current **Gloucester Management Plan (1984)** makes no definite plans to reduce production to a sustainable level, and yields were not significantly reduced until 1990/91, and remain well above the sustainable level.

The Commission has continued a policy of grossly unsustainable logging in this Management Area. In 1986/87 quota sawlog yield was 22,838 cubic metres net; in that year Allen Taylor & Company agreed to accept a quota cut-back from 19,380 cubic metres to 16,000 cubic metres, with further reductions planned. The Commission rejected this. In his Annual Report the District Forester commented: "This District is at a loss to why the offer was rejected by Head Office and why further opportunities (for reductions) have gone by the way." In 1987/88 total quota was 22,000 cubic metres, and the Annual Report for the year states that "In order to achieve a yield towards sustainable (10,000 cubic metres p.a. net) annual quotas will need to be reduced substantially from 1989 onwards. This fact is accepted by local industry and

it is expected the 1989 quotas will be ... 14,200 net... It can be seen that to eke out the remaining resource until 2020 (when regrowth will contribute about 50% of yield) an annual cut of about 11,300 cubic metres is required from 1989 onward."

Despite this, current figures from the Gloucester Office indicate that approximately 24,500 cubic metres of sawlogs and about 20,000 cubic metres of other logs were cut last year (1991-92); the Commission says this is about half the previous levels.

Current Management Accounts for the Management Area have not been made available to date; the Accounts for 1986/87 and 1987/88 show losses of $218,000 and $172,000 respectively. The Report for 1988 says that a dramatic increase in Head Office overheads contributed significantly to the result.

VIRTUAL CLEARFELLING

The Chichester Management Plan, published in 1980 and due to be revised in 1985, has still not been replaced. The 1988 Mt Royal Plan is more moderate in language, but the basic harvesting policy and silvicultural practice is the same.

The **Mt Royal Plan** states, with regard to the projected sustained yield of 2000 - 2500 per year from year 2040:

"To achieve such a level of yield, adequate regeneration to ensure a final stocking of at least 125 stems/ha of commercial tree species would be required on the 2050 hectares yet to be harvested or relogged in the current cutting cycle. The intensity of this harvesting should be sufficient to achieve the required level of regeneration without further silvicultural treatment."
"The harvesting and silvicultural treatments involved in the utilisation of the remaining old growth resource will establish the stand conditions necessary for optimum forest growth over most of the remainder of the productive area."

Licence agreements with two timber companies for the old growth resource, obtained by NEFA at the time of the injunction hearing, provide for 2250 m/3 gross class 1 logs each for the first year of the cycle (at $40.20 per cubic metre), and there is no specified limit on the quantity of class 2 logs (at $8.60). The total of 4,500m3 (class one logs only) per year is about double the volume given elsewhere in the Plan as a sustainable figure (see above).

UNDECLARED WAR ON RAINFOREST

"Sydney Blue Gum, Tallowood and Silvertop Stringybark forests (types 46,47 and 168) all have associated rainforest flora. The **Chichester Plan** describes these moist forests as having 'a high rainforest element', or as 'a wet sclerophyll forest with an understorey verging on rainforest'. These types make up 58% of the total (Chichester) forest, and in logging these areas the Management Plan states that 90% will be logged. The remaining 10% includes 'inaccessable areas, filter strips, preserved areas etc'. Therefore, very little of the poorly conserved moist hardwood with its associated rainforest will remain unlogged." (**Paul Scobie, 1982**).

Much of the remaining rainforest in the Hunter region consists of ribbons and pockets associated with streams, and is very vulnerable to damage and disturbance from roading and harvesting of hardwoods growing near their edge. Subsequent management, especially the use of fire, exacerbates the damage. There are numerous examples of damage and dieback of rainforest in these

forests.

The once-widespread misconception that rainforest logging no longer occurs in NSW persists in the minds of some people. Even the **Mt Royal Plan**, drafted to take account of the sensitivity of the issue, states that:
"Harvesting within rainforest stands will be restricted to:
- the salvage of dead or dying trees, or of trees damaged or likely to be damaged by forest operations.
- very selective harvesting of mature trees for specialty use, at an intensity low enough to maintain canopy and rainforest structure and composition."

Although the policy is not to otherwise log what little rainforest remains in Mt Royal State Forest, the reality of Commission practice is management directed towards the destruction of rainforest. In the case of Chichester, the war on rainforest is an openly declared war. The **Chichester Plan** states:

"During the late 1950's and early 1960's there was a period when fire was almost completely excluded from sections of the Management Area. The reduced fire occurrence in these sections was obviously a major factor in promoting development of mesic understorey and generally inhibiting the development of regeneration of eucalypts and related hardwoods....
Occurence of even a light fire, repeated at long intervals of years may be sufficient to **kill** most rainforest elements and subject to the presence of canopy openings of sufficient size, would favour regeneration of moist eucalypts and associated wet sclerophyll species... Broad area hazard reduction burning and pre-logging and post-logging burning not only provide fuel-reduced buffer zones as a fire protection measure, but **heavily favour the wet sclerophyll types and grass cover against the INVASION by rainforest elements." (My emphasis)**

Here the war on this intrusive invader is explicit. However, management practice in **Mt Royal** has also been clearly directed towards replacing rainforest elements with commercial hardwood species. Canopies are opened by roading and, and regular burning completes the decimation of rainforest elements. Of even greater significance for remaining rainforest elements in the old growth areas in Mt Royal forests, is the fact that the Commission's definition of "rainforest" excludes secondary rainforest containing eucalypts. Consequently the majestic ancient Messmates towering over beautiful cool temperate rainforest near the head of Cross Creek, below Mt Cockrow in the Davis Creek Section, adjacent to stands of Antarctic Beech, are to be roaded and logged under the proposed harvesting plan. Many other significant remnant rainforest areas are similarly threatened, such as Whispering Gully and the Upper Paterson River. These areas are included in the proposed Barrington Wilderness.

In the light of all this, the licence agreements and harvesting plans for the proposed operations in the remaining Mt Royal old growth are alarming. It is evident that the intensity of the operations in terms of removals of some 40-45,000 cubic metres of mature class one sawlogs and maximum removal of class 2 logs from the Davis Creek Section together with maximum ground disturbance and both top disposal and broadscale burning, will amount to trashing the Section in an integrated sawlog/pulplog operation for maximum yield and regeneration towards 125 stems per ha in one cutting cycle without further "silvicultural treatment". There is no pretence of a change to sustainable harvesting.

TAXPAYERS PAY FOR OLD GROWTH LOGGING

An Environmental Review prepared in 1983 for proposed operations in Davis Creek Section estimates a net gain of $89,000 to the Commission. Amendments in

1988 estimate the gain at $128,000. A number of factors suggest that the operations, if allowed to proceed, may result in a significant loss:

* the above estimates do not include legal costs to date and for any forthcoming action brought by NEFA;
* costs of the E.I.S. are not included;
* there is substantial evidence that Commission estimates of available timber and yields are based on inadequate data and are highly unreliable;
* even if legal action and political pressure fail to prevent the operations, it is most unlikely that operations based on yield estimates derived from the gross overcutting - virtual clearfelling - operations in the Chichester Management Area would be permitted to proceed without drastic reductions in yield volumes;
* the proposed operations are clearly in breach of the Management Plan; a revision of operations in accordance with Plan provisions would make the operations even less viable economically than they are already;
* it is very likely the final roading costs will be higher than the $160,000 original estimate (later revised to $210,000).
* it may be that the Commission has incurred other costs as a result of entering into a contract with licencees for operations found to be illegal in the Land and Environment Court.
* given the above, an estimated net gain of around $12-15,000 per annum doesn't leave much margin for error.

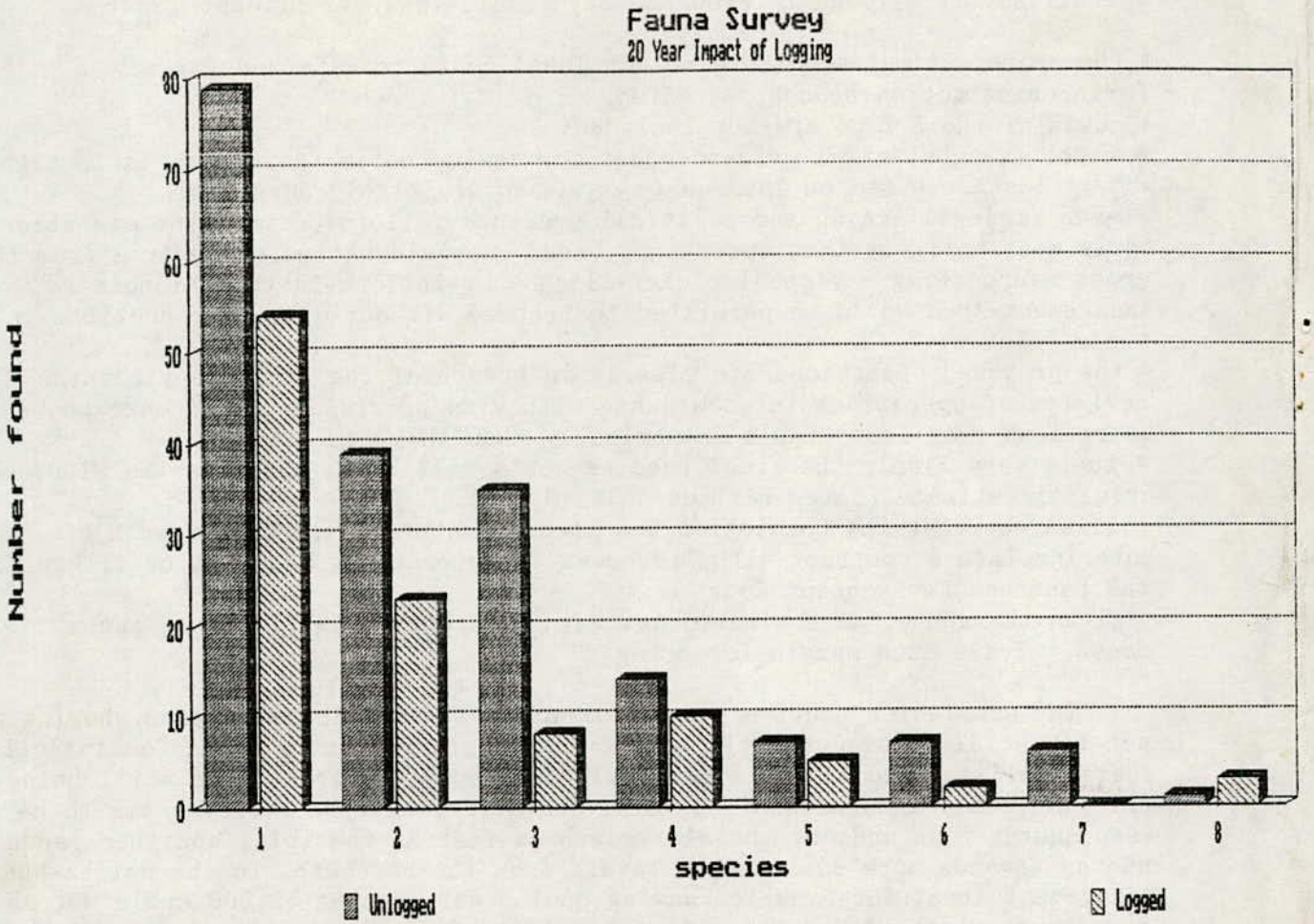
The Commission routinely overcut native forests in operations showing a net financial loss. Currently whilst the Commission talks about "ecological sustainability" and a "sustainable yield strategy", forests are still being cut at grossly unsustainable levels, and at a loss. The policy seems to be to keep quotas high and cut the old growth as fast as possible, and then reduce quotas towards more sustainable levels from the regrowth. In the Walcha-Nundle Management Area, for example, sawlog quotas were set at 52,000 cubic metres per annum, which was expected to exhaust the forests of millable wood by 1991, after which it would not be until year 2030 or 2040 that viable annual yields would again be available. A sustainable yield was considered to be 12,300 cubic metres per annum, possibly rising to 25,000 cubic metres over time. All Commission estimates are based on logging all remaining old growth, including those now subject to a morotorium pending an EIS a well as those currently being trashed while EISs are carried out. Last year (1990/91) the Walcha - Nundle Management Area lost $11,500 on its eucalypt operations and $228,100 on its pine plantations.

These figures, of course, are the Commission's figures which ignore the substantial subsidies which, after what is absorbed in waste and inefficiency, the Commission passes on to the industry. The NSW Parliamentary Accounts Committee reported that the industry benefits from public subsidies amounting to $16 million annually. The total figure is likely to be much higher. In addition, construction of roads and bridges for timber harvesting costs the taxpayer $12 million annuallly.

However, it would seem that even on the Commission's estimates and ignoring subsidies, if Davis Creek is logged it would be at significant cost to the taxpayer; and the real financial cost would be even greater.

But the greatest, and irreplaceable cost would be the loss of the last remaining old growth in the Mount Royal State Forest.

- Barrie Griffiths, August 5th 1992



	Unlogged	Key	Logged
Greater Gilder	79	1	54
Brown Antechinus	39	2	23
Yellow-bellied Glider	35	3	8
Long-nosed Bandicoot	14	4	10
Sugar Glider	7	5	5
Brushtail Possum	7	6	2
Koala	6	7	0
Ringtail Possum	1	8	3

In early 1991 the NSW Forest Commission conducted a Fauna Survey in the Mt Royal State Forest. The consultants conclude that there it no difference in habitat value between logged and unlogged forest. In the graph above each left-hand column represents the number of small native animals found in the study in unlogged forest. The right-hand column is the population of the same animal that they found in forest that had been logged 20 or more years ago.

Data from Forest Commission of N.S.W.
"Mt. Royal Management Area Fauna Survey - June 1991" s4.3

COPY 4 : NED

NORTH-EAST FOREST ALLIANCE
HUNTER REGION

GREEN ALLIANCE NETWORK
FAL BROOK WILDLIFE REFUGE

P.O. Box 9 Singleton 2330 Australia
phone: (065) 77.3105 fax/data: (065) 77.3001 E-mail: peg: ganref

Hello Tim, and best wishes.

The contrast between your world in chambers and that of Kempsey farmers & loggers may indeed warrant consideration for a environmental bravery medal, were it not that you are formidable enough in any company!

I have been assembling material in preparation for the Mount Royal E.I.S., which I believe will be published/exhibited some time close to September 1st. Apparently the latest holdup was because Head Office Wildlfe Assessment people wanted the F.I.S.s to be re-written. Dailan heard they'd had trouble with the consultants regarding the E.I.S.

I have accessed information from Newcastle Regional and Cessnock District Offices and next week also from Gloucester and Dungog Offices. Only by insistence including threatening subpoena did I obtain timber production statistics, and I am currently arguing similarly for access to annual management accounts/profit and loss accounts - the annual reports give operations revenue/expenditure figures but not things like interest on loan, Regional burden of Head Office overheads, depreciation and amortisation, E.I.S. and legal costs etc. In fact I do not even know Davis Creek roading costs, since the Mt Royal M.A. annual reports for the past three financial years haven't even got revenue/expenditure summaries - all state that "a financial report will be provided at a later date."

However, I don't know whether we have subpoena power at this stage - my reasoning is that unrestricted access was part of an agreement given effect by Order of Cripps, and "until further orders" lasts at least until E.I.S. is determined, when cause of our action vanishes and we need to initiate further action to use subpoena...

I want to be able to assemble precise details of gross overcutting and other abuses, and significant financial losses, in Mount Royal, Chichester and Gloucester Management Areas.

I enclose Flora and Fauna Studies for Mount Royal, just obtained. I am sending copies to Harry Recher, Harry Hines, Roger Lembit and others for comment. The fauna report seems to me outrageous, in drawing conclusions contradicted by the data (see enclosed graph) from inappropriate use of sophisticated statistical techniques, evidence of interference by the Commission in survey methodlogy and report, and by ignoring peers who have published material on impacts on fauna (as summarised by Dailan).

I will be consulting Roger Lembit regarding a soils/hydrology report and perhaps field review of the flora study. I believe a Determination could be challenged on grounds of misleading E.I.S., non-compliance with Management Plan, continued unsustainable yields, farcical economics, unstable soils/catchment, impact on fauna including threatened, rare and vulnerable species, unique flora/floral associations, inadequate representation in the Park, and overall massively destructive impact of integrated sawlog/pulplog operations to maximum yield within a small area of mostly steep, unstable catchment.

However, the E.I.S. isn't out yet, and I have more information to gather and analyse, before I can send a draft brief. If we have to litigate, I believe

John may prefer not to be applicant - myself or Marg McLean would be. I will contact you when the EIS is out as to whether we can prevent it being determined.

sincerely,

Barrie Griffiths

Copy 4: MED.

NORTH-EAST FORREST ALLIANCE
HUNTER REGION

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By fax August 13th 1992
Mr P. Smith
Environmental Assessment/FOI Management Sections
Forestry Commission of N.S.W.

Dear Mr Smith,
RE: FOI Access to Management Accounts/Profit & Loss Statements

On August 6th last at Newcastle Regional Office I was denied access to Management Accounts by your decision after the matter was referred to you by phone by a Newcastle Office employee. Approval had been given previously by Mike Rowland, Regional Planning Officer, who I believe consulted Regional Forester Col Nicholson in the matter. Neither Rowland nor Nicholson were in the offce when I called to collect the material. I had driven from home for the purpose, a journey of nearly three hours.

You told R.O. to inform me I should make separate application for this material, and I did so in a letter by hand on the spot, which I assume you have received. I reproduce that letter below, that there be no need for further delay in approving this request (I have added a few phrases for clarification):

"We are in the process of reviewing Regional, District and where necessary Head Office records in relation to the Hunter Region. Information made available to date includes among other things Timber Production Statistics and Annual Management Reports including annual financial statements of revenue and expenditure (itemised summaries).

However, in the case of Mt Royal M.A. Annual Reports for the past three years do not include financial summaries as in all previous reports, and itemised management accounts/profit and loss statements are not included. Accordingly approval was sought and obtained from Mike Rowland for access tc Management Accounts to date. I have travelled from Mt Royal today only to be informed these will not be made available without separate appplication.

We remind the Commission that full access to all records was agreed at the time of the Injunction Hearing and given effect by Order of Chief Justice Cripps. We say that in order to assess and respond to the impending E.I.S. we need access to significant information upon which it is based and which would be pertinent to consideration in the Determination or subsequent Court Hearing, including access to Management Accounts/profit and loss statements.

Whilst we feel that to date Col Nicholson and Mike Rowland from tbe Regional Office have been friendly and reasonable, the Commission's attitude in this matter could appropriatelty be subject to further complaint to the Ombudsman.

Hopefully, however this separate request will be fully and promptly granted and the general amicable tenor of relations to date with Newcastle Office not be further impaired by Head Offce.

Yours faithfully, etc."

I would add the following:
* We have submitted both general and specific Hunter Region FOI requests which include requests for "Annual Management Reports" and "any files pertaining to

the Management Areas, whether held in the District, Regional or Head Office."
* I believe we can subpoena the information required if necessary, for the Hunter Region.
* Management Accounts/profit and loss statements are also missing from information obtained by NEFA (by Rodney Knight) in relation to Gloucester and Chichester M.A.s. As explained above, we require this information for all M.A.s in the Hunter Region.
* I ask that this request be granted by phone call today to myself and Regional Office, that I may collect the required material this Friday from Newcastle, and next week from Dungog and Gloucester District Offices. I will then phone Dungog and Gloucester to arrange a time suitable to them.
* If this request is denied, I will refer the matter to Tim Robertson, NEFA counsel, for action as he may advise, and lodge formal complaint with the Ombudsman.

Yours faithfully,

Barrie Griffiths.

Added Friday August 14th to: Tim Robertson, Dailan Pugh, Ned Ricketts.

The upshot of phone conversations on Thursday with Head Office and Col Nicholson of Newcastle Office, and personal interview with Nicholson on Friday, is that Head Office are worried about establishing a precedent by granting this access, and so the application is to be treated as separate FOI application, and they say I should get reply within the statutory 21 days from August 6th.

Tim, in the event they refuse, can we issue subpoena?

I will send complaint to Ombusdman.

- Barrie

MICHAEL ROWLAND. NPT
NEWCASTLE FORESTRY OFFICE.

FORESTRY COMMISSION OF N.S.W.

MT. ROYAL MANAGEMENT AREA

FAUNA SURVEY

FINAL REPORT

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TABLE OF CONTENTS

TABLE OF CONTENTS cont...

page

1. INTRODUCTION

This report presents the results of a survey of selected faunal groups undertaken in Mount Royal Management Area. The Mount Royal Management Area consists of all of Mount Royal State Forest No.297 west of Mount Royal Range, about 45 km north of Singleton in the Hunter Valley. The Area occupies the south-western slopes of the extremities of Barrington Tops.

The survey was carried out by J.Shields, A.York, T.Brassil, K.Bamkin, W.Chapman and P.Murphy, with support from regional Forestry Commission personnel (see Appendix 1). Surveys of the avifauna and arboreal marsupials were primarily conducted by R.Webster of *ARMATA* Environmental Consultants. Surveys were conducted during the period 2nd January to 18th March 1991.

The objectives were as follows:

1. To compile an inventory of selected faunal groups. These faunal groups were determined to be those most effected by forestry management practices, and those considered to be "of special significance" because of conservation status and representations made by other interested parties.

2. To characterize the fauna particularly in relation to vegetation communities.

3. To evaluate the conservation significance of the fauna and their habitats in the study area in a local and regional context.

4. To assess the impact of past forestry practices on the faunal communities in order to provide guidelines for future management of the Area.

This report forms part of:

Shields,J., York,A. and Binns,D. (1991) *Flora and Fauna Survey, Mt.Royal Management Area, Newcastle Region, NSW.* Forest Resources Series No.17. Forestry Commission of New South Wales.

2. THE STUDY AREA

2.1 Vegetation Studies

The vegetation of the Area can be broadly described in structural terms as: Sclerophyll forest (84%), Rainforest (15%), and non-forested areas (1%) (Forestry Commission 1988). Of the sclerophyll forest, 66% can be considered to be composed of "Moist Hardwood" forest types, and 34% as "Dry Hardwood" forest types (Figure 1). Records suggest that timber harvesting began in the Carrow Brook catchment in the 1930's and the Fal Brook catchment in the 1960's, both catchments now having been extensively logged (Forestry Commission 1988). A detailed survey of vegetation communities has been undertaken and is described by Binns (1991).

2.2 Previous Fauna Studies

No comprehensive fauna surveys have been conducted in the Management Area. The Area forms the south-west corner of an extensive and continuous tract of forested country containing a diversity of habitat types. Barrington Tops National Park adjoins to the north, but no systematic fauna survey has been conducted within the Park.

A limited survey of terrestrial mammals was conducted near Mt. Royal in 1984 (Dickman and McKechnie 1985), primarily to locate populations of the Hastings River Mouse (*Pseudomys oralis*). This species was subsequently studied at the same localities in January 1988 and July 1989 (Read 1988, 1989). A similar limited survey of vertebrate fauna was conducted in the Davis and Cross Creek area (see Hines 1990) over 4 days in November 1989. Some data are available from Australian Museum studies in the Tuglo Wildlife Refuge, a private property located a few kilometres from Mt.Royal State Forest and with similar vegetation and from nearby Chichester and Gloucester Management Areas. Fauna detected in these surveys are indicated in Appendices 2, 3 & 4.

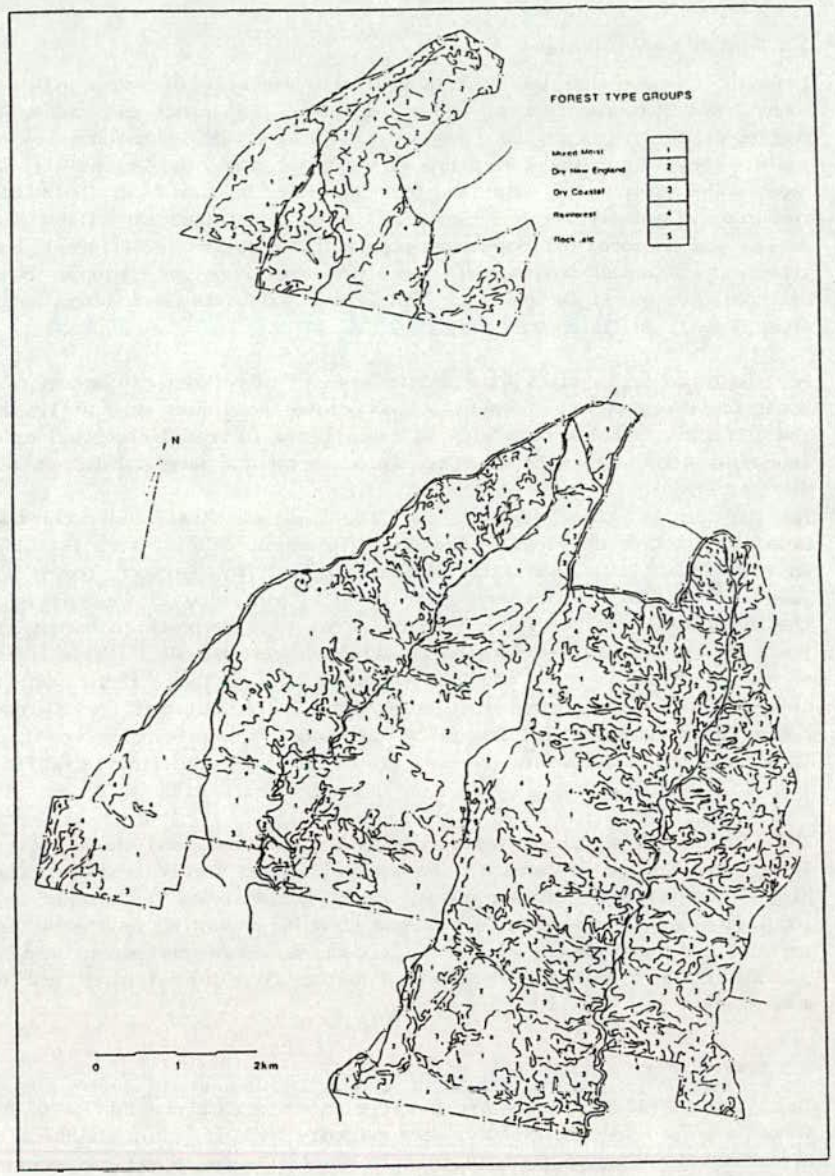

Figure 1. Mount Royal Management Area. Pattern of Occurrence of Broad Forest Type Groups (adapted from Forestry Commission Management Plan 1988).

3. METHODOLOGY

3.1 General Survey Design

In order to determine the distribution and abundance of fauna within the Mount Royal Management Area, and to document the impact of logging, two complementary strategies were employed. In the first instance, a broad scale survey (including literature review) was conducted across the whole area. The purpose of this was to determine the state of the wildlife resource in general terms. Secondly, a more detailed stratified survey design was employed to determine population density in different forest types and management treatments. The study area comprises the upper reaches of three catchments: Carrow Brook, Fal Brook, and Davis Creek (incorporating Cross Creek), and is shown in Figure 2.

For the broad scale study, the entire area of the three catchments of the Mount Royal region was surveyed. Appropriate techniques were utilised for the different faunal groups with an overall aim to record observations over the whole study area. These are presented in tabular form and discussed.

For the detailed phase of the study, the area was stratified according to broad forest type and logging history. Permanent "plots" were established in Rainforest, Moist Hardwood (*Eucalyptus*) and Dry Hardwood forest types (see Section 2.1). Plots were established within unlogged areas (primarily the Davis Creek catchment), and logged areas with regrowth in excess of 20 years of age. Rainforest logging is no longer carried out in State Forests, so this was not a consideration in this study. Thus, there were five categories of forest sampled: Rainforest, Moist Hardwood, Dry Hardwood, Logged Moist Hardwood and Logged Dry Hardwood. Fauna were surveyed using techniques most appropriate for each group following guidelines specified in York *et al.* (1991).

The detailed survey phase was statistically analysed, and the results are interpreted in the discussion. In general, broad forest type and logging history constituted class variables, which were analyzed in terms of animal population density and species richness (sample estimates) as the dependent variables. Analysis of variance procedures, both parametric and non-parametric, were employed for arboreal marsupials, diurnal birds and small mammals.

3.2 Study Sites

Twenty study "plots", representing 4 replicates of each combination of broad forest type and logging history, were randomly located within the Management Area. The location of study plots is shown in Figure 2, and are identified as follows:

Forest type	*Logged*	*Unlogged*
Dry Forest	1D,2D,3D,1D	11D,12D,13D,14D
Moist Forest	1M,2M,3M,5M	11M,12M,13M,14M
Rainforest		1R,2R,3R,4R

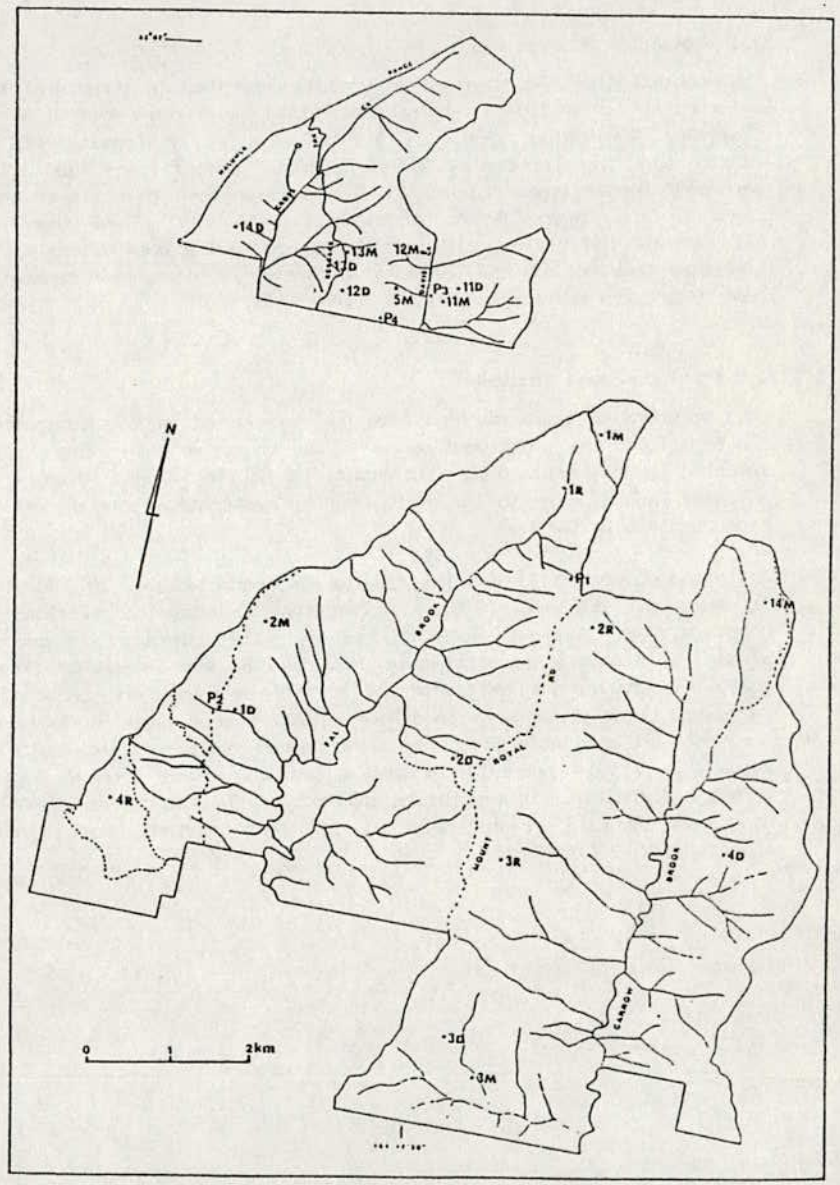

Figure 2. Mount Royal Management Area. Location of Fauna Study Plots.

Each study "plot" consisted of a transect five hundred metres long. Width and sub-division of each plot varied for the faunal group being sampled, with 5 study "points" being established systematically within each plot. In addition, 4 sites (P1-4) were specifically located in order to survey for the Hastings River Mouse *Pseudomys oralis* (see 3.7 below). The vegetation of each fauna study plot was sampled and is described by Binns (1991).

3.3 Avifauna Survey

The following configuration of study sites was used. A 500m transect was established as described above. A bird count station was established at 100m mark intervals along the transect and marked with flagging tape. Study plots are shown in Figure 2.

All birds seen and heard at each station were recorded for a ten minute period. The distance from the point to the bird was estimated, and recorded in pre-set distance categories (0-5m, 5-10m, 10-20m, 20-30m, 30-50m, and >50m) in corresponding columns on the data sheet.

Graphically, the area counted resembles the outline of a target or bull's-eye, with the station at the centre. Birds were recorded in each of the expanding rings of the target area in the appropriate columns on the data sheet. All those entirely outside the target areas, but within the habitat, are recorded in one column. Data for each bird species is recorded on a separate line on the data sheet.

The formal census was conducted from 2 January 1991 to 10 February 1991. Additional records for species occurrence were made from 1 March to 15 March 1991.

Four counts are made on each study plot on four different days, with the plots being censused from alternate ends to avoid temporal bias. That is, if a count begins at station 1 the first day, it was started from station 5 the following day. A balanced number of early and late counts is achieved in this manner.

A running list was compiled of the species encountered in each forest type and stream catchment, outside of the formal 10 minute count period, as all species encountered during the census procedure may not be recorded as part of the formal censuses. These records are reported in Appendix 2, where, with information from other sources, they constitute an inventory of the over-all avian resource.

3.4 Large Arboreal Mammal and Owl Survey

In the general survey, all roads within the Management Area were spotlighted from a vehicle travelling 5km per hour, using two observers and 100W spotlights. Surveys began when it was completely dark and ended one half hour before sunrise. At 5km intervals, taped calls from the Masked, Sooty and Powerful Owls were played for 5 minutes each (total of 15 minutes from a standard tape). Additionally, whenever a heavily forested stream catchment was crossed or "audibly" accessible (e.g. a ridge overlooking the stream), the owl calls were played.

Information recorded for each species observed included an accurate road location, distance from the road, tree species in which the animals was observed, DBH (diameter at breast height) of the tree, height of the tree and height of the animal. Notes on foraging, reproductive condition, sex and age were recorded where possible.

On the survey plots, observations were made from the onset of darkness (±1 hour after sunset) to one half hour before sunrise. An initial 10 minute listening period to detect any owls or mammals which were calling or moving about on the site was conducted at the beginning of the transect. Calls of the Sooty Owl, Masked Owl and Powerful Owl were played from a standardized tape through a 10W speaker for 15 minutes, followed by another 10 minutes of waiting for responses. The transect was then surveyed for a minimum of 45 minutes with two observers using 100W spotlights. In other words, at least 9 minutes were spent covering each 100 metres of the transect, if there were no animals seen. All animals seen within a 20m band either side of the transect were counted for the purpose of population density analysis. All animals seen were recorded to determine species richness information and additional explanatory data. Data for each species recorded: tree species, height of perch, and a perpendicular distance approximation from the transect line to the animal.

3.5 Small Arboreal Mammal Survey

In order to detect small arboreal mammals not always adequately detected by spotlighting and to quantify their use of the tree resource, 10 tree-mounted traps were installed in each study plot. At each of the 5 "points" within the plot, two 33x10x9cm aluminium ("Elliot") box traps were attached to brackets mounted approximately 2 metres above ground on trees representative of that forest type. Each trap was placed inside a small plastic bag to exclude moisture, and baited with candied honey (see Smith and Phillips 1984). The tree trunk adjacent to the trap was sprayed with a honey/water mixture as an attractant. Traps were checked daily, and re-baited as required. Animals captured were identified, weighed, sexed and measured, given a temporary marking to distinguish them if subsequently recaptured, and then released. Traps were operated for 4 successive nights during fine weather in early March 1991, providing data for 760 trap nights in total.

3.6 Large Terrestrial Mammal Survey

The presence in the study area of large terrestrial mammals was detected firstly through incidental observations made whilst surveying other groups, secondly by systematic searches at each study plot for evidence such as tracks, diggings, burrows and scats, and thirdly by the use of cage traps. Two 60x30x30cm wire cage traps were placed along animal runways at one "point" in each study plot. One trap of each pair was baited alternately with fish and chicken (to detect carnivorous marsupials) and the other with a peanut-butter/rolled oats mixture (to detect possums, bandicoots and small macropods). Traps were checked daily, and re-baited as required. Animals captured were identified, weighed, sexed and measured, given a temporary marking to distinguish them if subsequently recaptured, and then released. Traps were operated for 4 successive nights during fine weather in early March 1991, providing data for 152 trap nights in total.

3.7 Small Terrestrial Mammal Survey

In keeping with the specific goals of this project, survey of small terrestrial mammals was directed specifically towards one species, the Hastings River Mouse *Pseudomys oralis*, which reaches the southernmost limit of its known distribution in the Mt.Royal area. Four sites were chosen which were regarded as potentially good habitat for this species (see King 1984, Dickman and McKechnie 1985, Read 1988,1989). Twenty-five 33x10x9cm aluminium ("Elliot") box traps were placed along transect lines at each site and baited with a peanut butter/rolled oats mixture. Traps were checked daily, and re-baited as required. Animals captured were identified, weighed, sexed and measured, given a temporary marking to distinguish them if subsequently recaptured, and then released. Traps were operated for 3 successive nights during fine weather in early March 1991, providing data for 300 trap nights in total.

3.8 Reptile & Amphibian Survey

Reptiles and amphibians (frogs) were surveyed by opportunistic hand collecting, systematic searching and pitfall trapping. Two dry (non-baited) pitfall traps (plastic buckets 20cm diameter x 20cm deep, with funnel inserts) were installed at one "point" in each study plot. Traps were checked daily, and animals captured were identified, given a temporary marking to distinguish them if subsequently recaptured, and then released. Traps were operated for 4 successive days during fine weather in early March 1991, providing data for 152 trap nights in total. Systematic searches were conducted for 30 minutes at each point on every plot.

3.9 Survey Limitations

All faunal groups exhibit seasonal and diurnal patterns of abundance and activity which influence their "detection" in surveys. This study was conducted during the period 2nd January to 18th March 1991, which combined with an extended drought in the region, meant that a number of groups were under-sampled.

It is likely that many frog species were remaining dormant in response to the dry weather conditions, while the often cool conditions during autumn at this altitude meant that activity periods for many reptiles was greatly reduced. Similarly, the seasonal migrants within the bat fauna would not have been present and therefore rendering an extensive bat survey at this time impractical (recommendation by Greg Richards, CSIRO Division of Wildlife & Ecology).

A major constraint of this survey was one of access as dictated by the steep terrain. Access to the northern section of the Davis Creek catchment was not feasible, however study sites selected are considered representative of the catchment. Site 4D in the Carrow Brook catchment was only surveyed for birds and large arboreal mammals because of limited vehicular access.

Despite these limitations it is considered that the results of this survey represent an effective and significant sample of the fauna present. Realistic conclusions can therefore be drawn concerning the distribution of fauna and the future implications of forestry management practices.

3.10 Data Analysis

Throughout the Results and Discussion sections of this report, Forest Type refers to broad categories which incorporate both moisture levels (Dry/Moist) and logging history (logged/unlogged). Forest categories studied are therefore: Rainforest, Moist Sclerophyll Forest (logged & unlogged), and Dry Sclerophyll Forest (logged and unlogged).

Data are first presented in tabular form, partitioned by forest type and plot and/or replicate number. In order to establish the natural variability of the system, data for unlogged sites (rainforest, unlogged moist & dry sclerophyll forest) are then compared across the different forest types using One-way Analysis of Variance (ANOVA) procedures. With small sample sizes there was a risk that certain conditions required by this parametric procedure could not be verified, in particular, the homogeneity of variance (all variances equivalent). Therefore a non-parametric analysis (the Kruskal-Wallis 1-way ANOVA) was also utilised, and in addition, data were log-transformed to improve normality and homogeneity. In every case all procedures produced comparable results.

Where the ANOVA suggested that a significant difference between forest types did exist (with α=0.05), a multiple range test (Scheffe's procedure) was implemented to identify which group means were significantly different (where P<0.05). The significance (P) value represents the probability of obtaining this result due to chance factors alone (ie. random variability in the system). In this study, any result with a P value of <0.05 (5%) was deemed not to have occurred by chance and to reflect a real (significant) result. Appropriate test statistics and their probability values are noted in the text and detailed ANOVA tables provided in Appendix 5.

The second step was then to include logged sites into the overall context for comparison. The procedures described above were then utilised to compare logged and unlogged sites across all forest types.

Thirdly, sites were then partitioned according to logging history (logged/unlogged) and forest moisture levels (moist/dry), with Rainforest excluded from this analysis. This enabled a more detailed analysis (two-way ANOVA) to judge the effects of logging history and forest type on the measured faunal variables. Unless statistically significant interaction (α=0.05) was shown to exist between these two variables, the *interaction* term is not displayed in the ANOVA tables and was added to the *error* term in the analysis.

Data from the detailed (plot-based) component of the survey were analysed using the SPSSX statistical package (SPSSX Inc. 1988) on a VAX 11/785 mainframe computer and the SAS statistical package (SAS Inc. 1987) running on an Osborne 386 PC. Details of the analytical procedures used can be found in Steel and Torrie (1981) and Zar (1984).

4. RESULTS

4.1 Avifauna Survey

A total of 90 species of birds have been recorded from the Mount Royal study area (see Appendix 2). A limited four day study by Hines (unpublished data 1990) recorded 51 species of birds. His methods were not recorded, but the data indicates an informal search technique was used. Incidental species are included in the Hines list (Dusky Moohen, Peregrine Falcon). The current study recorded 73 species, 64 of which were recorded on the formal censuses (plot-based survey). Of those species not recorded on the formal censuses, six were nocturnal birds (Powerful Owl, Boobook Owl, Sooty Owl, Masked Owl, White-throated Night Jar, Tawny Frogmouth). The Peregrine Falcon recorded by Hines is the only species with a rarity rating in the NPWS Schedule 12.

Notable groups are the pigeons (4 species, three of which are fruit-eating rainforest birds), cockatoos (4 species, including the obligate Casuarina feeder, the Glossy Black Cockatoo and two pest species), honeyeaters (8 species, including the rainforest dwelling Scarlet Honeyeater) and owls (four species; see Section 4.2).

Species at the extremity of their distribution include the Noisy Pitta, Regent Bowerbird (southern limit) and the Pilot Bird (northern limit).

4.1.1 Population Analysis

A/ Unlogged forest

The three unlogged forest types were compared using analysis of variance. In terms of population density of the total bird community, there were differences among forest types (F=4.56 DF=2,237 P=0.011). The result from this parametric analysis of variance (ANOVA) procedure should be interpreted cautiously due to lack of homogeneity of variance among treatments, however the non-parametric procedures employed (Kruskal-Wallis) revealed similar results (χ^2=23.16 n=400 P<0.001), as did ANOVA with log-transformed data (F=18.78 DF=2,237 P<0.001).

Rainforest had the highest number of birds per hectare, and dry unlogged sclerophyll forest had the lowest, with moist unlogged sclerophyll forest occupying an intermediate position. A comparison of plot means using Scheffe's procedure indicated that there was a significant difference between dry forest and rainforest, but that moist unlogged sclerophyll forest was not significantly separated from either of the other two (Table 4.1). These results must be viewed cautiously, due to the lack of homogeneity of variance in the original analysis. Interpretation of the rankings in the Kruskall Wallis test, which indicated there was a significant difference among forest types gives more reliable information on the relationship among forest types. The rankings for dry and moist

sclerophyll were very similar (104.2 and 106.5, respectively) while the rainforest ranking was much higher (150.8). This indicates that rainforest clearly supported a higher population density of birds than the other two forest types.

Table 4.1 Population Density of Total Bird Community. Comparison of Mean Values in Unlogged Forest.

FOREST TYPE	Unlogged Dry	Unlogged Moist	Rainforest
MEAN* COUNT	3.7	4.3	5.6
MEAN# RANK	104.2	106.5	150.8
	X^2 = 23.16	P < 0.001	

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All forest types

The population density of the total bird community was not shown to be significantly different across all forest types by parametric analysis of variance at α=0.05 (F=2.32 DF=4,395 P=0.056). The probability value was very close to α, and the result must be interpreted cautiously due to lack of homogeneity in variance. The Kruskall Wallis test revealed a a very significant difference among all forest types (X^2=21.5 n=400 P=0.00003). No assumptions of the latter test were violated, and it is a robust measure of the relationship between bird population density and forest types. Similarly, ANOVA with log-transformed data revealed significant differences between forest types (F=4.58 DF=4,395 P=0.0013).

A comparison of mean values across all forest types using Scheffe's procedure revealed no difference among forest types, inherently, at α = 0.05, however the results of this test must be interpreted cautiously due to lack of homogeneity of variance in the original analysis. Inspection of the means (Table 4.2) shows rainforest and moist logged forest as the two most productive habitats in terms of bird population density (5.6 and 5.5 birds per hectare, respectively), while dry unlogged forest and moist unlogged forest were the two least productive habitats (3.7 and 4.3 birds per hectare, respectively. Dry logged forest occupied a central position in terms of bird productivity (5.0 birds per hectare). Heuristically, it would appear that there are close relationships between the bird productivity of rainforest and moist logged forest (high) and unlogged moist and dry forest (low).

Table 4.2. Population Density of Total Bird Community. Comparison of Mean Values for all Forest Types.

FOREST TYPE	Unlogged Dry	Unlogged Moist	Logged Dry	Logged Moist	Rainforest
MEAN* COUNT	3.7	4.3	5.0	5.5	5.6
MEAN# RANK	175.2	179.2	190.3	209.5	248.3
		X^2 = 21.5 P = 0.0003			

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

Inspection of the ranking values from the Kruskal-Wallis procedure agree with the preceding interpretation of the data. The two unlogged sclerophyll treatments had very similar low rankings (175.2 and 179.2). However, the productivity of rainforest in terms of population density was emphasized by the very high ranking (248.3), when compared to the closest sclerophyll plot (logged moist sclerophyll = 209.5)

C/ Logging Effects

The effect of logging was isolated in a two-way analysis of variance model. In this analysis, only the sclerophyll plots were considered, as there was no logged rainforest treatment (rainforest logging is not carried out in the Mount Royal Management Area). Forest type was not significant in terms of bird population density in this subset of the data (F=1.16 DF=1,317 P=0.281), while logging treatment was (F=4.85 DF=1,317 P=0.028). The logged treatments of both dry and moist sclerophyll forest had more birds per hectare than the unlogged treatments.

4.1.2 Total Habitat Species Richness

The total habitat species richness was estimated from the number of bird species recorded at each point during the formal (plot-based) census. These data reflect all species detected within the habitat, irrespective of distance from the point, and are therefore a good indicator of the general avian diversity of the habitat (forest type) sampled. There were four counts made on each of four plots, and there were five point counts within each plot; each forest type was thus sub-sampled 80 times.

A/ Unlogged forest

The three unlogged forest types were analyzed with ANOVA procedures. Both parametric and non-parametric tests indicated that all three unlogged forest types differed significantly in species richness (F=28.45 DF=2,237 P<0.001). Variance was homogeneous and results of these tests can be interpreted with confidence.

A comparison of plot means revealed that Rainforest had the highest mean number of species (10.8), dry unlogged forest the fewest (7.2), and moist unlogged forest occupied the intermediate position (8.8) (see Table 4.3).

Table 4.3 Total Habitat Bird Species Richness. Comparison of Mean Values in Unlogged Forest.

FOREST TYPE	Unlogged Dry	Unlogged Moist	Rainforest
MEAN* COUNT	7.2	8.8	10.8
MEAN# RANK	86.1	117.0	158.4
	X^2 = 44.06	P < 0.0001	

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All forest types

ANOVA tests revealed significant differences among forest types and logging histories when these treatments were included in the analysis (F=17.139 DF=4,395 P<0.0001). The two logged plots had the intermediate values, falling between the low numbers of species recorded on the unlogged sclerophyll plots and the high numbers recorded on the rainforest plots. All assumptions of the statistical tests were met, and these results can be interpreted with confidence.

A comparison of plot means indicated that dry logged sclerophyll (9.9 species per habitat), moist logged sclerophyll forest (10.4 species per habitat) and rainforest (10.8 species per habitat) did not differ significantly in total habitat species richness (Table 4.4). Unlogged moist sclerophyll and dry logged sclerophyll forest supported similar numbers of bird species (8.8 and 9.9 respectively), while dry unlogged sclerophyll was separated significantly from all other groups (7.2 species per habitat).

Table 4.4. Total Bird Community Habitat Species Richness. Comparison of Mean Values for all Forest Types.

FOREST TYPE	Unlogged Dry	Unlogged Moist	Logged Dry	Logged Moist	Rainforest
MEAN* COUNT	7.2	8.8	9.9	10.4	10.8
MEAN# RANK	128.3	177.9	217.5	231.9	246.7
		X^2 = 55.05	P<0.0001		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

A two-way analysis of variance procedure was employed to examine the effects of logging and forest moisture in sclerophyll habitats. Both factors were significant (forest moisture: F=22.47 DF=1,317 P=0.006; history: F=37.21 DF=1,317 P<0.000) in determining the number of bird species per habitat, with moist forest environments and logged forest environments having the highest species richness.

4.1.3 Bird Species Richness per Hectare

Bird species richness per hectare was determined from the total species count within each census point (50m radius circle). These data were analyzed to determine local, rather than general, species richness in each habitat sampled.

A/ Unlogged Forest

Analysis revealed a significant difference among forest types in terms of bird species richness per hectare (F=23.7 DF=2,237 P<0.0001). All assumptions of the tests were met and results can be interpreted with confidence.

Means testing separated all three unlogged forest types (Table 4.5), with rainforest supporting the highest number of species per hectare (6.5), dry unlogged forest the least (3.8) and moist unlogged forest occupying a central position (4.4). These results support those of the analysis of species per habitat.

Table 4.5. Bird Species Richness per Hectare. Comparison of Mean Values in unlogged forest.

FOREST TYPE	Unlogged Dry	Unlogged moist	Rainforest Dry
MEAN* COUNT	3.8	4.4	6.5
MEAN# RANK	94.1	106.5	160.9
	X^2 = 42.29	P < 0.0001	

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

Analysis of the entire suite of forest types sampled revealed differences among different groupings of habitats (F=9.95 DF=4,395 P<0.001). All assumptions of the statistical tests were met, and results can be interpreted directly.

Rainforest and moist logged sclerophyll were shown to be similar in species richness per hectare (6.9 and 5.2, respectively), although moist logged moist forest, dry logged forest and moist unlogged forest also formed a group that did not differ significantly (Table 4.6). A grouping of habitats that supported low numbers of species per hectare was also indicated, and these were dry unlogged sclerophyll forest, moist unlogged sclerophyll and dry logged forest.

Table 4.6. Bird Species Richness per Hectare. Comparison of Mean Values for all Forest Types.

FOREST TYPE	Unlogged Dry	Unlogged Moist	Logged Dry	Logged Moist	Rainforest
MEAN* COUNT	3.8	4.4	4.9	5.2	6.9
MEAN# RANK	156.2	177.1	197.9	204.7	266.8
		X^2 = 41.89	P<0.0001		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

This close grouping may be clarified by inspection of the rank values generated in the Kruskal-Wallis analysis. Dry unlogged sclerophyll had a very low ranking (156.2), while rainforest had a very high ranking (266.8). The two logged sclerophyll plots had very similar rankings (dry = 197.9, moist = 204.7). Moist unlogged forest (rank = 177.1) fell in between the dry unlogged forest and the logged treatments.

C/ Logging Effects

A two-way analysis of variance indicated that there was a significant effect for logging (F=8.73 DF=1,317 P=0.003) but not for forest moisture (F=1.55 DF=1,317 P=0.214), when both were factors were included in the model. Logged plots had higher bird species richness per hectare than unlogged plots.

4.1.4 Forest Dependent Birds

The preceding analyses investigated the nature of the distribution, abundance and diversity of the total bird community. To provide insight into the factors concerning the suite of birds species that are *dependent* on forest resources, a subset of data was analysed. Included in this group were the: Brown Pigeon, King Parrot, Ground Thrush, Cicada Bird, Rose Robin, Black-faced Monarch, Rufous Fan-tail, Red-browed Treecreeper, Scarlet Honeyeater and Green Cat-bird. Other species which are forest dwellers were excluded because: a) they are extremely abundant and they mask effects of treatment and forest type which are the subject of this particular analysis (for example, Brown Thornbill), or b) they occur in a wide variety of forested environments (city parks, gardens, remnant bush in paddocks) and similarly mask effects (for example, Yellow Robin, Spotted Pardalote). The suite of species chosen all have some dependence on natural forest resources such as tree hollows or forest interior micro-habitat.

Data analysed were the population estimates from the 50m radius circle at each point of the formal census. The nature of these data was not suitable for standard ANOVA testing, and they were subjected to the General Linearized Models procedure using the SAS statistical package, which deals with unbalanced design and heterogeneity of variance in a robust manner.

Results indicated that there was no significant difference between all forest types (logged & unlogged) with respect to the population density of forest dependent birds at the α=0.05 level of significance (F=2.28 DF=4,1462 P=0.0588). However, the probability value was very close to this level of confidence, and it can be assumed that there are some discernible differences among forest types and treatments.

Inspection of mean values (Table 4.7) reveals that rainforest supported the highest population density of this suite of species (0.65), and unlogged dry sclerophyll supported the lowest (0.50). Logged dry sclerophyll was the second highest in population density (0.62) and logged moist sclerophyll was the second lowest (0.52). Unlogged moist sclerophyll occupied the central position. These results in general support the those of the total bird community analysis, in that the high, low and median groupings remain consistent. There is a change in the order of the habitats within the median group, with moist unlogged forest supporting proportionately more forest specialist birds than forest generalists. It should be noted however that the rankings are nominal as plot means are not significantly different.

Table 4.7 Population Density of Forest Dependent Birds. Comparison of Mean Values in all Forest Types.

FOREST TYPE	Unlogged Dry	Logged Moist	Unlogged Moist	Logged Dry	Rainforest
MEAN*	0.50	0.52	0.55	0.62	0.65
COUNT					

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).

4.1.5 Bird Species of Special Concern

The Glossy Black Cockatoo has been put forward as a species of special concern, and there has been mention of the Ground Thrush in this context. The Rose Robin is common and wide-spread, but is a habitat specialist that may indicate suitable old forest interior micro-habitat.

Glossy Black Cockatoos were recorded most frequently in dry, logged forest. The data presented are from the formal census process in Table 4.8. During the course of field work for the entire project, Glossy Black Cockatoos were observed frequently in all catchments.

Table 4.8 Sightings of Glossy Black Cockatoos

Forest	Number of Records
Dry Logged	11
Dry Unlogged	2
Moist Logged	2
Moist Unlogged	3
Rainforest	0

The Ground Thrush was recorded exclusively in rainforest plots during the formal census. During nocturnal censuses for arboreal marsupials and owls, this species was frequently (11 records from 40 visits) picked up in spot-lights.

The Rose Robin occurred primarily in rainforest and moist unlogged forests on the formal censuses (Table 4.9). It was recorded in most areas with moist understorey through out the course of fieldwork, including creek lines in drier habitats.

Table 4.9 Sightings of Rose Robins

Forest	Number of Records
Dry Logged	0
Dry Unlogged	1
Moist Logged	1
Moist Unlogged	3
Rainforest	5

4.2 Owls

Owls were sampled on the 20 experimental sites by recording responses to taped calls and auditory censuses. The method is described in detail in the Arboreal Marsupial Section (4.3) of this report, as the two fauna groups were sampled simultaneously.

Data are presented in Table 4.10 and represent the total number of records of owls from two counts on four study plots within each forest type or treatment.

Table 4.10 Occurrence of Owl species detected in nocturnal surveys.

Forest Type	MASKED OWL	SOOTY OWL	POWERFUL OWL	BOO-BOOK OWL
Dry Unlogged	1	1	9	11
Dry Logged	3	2	2	9
Moist Unlogged	1	2	4	15
Moist Logged	3	2	6	10
Rainforest	0	1	2	4
TOTAL	8	8	23	49

The Masked Owl was recorded in all forest types except rainforest. A pair was spotlighted on the moist logged plot in Davis Creek catchment, and a single bird was recorded calling from the same spot near a logged dry plot in the Fal Brook catchment on several successive nights. Two other records were obtained from the general arboreal mammal and owl survey (not shown in Table). Both were on Cassel's road in logged forest in the Fal Brook catchment. From simultaneous records, it appears that there is one pair of Masked Owls in each catchment, although Carrow Brook Catchment birds may have been birds in passage.

The Sooty Owl was recorded in all forest types. Although there was only one record from a rainforest plot, most of the records from sclerophyll forest were influenced by the presence of rainforest in nearby gullies. Plots that were long distances from rainforest gullies did not have Sooty Owls. An additional record from the general road survey was obtained near the entrance to Mt. Royal State Forest on Cassel's road. A single bird was called in to a logged dry forest from the rainforest gully below the road. The isolated nature of the observations of the Sooty Owl prevent population estimates, but it appears likely that there is more than one pair resident in the rainforest gullies of each catchment.

The Powerful Owl was recorded in all forest types, but was most common in dry unlogged forest (9 records) and moist logged forest (6 records). The Powerful Owl was recorded from all catchments. Simultaneous records suggest that there are one pair of owls in each catchment. One individual was called to within ten metres of the moist logged plot in Davis Creek catchment. An additional record was obtained during the course of fieldwork from Fal Brook catchment, where a single individual was heard calling in logged dry forest near the base camp for the survey team on Cassel's Road.

The Boobook Owl was common in all forest types, and by far the commonest species of owl.

4.3 Large Arboreal Mammal Survey

Seven species of large arboreal mammal were detected during this survey (Common Ringtail Possum, Greater Glider, Yellow-bellied Glider, Sugar Glider, Common Brushtail Possum, Mountain Brushtail Possum, and Koala). No additional species have been recorded for this area (see Appendix 3) and none of these are listed in Schedule 12 of the National Parks and Wildlife Act (1974) as endangered in NSW.

The data described below represent the total sum of records for all individuals of all species recorded during the detailed survey phase of the study. They should be interpreted with caution due to the varying detectability of arboreal marsupials in different forest types. Arboreal marsupials were more easily observed in forest types with more open structure (dry, logged) than in closed forests (rainforest). However, the comprehensive nature of this data set makes it of interest to the overall analysis.

Inspection of Table 4.11 reveals that unlogged Dry Sclerophyll forest had the highest number of detections, followed by unlogged Moist Sclerophyll, logged Moist Sclerophyll, logged Dry Sclerophyll and Rainforest.

Table 4.11 Total Numbers of Arboreal Marsupials Observed in all Forest Types.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	9	8	5	3
	b	2	11	9	2	3
2	a	3	6	14	5	2
	b	4	8	14	4	5
3	a	2	8	14	3	1
	b	3	7	4	1	2
4	a	1	3	14	15	3
	b	2	3	11	13	5
TOTAL		17	55	88	48	24

* Plots are the 1-4 replicates within each class variable

\# Counts are the two repetitions within each replicate - each plot was counted twice.

Results from both the general survey and the detailed survey phase indicated that there were differences between forest types and treatments in the number of arboreal marsupials and the species richness of arboreal marsupials. Analyses were performed on the entire data set collected during

the detailed survey phase, and on subsets of this data. Results were generally consistent, in terms of both population density and species richness, that Dry Unlogged forest types had the highest numbers of arboreal marsupials, and Rainforest the lowest. Ranking within the other types and treatments was variable.

A/ Unlogged Forest

One-way Analysis of Variance revealed a significant difference (Table 4.12) between the counts of all arboreal marsupials recorded between different (unlogged) forest types ($F=20.26$ $DF=2,21$ $P<0.0001$). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. However, the non-parametric analysis (Kruskal-Wallis ANOVA) also revealed a significant difference between forest types ($\chi^2=16.08$ $n=24$ $P=0.0003$), as did ANOVA with log-transformed data ($F=21.01$ $DF=2,21$ $P<0.0001$).

Table 4.12 Mean Counts of Arboreal Mammals in Unlogged Forest Types.

FOREST TYPE	Rainforest	Unlogged Moist	Unlogged Dry
MEAN* COUNT	2.1	6.9	11.0
MEAN# RANK	5.1	13.4	19.1
	$\chi^2=16.08$ n=24 P=0.0003		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

Rainforest plots supported the lowest number of arboreal marsupials, with unlogged moist sclerophyll forest supporting (on average) 3 times as many individuals, and unlogged dry sclerophyll 2 times as many again (on average). This may be due to high numbers of Yellow-bellied Gliders and Sugar Gliders detected on some of the unlogged dry sclerophyll plots. Most of these detections were by call, and came from a considerable distance away from the transect lines, thus inflating the numbers of animals recorded. The following section, which deals with population density of a known area, addresses this problem.

B/ All Forest Types

A One-way Analysis of Variance revealed a significant difference (Table 4.13) in the total number of all arboreal marsupials between forest types ($F=9.54$ $DF=4,35$ $P<0.0001$). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types ($\chi^2=20.97$ $n=40$ $P=0.0003$), as did ANOVA with log-transformed data ($F=9.78$ $DF=4,35$ $P<0.0001$).

Table 4.13. Mean counts of arboreal mammals in all forest types.

FOREST TYPE	Rainforest	Logged Dry	Logged Moist	Unlogged Moist	Unlogged Dry
MEAN* COUNT	2.1	3.0	6.0	6.9	11.0
MEAN# RANK	9.4	13.6	20.9	25.6	33.0
	$\chi^2=20.97$ n=40 P=0.0003				

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

Unlogged dry sclerophyll forest clearly supports the highest numbers of arboreal marsupials (as determined by spotlighting). The number of individuals is significantly higher than that found on rainforest, and logged dry sclerophyll plots, however not significantly higher than numbers found on logged moist sclerophyll and unlogged moist sclerophyll plots.

C/ Logging Effects

A two-way analysis of variance indicated that there was a significant effect for logging ($F=10.05$ $DF=1,28$ $P=0.001$) but not for forest moisture ($F=2.53$ $DF=1,28$ $P=0.657$) when both were factors were included in the model. There was also a significant interaction between these two factors ($F=8.06$ $DF=1,28$ $P=0.008$), due primarily to the large numbers of individuals recorded on unlogged dry sclerophyll plots (see Table 4.11).

This suggests that logging history is a more important influence on the total numbers of arboreal marsupials found than forest moisture levels. Unlogged forest sites have the highest numbers of large arboreal mammals, irrespective of forest type (for sclerophyll forests). This is an artifact of the apparent reduction in the number of detected animals in logged dry sclerophyll forest as compared to unlogged dry sclerophyll forest. As in the analysis for other strata of data, the high level of detectability of *Petaurus* gliders in dry habitats is likely to have biased the results.

4.3.1 Population Density of all Arboreal Marsupials

Estimates of population density of all arboreal mammals observed on spotlighting transects are presented in Table 4.14.

Table 4.14 Population Density of Arboreal Marsupials Observed in all Forest Types[¶].

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	6	0	2	2
	b	2	3	3	0	1
2	a	3	3	5	2	2
	b	0	3	4	1	1
3	a	2	6	8	3	0
	b	2	4	3	1	1
4	a	0	1	3	2	2
	b	2	0	0	9	0
TOTAL		11	26	26	20	9

* Plots are the 1-4 replicates within each class variable

\# Counts are the two repetitions within each replicate - each plot was counted twice.

¶ Data are the number of all arboreal marsupials counted on a transect 40 m wide by 500 m long (20 m each side of the transect line)

A/ Unlogged Forest

A One-way Analysis of Variance revealed no significant difference in the population density of arboreal marsupials (as measured by spotlighting) between forest types ($F=2.22$ $DF=2,21$ $P=0.134$). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed no significant difference between forest types ($\chi^2=5.24$ $n=24$ $P=0.073$), as did ANOVA with log-transformed data ($F=1.61$ $DF=2,21$ $P=0.224$).

Unlogged dry sclerophyll forest supported (on average) the most arboreal marsupials, while rainforest supported the least (Table 4.15). Although mean values are higher for moist and dry sclerophyll forest sites, variability within sites is such that forest type does not appear to be influencing total arboreal mammal density.

Table 4.15 Mean values for population densities of arboreal marsupials in unlogged forest types.

FOREST TYPE	Rainforest	Unlogged Dry	Unlogged Moist
MEAN* COUNT	1.4	3.3	3.3
MEAN# RANK	7.9	14.6	15.0
	$\chi^2=5.24$ n=24 P=0.073		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).

\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance revealed no significant difference between forest types ($F=1.93$ $DF=4,35$ $P=0.127$). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed no significant difference between forest types ($\chi^2=8.58$ $n=40$ $P=0.0724$), as did ANOVA with log-transformed data ($F=1.54$ $DF=4,35$ $P=0.211$).

Although mean values are higher for unlogged moist and dry sclerophyll forest sites (Table 4.16), variability within sites is such that forest type does not appear to be influencing total arboreal mammal density. Inspection of the Kruskal-Wallis ranking reveals two groups of values. Logged plots and rainforest had low ranks (13-20) while the unlogged sclerophyll plots had high ranks (26-27).

Table 4.16 Mean values for population densities of arboreal marsupials in all forest types.

FOREST TYPE	Logged Dry	Rainforest	Logged Moist	Unlogged Dry	Unlogged Moist
MEAN* COUNT	1.1	1.4	2.5	3.2	3.3
MEAN# RANK	13.6	15.8	20.1	26.0	26.9
	$\chi^2=8.58$ n=40 P=0.0724				

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).

\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

A two-way analysis of variance indicated that neither logging history (F=16.53 DF=1,29 P=0.076) or forest moisture (F=3.78 DF=1,29 P=0.386) would seem to be influencing arboreal mammal density. Considering the eucalypt forest habitat alone, the relatively high numbers of arboreal marsupials in all forest types and treatments did not allow the model to separate main effects at the α = 0.05 level. However, logging effects were significant at the α = 0.1 level (P=0.076). This indicates that there is some interaction between logging history and the distribution of arboreal marsupials, with unlogged plots (on average) having higher population densities.

4.3.2 Species Richness of all Arboreal Marsupials

Estimates of species richness of all arboreal mammals observed on spotlighting transects are presented in Table 4.17.

Table 4.17 Species Richness of Arboreal Marsupials Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	4	1	1	2
	b	2	2	3	2	3
2	a	2	2	4	2	1
	b	2	2	2	1	3
3	a	1	3	4	1	1
	b	2	3	2	1	2
4	a	1	2	4	3	3
	b	1	1	4	3	1
TOTAL		11	19	24	14	16
MEAN		1.4	2.4	3.0	1.8	2.0

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
• Data are total number of species recorded on each transect.

A/ Unlogged Forest

A One-way Analysis of Variance revealed a significant difference in species richness of all arboreal mammals between forest types (F=5.72 DF=2,21 P=0.0104). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed a significant difference between forest types (χ^2=7.79 n=24 P=0.0203), as did ANOVA using log-transformed data (F=5.22 DF 2,21 P=0.015). Clearly rainforest supports the lowest numbers of arboreal mammal species and dry sclerophyll forest the highest, with moist sclerophyll occupying an intermediate position (Table 4.18).

Table 4.18 Mean values for species richness of arboreal marsupials in unlogged forest types.

FOREST TYPE	Rainforest	Unlogged Moist	Unlogged Dry
MEAN* COUNT	1.4	2.4	3.0
MEAN# RANK	7.4	13.5	16.6

χ^2=7.79 n=24 P=0.0203

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance revealed a significant difference between forest types (F=3.46 DF=4,35 P=0.0175). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed a significant difference between forest types (χ^2=9.62 n=40 P=0.0473), as did ANOVA using log-transformed data (F=3.02 DF=4,35 P=0.031).

Rainforest again supports the lowest number of species, and while moist and dry sclerophyll sites are more species rich, variability within sites indicates that neither forest type nor logging history *clearly* influences arboreal mammal species richness in sclerophyll forest. Dry unlogged sclerophyll forest was the most distinctive treatment, supporting higher species numbers than any of the other plots (see Table 4.19).

Table 4.19 Mean values for species richness of arboreal marsupials in unlogged forest types.

FOREST TYPE	Rainforest	Logged Moist	Logged Dry	Unlogged Moist	Unlogged Dry
MEAN* COUNT	1.4	1.8	2.0	2.4	3.0
MEAN# RANK	13.2	16.8	19.8	23.8	29.0

χ^2=9.62 n=40 P=0.0473

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

When only sclerophyll forest is considered, is it apparent that unlogged sites support a higher species richness whereas forest moisture is not an important factor (logging: F=3.54 DF=1,29 P=0.026, moisture: F=1.61 DF=1,29 P=0.215). This lends support to the general trends indicated in the preceding one factor models.

4.3.3 Total Counts of Greater Gliders

The total counts of Greater Gliders as observed on spotlighting transects are presented in Table 4.20.

Table 4.20 Total Counts of Greater Gliders Observed in all Forest Types.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	5	8	5	2
	b	0	7	7	1	1
2	a	0	5	6	4	2
	b	0	7	8	4	3
3	a	0	6	3	3	1
	b	0	6	2	1	1
4	a	0	2	2	10	2
	b	0	3	2	14	0
TOTAL		0	41	38	42	12

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.

A/ Unlogged Forest

A One-way Analysis of Variance revealed a significant difference in the total count of Greater Gliders between forest types (F=17.95 DF=2,21 P<0.001). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (χ^2=16.10 n=24 P=0.0003), as did ANOVA using log-transformed data (F=60.21 DF=2,21 P<0.001).

It is clear from this result that rainforest sites are not preferred habitat for Greater Gliders. Unlogged moist and dry sclerophyll forests would appear to support equivalent numbers of this species (see Table 4.21).

Table 4.21 Total counts of Greater Gliders in unlogged forest. Comparison of mean values.

FOREST TYPE	Rainforest	Unlogged Dry	Unlogged Moist
MEAN* COUNT	0.0	4.8	5.1
MEAN# RANK	4.5	16.4	16.6
	χ^2=16.10 n=24 P=0.0003		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance (ANOVA) revealed a significant difference between forest types (F=7.24 DF=4,35 P=0.0002). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (χ^2=25.53 n=40 P<0.0001), as did ANOVA using log-transformed data (F=20.75 DF=4,35 P<0.0001).

Although moist sclerophyll forest supports on average higher numbers of Greater Gliders, forest type is not clearly a significant determinant of these numbers (see Table 4.22). Rainforest and logged dry sclerophyll support low numbers of Greater Gliders.

Table 4.22 Total counts of Greater Gliders in all forest types

FOREST TYPE	Rainforest	Logged Dry	Unlogged Dry	Unlogged Moist	Logged Moist
MEAN* COUNT	0.0	1.5	4.8	5.1	5.3
MEAN# RANK	5.0	14.8	27.4	29.2	26.1
	χ^2=25.53 n=40 P<0.0001				

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

When only sclerophyll forest is considered, analysis of variance results confirm that numbers of Greater Gliders observed was not related to either logging history (F=2.28 DF=1,29 P=0.142) or forest moisture (F=3.97 DF=1,29 P=0.056). The probability value for this factor (P=0.056) in the model is close to α, and inspection of the means (Table 4.22) indicates that moist sites support more Greater Gliders than dry forest, irrespective of logging history.

4.3.4 Population Density of Greater Gliders

Estimates of population density of Greater Gliders as observed on spotlighting transects are presented in Table 4.23.

Table 4.23 Population Density of Greater Gliders Observed in all Forest Types•.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	2	3	0	1
	b	0	4	1	2	0
2	a	0	3	3	2	1
	b	0	2	3	3	2
3	a	0	4	2	1	1
	b	0	4	3	3	0
4	a	0	1	0	2	0
	b	0	0	2	9	2
TOTAL		0	20	17	22	7

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
• Data are the number of Greater Gliders counted on a transect 40 m wide by 500 m long (20 m each side of the transect line)

A/ Unlogged Forest

A One-way Analysis of Variance (ANOVA) revealed a significant difference in the population density of Greater Gliders between forest types (F=12.28 DF=2,21 P=0.0003). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed a significant difference between forest types (X^2=13.08 n=24 P=0.0014), as did ANOVA using log-transformed data (F=17.28 DF=2,21 P<0.0001). While Greater Gliders were absent from rainforest sites, their densities were not significantly different on unlogged moist and dry sclerophyll sites (Table 4.24).

Table 4.24 Population density of Greater Gliders in Unlogged Forest.

FOREST TYPE	Rainforest	Unlogged Dry	Unlogged Moist
MEAN* COUNT	0.0	2.1	2.5
MEAN# RANK	5.5	15.3	16.8
	X^2=13.08 n=24 P=0.0014		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance revealed a significant difference in population density of greater gliders between forest types (F=4.72 DF=4,35 P=0.0037). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (X^2=18.85 n=40 P=0.0008), as did ANOVA using log-transformed data (F=8.25 DF=4,35 P=0.0001).

A comparison of plot means revealed a similar pattern to the total count data discussed in the previous section: moist (logged & unlogged) sclerophyll forest supported the greatest numbers of Greater Gliders, respectively, followed by dry forest sites, while rainforest was unproductive (see Table 4.25). These differences, however, were not significant. This result extends the previous conclusion to show that Greater Gliders densities are not significantly different on both logged and unlogged moist and dry sclerophyll sites.

Table 4.25 Population densities of Greater Gliders in all Forest Types.

FOREST TYPE	Rainforest	Logged Dry	Unlogged Dry	Unlogged Moist	Logged Moist
MEAN* COUNT	0.0	0.9	2.1	2.5	2.8
MEAN# RANK	7.5	15.6	25.9	27.8	25.8

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

The two way model that considers logging history and forest moisture revealed no significant effects of either on population density of Greater Gliders (history: F=0.676 DF=1,29 P=0.418, moisture: F=3.424 DF=1,29 P=0.074). Although Greater Glider densities were on average slightly higher on Moist sclerophyll sites, logging history and forest moisture do not significantly influence animal densities in sclerophyll forest. The effect of forest moisture was more pronounced than logging.

4.3.5 Total Counts of all *Petaurus* Species

Total counts of all *Petaurus* species (Sugar and Yellow-bellied Gliders) as observed on spotlighting transects are presented in Table 4.26.

Table 4.26 Total Count of *Petaurus* Species Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	2	0	0	0
	b	1	3	1	1	1
2	a	0	1	5	1	0
	b	0	1	4	0	1
3	a	0	1	7	0	0
	b	2	0	2	0	0
4	a	0	0	9	4	2
	b	0	0	6	1	2
TOTAL		3	8	34	7	6

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are the total number of Sugar Gliders and Yellow-bellied gliders counted on each plot.

A/ Unlogged Forest

A One-way Analysis of Variance revealed a significant difference in the numbers of individuals of *Petaurus* species between forest types (F=9.16 DF=2,21 P=0.0014). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (X^2=9.56 n=24 P=0.0084), as did ANOVA using log-transformed data (F=8.72 DF=2,21 P=0.0017). There were a significantly higher number of *Petaurus* species on unlogged dry sclerophyll forest sites (Table 4.27). This would appear to be due to the very high number of Yellow-bellied Gliders on one site (see Table 4.30).

Table 4.27 Total counts of all *Petaurus* species in unlogged forest types as observed on spotlighting transects.

FOREST TYPE	Rainforest	Unlogged Moist	Unlogged Dry
MEAN* COUNT	0.4	1.0	4.3
MEAN# RANK	7.9	11.4	18.2
	X^2=9.56 n=24 P=0.0084		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance revealed a significant difference in the number of individuals of *Petaurus* species between forest types (F=7.17 DF=4,35 P=0.0002). This result should be interpreted cautiously however as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (X^2=11.75 n=40 P=0.0193), as did ANOVA using log-transformed data (F=5.32 DF=4,35 P=0.0019). It is clear that unlogged dry sclerophyll forest sites support higher numbers of individuals of *Petaurus* species (Table 4.28), however this would appear to be due specifically to the greater number of Yellow-bellied Gliders on these sites.

Table 4.28 Total counts of all *Petaurus* species in all forest types as observed on spotlighting transects.

FOREST TYPE	Rainforest	Logged Dry	Logged Moist	Unlogged Moist	Unlogged Dry
MEAN* COUNT	0.4	0.8	0.9	1.0	4.3
MEAN# RANK	13.9	18.4	18.0	20.5	31.7
	X^2=11.75 n=40 P=0.0193				

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

The numbers of individuals of *Petaurus* species vary significantly between sites with different logging history (F=7.84 DF=1,28 F=0.009) and forest moisture (F=5.83 DF=1,28 P=0.023). There is also a significant interaction between these two effects (F=6.80 DF=1,28 P=0.014). These results are seen primarily to be an artifact of the large number of individuals on a number of plots established on unlogged dry sclerophyll sites (see Table 4.26).

4.3.6 Population Density of all *Petaurus* Species

This data, which is not sufficient for analysis, is presented to give an over-view of the actual population density of *Petaurus* species occurring in these forest types. Population density was very low on most forest types. The total count data reflects the wide area that can be sampled for these species, due to their loud and persistent calling behaviour.

Table 4.29 Population Density Estimates of *Petaurus* Species Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	0	0	0	0
	b	1	1	0	0	0
2	a	0	1	0	0	0
	b	0	0	1	0	0
3	a	0	1	4	0	0
	b	1	0	1	0	0
4	a	0	0	0	0	1
	b	0	0	0	0	0
TOTAL		2	3	6	0	1

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are the total number of Sugar Gliders and Yellow-bellied gliders counted on the 40m x 500m transect.

4.3.7 Total Counts of Yellow-bellied Gliders

Total counts of all Yellow-bellied Gliders as observed on spotlighting transects are presented in Table 4.30.

Table 4.30 Total Counts of Yellow-bellied Gliders Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	1	0	0	0
	b	0	2	0	1	1
2	a	0	1	5	1	0
	b	0	1	4	0	0
3	a	0	1	5	0	0
	b	0	0	2	0	0
4	a	0	0	8	2	0
	b	0	0	5	1	2
TOTAL		0	6	29	5	3

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are the total number of Yellow-bellied gliders counted on each plot.

A/ Unlogged Forest

A One-way Analysis of Variance revealed a significant difference in the numbers of individual Yellow-bellied Gliders observed in different forest types (F=10.72 DF=2,21 P=0.0006). This result should be interpreted cautiously as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (X^2=11.21 n=24 P=0.0037), as did ANOVA using log-transformed data (F=11.23 DF=2,21 P=0.0005). It is apparent that while no Yellow-bellied Gliders were observed on rainforest sites, considerably higher numbers were recorded on unlogged dry sclerophyll sites than unlogged moist sclerophyll sites (Table 4.31).

Table 4.31 Total count of Yellow-bellied Gliders on Unlogged Forest Sites.

FOREST TYPE	Rainforest	Unlogged Moist	Unlogged Dry
MEAN* COUNT	0.0	0.8	3.6
MEAN# RANK	7.0	12.7	17.8

X^2=11.21 n=24 P=0.0037

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance revealed a significant difference in numbers of Yellow-bellied Gliders recorded between different forest types (F=9.09 DF=4,35 P<0.0001). This result should be interpreted cautiously as one of the conditions for the test (homogeneity of variances) was not met. A non-parametric analysis (Kruskal-Wallis ANOVA) however also revealed a significant difference between forest types (X^2=14.61 n=40 P=0.0056), as did ANOVA using log-transformed data (F=7.42 DF=4,35 P=0.0002). Clearly significantly higher numbers of Yellow-bellied Gliders were recorded on unlogged dry sclerophyll forest sites (Table 4.32).

Table 4.32 Numbers of Yellow-bellied Gliders in all Forest Types.

FOREST TYPE	Rainforest	Logged Dry	Logged Moist	Unlogged Moist	Unlogged Dry
MEAN* COUNT	0.0	0.4	0.6	0.8	3.6
MEAN# RANK	12.0	16.6	20.5	22.4	30.9

X^2=14.61 n=40 P=0.0056

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

Both logging history and forest moisture influence the numbers of Yellow-bellied gliders observed (history: F=9.80 DF=1,28 P=0.004, moisture: F=5.93 DF=1,28 P=0.022). There was significant interaction between these factors (F=8.39 DF=1,28 P=0.007). Specifically, the results showed that higher numbers were recorded on unlogged dry sclerophyll forest plots (Table 4.30).

4.3.8 Koalas

A total of six Koalas were recorded during the detailed survey phase of the census procedure, 3 each in unlogged moist and dry sclerophyll forest (Table 4.33). Three other Koalas were recorded during field investigations, all in logged dry sclerophyll forests. Two were in the logged portion of the Davis creek catchment, and a third was recorded near Cassel's road in the Fal Brook catchment.

Table 4.33 Total Numbers of Koalas Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	2	0	0	0
	b	0	0	1	0	0
2	a	0	0	2	0	0
	b	0	0	0	0	0
3	a	0	0	0	0	0
	b	0	1	0	0	0
4	a	0	0	0	0	0
	b	0	0	0	0	0
TOTAL		0	3	3	0	0

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are the total number of Koalas recorded during the formal census procedure.

4.3.9 Ringtail & Brushtail Possums

Numbers of Ringtail and Brushtail Possums were insufficient to permit statistical analysis, however a number of conclusions can be drawn from inspection of observation records.

Brushtail possums were recorded in all forest types and treatments. The records in Table 4.34 are from the detailed survey phase of the census procedure. During the general survey, this species was found to be abundant in parts of the Davis Creek catchment and in partially cleared areas of private property and logged forest along Cassel's road in Fal Brook catchment.

Table 4.34. Total Numbers of Common Brushtail Possums Observed in all Forest Types.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	0	0	0	0
	b	0	0	0	0	0
2	a	0	0	0	0	0
	b	0	0	0	0	1
3	a	0	1	0	0	0
	b	0	1	0	0	1
4	a	0	0	4	0	0
	b	2	0	1	0	0
TOTAL		2	2	5	0	2

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.

The Mountain Brushtail Possum was restricted to rainforest within the study area. Within this habitat, it was relatively common (Table 4.35).

Table 4.35 Total Numbers of Mountain Brushtail Possums Observed in all Forest Types.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	0	0	0	0
	b	0	0	0	0	0
2	a	2	0	0	0	0
	b	2	0	0	0	0
3	a	0	0	0	0	0
	b	1	0	0	0	0
4	a	0	0	0	0	0
	b	0	0	0	0	0
TOTAL		5	0	0	0	0

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.

The Ringtail Possum was most common in rainforest, but also occurred in sclerophyll forest. Numbers were relatively low in sclerophyll forest, but it was a common resident of rainforest (Table 4.36).

Table 4.36 Total Numbers of Ringtail Possums Observed in all Forest Types.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	0	0	0	1
	b	1	0	0	0	1
2	a	1	0	0	0	0
	b	2	0	0	0	0
3	a	2	0	1	0	0
	b	0	0	0	1	0
4	a	1	0	0	0	0
	b	0	0	0	0	0
TOTAL		7	0	1	1	2

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.

4.4 Small Arboreal Mammal Survey

Four species of small mammal that make substantial use of forest trees were detected during this survey (Brush-tailed Phascogale, Brown Antechinus, Sugar Glider, and Bush Rat). One additional species (Fawn-footed Melomys) has been reported for the area (see Appendix 3) but its preferred habitat was not sampled in this study. None of these species are listed in Schedule 12 of the National Parks and Wildlife Act (1974) as endangered in NSW.

Three species of small arboreal mammal were detected during the tree trapping program (Brown Antechinus, Sugar Glider, Bush Rat), and the Brush-tailed Phascogale and Sugar Glider were observed during spotlighting. Two Sugar Gliders were trapped on trees (plots 11M & 14D) and were recorded 15 times during spotlighting (see Table 4.37). Although Sugar Gliders were caught and/or observed in all forest types (and treatments), numbers are too low for meaningful analysis. Similarly, data for Bush Rats (5 individuals) and Brush-tailed Phascogales (1 sighting) cannot be interpreted in this study.

Table 4.37 Total Numbers of Sugar Gliders Observed in all Forest Types*.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	1	0	0	0
	b	1	0	1	0	0
2	a	0	0	1	0	0
	b	0	0	0	0	1
3	a	0	0	2	0	0
	b	2	0	0	0	0
4	a	0	0	1	2	2
	b	0	0	1	0	0
TOTAL		3	1	6	2	3

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are all Sugar Gliders recorded in forest types sampled by spotlighting.

Over the 4 day sampling period (760 trap nights), a total of 89 individuals of the Brown Antechinus *Antechinus stuartii* were caught in tree traps (99 captures, 13% capture rate). The data are presented in Table 4.38 and the results of statistical analysis presented below.

Table 4.38 Total Numbers of *Antechinus stuartii* Trapped in all Forest Types*.

Survey Plots*	Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
1	6	2	8	8	2
2	11	7	2	2	4
3	4	3	10	0	4
4	6	0	7	3	%
TOTAL	27	12	27	13	10
Numbers per Trap night	0.68	0.30	0.68	0.33	0.33

* Plots are the 1-4 replicates within each class variable
@ Data are numbers of *Antechinus stuartii* caught over 4 days at each site.
% Plot not sampled.

A/ Unlogged Forest

A One-way Analysis of Variance (ANOVA) revealed no significant difference in the numbers of *Antechinus stuartii* between unlogged forest types ($F=1.93$ $DF=2,9$ $P=0.201$). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed no significant difference between forest types ($\chi^2=2.95$ $n=12$ $P=0.228$), as did ANOVA using log-transformed data ($F=2.27$ $DF=2,9$ $P=0.159$). It is apparent therefore that there is no significant difference in the numbers of *Antechinus stuartii* caught in different unlogged forest types (Table 4.39).

Table 4.39 Mean numbers of *Antechinus stuartii* trapped on unlogged plots (rainforest, moist and dry sclerophyll).

FOREST TYPE	Unlogged Moist	Unlogged Dry	Rainforest
MEAN* COUNT	3.0	6.8	6.8
MEAN# RANK	4.0	8.0	7.5
	$\chi^2=2.95$ n=12 P=0.228		

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

B/ All Forest Types

A One-way Analysis of Variance (ANOVA) revealed no significant difference in the numbers of *Antechinus stuartii* between forest types (F=1.66 DF=4,14 P=0.215). A non-parametric analysis (Kruskal-Wallis ANOVA) also revealed no significant difference between forest types (χ^2=5.32 n=19 P=0.256), as did ANOVA using log-transformed data (F=1.50 DF=4,14 P=0.255).

It is therefore apparent from an inspection of mean values for each plot (Table 4.40) that the largest numbers of *Antechinus stuartii* were caught in rainforest and unlogged dry sclerophyll sites. High variability in capture rate however meant that these results were not statistically different from other plots.

Table 4.40 Numbers of *Antechinus stuartii* caught in tree traps across all forest types

FOREST TYPE	Unlogged Moist	Logged Moist	Logged Dry	Unlogged Dry	Rainforest
MEAN* COUNT	3.0	3.2	3.3	6.8	6.8
MEAN# RANK	7.0	7.5	8.2	13.4	13.5
	χ^2=5.32 n=19 P=0.256				

* Lines indicate group means not significantly different at the 0.05 level (Multiple Range Test - Scheffe's Procedure).
\# Kruskal-Wallis 1-way Analysis of Variance

C/ Logging Effects

A two way analysis of variance procedure was employed to separate effects of logging and forest moisture in sclerophyll habitats. Neither factor was significant (history: F=0.84 DF=1,12 P=0.378; moisture: F=1.71 DF=1,12 P=0.216) in determining the number of *Antechinus stuartii* per habitat.

It is apparent therefore that there is no significant difference in the numbers of *Antechinus stuartii* caught in forests with different logging histories or moisture levels.

4.5 Large Terrestrial Mammal Survey

4.5.1 Macropods

Eight species of Macropod (Red-necked Pademelon, Parma Wallaby, Red-necked Wallaby, Eastern Grey Kangaroo, Common Wallaroo, Swamp Wallaby, Long-nosed Potoroo and Rufous Bettong) were detected during the survey (see Appendix 3). Of these, the Parma Wallaby is listed as "vulnerable and rare" in Schedule 12 of the NPWS Act.

Macropods were recorded during spotlight surveys, night and day-time travel and the general road survey for arboreal marsupials. Small to medium sized macropods were ubiquitous and abundant throughout the study area. The two large species to be expected in the area, the Eastern Gray Kangaroo and the Wallaroo, were recorded, but not commonly. The Red-necked Wallaby and the Red-necked Pademelon were extremely abundant, with the former species predominating in forests with open grassy understorey, and the latter most common in moist sclerophyll and rainforest.

The Parma Wallaby was recorded once (T. Brassil, M. Rowlands, J. Shields). A single individual hopped onto the road-way at the Junction of Cassel's and Young's road during a road spot-light transect. It remained on the road for 10 minutes, and was positively identified by facial markings, hip stripe, size and bilateral colour pattern. It was in heavily logged moist sclerophyll forest.

The Long-nosed Potoroo was recorded once (J. Shields, R. Webster). A single female was observed with a young at foot on Cedar Road in logged moist sclerophyll forest. The young animal, about half the size of its mother, entered the pouch during observation.

The Rufous Bettong was observed once during the course of the study (D. Binns). A single individual was observed in moist sclerophyll forest with heavy regrowth of Acacia after logging.

4.5.2 Other Native Mammals

Five additional mid-sized native mammals have been reported from the Mt.Royal area (Echidna, Tiger Quoll, Northern Brown Bandicoot, Long-nosed Bandicoot and Common Wombat) (see Appendix 3). None of these are regarded as rare or endangered in NSW. One Tiger Quoll was caught in a cage trap in Fal Brook catchment (plot 1D) however they were commonly heard vocalising at night during spotlighting transects. Wombats were uncommon in the area, with scats and burrows evident in logged areas of the Carrow Brook catchment.

The Long-nosed Bandicoot was common throughout the study area, and was recorded in all forest types during the detailed survey phase of the study (Table 4.41). Moist logged sclerophyll had the fewest records, but the other habitats had similar numbers of Long-nosed Bandicoots.

Table 4.41 Total Numbers of Long-nosed Bandicoots Observed in all Forest Types@.

Survey Plots		Rainforest	Unlogged Moist	Unlogged Dry	Logged Moist	Logged Dry
Plot*	count#					
1	a	0	1	1	0	0
	b	0	0	0	0	1
2	a	0	0	0	0	1
	b	0	1	0	0	0
3	a	1	2	0	0	2
	b	0	0	0	1	1
4	a	4	1	3	0	1
	b	0	2	3	1	2
TOTAL		5	7	7	2	8

* Plots are the 1-4 replicates within each class variable
\# Counts are the two repetitions within each replicate - each plot was counted twice.
@ Data are the total number of Long-nosed Bandicoots on the study plots.

4.5.3 Introduced Mammals

Six species of introduced mammals (rabbit, dog, fox, cat, horse, cow and pig) are known from the study area (see Appendix 3). Feral horse and cattle are widespread through the area and have caused considerable trampling of ground vegetation and other habitat damage (see Binns 1991). Rabbits were common in open forest adjacent to pasture, dog tracks and scats were found along roads near habitation and one feral cat was trapped on a rainforest plot (3R). Foxes were occasionally seen in dry sclerophyll forest areas however no evidence of pigs was detected in this survey.

4.6 Small Terrestrial Mammal Survey

Eight small terrestrial mammals have been reported from the Mt.Royal area (Brown Antechinus, Dusky Antechinus, Common Dunnart, Bush Rat, Fawn-footed Melomys, Swamp Rat, House Mouse, Water Rat and Hastings River Mouse - see Appendix 3). The Hastings River Mouse *Pseudomys oralis* is regarded as very rare and endangered in NSW.

Except for the Hastings River Mouse, only the Brown Antechinus *Antechinus stuartii* was deliberately investigated in this survey, primarily because of its use of tree habitats for shelter. Results for this species have been described in Section 4.4. Habitat in the area is largely unsuitable for the Common Dunnart, Dusky Antechinus and Fawn-footed Melomys, and the Swamp Rat and Water Rat use habitats which are not directly effected by logging operations.

A number of investigators have conducted surveys for the Hastings River Mouse *Pseudomys oralis* in the Mt.Royal Management Area (see Dickman and McKechnie 1985, Read 1988,1989) and a general conclusion would seem to be that this species prefers moist areas near streams with dense ground vegetation (King 1984). This survey trapped one individual (sexually mature female) in logged forest in the Fal Brook catchment (plot P1). Previous researchers had also trapped animals in this area. There is growing evidence that the distribution of the species is more widespread in NSW than previously thought (D.Read *pers.com.*).

4.7 Reptile & Amphibian Survey

Seven species of frogs have been described from the Mt.Royal area (see Appendix 4) and none of these are protected in NSW under Schedule 12A of the NPWS Act. Due to seasonal dormancy and the drought conditions prevalent during the survey, only two species were detected on study plots. The Common Eastern Froglet *Ranidella signifera* was collected on logged moist sclerophyll forest plots in the Fal Brook catchment and unlogged moist sclerophyll forest plots in the Davis Creek catchment. Lesuer's Frog *Litoria lesueurii* was collected on one logged moist sclerophyll forest plot in the Carrow Brook catchment. No frogs were heard calling during the survey period.

Twenty species of reptiles have been described from the Mt.Royal area (see Appendix 4) and none of these are considered rare or endangered in NSW according to Schedule 12 of the NPWS Act. During this survey, 2 Agamid (dragon), 6 skink, and 4 snake species were recorded. Numbers of individuals recorded were insufficient for statistical analysis.

One Jacky Lizard *Amphibolurus muricatus* was collected on a logged dry sclerophyll plot in the Carrow Brook catchment, and several Eastern Water Dragons *Physignathus lesueurii* were observed adjacent to creek lines in logged moist forest in the Fal Brook catchment and unlogged moist forest in the Davis Creek catchment.

One Land Mullet *Egernia major* was captured in a cage trap in logged moist forest (with adjacent rainforest), and one Tree Skink *Egernia striolata* was captured in a pitfall trap on a logged moist sclerophyll plot in the Carrow Brook catchment. *Lampropholis challengeri* was captured during plot searches in rainforest and logged moist forest plots in the Carrow Brook catchment.

The Grass Skink *Lamprophobis delicata* was commonly observed in leaf litter in the Fal Brook and Davis Creek catchments, and the Weasel Skink *Saproscincus mustelina* was observed on one rainforest plot in the Fal Brook catchment. The Eastern Water Skink *Eulamprus quoyii* was commonly observed in logged and unlogged sclerophyll plots in all catchments.

During this study, four species of snake were captured or otherwise positively identified. The Diamond Python *Morelia spilota* was observed in logged sclerophyll plots in the Fal Brook and Carrow Brook catchments. The Eastern Tiger Snake *Notechis scutatus* was observed on a snigging-track in logged moist forest in the Carrow Brook catchment. One Red-bellied Black Snake *Pseudechis porphyriacus* was observed in logged dry sclerophyll forest in the Fal Brook catchment. The Eastern Brown Snake *Pseudonaja textilis* was collected from a road in logged moist forest and observed in rainforest in the Fal Brook catchment.

5. DISCUSSION

5.1 Avifauna

The avifauna of the Mt. Royal area is rich and diverse, and widely distributed throughout forest types and management treatments. Species and family distribution are typical of the mix of *Eucalyptus* forest and sub-tropical rainforest found in mid-altitude sub-coastal areas in temperate eastern Australia. Species typical of high altitude forest of the adjacent Barrington Tops National Park were not recorded, or expected, specifically the Rufous Scrub-bird and the Olive Whistler. This is in agreement with studies conducted in the National Park and adjacent areas of private property (Bell 1990, Ferrier 1985, Hyem 1936, 1937).

Species present here that are at the limit of their distribution (Noisy Pitta, Regent Bowerbird and Pilot Bird) are common in central regions of their range.

1/ Population Analysis

Of all the forest types, rainforest proved to be the most productive habitat in terms of bird population density for both the total avian community and for a suite of forest dependent birds. This difference was significant in statistical terms (α=0.05). In terms of the impact of logging, rainforest can be considered a permanent and productive refuge for the bird population for two reasons. Firstly, rainforest logging is not a current or proposed operation in the Mount Royal Management Area. Secondly, rainforest occurs in riparian strips along creeks in this region, and these stream-side areas are protected from disturbance by soil protection legislation and the management procedures of the Forestry Commission.

Logged areas were found to support more birds than unlogged areas when the entire bird community was considered, and this difference was significant in statistical terms (α=0.05). The nature of unlogged sclerophyll forest in the Mount Royal area is an open vegetation type with a grassy understorey (Binns 1991). The disturbance created by logging promotes undergrowth of the shrub and regeneration layer, which provides a larger number of foraging niches and more protection from nest predation than does the open understorey of unlogged forest. Thus, it can be expected that more birds would occur in logged habitat with increased structural and floristic diversity. In addition, the nature of the logging treatment sampled addol to the potential for retaining and maintaining bird populations. Logging was light in nature, and the treatments sampled demonstrated the effects of 20(+) years of recovery from logging.

In considering effects of logging on forest dependent birds, a somewhat different relationship was revealed. Again, rainforest was the most productive habitat. This difference was significant in statistical terms, and rainforest was demonstrated to be different from all other forest types and treatments, which were grouped together numerically. Unlogged dry and moist sclerophyll forest and unlogged moist forest had very similar population densities of forest birds within that sub-grouping. Logged dry sclerophyll forest had higher population density than the preceding three forest types. In terms of the impact of current logging practices, forest dependent birds should be maintained within rainforest reserves and logged areas.

2/ Species Richness

Bird species richness on both the macro (habitat) and micro (per hectare) level followed the much same pattern as population density. Rainforest was the most species rich habitat, followed by the logged sclerophyll habitats (moist and dry, respectively) and finally unlogged sclerophyll habitat (moist and dry, respectively). Dry unlogged habitat was particularly species poor, while logged moist sclerophyll was very close to rainforest in species richness (see Table 4.4). The floristic and structural uniformity of unlogged dry habitat does not contain the resources essential to many forest birds, particularly those species that require rainforest elements or thick cover. Both of these resources are readily available in logged moist sclerophyll.

These results were somewhat different than those of a similar study (Shields *et al.* 1985) conducted at Mt. Boss, near Wauchope N.S.W. In that study, moist and dry sclerophyll forest had the highest species richness when compared to three types of rainforest. This was due to the presence of a dense rainforest understorey in the moist sclerophyll forest, which supported many rainforest species of birds. At Mt. Royal, the eucalypt forest types had no or little rainforest elements in the understorey, and subsequently the avifauna was limited to non-rainforest species.

3/ Species of Special Concern

The Glossy Black Cockatoo is an obligate *Casuarina* feeder, obtaining most of its food resources from the seeds of this forest tree. A sub-canopy dominated by Casuarinas is a feature of the Mount Royal area, and consequently this species is wide-spread. It was recorded in all forest types except rainforest, and was by far the most common on dry logged sites. *Casuarina*, an invader species that fixes nitrogen in disturbed soils, is common in dry logged sites, and the preponderance of observations of the Glossy Black Cockatoo in this forest treatment is no doubt an artifact of the increased food resource available there.

The Glossy Black Cockatoo also requires large tree hollows for nesting. Reproduction and fecundity investigations were beyond the scope of this study. Direct removal of nest sites would be highly deleterious to the species continued survival in the Mount Royal area in its present numbers. Forest management plans call for the retention of habitat trees within all logged areas, and specific plans for the retention of known Glossy Black Cockatoo nest sites are in effect.

The Ground ("Bassian") Thrush is a tropical migrant with a requirement for forest interior habitat. The local subspecies has been put forward by some taxonomists as a true species, but there is some doubt about the validity of this classification. In some areas, there may be a threat to the Ground Thrush in conservation terms due to competition from the introduced Blackbird. At Mount Royal it was a common resident of rainforest habitat and not recorded in other forest types. It no doubt occurs in moist sclerophyll forest in low numbers, but rainforest is obviously the most important habitat. The effect of logging on rainforest is minimal for the proposed operations at Mount Royal, and, *ipso facto*, for the Ground Thrush. Similar conditions exist in the case of species such as the Rose Robin, Black-faced Monarch, and for the fruit-eating rainforest pigeons.

The Peregrine Falcon recorded by Hines (1990) is an incidental occurrence, and no population estimate, habitat requirement, or factor of distribution can be described in the context of the proposed operations. It is possible that there are nest sites on some of the local cliff faces.

5.2 Large Owls

Owls were recorded in all forest types and treatments and in all three catchments of the Management Area. Most of the rainforest gullies in the Area supported pairs of Powerful Owls, at a spacing of about five kilometres apart within the same catchment. The distribution of the Sooty Owl probably follow much the same pattern, but due to lack of reproductive behaviour, it was not possible to determine the exact pattern. The Masked Owl avoided rainforest, but was recorded in all other forested habitats and in adjoining open country.

The large owls in the study area are dependent upon large trees for nest sites, and this factor may be effected by logging. Otherwise, their prey base should remain constant, as indicated by the arboreal marsupials, and populations of owls would be retained within the context of the proposed operations, given that individual nest trees are not destroyed in the process of tree harvest.

5.3 Large Arboreal Marsupials

Large arboreal marsupials were common and widespread throughout the Management Area, and species richness was high. All species that could be expected in the Area were recorded on this study. Rainforest was the least productive habitat in terms of both species richness and population density, although it was the only habitat that supported populations of Mountain Brushtail Possums. It is possible that all methods underestimated populations of rainforest arboreal marsupials, due to the extremely dense nature of the understorey, canopy and sub-canopy. The lack of a *Eucalyptus* resource is responsible for the absence of Greater Gliders from this habitat, which in turn is responsible for the low total numbers of arboreal marsupials.

Unlogged moist and dry habitat supports the highest, and nearly equal, populations of arboreal marsupials. The productive nature of the canopy and lack of disturbance to the canopy are possible explanations for this factor.

Logged habitat supported a complete suite of species of large arboreal marsupials, but population density was lower than the corresponding unlogged habitats. Lack of consistent canopy resources (foliage, flowers, buds, shelter) explain this phenomena. Populations were high on some individual plots, indicating that high productivity sites can support populations of the total arboreal marsupial community.

1/ Greater Gliders

The Greater Glider was the most abundant, although not the most widespread, species of arboreal marsupial. It did not occur in rainforest regularly, due to the lack of a eucalypt resource. Populations were highest in logged moist sclerophyll forest, which was grouped alone by analysis procedures as the most productive habitat for this species. However, populations were very similar in unlogged moist sclerophyll forest, and these two habitats are no doubt the most important for the Greater Glider. The Greater Glider was uncommon and in some cases totally absent from logged dry sclerophyll forest. The richness and diversity of *Eucalyptus* foliage is the controlling factor in the distribution of this species in undisturbed forest, and this is reflected by the results of this study. In some cases, the shelter resource, tree hollows, may be a limiting factor, if these are totally removed. The logging operations sampled in the detailed survey part of the study were light and left many hollows, and this was apparently not a factor in distribution. Results from the general survey, which sampled heavily logged areas along Cassel's Road, found very few Greater Gliders, and the lack of hollows is the most likely explanation for this phenomena.

2/ Yellow-bellied Gliders

Yellow-bellied Gliders were most common in unlogged dry sclerophyll forest. This forest type was represented in the sample by two plots which occur on open, level country with a diverse mix of *Eucalyptus* species. The moist sites, although more productive, were less diverse in terms of tree species, and this factor explains the distribution of patterns observed. The Yellow-bellied Glider requires diverse *Eucalyptus* resources for energy supply throughout the year. The high populations and wide-spread nature of this species in dry forest is notable.

3/ Brushtail and Ringtail Possums

The Brushtail Possum was the most widespread species, occurring in all forest types and treatments; it was abundant throughout the study area. The Ringtail Possum was widespread, but nowhere abundant. The Mountain Brushtail Possum was confined to rainforest gullies. This suite of species showed no apparent response to logging, and only the preference of Mountain Brushtail possums for rainforest indicated a particular habitat selection.

4/ Koala

The Koala was relatively common in the area, but not abundant or widespread. A pair was recorded in the Davis Creek catchment, where they utilized both logged and unlogged moist sclerophyll forest. Another regular recording was made near Cedar Road in the Fal Brook catchment in heavily logged country on State Forest and adjoining private property. Aside from direct disturbance, the impact of logging was not demonstrated to be deleterious.

5.4 Small Arboreal Mammals

Results of a tree-mounted trapping program and extensive spotlighting has shown that Sugar Gliders are relatively uncommon in the Mt.Royal Area. Individuals were recorded in rainforest and both moist and dry sclerophyll forest. While the highest numbers were recorded in unlogged dry sclerophyll forest, animals were also recorded in logged forest plots. There is no evidence that past logging practices have had a deleterious effect on glider populations.

The Brown Antechinus *Antechinus stuartii* is an abundant member of the small arboreal mammal fauna in the Mt.Royal area. In unlogged forest it is equally abundant in rainforest and moist and dry sclerophyll forest. There was no significant difference in the numbers of individuals caught in logged and unlogged plots, suggesting that past management operations have not effected population numbers of this species.

Numbers of the Bush Rat *Rattus fuscipes* and Brush-tail Phascogale *Phascogale tapoatafa* were too low to draw meaningful conclusions, however both species were recorded from areas that had previously been logged.

5.5 Large Terrestrial Mammals

One of the main features of the environment at Mount Royal was the abundance and species richness of small and medium-sized macropods. This results from a corresponding richness and diversity in the grazing and browsing resource. In particular, the Red-necked Wallaby was able to exploit the open grassy understorey of both the moist and dry sclerophyll forest types. In rainforest, recently logged moist sclerophyll and the relatively uncommon areas of moist sclerophyll forest with thick understorey, the Red-necked Pademelon was extremely abundant. In these habitats the Swamp Wallaby also occurred, but at lower population levels.

For these species, a regime of continued disturbance from logging and fire can be expected to maintain overall population levels. After logging, when thicker regrowth replaces grassy understorey, the Red-necked Wallaby, a grazer, may decline and the Swamp Wallaby, a browser, may increase.

The Parma Wallaby, recorded only once during the study, occurs in logged forests and plantations as well as undisturbed sites through out its range in north-eastern New South Wales. Optimum habitat appears to be wet-sclerophyll forest with a thick, shrubby understorey associated with grassy patches (Maynes 1977). Initial disturbance by logging activity may displace some individuals, however habitat carrying capacity should remain at similar levels or increase after logging. The same logic and argument pertains to the Rufous Bettong and the Long-nosed Potoroo. All three species were recorded in heavily logged sclerophyll forest during this study.

Fire trails and primitive roads exist in the study area, and have been in existence since early in this century. The forest is by and large open and easy to travel through. The argument that the roading process would allow increased access to introduced predators is therefore not relevant.

Large macropods were uncommon in the study area, but abundant in adjoining cleared areas. Logging and roading might increase habitat carrying capacity for these species.

5.6 Other Native Mammals

The five other native mammal species occurring in the area have no known requirements for unlogged habitat. Wombats are common inhabitants of disturbed agricultural land and were only detected in the logged areas of the Carrow Brook catchment. The Northern Brown Bandicoot is approaching the southern limit of its distribution at Mt.Royal and is common and secure throughout its range. The Long-nosed Bandicoot is similarly secure within logged and unlogged components of its distribution. The Tiger Quoll is uncommon over most of its range but is regarded as having "secure" status (Strahan 1989). Records for the Quoll at Mt.Royal were restricted to logged dry sclerophyll forest.

5.7 Introduced Mammals

The introduced rabbit occurs in some areas adjacent to cleared private property. Habitat carrying capacity should decrease directly after logging, due to regrowth of woody shrubs and eucalyptus saplings, and may possibly increase as the forest matures. The effect and impact of this introduced species on native mammals is not significant in forested areas.

Introduced carnivores may be deleterious to populations of small macropods and other marsupials. An active and selective program of predator control is proposed for the Management Area to reduce this effect. The effect of logging on populations of these animals is minimal.

Horses and cattle occur throughout much of the area. Logging should, eventually, advantage these grazing species, after the first stages of woody regrowth vegetation are replaced by the more open understorey typical of mature forests in the area. Numbers should be monitored, but the effect of these animals on native species of fauna is minimal at current stocking levels. See Binns (1991) for a discussion of the possible effects of horses and pigs on swamp vegetation.

5.8 Small Terrestrial Mammals

Because of the great diversity of habitats in the Mt.Royal region, the area has a rich small terrestrial mammal fauna. The Water Rat has been recorded from the region but as it requires permanent water it is not likely to be a permanent resident within the Management Area. Similarly, while the Common Dunnart *Sminthopsis murina* is widespread in southern Australia, habitats are marginal for this species around Mt.Royal. Low-lying swampy areas provide good habitat for the Swamp Rat while dense rainforest vegetation along gullies is ideal habitat for the Fawn-footed Melomys. Both these species are not at risk from forestry operations due to existing Forestry Commission policies that protect streams and their riparian vegetation.

The Hastings River Mouse *Pseudomys oralis* reaches the southern limit of its known distribution at Mt.Royal. Fossil evidence suggests that it was once more widely distributed in NSW but it is currently known from only a few isolated locations. In 1974 it was listed as in "imminent danger of extinction" in Schedule 12 of the NPWS Act, however it is likely that further survey work may uncover more widespread populations. This species has been regularly caught within the Fal Brook catchment at Mt.Royal over the past 6 years. Its known habitat requirements suggest that it is not at risk from forestry operations, however there is no doubt that further investigations into the biology and requirements of the animal should be undertaken.

5.9 Reptiles & Amphibians

It is likely that the prime habitats for frogs in the Mt.Royal Management Area would be adjacent to the few permanent streams and within the large number of small swampy areas. These environments would provide good localised environments for a number of species, and forestry management practices are such that streams and accompanying riparian vegetation provide secure habitat in the region. Tree frogs are not at risk within areas of rainforest and there is no evidence that logging has diminished habitat quality for other forest dwelling species. Seven species of frog have been described from the Area and it is likely that this list would be extended with continued survey work.

Twenty species of reptile have been described from the region. Although conducted in Autumn, this survey uncovered 12 species, all of which were represented in logged forest areas. Representatives of groups requiring riparian vegetation (Eastern Water Dragon), moist vegetation (Eastern Water Skink), rainforest vegetation (Land Mullet), arboreal habitats (Tree Skink, Bearded Dragon), abundant leaf litter (*Lampropholis* spp.), and open forest habitats (Tiger, Black and Brown snakes) were detected during this survey. Although the impact of management practices could not be quantitatively assessed with this group, it would appear that the reptiles have not been adversely effected by past operations.

The National Parks and Wildlife Service expressed their concern about possible occurrences of the skink *Lampropholis caligula*, however its habitat requirements of cool-temperate forest are not met within the Management Area (Ingram & Rawlinson 1981).

5.10 Concluding Comments

Mount Royal State forest consists of 7,447 hectares of native forest with a widely variable logging history. A rich and diverse fauna currently occupies the area within this context. It forms the southern end (about 5%) of a much larger area of contiguous forest (140,000ha.), which includes Barrington Tops National Park (Forestry Commission 1988). Within this overall ecological domain, the effects of the proposed operation on fauna are consistent with the continued conservation of native species.

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APPENDIX 1. Survey Team Personnel.

A/ Forestry Commission of NSW

Jim Shields BSc. Dip.For. PhD.	Research Officer
Alan York BSc.(Hons) PhD.	Research Officer
Traecey Brassil BSc.	Technical Officer
Khia Bamkin BSc.	Technical Officer
Bill Chapman	Forest Assistant
Patrick Murphy	Field Assistant

Assisted by staff from the Newcastle, Port Macquarie & Coffs Harbour Regions.

B/ Consultants

Rick Webster BSc. - ARMATA Consultants

APPENDIX 2. List of Avifauna from Mount Royal Area.

ZOOLOGICAL NAME	COMMON NAME	CATCHMENT FB	CB	DC	FOREST DF	MF	RF	AUTHORITY F	H	M
Family ANATIDAE : Swans, Geese & Ducks										
Maned (Wood) Duck	*Chenonetta jubata*	X			X			X		X
Family ACCIPITRIDAE : Kites, Hawks, Eagles & Harriers										
Collared Sparrowhawk	*Accipiter cirrhocephalus*	X	X	X		X	X	X		
Grey Goshawk	*Accipiter novaehollandiae*	X				X		X		X
Brown Goshawk	*Accipiter fasciatus*	X		X	X	X		X		X
Little Eagle	*Hieraaetus morphnoides*	X			X			X		
Wedge-tailed Eagle	*Aquila audax*		X	X	X	X		X	X	X
Swamp Harrier	*Circus aeruginosus*									X
Family FALCONIDAE : Falcons & Kestrels										
Peregrine Falcon	*Falco peregrinus*	X							X	X
Brown Falcon	*Falco berigora*									X
Nankeen Kestral	*Falco cenchroides*									X
Family MEGAPODIIDAE : Mound-builders										
Australian Brush-turkey	*Alectura lathami*	X	X				X	X		X
Family PHASIANIDAE : Quails, Partridges and Pheasants										
Brown Quail	*Coturnix australis*									X
King Quail	*Coturnix chinensis*									X
Family RALLIDAE : Rails, Crakes, Water-hens & Coots										
Dusky Moorhen	*Gallinula tenebrosa*			X					X	
Family CHARADRIIDAE : Plovers & Dotterels										
Masked Plover	*Vanellus miles*								X	
Family COLUMBIDAE : Pigeons & Doves										
Topknot Pigeon	*Lopholaimus antarcticus*	X	X				X	X		X
White-headed Pigeon	*Columba leucomela*		X				X	X		X
Brown Cuckoo-dove (Brown Pigeon)	*Macropygia amboinensis*	X	X	X	X	X	X	X	X	X
Wonga Pigeon	*Leucosarcia melanoleuca*	X	X	X	X	X	X	X		
Emerald dove	*Chalcophaps indica*									X

cont..

APPENDIX 2. cont...

ZOOLOGICAL NAME	COMMON NAME	CATCHMENT FB	CB	DC	FOREST DF	MF	RF	AUTHORITY F	H	M
Family CACATUIDAE : Cockatoos										
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	X	X	X	X	X		X	X	X
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	X	X	X		X	X	X	X	X
Galah	*Cacatua roseicapilla*									
Sulphur-crested (White) Cockatoo	*Cacatua galerita*			X	X			X	X	X
Family POLYTELITIDAE : Long-tailed Parrots										
King Parrot	*Alisterus scapularis*	X	X	X	X	X	X	X	X	X
Family PLATYCERCIDAE : Broad-tailed Parrots										
Crimson Rosella	*Platycercus elegans*	X	X	X	X	X	X	X	X	X
Eastern Rosella	*Platycercus eximius*									X
Family CUCULIDAE : Cuckoos & Coucals										
Brush Cuckoo	*Cuculus variolosus*			X					X	X
Pallid Cuckoo	*Cuculus pallidus*									X
Fan-tailed Cuckoo	*Cuculus pyrrhophanus*			X		X		X	X	X
Horsfield's Bronze Cuckoo	*Chrysococcyx basalis*			X	X			X		
Shining Bronze Cuckoo	*Chrysococcyx lucidus*			X	X			X	X	X
Channel-billed Cuckoo	*Scythrops novaehollandiae*	X						X		X
Koel	*Eudynamys scolopacea*									X
Family STRIGIDAE : Owls										
Powerful Owl	*Ninox strenua*	X	X	X	X	X	X	X		
Southern Boobook (Owl)	*Ninox novaeseelandiae*	X	X	X	X	X	X	X	X	X
Family TYTONIDAE : Barn Owls										
Masked Owl	*Tyto novaehollandiae*	X	X	X	X	X		X		X
Sooty Owl	*Tyto tenebricosa*	X	X	X			X	X		
Family PODARGIDAE : Frogmouths										
Tawny Frogmouth	*Podargus strigoides*	X	X	X		X		X	X	
Family AEGOTHELIDAE : Owlet-Nightjars										
(Australian) Owlet-Nightjar	*Aegotheles cristatus*	X	X	X	X	X		X		
Family APODIDAE : Swifts										
White-throated Needletail (Spine-tailed Swift)	*Hirundapus caudacutus*	X	X	X	X	X		X		X

cont...

APPENDIX 2. cont...

ZOOLOGICAL NAME	COMMON NAME	CATCHMENT			FOREST			AUTHORITY		
		FB	CB	DC	DF	MF	RF	F	H	M
Family ALCEDINIDAE : Kingfishers & Kookaburras										
Laughing Kookaburra	*Dacelo novaeguineae*	X	X	X	X	X	X	X	X	X
Sacred Kingfisher	*Halcyon sancta*	X		X	X			X	X	
Azure Kingfisher	*Ceyx azureus*									X
Family CORACIIDAE : Rollers										
Dollar-bird	*Eurystomus orientalis*									X
Family PITTADAE : Pittas										
Noisy Pitta	*Pitta versicolor*	X					X	X		
Family MENURIDAE : Lyrebirds										
Superb Lyrebird	*Menura novaehollandiae*	X	X	X	X	X	X	X	X	X
Family HIRUNDINIDAE : Swallows & Martins										
Welcome Swallow	*Hirundo neoxeno*									X
Family CAMPEPHAGIDAE : Cuckoo-shrikes & Trillers										
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X		X	X	X	X	X		X
White-winged Triller	*Lalage sueuri*									X
White-bellied (Little) Cuckoo-shrike	*Coracina papuensis*			X	X			X		
Cicada-bird	*Coracina tenuirostris*	X	X	X	X	X		X	X	
Family MUSCICAPIDAE : Thrushes, Flycatchers, Monarchs and Fantails										
White's (Scaly) (Ground) Thrush	*Zoothera dauma*	X	X	X			X	X	X	X
Rose Robin	*Petroica rosea*	X	X		X	X	X	X	X	X
Scarlet Robin	*Petroica multicolor*	X	X	X	X	X		X	X	X
Eastern Yellow Robin	*Eopsaltria australis*	X	X	X	X	X	X	X	X	X
Jacky-Winter (Brown Flycatcher)	*Microeca leucophaea*			X				X		
Crested Shrike-tit	*Falcunculus frontatus*		X	X			X	X	X	X
Rufous Whistler	*Pachycephala rufiventris*			X					X	
Golden Whistler	*Pachycephala pectoralis*	X	X	X	X	X	X	X	X	X
Grey Shrike-thrush	*Colluricincla harmonica*	X	X	X	X	X	X	X	X	X
Black-faced Monarch	*Monarcha melanopsis*	X	X	X	X	X	X	X	X	X
Satin Flycatcher	*Myiagra cyanoleuca*	X		X	X	X		X	X	X
Rufous Fantail	*Rhipidura rufifrons*	X	X	X	X	X	X	X	X	X
Grey Fantail	*Rhipidura fuliginosa*	X	X	X	X	X	X	X	X	X
Willie Wagtail	*Rhipidura leucophrys*									X

cont...

APPENDIX 2. cont...

ZOOLOGICAL NAME	COMMON NAME	CATCHMENT			FOREST			AUTHORITY		
		FB	CB	DC	DF	MF	RF	F	H	M
Family ORTHONYCHIDAE : Chowchillas & Quail-thrushes										
Logrunner	*Orthonyx temminckii*	X	X				X	X		X
Eastern Whipbird	*Psophodes olivaceus*	X	X	X	X	X	X	X		X
Spotted Quail-thrush	*Cinclosoma punctatum*	X	X	X	X		X	X	X	X
Family MALURIDAE : Australian Warblers (Wrens)										
Superb (Blue Wren) Fairy-wren	*Malurus cyaneus*	X	X	X	X	X		X	X	X
Variegated (Wren) Fairy-wren	*Malurus lamberti*	X	X	X	X	X		X		X
Family ACANTHIZIDAE : Australian Warblers, Scrubwrens, Thornbills										
Pilot-bird	*Pycnoptilus floccosus*	X					X	X		
Large-billed Scrub wren	*Sericornis magnirostris*	X	X				X	X		X
Yellow-throated Scrub wren	*Sericornis citreogularis*	X	X	X		X		X	X	X
White-browed Scrub wren	*Sericornis frontalis*	X	X	X	X	X	X	X	X	X
Brown Thornbill	*Acanthiza pusilla*	X	X	X	X	X	X	X	X	X
Buff-rumped Thornbill	*Acanthiza reguloides*		X	X	X	X		X	X	X
Striated Thornbill	*Acanthiza lineata*	X	X	X	X	X	X	X	X	X
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*									X
Yellow Thornbill	*Acanthiza nana*			X	X			X		X
Brown (Warbler) Gerygone	*Gerygone mouki*	X	X	X		X	X	X	X	X
Weebill	*Smicrornis brevirostris*									X
Family NEOSITTIDAE : Sittellas										
Varied Sittella	*Daphoenositta chrysoptera*	X	X	X	X			X		X
Family CLIMACTERIDAE : Treecreepers										
White-throated Treecreeper	*Climacteris leucophaea*	X	X	X	X	X	X	X	X	X
Red-browed Treecreeper	*Climacteris erythrops*	X	X	X	X	X	X	X	X	X
Family MELIPHAGIDAE : Honeyeaters										
Red Wattlebird	*Anthochaera carunculata*	X	X	X	X	X	X	X	X	X
Spiny-cheeked Honeyeatyer	*Acanthagenys rufogularis*									X
Noisy Friarbird	*Philemon corniculatus*	X	X	X	X	X		X	X	X
Bell Miner	*Manorina melanophrys*		X					X		
Lewin's Honeyeater	*Meliphaga lewini*	X	X	X	X	X	X	X	X	X
Yellow-faced Honeyeater	*Lichenostomus chrysops*	X	X	X	X	X	X	X	X	X
White-naped Honeyeater	*Melithreptus lunatus*	X	X	X	X	X		X		X
White-cheeked Honeyeater	*Phylidonyris nigra*									X
Eastern Spinebill	*Acanthorhynchus tenuirostris*	X	X	X	X	X	X	X	X	X
Scarlet Honeyeater	*Myzomela sanguinolenta*	X	X		X	X		X		

cont...

PPENDIX 2. cont...

OLOGICAL NAME	COMMON NAME	CATCHMENT FB	CE	DC	FOREST DF	MF	RF	AUTHORITY F	H	M
amily DICAEIDAE : Flowerpeckers										
istletoebird	*Dicaeum hirundinaceum*	X	X	X	X	X	X	X	X	X
amily PARDALOTIDAE : Pardalotes										
potted Pardalote	*Pardalotus punctatus*	X	X	X	X	X	X	X	X	X
triated Pardalote	*Pardalotus striatus*			X		X		X	X	X
amily ZOSTEROPIDAE : (Silvereyes) White-eyes										
ilvereye	*Zosterops lateralis*	X	X	X	X	X	X	X	X	X
amily PLOCEIDAE : Australian Grass Finches & Allies										
ed-browed Firetail	*Emblema temporalis*	X	X	X	X	X	X	X	X	X
amily ORIOLIDAE : Orioles & Figbirds										
live-backed Oriole	*Oriolus sagittatus*			X	X			X		
amily PARADISAEIDAE : Bowerbirds, Cattirds and Riflebirds										
Satin Bowerbird	*Ptilonorhynchus violaceus*	X	X	X	X	X	X	X		X
Regent Bowerbird	*Sericulus chrysocephalus*		X				X	X		
Green Catbird	*Ailuroedus crassirostris*	X	X		X	X	X	X		X
Family ARTAMIDAE : Woodswallows										
Dusky Woodswallow	*Artamus cyanopterus*	X				X		X		
Family CRACTICIDAE : Currawongs, Butcherbirds & Magpies										
Grey Butcherbird	*Cracticus torquatus*		X	X	X			X	X	
Australian Magpie	*Gymnorhina tibicen*	X		X	X	X		X	X	X
Pied Currawong	*Strepera graculina*	X	X	X	X	X	X	X	X	X
Family CORVIDAE : Ravens, Jays & Crows										
Australian Raven	*Corvus coronoides*	X		X	X	X		X	X	

Reference: List of Recommended English Names, The Emu, Royal Australasian Ornithologists Union. Vol. 77 May 1978

CATCHMENT: FB Fal Brook CB Carrow Brook DC Davis Creek
FOREST: DF Dry MF moist RF Rainforest
AUTHORITY: F Forestry Commission Survey H Hines (1990)
M Commission Management Plan 1988 (Compiled from local knowledge and a list supplied by the Australian Museum based on preliminary studies in Tuglo Wildlife Refuge a few kilometres from Mt.Royal State Forest, and Gloucester and Chistester Management Plans).

APPENDIX 3. List of Mammal Fauna from Mount Royal Area.

Common name	Scientific name	Catchment			Forest type			Authority				
		FB	CB	DC	DF	MF	RF	R	D	F	H	M
MONOTREMES												
Family TACHYGLOSSIDAE : Spiny Anteaters												
Echidna	*Tachyglossus aculeatus*	X		X	X				X		X	X
Family ORNITHORHYNCHIDAE												
Platypus	*Ornithorhynchus anatinus*											X
MARSUPIALS												
Family DASYURIDAE : Marsupial Mice & Native Cats												
Tiger Quoll	*Dasyurus maculatus*	X		X	X				X	X		X
Brush-tailed Phascogale	*Phascogale tapoatafa*		X	X						X		
Brown Antechinus	*Antechinus stuartii*	X	X	X	X	X	X	X	X	X	X	X
Dusky Antechinus	*Antechinus swainsonii*	X				X		X				
Common Dunnart	*Sminthopsis murina*											X
Family PERAMELIDAE : Bandicoots											X	X
Northern Brown Bandicoot	*Isoodon macrourus*			X								
Long-nosed Bandicoot	*Perameles nasuta*	X	X	X	X	X	X			X		X
Family PHASCOLARCTIDAE :Koala												
Koala	*Phascolarctos cinereus*			X	X	X				X	X	X
Family VOMBATIDAE : Wombats												
Common Wombat	*Vombatus ursinus*		X	X	X					X	X	X
Family PETAURIDAE : Ringtails & Larger Gliders												
Common Ringtail Possum	*Pseudocheirus peregrinus*	X	X	X	X		X		X	X	X	X
Greater Glider	*Petauroides volans*	X	X	X	X	X			X	X	X	X
Yellow-bellied Glider	*Petaurus australis*	X	X	X	X	X			X	X	X	
Sugar Glider	*Petaurus breviceps*	X	X	X	X	X	X		X	X		X
Family PHALANGERIDAE : Possums												
Common Brushtail Possum	*Trichosurus vulpecula*	X	X	X	X	X	X		X	X		X
Mountain Brushtail Possum	*Trichosurus caninus*		X	X			X			X	X	X
Family POTOROIDAE : Potoroos & Bettongs												
Long-nosed Potoroo	*Potorus tridactylus*	X		X		X				X		X
Rufous Bettong	*Aepyprymnus rufescens*	X				X			X			
Family MACROPODIDAE : Kangaroos & Wallabies												
Red-necked Pademelon	*Thylogale thetis*	X	X	X		X	X			X	X	X
Parma Wallaby	*Macropus parma*		X			X					X	
Red-necked Wallaby	*Macropus rufogriseus*	X	X	X		X	X		X	X	X	X
Eastern Grey Kangaroo	*Macropus giganteus*	X		X		X				X	X	X
Common Wallaroo	*Macropus robustus*	X				X					X	X
Swamp Wallaby	*Wallabia bicolor*	X		X			X	X	X	X	X	X

cont...

APPENDIX 3. cont...

Common name	Scientific name	Catchment			Forest type			Authority				
		FB	CB	DC	DF	MF	RF	R	D	F	H	N
EUTHERIAN MAMMALS												
Family VESPERTILIONIDAE : "Ordinary" Bats												
Little Cave Eptesicus	*Eptesicus darlingtoni*										X	
King River Bat	*Vespadelus regulus*										X	
Family MURIDAE : Rats & Mice												
Hastings River Mouse	*Pseudomys oralis*	X				X		X	X	X		X
Bush Rat	*Rattus fuscipes*	X	X	X	X	X	X	X	X	X	X	X
Swamp Rat	*Rattus lutreolus*	X		X		X		X	X	X	X	
House Mouse	*Mus musculus*	X			X					X		X
Fawn-footed Melomys	*Melomys cervinipes*	X		X		X			X		X	
Water Rat	*Hydromys chrysogaster*	X				X			X			
OTHERS												
Rabbit	*Oryctolagus cuniculus*	X			X	X		X	X	X		X
Feral Dog, Dingo	*Canis familiaris*	X	X	X	X	X		X	X	X		X
Fox	*Vulpes vulpes*	X		X	X				X		X	X
Cat	*Felis catus*	X	X	X	X		X	X	X	X	X	X
Horse	*Equus caballus*	X	X	X	X	X				X	X	
Cow	*Bos taurus*	X	X	X	X	X				X		
Pig	*Sus scrofa*	X				X			X			

Reference: Names as in Strahan (1983) The Australian Museum Complete Book of Australian Mammals.

CATCHMENT: FB Fal Brook CB Carrow Brook DC Davis Creek
FOREST: DF Dry MF moist RF Rainforest
AUTHORITY: R Read (1988,9) D Dickman & McKechie (1985)
F Forestry Commission Survey H Hines (1990)
N Commission Management Plan 1988 (Compiled from local knowledge and a list supplied by the Australian Museum based on preliminary studies in Tuglo Wildlife Refuge a few kilometres from Mt.Royal State Forest, and Gloucester and Chistester Management Plans).

APPENDIX 4. List of Reptiles & Amphibians from Mt.Royal Area.

Common name	Scientific name	Catchment			Forest type			Authority	
		FB	CB	DC	DF	MF	RF	F	H
FROGS									
Common Eastern Froglet	*Ranidella signifera*	X		X		X		X	X
Peron's Tree Frog	*Litoria peronii*			X					X
----	*Litoria verreauxii*			X					X
Blue Mountains Tree Frog	*Litoria citropa*			X					X
Eastern Dwarf Tree Frog	*Litoria fallax*			X					X
Lesuer's Frog	*Litoria lesueurii*		X			X		X	
----	*Uperolia laevigata*			X					X
AGAMIDS									
Bearded Dragon	*Amphibolurus barbatus*			X		X			X
Jacky Lizard	*Amphibolurus muricatus*		X	X	X			X	X
Eastern Water Dragon	*Physignathus lesueurii*	X		X		X		X	
SKINKS									
Copper-tailed Skink	*Ctenotus taeniolatus*			X					X
Land Mullet	*Egernia major*		X			X		X	
Tree Skink	*Egernia striolata*		X			X		X	
----	*Hemiergis decresiensis*			X					X
----	*Lampropolis challengeri*		X	X		X	X	X	
----	*Lampropholis delicata*	X		X	X			X	X
----	*Lampropholis guichenoti*			X					X
Weasel Skink	*Saproscincus mustelina*	X		X			X	X	X
Red-throated Skink	*Leiolopisma platynotum*			X					X
----	*Leiolopisma entrecasteauxii*			X					X
----	*Saiphos equalis*			X					X
Eastern Water Skink	*Eulamprus quoyii*	X	X	X	X	X		X	X
----	*Eulamprus heatwolei*			X					X
SNAKES									
Family BOIDAE									
Diamond Python	*Morelia spilota*	X	X			X	X		X
Family ELAPIDAE									
Eastern Tiger Snake	*Notechis scutatus*		X				X		X
Red-bellied Black Snake	*Pseudechis porphyriacus*	X		X		X		X	X
Eastern Brown Snake	*Pseudonaja textilis*	X				X	X		X

Reference: Names as in Cogger (1983) Reptiles and Amphibians of Australia.

CATCHMENT: FB Fal Brook CB Carrow Brook DC Davis Creek
FOREST: DF Dry MF moist RF Rainforest
AUTHORITY: F Forestry Commission Survey (1991)
H Hines (1990)

APPENDIX 5. Tabular Results of Analysis of Variance (ANOVA) Procedures.

*Note: for all P values, * indicates significance at α=0.05*

Population Density of Total Bird Community. One-way ANOVA testing for differences between unlogged plots (rainforest, moist and dry sclerophyll).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Between Forests	138.86	2	69.43	4.56	0.0114*
Within	3608.94	237	15.23		
Total	3747.79	239			

Population Density of Total Bird Community. One-way ANOVA testing for differences between all forest types (unlogged rainforest, moist & dry sclerophyll and logged moist and dry sclerophyll plots).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	207.63	4	51.91	2.32	0.0564*
Error	8838.13	395	22.38		
Total	9045.75	399			

Population Density of Total Bird Community. Two-way ANOVA testing for forest type and logging history effects (moist and dry sclerophyll plots only).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Moisture	30.01	1	30.01	1.16	0.281
Logging History	125	1	125	4.85	0.028*
Residual	8170.38	317	25.77		
Total	8325.39	319	26.09		

Total Habitat Bird Species Richness. One-way ANOVA testing for differences between unlogged plots (rainforest, moist and dry sclerophyll).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	520.5	2	260.3	28.45	0.00*
Error	2167.8	237	9.14		
Total	2688.4	239			

Total Habitat Bird Species Richness.
One-way ANOVA testing for differences between all forest types (unlogged rainforest, moist & dry sclerophyll and logged moist and dry sclerophyll plots).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	695.06	4	173.765	17.139	0.000*
Error	4004.54	395	10.138		
Total	4699.59	399			

Bird Species Richness of Total Habitat. Two-way ANOVA testing for forest type and logging history effects (moist and dry sclerophyll plots only).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Moisture	84.05	1	84.05	7.72	0.006*
Logging History	405.00	1	405.0	37.21	0.000*
Residual	3450.50	317	10.89		
Total	3939.55	319	12.35		

Bird Species Richness per Hectare. One-way ANOVA testing for differences between unlogged plots (rainforest, moist and dry sclerophyll).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	319.41	2	159.7	23.72	0.000*
Error	1595.78	237	6.73		
Total	1915.18	239			

Bird Species Richness per Hectare. One-way ANOVA testing for differences between all forest types (unlogged rainforest, moist & dry sclerophyll and logged moist and dry sclerophyll plots).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	325.59	4	81.39	9.95	0.000*
Error	3232.05	395	8.182		
Total	3557.64	399			

Bird Species Richness per Hectare. Two-way ANOVA testing for forest type and logging history effects (moist and dry sclerophyll plots only).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Moisture	14.03	1	14.03	1.55	0.214
Logging History	79.00	1	79.00	8.73	0.003*
Residual	2870.34	317	9.06		
Total	2963.37	319	9.29		

Population Density of Forest Dependent Birds*. One-way ANOVA testing for differences between all forest types (unlogged rainforest, moist & dry sclerophyll and logged moist and dry sclerophyll plots).

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Forest Type	3.926	4	0.9825	2.28	0.0588
Error	629.6046	1462	0.4306		
Total	633.531	1466			

* Data are a population estimate of forest birds with habitat requirements for forest ecosystems. Species are listed in the text.

Two-way ANOVA table for effects of logging history and forest moisture on numbers of arboreal mammals.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	157.53	1	157.53	10.05	0.001*
Forest Moisture	2.53	1	2.53	0.20	0.657
Interaction	101.53	1	101.53	8.06	0.008*
Residual	352.88	28	12.60		
Total	614.47	31	19.82		

Two-way ANOVA table for effects of logging history and forest moisture on population density of arboreal marsupials.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	16.53	1	16.53	3.38	0.076
Forest Moisture	3.78	1	3.78	0.77	0.386
Residual	141.66	29	4.89		
Total	161.97	31	5.23		

Two-way ANOVA table for effects of logging history and forest moisture on species richness of arboreal marsupials.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	5.28	1	5.28	3.54	0.026*
Forest Moisture	1.53	1	1.53	1.61	0.215
Residual	27.66	29	0.95		
Total	34.47	31	1.11		

Two-way ANOVA table for effects of logging history and forest moisture on numbers of Greater Gliders.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	19.53	1	19.53	2.28	0.142
Forest Moisture	34.03	1	34.03	3.97	0.056
Residual	248.66	29	8.57		
Total	302.22	31	9.75		

Two-way ANOVA table for effects of logging history and forest moisture on population density of Greater Gliders.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	2.00	1	2.00	0.676	0.418
Forest Moisture	10.13	1	10.13	3.424	0.074
Residual	81.25	29	2.90		
Total	97.88	31	3.16		

Two-way ANOVA table for effects of logging history and forest moisture on numbers of individuals of *Petaurus* species.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	26.28	1	26.28	7.84	0.009*
Forest Moisture	19.53	1	19.53	5.83	0.023*
Interaction	22.78	1	22.78	6.80	0.014*
Residual	93.88	28	3.35		
Total	162.47	31	5.24		

Two-way ANOVA table for effects of logging history and forest moisture on numbers of individuals of the Yellow-bellied Glider.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	22.78	1	22.78	9.80	0.004*
Forest Moisture	13.78	1	13.78	5.93	0.022*
Interaction	19.53	1	19.53	8.39	0.007*
Residual	65.13	28	2.33		
Total	121.22	31	3.91		

Two-way ANOVA table for effects of logging history and forest moisture on numbers of individuals *Antechinus stuartii*.

Sources of Variation	Sum of Squares	DF	Mean Square	F	P
Logging History	7.73	1	7.73	0.84	0.378
Forest Moisture	15.73	1	15.73	1.71	0.216
Residual	110.58	12	9.22		
Total	135.73	14	9.69		

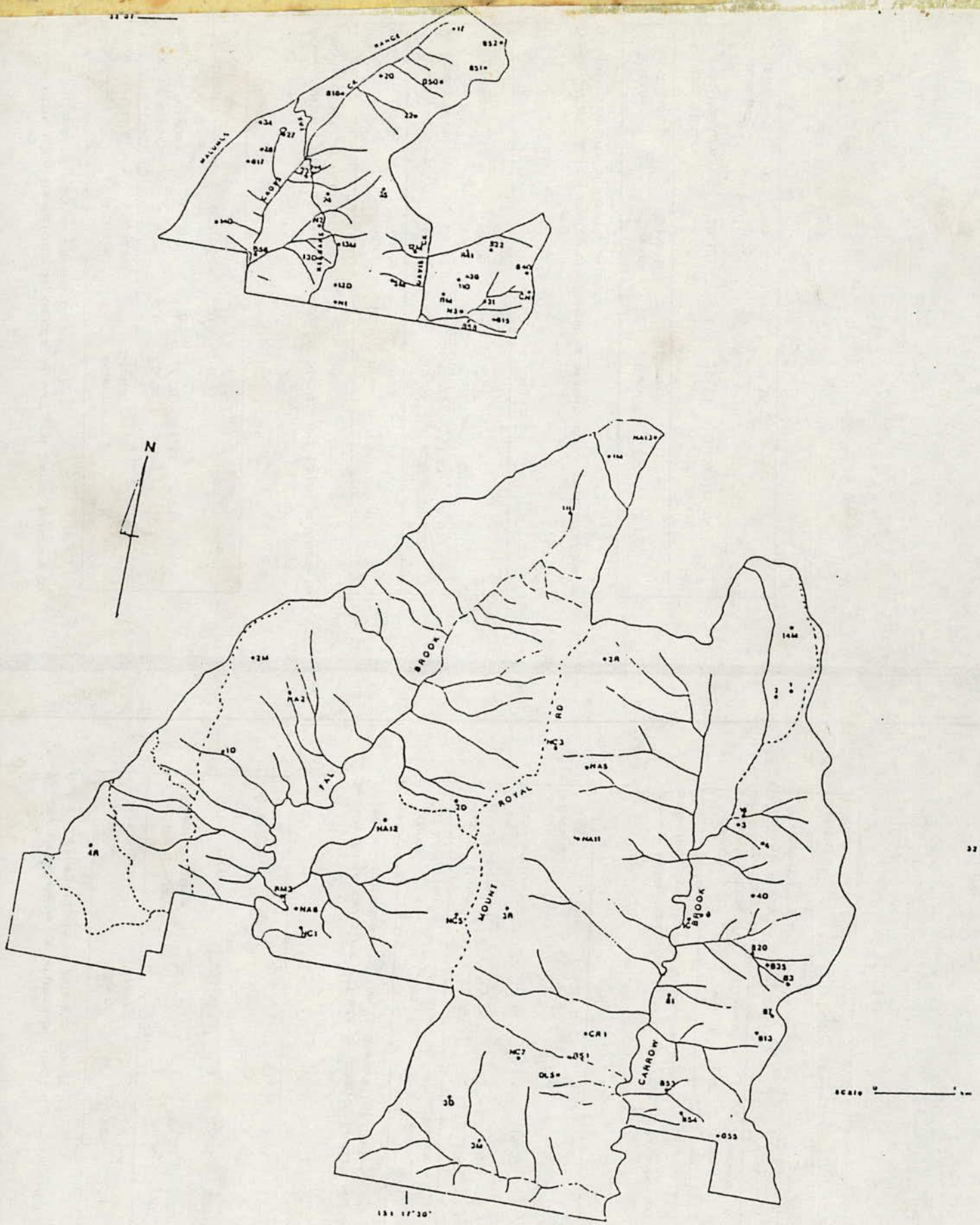

Figure 1. Flora survey Mount Royal M.A.

Approx. locations of survey plots

adjacent to rainforest, there is a dense to closed understorey of tall shrubs and this unit grades into, and would be most appropriately mapped as, unit Yh. Low closed forest of *Melaleuca stypheliodes* or *Leptospermum polygalifolium* occurs as small, linear stands along some creeks in gently sloping areas of poor drainage. *Carex appressa*, *C. longebrachiata* and *Juncus* spp. may be locally common in minor drainage depressions, and there are several more extensive areas (>1ha) of impeded drainage which are sedgelands with only scattered, stunted trees.

Eucalyptus obliqua becomes increasingly dominant (and *E. saligna* less frequent) at higher altitudes, where this unit overlaps with Ne' and should perhaps be mapped as such. At lower altitudes, *E. campanulata* or *E. canaliculata* may be locally dominant and Na' grades into either Nc' or Dl respectively.

Na⁻ This unit is similar to Na' but generally has a lower canopy height (usually <30m) and tends to occur on drier sites. Understorey structure and floristics are very similar. *Eucalyptus saligna* is less frequent in the overstorey while *E. campanulata* and *E. canaliculata* are more frequent. This unit is intermediate between typical Na' and Dl and grades into both.

Nb' A tall open forest dominated by *Eucalyptus laevopinea*, with or without *E. saligna*, with grassy understorey. As mapped, this unit is not distinct from Na'.

Nb⁻ A minor variant of Nb' on slightly drier sites, with slightly lower canopy height. Not distinct from Na'.

Nc' A tall (35m) open forest floristically very similar to typical Na'. *Eucalyptus campanulata* tends to be more prominent in the overstorey and may be locally dominant, but is absent from some stands.

Nc⁻ In Fal Brook and Carrow Brook catchments, this is a grassy open forest (up to 35m tall) in which *Eucalyptus campanulata* is usually prominent. It grades into Dl on drier sites, with increasing frequency of *E. eugenioides*, *E. canaliculata* and *E. acmenoides*. In Davis Creek area it is a taller, slightly more mesic forest in which *E. laevopinea* or *E. obliqua* are dominant and which is intermediate between Na' and Ne'.

Ne' Tall open forest of *E. obliqua* (35m) with dense grassy understorey dominated by *Poa sieberiana* and *Lomandra longifolia*.

Ne⁻ Very similar to Ne', but with generally lower canopy height (usually <30m).

Ng⁻ A map unit of very limited extent, occurring in two separate small patches in the Davis Creek area. The more southerly patch is almost exclusively *E. obliqua* with scattered or occasionally locally common

E. nobilis, and is not distinct from Ne⁻. The more northerly patch is a woodland of *E. obliqua* with *E. pauciflora*, which is otherwise floristically very similar to Ne⁻.

Dh Open forest of very mixed canopy composition and variable canopy height, usually below 35m but up to 45m on favourable sites. Canopy species include *Eucalyptus saligna*, *E. acmenoides*, *E. eugenioides* and *E. canaliculata*. There is usually a sparse to moderately dense shrub stratum of *Acacia irrorata* or *A. maidenii*, with a grassy ground cover. Limited areas on lower slopes adjacent to rainforest have a more well developed understorey of tall shrubs or small trees of *A. irrorata*, *Callistemon salignus* or *Melaleuca styphelioides*. This unit grades into Dl and to some extent, Na'. It usually has a more mesic shrubby understorey than Dl.

Dl Open forest (mostly <30m tall) of mixed canopy composition, occurring mainly on drier sites at low altitudes. Typical canopy species include *Eucalyptus canaliculata*, *E. campanulata*, *E. eugenioides* and *E. acmenoides*. *E. saligna* and *E. laevopinea* may be locally common, especially on more mesic sites where this type grades into typical Na'. *Allocasuarina torulosa* invariably occurs as a subcanopy species, often with *Angophora floribunda*. Understorey is grassy with sparse or absent shrub layer, common ground cover species being *Poa labillardieri*, *Imperata cylindrica*, *Lomandra longifolia*, *Dianella caerulea*, *Dichondra repens* and *Glycine clandestina*.

Gm Open forest (up to 35m tall) dominated by *Eucalyptus canaliculata* with a subcanopy of *Angophora floribunda* and *Allocasuarina torulosa*, representing the drier end of the open forest gradient in the area. Overlaps with Dh, Dl and to a lesser extent, Na' and Nc⁻ on drier, low altitude sites.

Cn This map unit which occurs as several small patches includes two different grassland vegetation types. Trees and shrubs are absent or rare. On very steep upper slopes at high altitudes it is floristically very similar to the understorey of units Ne⁻ and Nc⁻. The patch on gentle slopes north-west of Mount Carrow differs in being an area of impeded drainage on a basalt bench. Species of Cyperaceae and Juncaceae are more abundant and there are several small swamps. These were not sampled.

Cr This is a distinct unit occurring as a single discrete patch. It is a mosaic of shrub thickets (mostly <3m tall) and bare rock. The shrub thickets are variously dominated by *Leptospermum variabile*, *Baeckea* sp. aff. *diosmifolia* and *Plectranthus graveolens*, with a ground cover of *Lepidosperma laterale*.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Pollia crispata	5	.	.	.	.	0.67	.	.	0.25	0.50	.
Polygala veronicea	1	0.03	.	.	.	.	.	.	.	.	.
Polyosma cunninghamii	7	.	.	.	.	.	.	0.67	0.63	.	.
Polyscias murrayi	2	.	.	.	0.17	.	.	.	0.13	.	.
Polyscias sambucifolia	9	0.18	0.10	.	0.17	.	.	.	.	.	.
Polystichum australiense	1	.	.	.	.	.	.	.	.	0.50	.
Polystichum fallax	12	0.21	0.10	0.50	0.33	.	.	.	.	.	.
Polystichum proliferum	3	.	0.20	.	.	.	.	.	.	.	1.00
Poranthera microphylla	15	0.18	0.70	.	0.17	.	.	.	.	.	.
Pratia pedunculata	1	0.03	.	.	.	.	.	.	.	.	.
Pratia purpurascens	41	0.72	0.90	1.00	0.17	.	1.00	.	.	.	.
Prunella vulgaris	5	0.08	.	1.00	.	.	.	.	.	.	.
Psychotria loniceroides	19	0.21	.	.	0.33	1.00	.	.	0.75	.	.
Pteridium esculentum	50	0.85	0.80	1.00	1.00	.	.	.	.	.	.
Pteris tremula	13	0.21	.	.	0.33	0.67	.	.	.	0.50	.
Pteris umbrosa	10	.	.	.	.	0.33	.	0.33	0.88	0.50	.
Pterostylis coccinea	2	.	0.20	.	.	.	.	.	.	.	.
Pterostylis curta	5	0.10	0.10	.	.	.	.	.	.	.	.
Pterostylis decurva	7	0.05	0.50	.	.	.	.	.	.	.	.
Pterostylis longifolia	1	.	0.10	.	.	.	.	.	.	.	.
Pterostylis nutans	1	.	0.10	.	.	.	.	.	.	.	.
Pyrrosia confluens	11	0.03	.	.	0.17	1.00	.	.	0.50	1.00	.
Pyrrosia rupestris	17	0.26	0.10	.	0.17	0.67	.	.	0.25	.	1.00
Quintinia sieberi	1	.	.	.	.	.	.	.	.	.	1.00
Ranunculus plebeius	22	0.26	0.90	1.00	0.17	.	.	.	.	.	.
Rapanea howittiana	4	.	0.10	.	0.33	.	.	.	0.13	.	.
Rapanea variabilis	17	0.23	0.10	.	0.50	1.00	.	0.33	.	.	.
Rhodamnia rubescens	6	0.08	.	.	.	1.00	.	.	.	.	.
Ripogonum album	7	.	.	.	.	.	.	.	0.63	1.00	.
Ripogonum discolor	1	.	.	.	.	.	.	0.33	.	.	.
Ripogonum fawcettianum	1	.	.	.	.	.	.	.	.	0.50	.
Rubus hillii	3	0.03	.	.	.	.	.	.	.	1.00	.
Rubus parvifolius	38	0.74	0.40	0.50	0.50	.	.	.	.	.	.
Rubus rosifolius	20	0.26	0.10	0.50	0.83	0.67	.	.	.	0.50	.
Rubus sp. aff. moorei	1	.	.	.	.	.	.	.	0.13	.	.
Rumex brownii	10	0.21	.	0.50	0.17	.	.	.	.	.	.
Sambucus australasica	2	.	.	.	.	.	.	.	0.25	.	.
Sarcochilus falcatus	15	0.08	.	.	0.17	0.67	.	0.33	0.63	1.00	1.00
Sarcochilus olivaceus	1	.	.	.	.	.	.	.	0.13	.	.
Sarconelicope simplicifolia	1	.	.	.	.	.	.	.	0.13	.	.
Sarcopetalum harveyanum	4	0.03	.	.	.	0.67	.	.	0.13	.	.
Scaevola albida	1	0.03	.	.	.	.	.	.	.	.	.
Schizoneria ovata	7	.	0.10	.	0.17	0.67	.	0.67	0.13	.	.
Schoenus apogon	7	0.05	0.30	1.00	.	.	.	.	.	.	.
Scleranthus biflorus	3	0.05	0.10	.	.	.	.	.	.	.	.
Scutellaria humilis	4	0.05	0.10	.	0.17	.	.	.	.	.	.
Scutellaria mollis	1	.	.	.	0.17	.	.	.	.	.	.
Senecio amygdalifolius	15	0.21	0.20	.	0.67	0.33	.	.	.	.	.
Senecio biserratus	1	0.03	.	.	.	.	.	.	.	.	.
Senecio hispidulus	10	0.18	0.20	.	0.17	.	.	.	.	.	.
Senecio lautus ssp. aff. maritimus	3	.	0.30	.	.	.	.	.	.	.	.
Senecio linearifolius	11	0.15	0.20	.	0.50	.	.	.	.	.	.
Senecio macranthus	3	0.08	.	.	.	.	.	.	.	.	.
Senecio minimus	6	0.08	.	0.50	0.33	.	.	.	.	.	.
Senecio sp. B (aff.spargiaefolius)	20	0.28	0.90	.	.	.	.	.	.	.	.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Microlaena stipoides	19	0.33	0.40	.	0.33	.	.	.	.	.	.
Microsorium diversifolium	1	.	.	.	.	.	.	.	0.13	.	.
Microsorium scandens	11	.	.	.	.	0.67	.	0.33	0.88	.	1.00
Microtis sp.	1	0.03	.	.	.	.	.	.	.	.	.
Mischocarpus australis	7	.	.	.	.	0.33	.	0.33	0.63	.	.
Morinda jasminoides	12	0.03	.	.	0.17	0.67	.	.	0.88	0.50	.
Myosotis suaveolens	2	.	0.20	.	.	.	.	.	.	.	.
Neolitsea australiensis	1	.	.	.	.	0.33	.	.	.	.	.
Neolitsea dealbata	10	.	.	.	0.17	0.33	.	0.67	0.63	0.50	.
Notelaea longifolia	5	.	0.10	.	0.17	.	.	.	.	1.00	1.00
Notelaea venosa	1	0.03	.	.	.	.	.	.	.	.	.
Nothofagus moorei	1	.	.	.	.	.	.	.	.	.	1.00
Olearia oppositifolia	3	0.03	0.20	.	.	.	.	.	.	.	.
Omalanthus populifolius	1	.	.	.	0.17	.	.	.	.	.	.
Opercularia aspera	3	0.05	.	.	.	.	1.00	.	.	.	.
Oplismenus imbecillus	34	0.62	0.10	.	1.00	0.33	.	.	.	1.00	.
Oreomyrrhis eriopoda	4	.	0.40	.	.	.	.	.	.	.	.
Orites excelsa	6	.	.	.	0.17	.	.	1.00	0.13	.	1.00
Oxalis ?radicosa	3	0.05	0.10	.	.	.	.	.	.	.	.
Oxylobium ilicifolium	3	0.05	0.10	.	.	.	.	.	.	.	.
Palmeria scandens	8	.	.	.	.	0.33	.	0.67	0.63	.	.
Pandorea pandorana	28	0.33	0.30	.	0.50	0.67	.	0.67	0.50	0.50	.
Papillilabium beckleri	3	0.03	.	.	.	0.33	.	.	.	0.50	.
Pararchidendron pruinosum	2	.	.	.	.	.	.	.	0.25	.	.
Parsonsia brownii	1	.	.	.	.	.	.	.	.	.	1.00
Parsonsia species A	1	.	.	.	.	.	.	.	.	0.50	.
Parsonsia straminea	17	0.13	.	.	0.33	1.00	.	0.67	0.63	.	.
Parsonsia velutina	6	.	.	.	.	.	.	.	0.75	.	.
Paspalum dilatatum	1	.	.	0.50	.	.	.	.	.	.	.
Pellaea falcata var. falcata	23	0.36	0.10	.	0.67	0.67	.	.	.	1.00	.
Pellaea falcata var. nana	6	.	.	.	.	0.33	.	.	0.50	0.50	.
Pellaea paradoxa	1	0.03	.	.	.	.	.	.	.	.	.
Pennantia cunninghamii	12	.	.	.	0.17	.	.	0.67	1.00	0.50	.
Pennisetum alopecuroides	1	.	.	0.50	.	.	.	.	.	.	.
Peperomia tetraphylla	1	.	.	.	.	.	.	.	0.13	.	.
Persicaria decipiens	2	0.03	.	0.50	.	.	.	.	.	.	.
Persoonia linearis	14	0.33	.	.	.	.	.	.	.	.	.
Phragmites australis	1	.	.	0.50	.	.	.	.	.	.	.
Phyllanthus gasstroemii	3	.	.	.	0.17	.	1.00	.	.	0.50	.
Phyllanthus similis	1	.	0.10	.	.	.	.	.	.	.	.
Phytolacca octandra	1	0.03	.	.	.	.	.	.	.	.	.
Picris hieracioides	14	0.13	0.80	.	0.17	.	.	.	.	.	.
Pimelea ligustrina ssp. ligustrina	2	.	.	.	0.17	0.33	.	.	.	.	.
Piper novae-hollandiae	6	.	.	.	.	0.33	.	.	0.63	.	.
Pittosporum revolutum	8	0.18	.	.	0.17	.	.	.	.	.	.
Pittosporum undulatum	7	0.08	0.10	.	0.33	0.33	.	.	.	.	.
Planchonella australis	2	.	.	.	.	0.33	.	.	0.13	.	.
Plantago debilis	27	0.46	0.80	.	0.17	.	.	.	.	.	.
Platycerium bifurcatum	12	0.13	.	.	.	0.33	.	0.33	0.50	0.50	.
Platysace lanceolata	2	0.03	.	.	.	.	1.00	.	.	.	.
Plectorhiza tridentata	2	0.03	.	.	.	.	.	.	0.13	.	.
Plectranthus graveolens	1	.	.	.	.	.	1.00	.	.	.	.
Plectranthus parviflorus	28	0.56	0.10	.	0.50	.	.	.	.	0.50	.
Poa labillardieri	59	0.97	1.20	1.00	0.67	.	1.00	.	.	0.50	.
Poa sieberiana	4	.	0.40	.	.	.	.	.	.	.	.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Haloragis ?serra	1	0.03	.	.	.	.	.	.	.	.	.
Hardenbergia violacea	26	0.51	0.50	.	.	.	.	.	.	.	.
Hedycarya angustifolia	5	.	0.20	.	0.50	.	.	.	.	.	.
Helichrysum apiculatum	1	.	0.10	.	.	.	.	.	.	.	.
Helichrysum bracteatum	11	0.15	0.40	.	0.17	.	.	.	.	.	.
Helichrysum diosmifolium	2	0.05	.	.	.	.	.	.	.	.	.
Helichrysum elatum	2	0.03	.	.	.	.	1.00	.	.	.	.
Helichrysum rufescens	11	0.15	0.10	.	0.50	.	.	.	.	0.50	.
Helichrysum scorpioides	1	.	0.10	.	.	.	.	.	.	.	.
Helipterum anthemoides	3	0.03	0.20	.	.	.	.	.	.	.	.
Hibbertia dentata	15	0.31	0.10	.	0.33	.	.	.	.	.	.
Hibbertia scandens	36	0.67	0.40	.	1.00	.	.	.	.	.	.
Hibiscus heterophyllus	1	0.03	.	.	.	.	.	.	.	.	.
Histiopteris incisa	1	.	.	.	.	.	.	.	.	.	.
Hydrocotyle acutiloba	40	0.56	1.00	.	1.17	.	.	.	.	.	1.00
Hydrocotyle geraniifolia	1	0.03	.	.	.	.	.	.	.	.	.
Hydrocotyle pedunclaris	8	0.10	0.20	1.00	.	.	.	.	.	.	.
Hydrocotyle tripartita	3	0.03	.	.	.	.	.	.	.	.	.
Hymenanthera dentata	10	0.15	.	.	0.17	.	.	.	0.13	1.00	.
Hymenosporum flavum	7	.	0.10	.	0.17	0.33	.	.	0.25	1.00	.
Hypericum gramineum	16	0.28	0.20	.	0.33	.	1.00	.	.	.	.
Hypochoeris radicata	21	0.28	0.90	0.50	.	.	.	.	.	.	.
Hypolepis glandulifera	8	0.03	0.10	0.50	0.67	0.33	.	.	.	.	.
Imperata cylindrica var. major	33	0.59	0.20	1.00	0.67	.	1.00	.	.	.	.
Indigofera australis var. australis	16	0.31	0.20	.	0.17	.	.	.	.	.	.
Juncus filicaulis	2	0.03	.	0.50	.	.	.	.	.	.	.
Juncus homalocaulis	1	0.03	.	.	.	.	.	.	.	.	.
Juncus pauciflorus	14	0.21	.	1.00	0.33	.	.	.	.	.	.
Juncus prismatocarpus	1	.	.	0.50	.	.	.	.	.	1.00	.
Juncus sarophorus	6	0.08	.	1.00	0.17	.	.	.	.	.	.
Kennedia rubicunda	11	0.28	.	.	.	.	.	.	.	.	.
Lagenifera stipitata	9	0.13	0.30	.	.	.	1.00	.	.	.	.
Lastreopsis acuminata	4	.	.	.	.	.	.	.	0.50	.	.
Lastreopsis decomposita	8	.	.	.	.	0.33	.	1.00	0.38	0.50	.
Lastreopsis microsora	5	.	.	.	.	.	.	.	0.50	0.50	.
Lastreopsis munita	1	.	.	.	.	.	.	.	0.13	.	.
Lepidosperma laterale	23	0.36	0.60	.	0.33	.	1.00	.	.	.	.
Leucopogon fraseri	2	.	0.20	.	.	.	.	.	.	.	.
Leucopogon lanceolatus	13	0.08	0.90	.	0.17	.	.	.	.	.	.
Libertia paniculata	1	0.03	.	.	.	.	.	.	.	.	.
Litsea reticulata	3	0.03	.	.	.	0.33	.	.	0.13	.	.
Livistona australis	1	.	.	.	.	.	.	.	0.13	.	.
Logania albiflora	1	.	.	.	.	.	1.00	.	.	.	.
Lomandra filiformis	1	0.03	.	.	.	.	.	.	.	.	.
Lomandra hystrix	1	.	.	.	.	.	.	.	.	.	.
Lomandra longifolia	55	0.95	1.00	1.00	0.67	.	1.00	.	0.50	.	.
Lomandra spicata	16	.	.	.	0.17	1.00	.	1.00	1.00	1.00	.
Luzula meridionalis	10	0.08	0.70	.	.	.	.	.	.	.	.
Maclura cochinchinensis	4	.	.	.	0.17	0.33	.	.	0.13	0.50	.
Malaisia scandens	5	.	.	.	.	0.33	.	.	0.50	.	.
Marsdenia rostrata	6	0.05	.	.	0.17	0.33	.	.	0.13	0.50	.
Marsdenia suberosa	2	0.03	.	.	.	.	.	.	0.13	.	.
Maytenus silvestris	1	0.28	.	.	0.17	.	.	.	.	.	.
Melaleuca styphelioides	3	0.08	.	.	.	.	.	.	.	.	.
Mentha dienenica	10	0.26	.	.	.	.	.	.	.	.	.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Elaeocarpus kirtonii	1	.	.	.	.	.	.	.	0.13	.	.
Elaeocarpus obovatus	1	.	.	.	0.17	.	.	.	.	.	.
Elaeocarpus reticulatus	2	0.05	.	.	.	.	.	.	.	.	.
Elatostema reticulatum	6	.	.	.	0.17	.	.	.	0.38	1.00	.
Elattostachys nervosa	1	.	.	.	.	.	.	0.33	.	.	.
Elymus scaber var. scaber	10	0.15	0.40	.	.	.	.	.	.	.	.
Embelia australiana	2	.	.	.	.	.	.	.	0.25	.	.
Endiandra sieberi	4	0.03	.	.	0.17	0.33	.	.	0.13	.	.
Entolasia marginata	3	0.05	.	.	0.17	.	.	.	.	.	.
Entolasia stricta	2	0.03	.	.	.	.	1.00	.	.	.	.
Epilobium billardieranum ssp. hydrophilum	1	0.03	.	0.50	.	.	.	.	.	.	.
Eragrostis leptostachya	1	.	.	.	.	.	1.00	.	.	.	.
Eucalyptus acmenioides	5	0.13	.	.	.	.	.	.	.	.	.
Eucalyptus campanulata	20	0.36	.	.	0.50	0.67	.	.	.	.	.
Eucalyptus canaliculata	19	0.44	.	.	0.17	.	.	.	.	.	.
Eucalyptus eugenioides	14	0.36	.	.	.	.	.	.	.	.	.
Eucalyptus laeropirea	32	0.54	0.60	.	0.50	0.67	.	.	.	.	.
Eucalyptus microcorys	1	0.03	.	.	.	.	.	.	.	.	.
Eucalyptus nobilis	7	0.10	0.10	1.00	.	.	.	.	.	.	.
Eucalyptus obliqua	9	0.03	0.80	.	.	.	.	.	.	.	.
Eucalyptus pauciflora	1	.	0.10	.	.	.	.	.	.	.	.
Eucalyptus quadrangulata	7	0.13	0.20	.	.	.	.	.	.	.	.
Eucalyptus resinifera	1	.	.	.	.	.	.	.	0.13	.	.
Eucalyptus saligna	36	0.64	.	.	1.00	1.00	.	.	0.13	0.50	.
Eucalyptus tereticornis	4	0.08	.	.	.	.	1.00	.	.	.	.
Euodia micrococca	9	0.05	.	.	0.33	0.67	.	0.33	0.13	0.50	.
Euponatia laurina	11	0.03	.	.	0.17	1.00	.	0.33	0.63	.	.
Eustrephus latifolius	26	0.46	0.20	.	0.83	0.33	.	.	.	.	.
Exocarpos cupressiformis	1	0.03	.	.	.	.	.	.	.	.	.
Ficus coronata	7	.	.	.	.	.	.	.	0.63	1.00	.
Ficus obliqua	2	.	.	.	.	.	.	.	0.25	.	.
Gahnia melanocarpa	9	0.13	.	.	0.50	0.33	.	.	.	.	.
Gahnia sieberana	2	0.05	.	.	.	.	.	.	.	.	.
Galium binifolium	3	.	0.20	.	0.17	.	.	.	.	.	.
Galium gaudichaudii	1	0.03	.	.	.	.	.	.	.	.	.
Galium spp.	36	0.64	0.80	0.50	0.33	.	.	.	.	.	.
Geitonoplesium cymosum	19	0.26	0.10	.	0.67	0.67	.	.	.	1.00	.
Genoplesium sp.	1	.	0.10	.	.	.	.	.	.	.	.
Geranium neglectum	1	.	.	0.50	.	.	.	.	.	.	.
Geranium potentilloides	40	0.62	0.90	1.00	0.50	.	.	.	.	1.00	.
Geranium solanderi	6	0.10	0.20	.	.	.	.	.	.	.	.
Glyceria australis	1	.	.	0.50	.	.	.	.	.	.	.
Glycine clandestina	53	0.87	1.00	.	1.00	.	1.00	.	.	0.50	.
Gmelina leichhardtii	1	.	.	.	.	0.33	.	.	.	.	.
Gnaphalium gymnocephalum	22	0.36	0.70	0.50	.	.	.	.	.	.	.
Gnaphalium sphaericum	1	0.03	.	.	.	.	.	.	.	.	.
Gonphocarpus sp.	5	0.10	.	.	0.17	.	.	.	.	.	.
Gonocarpus humilis	26	0.44	0.80	.	0.17	.	.	.	.	.	.
Goodenia ovata	1	.	.	.	0.17	.	.	.	.	.	.
Gratiola latifolia	3	.	.	0.50	0.17	.	.	.	.	0.50	.
Guioa semiglauca	13	0.10	.	.	0.33	0.67	.	0.67	0.25	0.50	.
Gymnostachys anceps	19	0.15	.	.	0.33	0.67	.	0.33	0.75	1.00	.
Hakea eriantha	1	.	0.10	.	.	.	.	.	.	.	.
Haloragis heterophylla	18	0.33	0.20	1.00	0.17	.	.	.	.	.	.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Cryptocarya obovata	7	.	.	.	.	0.67	.	0.33	0.38	0.50	.
Cyathea australis	1	.	.	.	0.17	.	.	.	.	.	.
Cyathea leichhardtiana	2	.	.	.	.	.	.	0.67	.	.	.
Cymbidium suave	6	0.15	.	.	.	.	.	.	.	.	.
Cymbopogon refractus	3	0.08	.	.	.	.	.	.	.	.	.
Cynoglossum australe	3	0.05	0.10	.	.	.	.	.	.	.	.
Cynoglossum latifolium	27	0.41	0.20	0.50	1.00	0.33	.	.	.	0.50	.
Cynoglossum suaveolens	1	0.03	.	0.50	.	.	.	.	.	.	.
Cyperus enervis	3	0.05	.	.	.	.	.	.	.	0.50	.
Cyperus flaccidus	1	0.03	.	.	.	.	.	.	.	.	.
Cyperus imbecillis	13	0.23	0.10	.	0.50	.	.	.	.	.	.
Cyperus lhotskyanus	2	0.03	.	0.50	.	.	.	.	.	.	.
Cyperus lucidus	5	0.05	.	1.00	.	.	.	.	.	0.50	.
Cyperus tetraphyllus	9	0.03	.	.	0.17	1.00	.	.	0.25	1.00	.
Danthonia laevis	1	.	0.10	.	.	.	.	.	.	.	.
Danthonia longifolia	2	0.05	.	.	.	.	.	.	.	.	.
Danthonia racemosa	13	0.26	0.30	.	.	.	.	.	.	.	.
Daphandra micrantha	20	0.05	0.10	.	0.33	1.00	.	0.67	1.00	1.00	.
Daucus glochidiatus	3	0.08	.	.	.	.	.	.	.	.	.
Davallia pyxidata	2	0.03	.	.	.	0.33	.	.	.	.	.
Deeringia amaranthoides	2	.	.	.	0.17	.	.	.	.	0.50	.
Dendrobium fairfaxii	3	.	.	.	.	0.33	.	.	0.25	.	.
Dendrobium gracilicaule	1	.	.	.	.	.	.	.	0.13	.	.
Dendrobium mortii	1	.	.	.	.	.	.	.	0.13	.	.
Dendrobium pugioniforme	7	.	.	.	.	0.33	.	0.33	0.50	.	1.00
Dendrobium tarberi	3	.	.	.	.	.	.	.	0.13	1.00	.
Dendrocnide excelsa	9	.	.	.	0.17	.	.	0.33	0.75	0.50	.
Dennstaedtia davallioides	10	.	.	.	0.33	1.00	.	.	0.25	1.00	1.00
Desmodium brachypodum	1	0.03	.	.	.	.	.	.	.	.	.
Desmodium rhytidophyllum	3	0.08	.	.	.	.	.	.	.	.	.
Desmodium varians	50	0.87	1.00	0.50	0.67	.	.	.	.	.	.
Deyeuxia quadriseta	1	.	0.10	.	.	.	.	.	.	.	.
Dianella caerulea	46	0.82	0.80	.	0.83	.	.	.	.	.	.
Dianella longifolia	2	0.03	0.10	.	.	.	.	.	.	.	.
Dianella revoluta	2	0.05	.	.	.	.	.	.	.	.	.
Dianella tasmanica	7	0.08	0.30	0.50	.	.	.	.	.	.	.
Dichelachne micrantha	6	0.08	0.30	.	.	.	.	.	.	.	.
Dichelachne rara	3	.	0.30	.	.	.	.	.	.	.	.
Dichondra repens	43	0.79	0.80	.	0.67	.	.	.	.	.	.
Dicksonia antarctica	2	.	.	.	.	.	.	.	0.13	.	1.00
Dictymia brownii	4	.	.	.	.	.	.	.	0.50	.	.
Digitaria parviflora	1	0.03	.	.	.	.	.	.	.	.	.
Dioscorea transversa	16	0.10	.	.	0.67	1.00	.	.	0.38	1.00	.
Diospyros australis	14	0.05	.	.	0.33	1.00	.	.	0.63	1.00	.
Diospyros pentamera	8	.	.	.	.	.	.	1.00	0.63	.	.
Diplazium assimile	2	.	.	.	.	.	.	.	0.25	.	.
Diploglottis australis	12	0.03	.	.	0.17	0.67	.	1.00	0.63	.	.
Dipodium variegatum	4	0.10	.	.	.	.	.	.	.	.	.
Doodia aspera	40	0.56	0.20	.	0.83	1.00	.	0.33	0.63	1.00	.
Doodia caudata	3	0.08	.	.	.	.	.	.	.	.	.
Doodia media	2	0.03	.	.	0.17	.	.	.	.	.	.
Doryphora sassafras	14	.	.	.	0.33	0.33	.	1.00	0.88	.	1.00
Dysoxylum fraserianum	13	0.03	.	.	.	0.33	.	1.00	1.00	.	.
Echinopogon ovatus	26	0.41	0.60	.	0.50	.	.	.	.	0.50	.
Ehretia acuminata	4	.	.	.	0.17	.	.	.	0.25	0.50	.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Botrychium australe	2	0.05	.	.	.	.	.	.	.	.	.
Brachychiton acerifolius	6	.	.	.	.	.	.	0.33	0.63	.	.
Brachycome microcarpa	14	0.15	0.80	.	.	.	.	.	.	.	.
Breynia oblongifolia	14	0.31	.	.	0.17	.	.	.	.	0.50	.
Caldcluvia paniculosa	12	0.03	.	.	0.17	0.67	.	1.00	0.63	.	.
Callicoma serratifolia	1	.	.	.	0.17	.	.	.	.	.	.
Callistemon salignus	4	0.05	.	.	.	0.33	1.00	.	.	.	.
Callitriche muelleri	2	.	.	.	0.17	.	.	.	.	0.50	.
Calochlaena dubia	8	0.05	.	.	0.67	0.33	.	.	.	0.50	.
Canthium coprosmoides	2	.	.	.	.	.	.	.	0.25	.	.
Cardamine paucijuga	4	0.10	.	.	.	.	.	.	.	.	.
Cardamine sp. T	7	0.05	0.50	.	.	.	.	.	.	.	.
Carex appressa	18	0.26	0.10	1.00	0.67	.	.	.	.	0.50	.
Carex breviculmis	3	0.05	0.10	.	.	.	.	.	.	.	.
Carex declinata	1	.	0.10	.	.	.	.	.	.	.	.
Carex fascicularis	1	.	.	0.50	.	.	.	.	.	.	.
Carex hattoriana	3	.	.	.	.	.	.	.	0.25	0.50	.
Carex inversa	27	0.41	0.70	0.50	0.33	.	.	.	.	0.50	.
Carex lobolepis	1	.	.	0.50	.	.	.	.	.	.	.
Carex longebrachiata	11	0.15	.	0.50	0.50	.	.	.	.	0.50	.
Cassine australis	4	.	.	.	.	.	.	0.33	0.38	.	.
Cassinia compacta	8	0.15	0.10	.	0.17	.	.	.	.	.	.
Casuarina cunninghamiana	2	.	.	.	.	.	.	.	.	1.00	.
Cayratia clematidea	4	0.08	.	.	0.17	.	.	.	.	.	.
Celastrus australis	3	0.03	.	.	.	.	.	.	0.13	0.50	.
Centaurium erythraea	1	0.03	.	.	.	.	.	.	.	.	.
Centella asiatica	2	0.05	.	.	.	.	.	.	.	.	.
Cephalaralia cephalobotrys	6	.	.	.	.	0.67	.	.	0.38	0.50	.
Cerastium glomeratum	1	0.03	.	.	.	.	.	.	.	.	.
Cheilanthes austrotenuifolia	1	0.03	.	.	.	.	.	.	.	.	.
Cheilanthes sieberi	1	.	.	.	.	.	1.00	.	.	.	.
Chiloglottis gunnii	1	.	0.10	.	.	.	.	.	.	.	.
Chiloglottis spp.	4	0.03	0.30	.	.	.	.	.	.	.	.
Christella dentata	1	.	.	.	.	.	.	.	.	0.50	.
Cirsium vulgare	27	0.51	0.30	1.00	0.33	.	.	.	.	.	.
Cissus antarctica	19	0.13	.	.	0.50	0.67	.	0.33	0.75	1.00	.
Cissus hypoglauca	21	0.26	.	.	0.33	0.67	.	0.33	0.50	1.00	.
Citriobatus pauciflorus	19	0.05	.	.	0.17	1.00	.	1.00	1.00	1.00	.
Citronella moorei	5	.	.	.	.	.	.	.	0.63	.	.
Claoxylon australe	2	.	.	.	.	0.33	.	0.33	0.13	0.50	.
Clematis aristata	30	0.49	0.70	.	0.50	0.33	.	.	.	.	.
Clematis glycinoides	2	.	.	.	0.17	0.33	.	.	.	.	.
Clerodendrum floribundum	1	.	.	.	.	0.33	.	.	.	.	.
Clerodendrum tomentosum	1	0.03	.	.	.	.	.	.	.	.	.
Commelina cyanea	4	0.05	.	.	0.17	.	.	.	.	0.50	.
Conyza albida	13	0.28	0.10	.	0.17	.	.	.	.	.	.
Coprosma quadrifida	12	0.10	0.50	.	0.33	.	.	.	.	.	1.00
Correa reflexa	1	.	.	.	.	.	1.00	.	.	.	.
Corybas sp.	1	.	0.10	.	.	.	.	.	.	.	.
Crassula sieberiana	6	0.08	0.30	.	.	.	.	.	.	.	.
Croton verreauxii	2	0.03	.	.	.	.	.	.	0.13	.	.
Cryptocarya erythroxylon	5	.	.	.	.	0.33	.	.	0.50	.	.
Cryptocarya foveolata	3	.	.	.	.	.	.	0.33	0.25	.	.
Cryptocarya glaucescens	11	.	.	.	0.33	1.00	.	0.67	0.38	0.50	.
Cryptocarya microneura	9	0.08	.	.	.	1.00	.	.	0.25	0.50	.

Appendix 2. Frequency of occurrence of vascular plant species in floristic communities. Species are listed alphabetically.
Frequencies shown under each community are the proportion of plots within the community in which the species was recorded.
. = not recorded in that community.

	Tot. Freq.	Community number 1 (39)	2 (10)	3 (2)	4 (6)	5 (3)	6 (1)	7 (3)	8 (8)	9 (2)	10 (1)
Acacia implexa	1	0.03	.	.	.	.	.	.	.	.	.
Acacia irrorata	11	0.13	.	.	.	.	.	.	.	.	.
Acacia maidenii	23	0.41	0.30	.	0.33	0.33	1.00	.	.	.	.
Acacia melanoxylon	12	0.13	0.50	0.50	0.67	.	.	.	.	0.50	.
Acaena novae-zelandiae	29	0.54	0.40	1.00	.	0.33	.	.	.	.	.
Acianthus fornicatus	4	0.05	0.20	.	0.33	.	.	.	.	.	.
Acmena smithii	15	.	.	.	.	.	.	.	.	.	.
Acronychia oblongifolia	3	0.03	.	.	0.50	1.00	.	0.67	0.75	0.50	.
Adiantum aethiopicum	17	0.33	0.10	.	.	.	.	0.67	.	.	.
Adiantum diaphanum	1	.	.	.	0.33	.	.	.	.	0.50	.
Adiantum formosum	19	0.13	0.10	.	.	.	.	.	0.13	.	.
Adiantum hispidulum	3	0.05	.	.	0.17	0.67	.	0.33	0.88	1.00	.
Ageratina adenophora	1	.	.	.	.	.	.	.	0.13	.	.
Agrostis aemula	2	.	0.20	.	.	.	.	.	.	0.50	.
Agrostis avenacea var. avenacea	5	0.08	0.10	0.50	.	.	.	.	.	.	.
Ajuga australis	3	0.05	0.10	.	.	.	.	.	.	.	.
Alangium villosum ssp. polyosmoides	8	.	.	.	.	.	.	.	.	.	.
Alectryon subcinereus	12	.	.	.	.	.	.	0.33	0.88	.	.
Allocasuarina torulosa	32	0.74	.	.	.	0.67	.	0.67	0.75	1.00	.
Alyxia ruscifolia	1	.	.	.	0.33	.	.	.	.	.	.
Amaobium alatum	1	.	0.10	.	.	.	.	.	0.13	.	.
Amyema congener ssp. congener	5	0.13	.	.	.	.	.	.	.	.	.
Amyema pendulum ssp. pendulum	3	0.08	.	.	.	.	.	.	.	.	.
Aneilema acuminatum	7	.	.	.	.	.	.	.	.	.	.
Aneilema biflorum	1	.	.	.	0.50	0.33	.	.	.	.	.
Angophora floribunda	16	0.36	0.10	.	.	.	.	.	0.13	1.00	.
Aphanopetalum resinosum	4	.	.	.	0.17	.	.	.	.	0.50	.
Arthropodium milleflorum	13	0.26	0.30	.	.	.	.	0.33	0.25	0.50	.
Arthropodium minus	3	0.08	.	.	.	.	.	.	.	.	.
Arthropteris tenella	13	.	.	.	.	.	.	.	.	.	.
Asparagus sp.	1	0.03	.	.	.	0.67	.	1.00	1.00	.	.
Asperula scoparia	2	0.05	.	.	.	.	.	.	.	.	.
Asplenium australasicum	8	.	.	.	.	.	.	.	.	.	.
Asplenium bulbiferum	1	.	.	.	.	.	.	.	.	.	.
Asplenium flabellifolium	7	0.15	0.10	.	.	.	.	0.75	1.00	.	.
Astrotricha latifolia	4	0.05	.	.	.	.	.	0.13	.	.	.
Australina pusilla	1	.	.	.	0.33	.	.	.	.	.	.
Austromyrtus bidwillii	2	.	.	.	.	.	.	.	0.50	.	.
Backhousia myrtifolia	1	.	.	.	.	.	.	.	0.50	.	.
Baloghia lucida	6	.	.	.	.	.	.	0.25	.	.	.
Billardiera scandens	4	0.08	.	.	.	.	.	.	0.50	.	.
Blechnum cartilagineum	2	.	.	0.17	.	.	0.33	0.63	.	.	.
Blechnum patersonii	2	.	.	.	0.33	.	.	.	.	.	.
								0.13	.	.	
								0.25	.	.	

CYPERACEAE
H *Carex appressa* R. Br.
H *Carex breviculmis* R. Br.
H *Carex declinata* Boott
H *Carex fascicularis* Soland. ex Boott
H *Carex gaudichaudiana* Kunth
H *Carex hattoriana* Nakai ex Tuyama
H *Carex inversa* R. Br.
H *Carex lobolepis* F. Muell.
H *Carex longebrachiata* Boeck.
H *Cyperus enervis* R. Br.
H *Cyperus imbecillis* R. Br.
H *Cyperus lhotskyanus* Boeck.
Cyperus lucidus R. Br.
H *Cyperus tetraphyllus* R. Br.
H *Eleocharis atricha*
H *Eleocharis sphacelata*
Gahnia melanocarpa
Gahnia sieberiana Kunth
H *Isolepis inundata*
Lepidosperma laterale R. Br.
H *Schoenoplectus mucronatus*
H *Schoenus apogon* Roem. & Schult.
DIOSCOREACEAE
Dioscorea transversa R. Br.
IRIDACEAE
Libertia paniculata (R. Br.) Spreng.
JUNCACEAE
H *Juncus filicaulis* Buchen
H *Juncus homalocaulis* F. Muell. ex Benth.
H *Juncus pauciflorus* R. Br.
H *Juncus prismatocarpus* R. Br.
H *Juncus sarophorus* L. A. S. Johnson
H *Juncus usitatus*
H *Luzula meridionalis* Nordenskiold
ORCHIDACEAE
Acianthus fornicatus R. Br.
Chiloglottis gunnii Lindl.
H *Chiloglottis* sp. aff. *reflexa* (Labill.) Druce
Corybas ?fimbriatus (R. Br.) Reichb. f.
Cymbidium suave R. Br.
Dendrobium fairfaxii F. Muell. & Fitzg.
Dendrobium gracilicaule F. Muell.
Dendrobium mortii F. Muell.
Dendrobium pugioniforme A. Cunn.
Dendrobium tarberi M. Clements & D. Jones
Dipodium ?variegatum M. Clements & D. Jones
Genoplesium sp.
Microtis sp.
Papillilabium beckleri (F. Muell. ex Benth.) Dockr.
Plectorhiza tridentata (Lindl.) Dockr.
Pterostylis coccina Fitzg.
Pterostylis curta R. Br.
H *Pterostylis decurva* R. S. Rogers
Pterostylis longifolia R. Br.
Pterostylis nutans R. Br.
Sarcochilus falcatus R. Br.
Sarcochilus olivaceus Lindl.

PHILESIACEAE
Eustrephus latifolius R. Br.
Geitonoplesium cymosum (R. Br.) A. Cunn. ex Hook
PHORMIACEAE
Dianella caerulea Sims
Dianella longifolia R. Br.
Dianella revoluta R. Br.
Dianella tasmanica Hook. f.
Stypandra glauca R. Br.
POACEAE
Agrostis aemula R. Br.
Agrostis avenacea Gmel. var. avenacea
Cymbopogon refractus (R. Br.) A. Camus
H *Danthonia longifolia* R. Br.
H *Danthonia racemosa* R. Br.
H *Deyeuxia quadriseta* (Labill.) Benth.
Dichelachne micrantha (Cav.) Domin
Dichelachne rara (R. Br.) Vickery
H *Digitaria parviflora* (R. Br.) Hughes
Echinopogon ovatus (Forst. f.) Beauc.
Elymus scaber (R. Br.) A. Love
H *Entolasia marginata* (R. Br.) Hughes
Entolasia stricta (R. Br.) Hughes
H *Eragrostis leptostachya* Steud
H *Glyceria australis* C. E. Hubbard
Imperata cylindrica Beauv.
var. *major* (Nees) C. E. Hubbard
H *Microlaena stipoides* (Labill.) R. Br. var. st
Oplismenus imbecillus (R. Br.) Roem. & Schult
H *Panicum obseptum*
Paspalum dilatatum Poir.
H *Pennisetum alopecuroides* (L.) Spreng.
Phragmites australis (Cav.) Trin. ex Steud.
H *Poa labillardieri* Steud. var. *labillardieri*
H *Poa queenslandica*
H *Poa sieberiana* Spreng. var. *sieberiana*
H *Sorghum leiocladum* (Hack.) C. E. Hubbard
Stipa ramosissima Trin.
Themeda australis (R. Br.) Stapf
POMATOGETONACEAE
H *Pomatogeton tricarinatus*
SMILACACEAE
Ripogonum album R. Br.
Ripogonum discolor F. Muell
Ripogonum fawcettianum F. Muell.
Smilax australis R. Br.
SPARGANIACEAE
H *Sparganium subglobosum* Morong
LOMANDRACEAE
Lomandra filiformis (Thunb.) Britten
Lomandra histrix (R. Br.) L. Fraser & Vick.
Lomandra longifolia Labill.
Lomandra spicata A. T. Lee
XANTHORRHOEACEAE
Xanthorrhoea sp.

Hymenosporum flavum (Hook.) F. Muell.
Pittosporum revolutum Ait.
Pittosporum undulatum Vent.

PLANTAGINACEAE

Plantago debilis R. Br.

POLYGONACEAE

H *Muehlenbeckia gracillima* Meisn.
H *Persicaria decipiens*
H *Persicaria hydropiper*
H *Persicaria strigosa*
Rumex brownii Campd.

PROTEACEAE

Hakea eriantha R. Br.
Lomatia arborescens L. Fraser & Vickery
Orites excelsa R. Br.
Persoonia linearis Andr.
Stenocarpus salignus R. Br.

RANUNCULACEAE

Clematis aristata R. Br. ex DC.
Clematis glycinoides DC.
H *Ranunculus inundatus*
Ranunculus plebeius R. Br. ex DC.

RHAMNACEAE

Pomaderris aspera Sieber ex DC.
Pomaderris ligustrina Sieber ex DC.

ROSACEAE

Acaena novae-zelandiae Kirk
Rubus hillii F. Muell.
Rubus sp. aff. *moorei* F. Muell.
Rubus parvifolius L.
Rubus rosifolius Sm.

RUBIACEAE

Asperula scoparia Hook. f.
Canthium coprosmoides F. Muell.
Coprosma quadrifida (Labill.) B. L. Rob.
Galium binifolium N. A. Wakef.
Galium spp.
Morinda jasminoides A. Cunn.
Opercularia aspera Gaertn.
Psychotria loniceroides Sieber ex DC.

RUTACEAE

Acronychia oblongifolia (A. Cunn. ex Hook.) Endl. ex Heynh.
Correa reflexa (Labill.) Vent.
H *Melicope micrococca* (F. Muell.) T. G. Hartley
Sarcomelicope simplicifolia (Endl.) T. G. Hartley
Zieria arborescens Sim s. lat.

SANTALACEAE

Exocarpos cupressiformis Labill.

SAPINDACEAE

Alectryon subcinereus (A. Gray) Radlk.
Diploglottis australis (G. Don) Radlk.
Elattostachys nervosa (F. Muell.) Radlk.
Guioa semiglauca (F. Muell.) Radlk.
H *Mischocarpus australis* S. Reyn.

SAPOTACEAE

Planchonella australis (R. Br.) Pierre

SCROPHULARIACEAE

H *Gratiola latifolia* R. Br.
Veronica calycina R. Br.
Veronica notabilis F. Muell. ex Benth.
Veronica plebeia R. Br.

SOLANACEAE

H *Solanum aviculare* Forst. f.
H *Solanum brownii* Dunal
Solanum prinophyllum Dunal
Solanum stelligerum Sm.

STERCULIACEAE

Brachychiton acerifolius F. Muell.

SYMPLOCACEAE

Symplocos stawellii F. Muell.

THYMELAEACEAE

Pimelea ligustrina Labill. ssp. *ligustrina*

ULMACEAE

Trema aspera (Brongn.) Bl.

URTICACEAE

Australina pusilla Gaudich
Dendrocnide excelsa (Wedd.) Chew
Elatostemma reticulatum Wedd.
Urtica incisa Poir.

VERBENACEAE

Clerodendrum floribundum R. Br.
Clerodendrum tomentosum R. Br.
Gmelina leichhardtii F. Muell.
* *Verbena bonariensis* L.
H *Verbena officinalis* L.

VIOLACEAE

Hymenanthera dentata R. Br. ex Ging.
Viola betonicifolia Sm.
Viola hederacea Labill.

VITACEAE

Cayratia clematidea (F. Muell.) Domin
Cissus antarctica Vent.
H *Cissus hypoglauca* A. Gray
Tetrastigma nitens (F. Muell.) Planch.

WINTERACEAE

Tasmannia insipida R. Br. ex DC.

Subclass LILIIDAE

ANTHERICACEAE

Arthropodium milleflorum (Red.) Macbride
Arthropodium minus R. Br.

ARACEAE

Gymnostachys anceps R. Br.

ARECACEAE

Livistona australis (R. Br.) Mart.

ASPARAGACEAE

* *Asparagus setaceus* (Kunth) Jessop

COMMELINACEAE

Aneilema acuminatum R. Br.
H *Aneilema biflorum* R. Br.
Commelina cyanea R. Br.
Pollia crispata (R. Br.) Benth.

Trifolium repens L.
FAGACEAE
Nothofagus moorei (F. Muell.) Krasser
GENTIANACEAE
Centaurium erythraea Rafn
GERANIACEAE
Geranium neglectum Carolin
H *Geranium potentilloides* L'Herit. ex DC.
H *Geranium solanderi* Carolin
GOODENIACEAE
Goodenia ovata Sm.
H *Scaevola albida* R. Br.
HALORAGACEAE
H *Gonocarpus humilis* Orch.
H *Haloragis heterophylla* Brongn.
H *Haloragis ?serra* Brongn.
HYPERICACEAE
Hypericum gramineum Forst. f.
H *Hypericum japonicum* Thunb.
ICACINACEAE
H *Citronella moorei* (F. Muell. ex Benth.) Howar
Pennantia cunninghamii Forst. & Forst. f.
LAMIACEAE
Ajuga australis R. Br.
H *Mentha diemenica* Spreng.
Plectranthus graveolens R. Br.
Plectranthus parviflorus Willd.
Prunella vulgaris L.
H *Salvia plebeia*
Scutellaria humilis R. Br.
Scutellaria mollis R. Br.
LAURACEAE
Cryptocarya erythroxylon Maiden & Betche
Cryptocarya foveolata C. T. White & Francis
Cryptocarya glaucescens R. Br.
Cryptocarya microneura Meisn.
Cryptocarya obovata R. Br.
Endiandra sieberi Nees
Litsea reticulata (Meisn.) F. Muell.
Neolitsea australiensis Kosterm.
Neolitsea dealbata (R. Br.) Merr.
LOBELIACEAE
Pratia purpurascens (R. Br.) E. Wimmer
LOGANIACEAE
Logania albiflora (Andr.) Druce
LORANTHACEAE
H *Amyema congener* (Sieber ex Schult. & Schult. f.) Tieghem ssp. *congener*
Amyema pendulum (Sieber ex Spreng.) Tieghem
H *Muellerina eucalyptoides* (DC.) Barlow
MALVACEAE
Hibiscus heterophyllus Vent.
MELIACEAE
Dysoxylum fraserianum (A. Juss.) Benth.
Synoum glandulosum (Sm.) A. Juss.
Toona australis (F. Muell.) Harms
MENISPERMACEAE
Sarcopetalum harveyanum F. Muell.
Stephania japonica (Thunb.) Miers var. *discolor* (Bl.) Forman

MONIMIACEAE
Daphandra micrantha (Tul.) Benth.
Doryphora sassafras Endl.
Hedycarya angustifolia A. Cunn.
Palmeria scandens F. Muell.
MORACEAE
Ficus coronata Spin
Ficus obliqua Forst. f.
Ficus rubiginosa Desf. ex Vent.
Maclura cochinchinensis (Lour.) Corner
Malaisia scandens (Lour.) Planch.
Streblus brunonianus (Endl.) F. Muell.
MYRSINACEAE
Embelia australiana (F. Muell.) Mez
Rapanea howittiana Mez
Rapanea variabilis (R. Br.) Mez
MYRTACEAE
Acmena smithii (Poir.) Merr. & Perry
Angophora floribunda (Sm.) Sweet
Austromyrtus bidwillii (Benth.) Burret
Backhousia myrtifolia Hook. f. & Harv.
H *Baeckea* sp. aff. *diosmifolia*
H *Baeckea* sp. aff. *virgata*
Callistemon salignus (Sm.) DC.
H *Eucalyptus acmenoides* Schauer
Eucalyptus campanulata R. T. Bak. & H.G. Sm.
H *Eucalyptus canaliculata* Maiden
H *Eucalyptus eugenioides* Sieber ex Spreng.
Eucalyptus laevopinea R. T. Bak.
Eucalyptus microcorys F. Muell.
H *Eucalyptus nobilis* L. Johnson & K. Hill
Eucalyptus obliqua L'Herit.
Eucalyptus pauciflora Sieber ex Spreng.
Eucalyptus quadrangulata H. Deane & Maiden
Eucalyptus resinifera Sm.
Eucalyptus saligna Sm.
Eucalyptus tereticornis Sm.
H *Leptospermum polygalifolium* Salisb. ssp. *montanum* J. Thompson
Leptospermum variabile J. Thompson
H *Melaleuca styphelioides* Sm.
Rhodamnia rubescens (Benth.) Miq.
Syncarpia glomulifera (Sm.) Nied
Syzygium australe (Wendl. ex Link) B. Hyland
Tristaniopsis collina Peter G. Wilson & Waterhouse
OLEACEAE
Notelaea longifolia P. S. Green
Notelaea venosa F. Muell
ONAGRACEAE
Epilobium billardieranum Ser. ssp. *hydrophilum* Raven & Englehorn
OXALIDACEAE
H *Oxalis ?radicosa* A. Rich.
PEPEROMIACEAE
Peperomia tetraphylla (Forst. f.) Hook & Arn.
PHYTOLACCACEAE
Phytolacca octandra L.
PIPERACEAE
Piper novae-hollandiae Miq.
PITTOSPORACEAE
Billardiera scandens Sm.
Citriobatus pauciflorus A. Cunn. ex Ettingsh.

Conyza albida Willd. ex Spreng.
H *Gnaphalium gymnocephalum* DC.
H *Gnaphalium sphaericum* Willd.
H *Helichrysum apiculatum* (Labill.) D. Don
Helichrysum bracteatum (Vent.) Andr.
Helichrysum diosmifolium (Vent.) Sweet
Helichrysum elatum A. Cunn ex DC.
Helichrysum rufescens (DC.) N. T. Burb.
Helichrysum scorpioides Labill.
H *Helipterum anthemoides* (Sieber ex Spreng.) DC.
**Hypochoeris radicata* L.
Lagenifera stipitata (Labill.) Druce
Olearia nernstii (F. Muell.) F. Muell. ex Benth.
H *Olearia oppositifolia* (F. Muell.) Lander
H *Olearia viscidula* (F. Muell.) Benth.
**Picris hieracioides* L.
Senecio amygdalifolius F. Muell.
H *Senecio biserratus* Belcher
H *Senecio hispidulus* A. Rich. var. *hispidulus*
H *Senecio lautus* Forst. f. ex Willd. ssp. aff. *maritimus* Ali
H *Senecio linearifolius* A. Rich.
H *Senecio macranthus* A. Rich.
Senecio minimus Poir.
H *Senecio* sp. E (aff. *apargiaefolius* Walp.)
Senecio vagus F. Muell. ssp. *vagus*
Sigesbeckia orientalis L.
**Sonchus oleraceus* L.
**Taraxacum officinale* Weber
Vernonia cinerea Less. var. *cinerea*
Vernonia cinerea Less. var. *lanata* Koster
H *Vittadinia tenuissima* (Benth.) J. M. Black

BIGNONIACEAE
Pandorea pandorana (Andr.) Steenis

BORAGINACEAE
Cynoglossum australe R. Br. var. australe
Cynoglossum latifolium R. Br.
Cynoglossum suaveolens R. Br.
Ehretia acuminata R. Br.
Myosotis exarrhena F. Muell.

BRASSICACEAE
Cardamine paucijuga Turcz.
Cardamine sp. Y

CALLITRICHACEAE
H *Callitriche muelleri* Sond.

CAMPANULACEAE
H *Wahlenbergia stricta* Sweet ssp. *stricta*

CAPRIFOLIACEAE
Sambucus australasica (Lindl.) Fritsch

CARYOPHYLLACEAE
**Cerastium glomeratum* Thuill.
H *Scleranthus biflorus* (Forst. & Forst. f.) Hook. f.
Stellaria flaccida Hook.
**Stellaria media* (L.) Vill.

CASUARINACEAE
Allocasuarina torulosa Ait. L. A. S. Johnson
Casuarina cunninghamiana Miq.

CELASTRACEAE
H *Cassine australis* (Vent.) Kuntze
Celastrus australis Harv. & F. Muell.
Maytenus silvestris Lander & L. A. S. Johnson

CONVOLVULACEAE
Dichondra repens Forst. & Forst. f.

CRASSULACEAE
Crassula sieberiana (Schult.) Druce

CUNONIACEAE
Aphanopetalum resinosum Endl.
Caldcluvia paniculosa (F. Muell.) Hoogl
Callicoma serratifolia Andr.
Schizomeria ovata D. Don
Vesselowskya rubifolia (F. Muell.) Pampanini

DILLENIACEAE
Hibbertia dentata R. Br. ex DC.
H *Hibbertia ?diffusa* R. Br. ex DC.
Hibbertia scandens (Willd.) Gilg.

EBENACEAE
Diospyros australis (R. Br.) Hiern
Diospyros pentamera (Woolls & F. Muell.) F. Muell.

ELAEOCARPACEAE
Elaeocarpus kirtonii F. Muell. ex F. M. Bail.
Elaeocarpus obovatus G. Don
Elaeocarpus reticulatus Sm.
Sloanea australis (Benth.) F. Muell.
Sloanea woollsii F. Muell.

EPACRIDACEAE
Leucopogon fraseri A. Cunn.
Leucopogon lanceolatus (Sm.) R. Br.
Trochocarpa laurina R. Br.
H *Trochocarpa* sp. aff. *laurina*

ESCALLONIACEAE
Polyosma cunninghamii Benn.
Quintinia sieberi DC.

EUPHORBIACEAE
Baloghia lucida Endl.
Breynia oblongifolia Muell. Arg.
Claoxylon australe Baill.
Croton verreauxii Baill.
Omalanthus populifolius Grah.
Phyllanthus gasstroemii Muell. Arg.
Phyllanthus similis
Poranthera microphylla Brongn.

EUPOMATIACEAE
Eupomatia laurina R. Br.

FABACEAE
MIMOSOIDEAE
Acacia implexa Benth.
Acacia irrorata Sieber ex Spreng.
H *Acacia maidenii* F. Muell.
Acacia melanoxylon R. Br.
FABOIDEAE
H *Daviesia genistifolia* A. Cunn. ex Benth.
Desmodium brachypodum A. Gray
Desmodium rhytidophyllum F. Muell. ex Benth.
Desmodium varians (Labill.) Endl.
H *Glycine clandestina* Wendl.
Hardenbergia violacea (Schneev.) Stearn
Indigofera australis Willd.
Kennedia rubicunda (Schneev.) Vent.
Oxylobium ilicifolium (Andr.) Domin
Pararchidendron pruinosum (Benth.) Nielsen
Swainsona galegifolia (Andr.) R. Br.

Appendix 1. List of vascular plant species recorded during a survey of Mount Royal Management Area. Taxonomy and nomenclature follow Jacobs and Pickard (1981), Jacobs and Lapinpuro (1986) and Harden (1990,1991), except where more recent revisions are available.

Symbols are: H specimen retained at FC NSW Herbarium, West Pennant Hills
* naturalized taxon
? determination uncertain

Class FILICOPSIDA

ADIANTACEAE
Adiantum aethiopicum L.
H *Adiantum diaphanum* Bl.
Adiantum formosum R. Br.
Adiantum hispidulum Sw.
ASPLENIACEAE
Asplenium australasicum R. Br.
Asplenium bulbiferum Forst. f.
Asplenium flabellifolium Cav.
ATHYRIACEAE
H *Diplazium assimile* (Endl.) Beddome
Diplazium australe (R. Br.) Wakef.
BLECHNACEAE
Blechnum cartilagineum Sw.
Blechnum patersonii (R. Br.) Mett.
Doodia aspera R. Br.
H *Doodia caudata* (Cav.) R. Br.
H *Doodia media* R. Br.
CYATHEACEAE
Cyathea australis (R. Br.) Domin
Cyathea leichhardtiana (F. Muell.) Copel.
DAVALLIACEAE
Davallia pyxidata Cav.
DENNSTAEDTIACEAE
H *Dennstaedtia davallioides* (R. Br.) T. Moore
Histiopteris incisa (Thunb.) J. Sm.
H *Hypolepis glandulifera* (Thunb.) Kuhn
Pteridium esculentum (Forst.) Nakai
DICKSONIACEAE
Calochlaena dubia (R. Br.) M. Turner & R. White
Dicksonia antarctica Labill.
DRYOPTERIDACEAE
Lastreopsis acuminata
H *Lastreopsis decomposita* (R. Br.) Tindale
H *Lastreopsis microsora* (Endl.) Tindale
H *Lastreopsis munita* (Mett.) Tindale
H *Polystichum australiense* Tindale
H *Polystichum fallax* Tindale
H *Polystichum proliferum* (R. Br.) Presl
HYMENOPHYLLACEAE
Hymenophyllum cupressiforme Labill.
OLEANDRACEAE
Arthropteris tenella (Forst. f.) J. Sm.
OPHIOGLOSSACEAE
H *Botrychium australe* R. Br.

POLYPODIACEAE
Dictymia brownii (Wikstr.) Copel.
Microsorum diversifolium (Willd.) Copel.
Microsorum scandens (Forst. f.) Tindale
Platycerium bifurcatum (Car.) C. Chr.
Pyrrosia confluens (R. Br.) Ching
Pyrrosia rupestris (R. Br.) Ching
PTERIDACEAE
Pteris tremula R. Br.
Pteris umbrosa R. Br.
SINOPTERIDACEAE
Cheilanthes austrotenuifolia (Burm. f.) Sw.
Cheilanthes sieberi Kuntze
Pellaea falcata (R. Br.) Fee var. *falcata*
Pellaea falcata (R. Br.) Fee var. *nana* Hook.
Pellaea paradoxa (R. Br.) Hook.
THELYPTERIDACEAE
Christella dentata (Forsskal) Brownsey & Jermy

Class MAGNOLIOPSIDA
Subclass MAGNOLIIDAE

ALANGIACEAE
Alangium villosum (Bl.) Wangerin
ssp. *polysomoides* (F. Muell.) Bloemb.
AMARANTHACEAE
H *Deeringia amaranthoides* (Lamk.) Merr.
APIACEAE
Centella asiatica (L.) Urban
Daucus glochidiatus (Labill.) Fisch., C. A. Meyer & Ave-Lall.
H *Hydrocotyle acutiloba* (F. Muell.) N.A. Wakef. s. lat.
Hydrocotyle geraniifolia F. Muell.
Hydrocotyle peduncularis R. Br. ex A. Rich. s. lat.
Hydrocotyle tripartita R. Br. ex A. Rich.
H *Oreomyrrhis eriopoda* (DC.) Hook. f.
Platysace lanceolata (Labill.) Druce
APOCYNACEAE
Parsonsia brownii (Britten) Pichon
Parsonsia straminea (R. Br.) F. Muell.
Parsonsia velutina R. Br.
Parsonsia species A
ARALIACEAE
Astrotricha latifolia Benth.
Cephalaralia cephalobotrys (F. Muell.) Harms
Polyscias murrayi (F. Muell.) Harms
Polyscias sambucifolia (Sieber ex DC.) Harms
ASCLEPIADACEAE
**Gomphocarpus sp.*
Marsdenia rostrata R. Br.
Marsdenia suberosa S. T. Blake
Tylophora barbata R. Br.
Tylophora paniculata R. Br.
ASTERACEAE
**Ageratina adenophora* (Spreng.) R.M. King & H. Robinson
H *Ammobium alatum* R. Br.
H *Brachycome microcarpa* F. Muell.
Calotis cuneifolia R. Br.
H *Cassinia compacta* F. Muell.
**Cirsium vulgare* (Savi) Ten.

benign in terms of invasion by exotics. Long term changes which may have occurred in floristic composition, particularly of the herbaceous component, and the extent to which current vegetation reflects the grazing history, is unknown.

Of possible concern is localised heavier disturbance in perched swamps. Several such swamps had been heavily trampled, in some cases most of the above ground vegetation in particular patches having been destroyed. However, most swamps appeared relatively undisturbed and naturalised weeds were a minor component or non-existent. Most of the dominant species are tufted or rhizomatous monocotyledons which would be expected to be fairly resilient to destruction of their above-ground parts. Heavy disturbance by large herbivores appears to have been periodic and has probably allowed adequate regrowth during disturbance-free periods. However, it is not clear whether, if at all, the current abundance of apparently resilient species is a result of past disturbance history, more sensitive species having been possibly eliminated. Although there is no evidence of adverse impact or otherwise, there would be some concern over increased grazing intensity and subsequent potential increase in disturbance of these swamps.

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Caldcluvia). The conservation status of the latter is regarded as excellent. Community ROY9 represents a structurally poorly-developed rainforest with floristic similarities to suballiances 14 (*Doryphora-Daphnandra-Dendrocnide-Ficus-Toona*) and 23 (*Ficus-Streblus-Dendrocnide Cassine*). Suballiance 14 is regarded as well conserved, while 23 is inadequately conserved, with no representative samples reserved in the south of the range of this suballiance, south of the Manning River. Reservation of stands in Mount Royal M.A. would contribute in only a minor way to improvement of the conservation status of this suballiance, since the Mount Royal stands are poorly-developed, atypical examples. Much more well developed examples occur elsewhere (e.g. Whispering Gully, Chichester S.F.)

The shrubland community ROY6 appears to have no Benson equivalent, probably not surprising considering its very restricted extent in the survey area and Benson's aim to describe primarily "major" associations. Benson includes an *Eleocharis sphacelata* association (possible equivalent to community ROY3B) which he regards as adequately conserved. There appears to be no equivalent to community ROY3A. In any case, all the shrub or herb dominated communities are of very limited extent in the survey area and are worthy of particular consideration.

4.4 Impact of logging

Although both logged and unlogged stands were sampled, it was very difficult to assess logging impact, for the following reasons:

i) There are no detailed pre-logging data available, and substantial differences exist between major environmental features of previously logged and unlogged areas. Davis Creek section is largely on basalt and mostly at higher altitudes than the previously logged Fal Brook catchment and western side of Carrow Brook catchment, so that present differences in vegetation may be related more to site factors other than logging history.

ii) Previously logged areas were often logged repeatedly or using different prescriptions to that planned for future operations. It is thus difficult to relate impact of past logging to that of planned logging.

As a result of these complications, it would be very difficult to attempt to interpret logging impact on individual species. Relationships among plots resulting from the community classification give a broad indication of impact. If logging impact on floristic composition was major, logged plots would be expected to be group together at a high level of dissimilarity compared to unlogged plots. The classification dendrogram shows a strong tendency for logged plots in the extensive open grassy forest to be grouped separately from the unlogged plots, although the two groups are more similar to each other than to other vegetation types. The grouping corresponds even more strongly to the division between Davis Creek plots and those elsewhere, with only three plots out of 21 in the "Davis Creek group" being misclassified. Thus plots within each of the two broad physio-geographic units tend to be grouped together regardless of logging history and the apparent logging impact in the open grassy forest is more likely due to site differences unrelated to logging. For moist eucalypt forests and rainforests, logged plots are generally dispersed among unlogged plots in terms of floristic similarity, suggesting that logging impact is within the range of variation due to site differences.

Of a total of 23 logged plots, only plot 4D shows a clear separation floristically from other groups of plots. It is an anomalous dry forest plot which differs mainly due to very low floristic richness. Since the floristic richness of logged plots is not significantly different to that of unlogged plots (overall means of 46.0 and 46.2 respectively, $p>0.05$), it is unlikely that the anomalous nature of plot 4D is simply due to logging. Plot NA8 is a slightly unusual logged plot which, with unlogged plot B55, represents a transition between moist forest (community ROY4) and wet sclerophyll forest with mesophyll shrub understorey (community ROY5). Its composition may be partly due to previous heavy logging and partly due to physical site factors and fire history.

Even though it is not possible to examine logging impact in detail, vegetation post-logging remains broadly similar to unlogged forest.

4.5 Weeds

A small number of weed species are widespread in the area but, with the exception of a narrow (<10m wide) strip along parts of some frequently traversed roads, form only a very minor component of the flora. *Trifolium repens, Hypochoeris radicata, Picris hieracioides* and *Cirsium vulgare* are widely distributed in a range of habitats, including both logged and unlogged areas, presumably due to the long history of grazing, but are never abundant.

"Pioneer" species proliferate after major soil disturbance, particular along roadsides such as the recently constructed part of Cassells Road in Davis Creek catchment. Both native (e.g. *Goodenia ovata, Juncus usitatus, Senecio linearifolius, Solanum aviculare*) and naturalized (*Cirsium vulgare, Conyza albida*) species are prominent in the roadside flora. Small depressions are colonised by native species such as *Isolepis inundata, Persicaria decipiens* and *Salvia plebeia* and the possibly introduced *Persicaria hydropiper*.

Creek beds and banks, particularly near the boundary with private pasture land, are commonly colonised by introduced weeds, probably due to fairly intensive use of these areas by cattle. These are usually a very minor component of the flora, but *Ageratina adenophora* (crofton weed) is locally abundant on banks of the larger streams near the forest boundary with private property.

Apart from the few widespread weeds which occur throughout the area in both logged and unlogged stands, several species colonise small highly disturbed patches immediately after logging. These tend to be the species which proliferate along recently constructed roads. The absence of these species from older logged areas suggests that they do not persist as actively growing individuals beyond about 5-10yr post-logging, although some undoubtedly persist as soil-stored seed.

4.6 Impact of grazing

It was not possible to assess grazing impact by sampling grazed and ungrazed areas because grazing by native macropods, feral horses and feral and domestic cattle was ubiquitous in open forest, in both the State Forest and adjacent National Park. The widespread, although minor, occurrence of herbaceous weeds is probably due to grazing. That they remain a minor component of the flora suggests a long history of light grazing is fairly

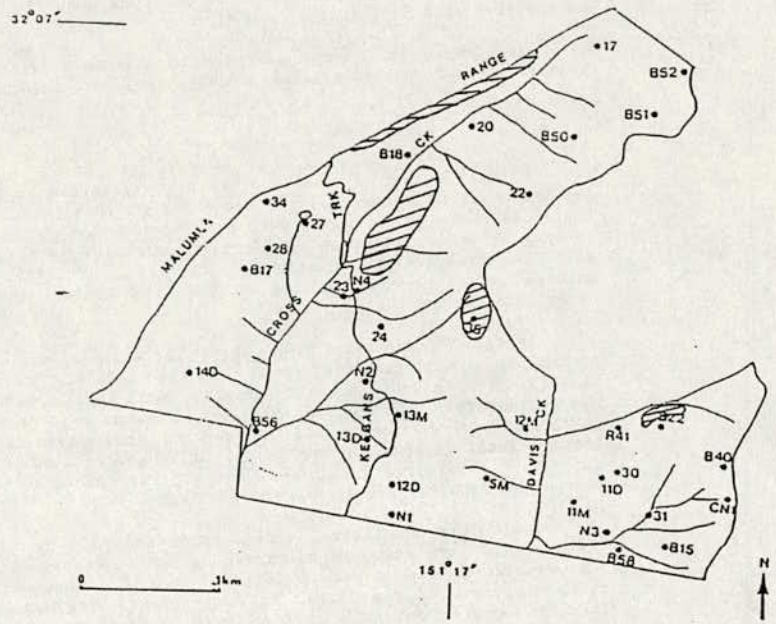


Figure 3. Approx. location of populations of *Senecio macranthus*

Species which apparently do not occur south of the Hunter River valley and are near their southern limit are:

Alangium villosum
Austromyrtus bidwillii
Lastreopsis munita

4.3 Conservation status of plant communities

It is very difficult to assess the conservation status of plant communities because of the ultimately subjective nature of community definition and its dependence on scale. Attempts to assess conservation status at a national scale are too broad for adequate consideration of regional conservation requirements. Benson (1989) has made an attempt to describe conservation status of plant associations in NSW. This provides a preliminary basis for conservation assessment, although it considers only the tallest vegetation stratum and there are difficulties in relating observed stands to Benson's associations because no descriptions are provided. Assessment of conservation status is also severely restricted by the lack of adequate site-specific data for the existing reserve system state-wide.

Much of the eucalypt forest in the survey area may be broadly equated to the following of Benson's associations:

E. saligna association - equates to forest type 46 and possibly partly type 168; floristic communities 1,2,3 and 3; coded N3, not threatened and adequately conserved.

E. obliqua ± *E. andrewsii* - probably includes type 153 and type 140; floristic community 2; coded N2, not threatened but regarded as inadequately conserved.

E. laevopinea - includes type 167 and partly type 168; floristic communities 1,2 and 4; coded N2, not threatened but regarded as inadequately conserved.

E. (*andrewsii* ssp.) *campanulata* - equates to type 163; floristic community 1; coded N3, not threatened and adequately conserved.

The fairly widespread grey gum - stringybark forest type (type 62, floristic community 1, in part) characterised by *Eucalyptus canaliculata*, *E. eugenioides* and *E. acmenoides* is more difficult to relate to Benson's associations. It may have most similarities to the *E. acmenoides* - *E. propinqua* association. In the broad sense, forest type 62 is widespread in north-eastern NSW and probably well conserved. In the narrower sense, the conservation status of forests containing specifically *E. canaliculata* as the grey gum is unclear, and would be worthy of further investigation due to the geographically restricted distribution of *E. canaliculata* (which occurs only between Gloucester and the Hunter River).

The conservation status of the rainforest vegetation may be assessed by comparisons with Floyd's (1990) suballiances. Floristic community ROY7 has most similarities with suballiances 13 (*Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens*) and 39 (*Schizomeria-Doryphora-Caldcluvia-Orites*). These suballiances are both regarded as adequately conserved. Community ROY8 has affinities with suballiance 13 and also 12 (*Sloanea woollsii-Dysoxylum fraserianum-Argyrodendron actinophyllum-*

4. DISCUSSION

4.1 General

The extensive grassy nature of much of the forest understorey and the general paucity of shrubs over large areas is slightly unusual. It may be the result of a long history of combined fire and grazing. A dense grass sward provides intense competition for seedlings of woody plants and once established, would tend to persist even if fire frequency was reduced.

Except for the association of perched swamps with basalt 'benches', no clear relationship was found between geological substrate and vegetation, possibly because of widespread basaltic enrichment of downslope sedimentary substrates.

As noted by Floyd (1983), the Mount Royal Range in the broad sense (and Malumla Range in particular) is the highest of the north-south ranges in the Barrington Tops massif and is on the westerly side, presenting a topographic barrier to moisture-bearing easterly air flows. The broad, low Hunter River valley has been a dry southerly barrier to plant dispersal. The combination of these two factors results in the study area, by virtue of its position, being at the southern and western limit of distribution for a number of rainforest species. These are discussed below. Valleys become progressively moister towards the east, resulting in the occurrence of a greater range of rainforest species and generally better development of rainforest than exists in the survey area. This pattern is comprehensively discussed by Floyd (1983).

4.2 Significant Plant Species.

The conservation significance of plant species is assessed on a national basis using Briggs and Leigh (1988) as a standard. Only two of the species recorded in the area are listed by Briggs and Leigh as rare or threatened.

Botrychium australe - widespread, not listed by Briggs and Leigh, but generally regarded as uncommon. Only a two individuals were recorded during the survey, in open grassy forest.

Haloragis ?serra - This species is rare and localised in the survey area, the few individuals in plot 35 being the only population noted during the survey. Although widespread and not listed by Briggs and Leigh, *H. serra* is represented by relatively few specimens at NSW National Herbarium and appears to be uncommon throughout its range. The record from Mount Royal M.A. is the first from the Northern Tablelands subdivision, although the survey area is very close to the boundary with the Central Western Slopes subdivision for which previous records exist. As noted above, it is possible that the record is actually *H. exalata*, a species listed as 3RCa by Briggs and Leigh. Until the identity of the Mount Royal plants can be confirmed, and the conservation status of *H. serra* further investigated, it is best to regard the record as being of conservation significance.

Papillilabium beckleri (3RC-, Briggs and Leigh 1988) - uncommon and localised in the survey area, occurring mainly in riparian rainforest at lower altitudes, or rarely in lower slope eucalypt forest (e.g. on

Rhodamnia rubescens in plot B1). It is distributed from south-east Queensland to Wollongong and occurs in several National Parks and other reserves. It is an inconspicuous twig epiphyte which appears to be much more common than its risk code would indicate.

Senecio macranthus (3RC-, Briggs and Leigh 1988) - fairly widespread and sometimes locally common in the area, mostly on steep, rocky basalt slopes in open grassy forest. It was noted to be regenerating, presumably from seed, along recently (<2yr) constructed road batters in the Davis Creek area. The approximate extent of known populations in the study area is shown in Fig. 3. It is endemic to eastern N.S.W., occurring between Wollomombi Falls and Tallong, mainly on the tablelands, but is also recorded from the coast and western slopes. The only reserve from which it is recorded by Briggs and Leigh (1988) is Kanagra-Boyd N.P., but there are also specimens at NSW National Herbarium from Oxley Wild Rivers NP, Barrington Tops NP and Winburndale NR. There is a total of 32 collections at the NSW Herbarium representing at least 15 separate localities, although many of the collections are old, with vague locality data. It is doubtful whether this species should be considered rare.

Species which occur at the geographical limit of their distribution in the survey area, according to Floyd (1983,1989), or from specimens held in the NSW National Herbarium (NH), are listed below, with localities previously reported as geographical limits (S=southern limit; W=western; N=northern).

Cryptocarya erythroxylon	S,W	Boonabilla Creek
Cryptocarya foveolata	S,W	Mt Royal
Dendrobium tenuissimum	S	
Diplazium assimile	S,W	NH (Nabiac)
Eucalyptus campanulata	S	NH (Mt Royal)
Eucalyptus nobilis	S	NH (Barrington Tops)
Helichrysum rufescens	S	Blue Gum Flat, Boonabilla Ck
Leptospermum variabile	S	NH (Gloucester Buckets)
Lomatia arborescens	S	Barrington Tops
Nothofagus moorei	SW	Mt Cockrow
Orites excelsa	S	Jerusalem Creek
Sloanea woollsii	S,W	Chichester River
Trochocarpa sp. aff. *laurina*	S,W	Barrington Tops
Vesselowskia rubifolia	S,W	Fal Brook

Table 4 cont.

Forest Type	Veg. Con.	n	Stratum 1+2 >20m	FR	HC	Stratum 3 6-20m	FR	HC	Stratum 4 1-6m	FR	HC	Stratum 5 0-1m	FR	HC
168	4	4	Eucalyptus laevopinea	0.7	3.0	Acacia maidenii	0.7	2.0	Geitonoplesium cymosum	1.0	1.5	Hypolepis glandulifera	1.0	3.5
			Eucalyptus saligna	0.7	3.0	Eucalyptus laevopinea	0.7	2.0	Dioscorea transversa	0.7	1.3	Rubus rosifolius	1.0	2.3
						Eucalyptus saligna	0.5	2.5	Eustrephus latifolius	0.7	1.3	Hydrocotyle acutiloba	1.0	2.0
									Helichrysum rufescens	0.7	1.3	Viola hederacea	1.0	2.0
									Clematis aristata	0.7	1.0	Oplismenus imbecillus	1.0	1.8
224	6	1				Acacia irrorata	1.0	1.0	Leptospermum variabile	1.0	5.0	Lepidosperma laterale	1.0	3.0
						Eucalyptus tereticornis	1.0	1.0	Phyllanthus gasstroemii	1.0	2.0	Cheilanthes sieberi	1.0	2.0
									Plectranthus graveolens	1.0	2.0	Entolasia stricta	1.0	2.0
									Callistemon salignus	1.0	1.0	Imperata cylindrica	1.0	2.0
									Correa reflexa	1.0	1.0	Lagenifera stipitata	1.0	2.0
230	2	1	Eucalyptus laevopinea	1.0	2.0							Poa sieberiana	1.0	4.0
			Eucalyptus obliqua	1.0	2.0							Sorghum leiocladum	1.0	4.0
												Dichelachne micrantha	1.0	3.0
												Poa labillardieri	1.0	3.0
												Scleranthus biflorus	1.0	3.0
231	3	2				Eucalyptus nobilis	1.0	2.0	Eucalyptus nobilis	0.5	1.0	Cyperus lucidus	1.0	3.5
												Juncus sarophorus	1.0	3.0
												Poa labillardieri	1.0	3.0
												Hydrocotyle peduncularis	1.0	2.5
												Juncus pauciflorus	1.0	2.5

Table 4 cont.

Forest Type	Veg. Con.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
163	1	8	Eucalyptus campanulata	1.0	3.4	Eucalyptus campanulata	0.8	2.1	Eucalyptus campanulata	0.6	1.8	Imperata cylindrica	1.0	3.5
									Allocasuarina torulosa	0.6	1.6	Pteridium esculentum	1.0	2.4
									Persoonia linearis	0.5	1.8	Lomandra longifolia	1.0	2.3
												Glycine clandestina	1.0	1.8
												Hibbertia scandens	1.0	1.8
167	1	6	Eucalyptus laevopinea	1.0	3.7	Eucalyptus laevopinea	0.8	1.8				Poa labillardieri	1.0	4.7
												Lomandra longifolia	1.0	2.5
												Desmodium varians	1.0	2.2
												Pteridium esculentum	1.0	2.0
												Wahlenbergia stricta	1.0	1.7
167	2	2	Eucalyptus laevopinea	1.0	4.0	Angophora floribunda	0.5	2.0	Acacia maidenii	1.0	2.0	Poa labillardieri	1.0	2.5
						Acacia maidenii	0.5	1.0	Cassinia compacta	0.5	4.0	Lomandra longifolia	1.0	3.5
									Hymenosporum flavum	0.5	2.0	Carex inversa	1.0	2.0
									Indigofera australis	0.5	2.0	Desmodium varians	1.0	2.0
									Eucalyptus laevopinea	0.5	1.0	Dichondra repens	1.0	2.0
168	1	7	Eucalyptus laevopinea	1.0	2.9	Allocasuarina torulosa	0.7	2.0				Poa labillardieri	1.0	4.2
			Eucalyptus saligna	1.0	2.8	Eucalyptus laevopinea	0.5	1.6				Pteridium esculentum	1.0	2.6
												Pratia purpurascens	1.0	1.8
												Desmodium varians	0.8	2.0
												Geranium potentilloides	0.8	1.9

Table 4 cont.

Forest Type	Veg. Con.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
247	1	1	Eucalyptus microcorys	1.0	3.0	Eucalyptus saligna	1.0	2.0	Poa labillardieri	1.0	3.0	Smilax australis	1.0	2.0
			Eucalyptus saligna	1.0	3.0	Eustrephus latifolius	1.0	2.0	Syncarpia glomulifera	1.0	3.0	Gahnia sieberana	1.0	1.0
			Eucalyptus canaliculata	1.0	2.0	Syncarpia glomulifera	1.0	2.0	Acacia melanoxylon	1.0	2.0	Syncarpia glomulifera	1.0	3.0
			Eucalyptus eugenioides	1.0	2.0	Synoum glandulosum	1.0	2.0	Breynia oblongifolia	1.0	2.0	Cissus hypoglauca	1.0	2.0
			Eucalyptus campanulata	1.0	1.0				Cissus antarctica	1.0	2.0	Culcita dubia	1.0	2.0
62	-	1	Eucalyptus campanulata	1.0	2.0	Acacia irrorata	1.0	2.0	Acacia irrorata	1.0	3.0	Hardenbergia violacea	1.0	2.0
	-		Eucalyptus canaliculata	1.0	2.0				Allocasuarina torulosa	1.0	2.0	Imperata cylindrica	1.0	2.0
												Indigofera australis	1.0	2.0
												Lomandra longifolia	1.0	2.0
												Poa labillardieri	1.0	2.0
62	1	6	Eucalyptus canaliculata	1.0	2.6	Allocasuarina torulosa	0.7	3.0	Eucalyptus eugenioides	0.5	1.5	Poa labillardieri	1.0	4.0
			Eucalyptus eugenioides	0.7	2.8	Eucalyptus eugenioides	0.7	2.0				Desmodium varians	1.0	2.0
												Dichondra repens	1.0	2.0
												Lomandra longifolia	1.0	1.9
												Plectranthus parviflorus	1.0	1.6
140	2	1	Eucalyptus obliqua	1.0	3.0				Eucalyptus obliqua	1.0	1.0	Poa labillardieri	1.0	5.0
			Eucalyptus pauciflora	1.0	3.0							Lomandra longifolia	1.0	3.0
												Arthropodium milleflorum	1.0	2.0
												Carex inversa	1.0	2.0
												Clematis aristata	1.0	2.0
153	2	6	Eucalyptus obliqua	1.0	3.8	Eucalyptus obliqua	0.6	1.3	Eucalyptus obliqua	0.5	1.7	Lomandra longifolia	1.0	3.5
			Eucalyptus laevopinea	0.5	2.3				Tristaniopsis collina	0.5	1.7	Poa labillardieri	1.0	3.0
												Desmodium varians	1.0	2.0
												Dianella caerulea	1.0	2.0
												Glycine clandestina	1.0	2.0

Table 4 cont.

Forest Type	Veg. Con.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
46	1	8	Eucalyptus saligna	1.0	3.6	Allocasuarina torulosa	0.8	2.6	Eucalyptus saligna	0.5	1.5	Poa labillardieri	1.0	3.6
			Eucalyptus eugenioides	0.5	1.8	Angophora floribunda	0.5	2.5				Dichondra repens	0.8	2.0
												Lomandra longifolia	0.8	1.6
												Dianella caerulea	0.8	1.4
												Glycine clandestina	0.8	1.4
46	4	2	Eucalyptus saligna	1.0	3.0	Acacia irrorata	0.5	4.0	Melicope micrococca	0.5	2.0	Hydrocotyle acutiloba	1.0	2.0
			Eucalyptus capanulata	0.5	3.0	Eucalyptus saligna	0.5	2.0	Eustrephus latifolius	0.5	2.0	Hibbertia scandens	1.0	2.0
						Allocasuarina torulosa	0.5	1.0	Neolitsea dealbata	0.5	2.0	Poa labillardieri	1.0	2.0
						Angophora floribunda	0.5	1.0	Rapanea howittiana	0.5	2.0	Viola hederacea	1.0	2.0
									Acacia irrorata	0.5	1.0	Cynoglossum latifolium	1.0	1.5
46	5	3	Eucalyptus saligna	1.0	3.7	Acmena smithii	1.0	2.7	Synoum glandulosum	0.6	2.5	Lomandra spicata	1.0	2.0
			Eucalyptus laevopinea	0.6	1.0	Cryptocarya glaucescens	1.0	2.0	Euponatia laurina	0.6	2.0	Doodia aspera	1.0	1.7
						Synoum glandulosum	0.6	3.0	Psychotria loniceroides	0.6	2.0	Citriobatus pauciflorus	1.0	1.3
						Caldcluvia paniculosa	0.6	2.5	Cryptocarya microneura	0.6	1.5	Adiantum formosum	0.6	2.0
						Melicope micrococca	0.6	1.5	Dioscorea transversa	0.6	1.0	Daphnandra sp. A	0.6	1.5
46	8	1	Daphnandra sp. A	1.0	3.0	Dendrocnide excelsa	1.0	3.0	Cissus antarctica	1.0	3.0	Lastreopsis microsora	1.0	3.0
			Eucalyptus saligna	1.0	3.0	Doryphora sassafras	1.0	2.0	Cryptocarya glaucescens	1.0	3.0	Adiantum formosum	1.0	2.0
			Eucalyptus resinifera	1.0	2.0	Baloghia lucida	1.0	1.0	Euponatia laurina	1.0	3.0	Daphnandra sp. A	1.0	2.0
			Ficus obliqua	1.0	2.0	Brachychiton acerifolius	1.0	1.0	Ripogonum album	1.0	3.0	Pollia crispata	1.0	2.0
						Caldcluvia paniculosa	1.0	1.0	Baloghia lucida	1.0	2.0	Pteris umbrosa	1.0	2.0

Table 4. Floristic composition of vegetation strata of Forest Types (FC NSW 1989), Mount Royal N.P.
Veg. Com. is the corresponding community or communities derived from the floristic classification; n=no. of plots; FR=frequency of occurrence; MC=mean cover code.
For each forest type+community combination, only species with a frequency >0.5 are listed, or the five most abundant such species where there are more than 5. Within each combination, species are listed in order of decreasing frequency and abundance.

Forest Type	Veg. Com.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
2/3	8	7	Daphnandra sp. A	0.8	2.3	Pennantia cunninghamii	0.8	2.3	Alangium villosum	0.7	2.0	Lomandra spicata	1.0	1.7
			Dysoxylum fraserianum	0.7	3.4	Cissus antarctica	0.7	2.2	Acmena smithii	0.5	1.5	Citriobatus pauciflorus	1.0	1.6
						Baloghia lucida	0.5	3.3	Baloghia lucida	0.5	1.5	Pteris umbrosa	0.8	2.5
						Dendrocnide excelsa	0.5	2.3	Diospyros pentamera	0.5	1.5	Adiantum formosum	0.8	2.2
						Doryphora sassafras	0.5	2.3	Dysoxylum fraserianum	0.5	1.5	Daphnandra sp. A	0.7	1.6
3	7	3	Caldcluvia paniculosa	1.0	2.7	Diospyros pentamera	1.0	2.7	Guioa semiglauca	0.6	2.5	Lastreopsis decomposita	1.0	3.3
			Dysoxylum fraserianum	0.6	2.0	Diploglottis australis	1.0	1.7	Tasmannia insipida	0.6	2.5	Lomandra spicata	1.0	2.0
						Doryphora sassafras	1.0	1.7	Alectryon subcinereus	0.6	1.5	Citriobatus pauciflorus	1.0	1.7
						Acmena smithii	0.6	3.0	Cyathea leichhardtiana	0.6	1.5	Arthropteris tenella	0.6	1.5
						Orites excelsa	0.6	2.5	Dysoxylum fraserianum	0.6	1.5			
6	9	2	Casuarina cunninghamiana	1.0	2.0	Cissus antarctica	1.0	4.0	Daphnandra sp. A	0.5	3.0	Adiantum formosum	1.0	2.5
			Daphnandra sp. A	0.5	3.0	Ficus coronata	1.0	3.0	Aphanopetalum resinosum	0.5	2.0	Doodia aspera	1.0	2.5
			Eucalyptus saligna	0.5	1.0	Alectryon subcinereus	1.0	2.5	Hymenanthera dentata	0.5	2.0	Aneilema acuminatum	1.0	2.0
						Cissus hypoglauca	1.0	2.0	Ripogonum album	0.5	2.0	Citriobatus pauciflorus	1.0	2.0
						Dioscorea transversa	1.0	2.0	Bachousia myrtifolia	0.5	1.0	Oplismenus imbecillus	1.0	2.0
16	10	1	Nothofagus moorei	1.0	4.0	Doryphora sassafras	1.0	4.0	Coprosma quadrifida	1.0	2.0	Lomandra spicata	1.0	2.0
						Quintinia sieberi	1.0	3.0	Dicksonia antarctica	1.0	2.0	Polystichum proliferum	1.0	2.0
						Nothofagus moorei	1.0	2.0	Doryphora sassafras	1.0	2.0	Dennstaedtia		
						Orites excelsa	1.0	2.0	Hotelaea longifolia	1.0	1.0	davallioides	1.0	1.0
									Nothofagus moorei	1.0	1.0	Histiopteris incisa	1.0	1.0

ROY 7. *Caldcluvia-Orites-Doryphora* rainforest.
Plots 1R,3R,4R
Map units Rm', Rm⁻

Fairly extensive stands of this essentially warm temperate rainforest, often with well developed structure, occur in Fal Brook catchment and on sheltered slopes in Carrow Brook catchment. Common canopy species include *Caldcluvia paniculosa, Orites excelsa, Doryphora sassafras* and *Diospyros pentamera*. Other frequent species include *Diploglottis australis, Citriobatus pauciflorus, Lomandra spicata* and *Arthropteris tenella*.

ROY 8. *Dysoxylum* rainforest.
Plots 2R,RS1,16,J1,B13,B18,B20,B53
Map units Rm', Rm⁻, Rs

A subtropical rainforest which is widely distributed in the area but with individual patches of generally limited extent and largely confined to narrow strips along creeks and on sheltered slopes. Structure and floristic composition are variable, with a canopy of varying height (maximum heights between 30m and 45m) and development. The canopy is typically very uneven, with the tallest dominants commonly of less than 50% canopy cover. Common tree species are *Dysoxylum fraserianum, Baloghia lucida, Pennantia cunninghamii, Daphnandra micrantha, Dendrocnide excelsa* and *Cryptocarya erythroxylon*. Understorey species include *Citriobatus pauciflorus, Lomandra spicata, Arthropteris tenella* and *Adiantum formosum*.

ROY 9. *Ficus coronata-Casuarina cunninghamii* gallery forest.
Plots B56,RM2
Map units Rm⁻, Rs

A variable and often floristically rich (up to 78 species per 0.1ha) type occurring in narrow bands (usually <30m wide) along streams at altitudes below 600m. There are occasional tall (up to 45m) emergent trees of *Casuarina cunninghamii*, with lower strata of a mosaic of closed thickets (usually below 20m height) of *Acmena smithii, Ficus coronata, Alectryon subcinereus* and *Streblus brunonianus*, with many gaps. Lianes are prominent, especially *Cissus hypoglauca* and *C. antarctica*. Plot B56 samples a depauperate form on an apparently marginal site, which includes dense thickets of *C. antarctica*.

ROY 10. *Nothofagus moorei* rainforest.
Plot 17
Map unit Rb'

A very well defined and well developed (maximum canopy height 45m) but floristically poor (17 species per 0.1ha) cool temperate rainforest of *Nothofagus moorei* occurs over about 17ha at the head of Cross Creek above 950m altitude. This is the only known location for *N. moorei* in the survey area. Associated tree species are *Doryphora sassafras, Quintinia sieberi* and *Orites excelsa*, all of which occur commonly in other rainforest stands in the area. This stand represents the southern and western limit of distribution for this vegetation type.

3.1.2 Comparison of vegetation map units and floristic communities

As indicated above, the most extensive floristic community (mid-altitude grassy forest) encompasses a very wide range of map units. Similarly, the most extensive map units are variable in floristic composition and each includes a range of floristic communities. Overstorey types within the broad category of open grassy forest correspond more closely to map units, with variations mainly due to differences in scale of stand definition. The structurally distinct and generally restricted floristic communities correspond much more closely to map units (e.g. Rb, Rm, Rs, Cr). The general lack of correspondence between the more extensive map units and floristic communities is a result of several factors, as follows:

i) Map units are defined on the basis of structure and floristics of the overstorey only. Variations in understorey, which are important in defining floristic communities, are not considered.

ii) Map units have a coarse resolution, of the order of hectares, relative to the finer resolution of 0.1 ha plots. Details of variation in overstorey composition recorded on a plot basis are obscured in map units. Some map units, such as Dl and Dh, are very variable in overstorey floristic composition in any case, by definition.

iii) There appear to be some mapping inaccuracies possibly due to misidentification of species from air photos. In particular, forest dominated by *E. obliqua* seems more extensive than the mapping indicates, and occurs in map units Na, Nc and Ng as well as unit Ne with which it nominally corresponds. *E. pauciflora* forest is much less extensive than indicated and is restricted to a single small stand of several hectares at most. Most of the area mapped as Ng is dominated by *E. obliqua*.

Appendix 3 provides descriptions of map units on the basis of plot data and general observations recorded while traversing the area.

3.1.3 NSW Forestry Commission Forest Types

For each plot, the vegetation was allocated to the most appropriate forest type (Anon. 1989) on the basis of canopy composition. The resultant range of types corresponds reasonably well to those described in the management plan for the area (Anon. 1988). The main discrepancies are as follows:

. stands dominated by *E. obliqua* have been allocated to type 153 (which usually includes *E. laevopinea* as a co-dominant) rather than type 151, due to the absence of *E. fastigata*.

. poorly stuctured rainforest at lower altitudes has been equated to type 6, rather than 23/26, because type 6 more accurately reflects the floristic composition of the stands.

Some forest types equate well with single floristic communities. Other types, notably the extensive type 46, vary considerably in understorey composition and include several floristic communities. Table 4 shows the relationships between forest types and floristic communities and list major species in each vegetation height stratum for each forest type-community combination.

Five overstorey types may be recognised within this broad community, as follows:

1A. *E. campanulata*, often associated with *E. canaliculata*, *E. saligna* or *E. laevopinea*.
Plots 1,1D,2D,14M,B3,NC3,NC5
Map units Na⁻,Na⁺,Nc⁺,Nc⁻

1B. Mixed stands with *Allocasuarina torulosa* prominent as a subcanopy tree, usually at lower altitudes. Common canopy species include *Eucalyptus canaliculata*, *E. eugenioides*, *E. saligna* and *Angophora floribunda*. This represents the drier end of the open forest continuum in the area.
Plots 9,24,27,34,3D,13D,B1,B54,DL5,N1,N2,NC1,NC7
Map units D1,Gm,Na⁺,Na⁻,Nc⁻,Y1

1C. *E. saligna* with *E. campanulata* or *E. laevopinea*.
Plots 28,1M,2M,3M,5M,NA12,B35,B58
Map units Na⁺,Nb⁺,Nc⁺

1D. *E. saligna* dominant.
Plots 3,4,23,12D,13M
Map units Dh,D1,Na⁺,Yf

1E. *E. laevopinea* dominant.
Plots 35,14D,12M,B15,B41,N3
Map units D1,Na⁺,Na⁻,Nb⁺,Nb⁻,Nc⁻

ROY 2. High altitude grassy forest
Plots 11D,NA13,CN1,20,22,B22,B40,B50,B51,B52
Map units Na⁺,Na⁻,Nc⁻,Ne⁺,Ne⁻,Ng⁻,Cn

Structurally and floristically similar to community 1 but occurring at higher altitudes. *Eucalyptus obliqua* is usually dominant, associated with *E. laevopinea* at lower altitudes. The understorey is dominated by *Lomandra longifolia* and *Poa* spp. with scattered small shrubs, commonly *Leucopogon lanceolatus*.

Plots 11D and B22 represent stands transitional with community 1. Plot CN1 is an area of grassland with scattered stunted eucalypts, which is floristically very similar to the open forest stands. Plot B52 samples the only stand in the study area containing *E. pauciflora*, a small area north of Mount Cockrow.

ROY 3. Sedgeland

3A. *Carex-Cyperus-Juncus* sedgeland (plots 30,B17)

Widespread but of limited overall extent, occurring in soakage areas and perched swamps on basalt. Variable in composition with a mixture of graminoids, commonly abundant species being *Cyperus lucidus*, *Carex longebrachiata*, *Juncus sarophorus* and *J. pauciflorus*. There are occasional eucalypts, often *E. nobilis*.

3B. *Eleocharis sphacelata* sedgeland

Only two stands of this type, each of several hectares, occur in the area, in Davis Creek section. *E. sphacelata* is dominant in the wettest zone, associated with species such as *Schoenoplectus mucronatus* and *Isolepis inundata*. This community was not quantitatively sampled and is not included in figure 2.

ROY 4. *E. saligna-E. laevopinea* moist forest
Plots 11M,NA2,NA5,NA11
Map units Na⁺,Na⁻

A tall open forest with mesomorphic herb and fern understorey with moderate to well developed shrub stratum. Common shrub species are *Synoum glandulosum* and *Hedycarya angustifolia*. *Hypolepis glandulifera*, *Calochlaena dubia*, *Rubus rosifolius* and *Senecio amygdalifolius* are common ground cover species.

Plots NA8 and B55 are transitional between this community and ROY 5. NA8 is a previously heavily logged stand of *E. saligna* with dense subcanopy of *Acacia irrorata* and shrub thickets of rainforest species. Plot B55 is a sheltered site with a very dense fern ground cover (*Calochlaena dubia* and *Hypolepis glandulifera*), which is near the forest boundary and probably regularly burnt.

ROY 5. *E. saligna* wet sclerophyll forest.
Plots 2,10,B7
Map units Na⁺,Yh

A tall open forest with well developed shrub and small tree understorey, often of rainforest species such as *Acmena smithii*, *Synoum glandulosum*, *Cryptocarya glaucescens* and *Psychotria loniceroides*. Ferns such as *Doodia aspera* and *Dennstaedtia davallioides* and the herb *Lomandra spicata* are common in the usually sparse ground layer.

This community occurs on sheltered aspects and lower slopes, usually adjacent to rainforest communities. It is of limited extent in the Davis Creek section and the eastern part of Carrow Brook catchment, but is more extensive elsewhere.

ROY 6. *Leptospermum variabile* shrubland.
Plot CR1
Map unit Cr

A very distinctive but floristically poor community of localised extent corresponding to map unit Cr and occurring on an extensive rock slab. Variously dominated by dense thickets, mostly below 3m tall, of *Leptospermum variabile* or *Baeckea* sp. aff. *diosmifolia*, with *Plectranthus graveolens*.

Table 3. Altitude, vegetation structure and floristic richness of floristic communities.

11

Community	n	Altitude(m) range	Altitude(m) median	Median % canopy cover Strat 1 (>35m)	Strat 2 (20-35m)	Strat 3 (6-20m)	Strat 4 (1-6m)	Strat 5 (<1m)	Max. canopy height (m) range	Max. canopy height (m) median	Floristic richness (spp./0.1ha) range	Floristic richness (spp./0.1ha) median
1	36	380-1090	755	27.5	30	10	1	70	25-50	35	13-81	44
2	10	920-1350	1150	46	32.5	2	1	70	25-45	35	38-60	45.5
3	2	780-950	865			3	1	100	12-20	16	31-42	36.5
4	6	540-790	705	12.5	10	10	15	50	25-45	36	38-64	61
5	3	360-650	530	30		70	37.5	25	40-55	40	53-56	56
6	1		490			1	70	10		10		24
7	3	670-810	810	15.5	53	40	12.5	25	30-40	40	24-35	33
8	8	370-890	615	20	55	65	7.5	10	30-40	40	35-64	51.5
9	2	550-620	585	5	6	90	2	40	25-40	35	54-79	66.5
10	1		1140	35		45	3	4		45		17

Table 2 cont.

10

Veg. Com.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
10	1	Nothofagus moorei	1.00	4.0	Doryphora sassafras	1.00	4.0	Coprosma quadrifida	1.00	2.0	Lomandra spicata	1.00	2.0
					Quintinia sieberi	1.00	3.0	Dicksonia antarctica	1.00	2.0	Polystichum proliferum	1.00	2.0
					Nothofagus moorei	1.00	2.0	Doryphora sassafras	1.00	2.0	Dennstaedtia davallioides	1.00	1.0
					Orites excelsa	1.00	2.0	Hoteiaea longifolia	1.00	1.0			
								Nothofagus moorei	1.00	1.0	Histiopteris incisa	1.00	1.0

Table 2 cont.

Veg. Con.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
5	3	Eucalyptus saligna	1.00	3.7	Acmena smithii	1.00	2.7	Synoum glandulosum	0.67	2.5	Lomandra spicata	1.00	2.0
		Eucalyptus laevopinea	0.67	1.0	Cryptocarya glaucescens	1.00	2.0	Euponatia laurina	0.67	2.0	Doodia aspera	1.00	1.7
					Synoum glandulosum	0.67	3.0	Psychotria loniceroides	0.67	2.0	Citriobatus pauciflorus	1.00	1.3
					Caldcluvia paniculosa	0.67	2.5	Cryptocarya microneura	0.67	1.5	Adiantum formosum	0.67	2.0
					Helicope micrococca	0.67	1.5	Dioscorea transversa	0.67	1.0	Daphnandra sp. A	0.67	1.5
6	1				Acacia irrorata	1.00	1.0	Leptospermum variabile	1.00	5.0	Lepidosperma laterale	1.00	3.0
					Eucalyptus tereticornis	1.00	1.0	Phyllanthus gasstroemii	1.00	2.0	Cheilanthes sieberi	1.00	2.0
								Plectranthus graveolens	1.00	2.0	Entolasia stricta	1.00	2.0
								Callistemon salignus	1.00	1.0	Imperata cylindrica	1.00	2.0
								Correa reflexa	1.00	1.0	Lagenifera stipitata	1.00	2.0
7	3	Caldcluvia paniculosa	1.00	2.7	Diospyros pentamera	1.00	2.7	Guioa semiglauca	0.67	2.5	Lastreopsis decomposita	1.00	3.3
		Dysoxylum fraserianum	0.67	2.0	Diploglottis australis	1.00	1.7	Tasmannia insipida	0.67	2.5	Lomandra spicata	1.00	2.0
					Doryphora sassafras	1.00	1.7	Alectryon subcinereus	0.67	1.5	Citriobatus pauciflorus	1.00	1.7
					Acmena smithii	0.67	3.0	Cyathea leichhardtiana	0.67	1.5	Arthropteris tenella	0.67	1.5
					Orites excelsa	0.67	2.5	Dysoxylum fraserianum	0.67	1.5			
8	8	Daphnandra sp. A	0.88	2.4	Pennantia cunninghamii	0.88	2.1	Alangium villosum	0.75	1.8	Lomandra spicata	1.00	1.6
		Dysoxylum fraserianum	0.63	3.4	Cissus antarctica	0.75	2.0	Ripogonum album	0.63	1.8	Citriobatus pauciflorus	1.00	1.5
					Baloghia lucida	0.63	2.8	Baloghia lucida	0.63	1.6	Pteris umbrosa	0.88	2.4
					Dendrocnide excelsa	0.63	2.4	Diospyros pentamera	0.63	1.4	Adiantum formosum	0.88	2.1
					Doryphora sassafras	0.63	2.2	Dysoxylum fraserianum	0.63	1.4	Daphnandra sp. A	0.75	1.7
9	2	Casuarina cunninghamiana	1.00	2.0	Cissus antarctica	1.00	4.0	Daphnandra sp. A	0.50	3.0	Adiantum formosum	1.00	2.5
		Daphnandra sp. A	0.50	3.0	Ficus coronata	1.00	3.0	Aphanopetalum resinosum	0.50	2.0	Doodia aspera	1.00	2.5
		Eucalyptus saligna	0.50	1.0	Alectryon subcinereus	1.00	2.5	Hynenanthera dentata	0.50	2.0	Aneilema acuminatum	1.00	2.0
					Cissus hypoglauca	1.00	2.0	Ripogonum album	0.50	2.0	Citriobatus pauciflorus	1.00	2.0
					Dioscorea transversa	1.00	2.0	Backhousia myrtifolia	0.50	1.0	Oplismenus imbecillus	1.00	2.0

Table 2. Floristic composition of vegetation strata of floristic communities, Mount Royal N.P.
n=no. of plots; FR=frequency of occurrence; MC=mean cover code.
For each community, only species with a frequency >0.5 are listed, or the five most abundant such species where there are more than 5. Within each community, species are listed in order of decreasing frequency and abundance. Absence of records for a stratum does not necessarily imply that the stratum is non-existent, only that no species occurred with frequency >0.5.

Veg. Com.	n	Stratum 1+2 >20m	FR	MC	Stratum 3 6-20m	FR	MC	Stratum 4 1-6m	FR	MC	Stratum 5 0-1m	FR	MC
1	36	Eucalyptus saligna	0.59	2.9	Allocasuarina torulosa	0.69	2.4						
		Eucalyptus laevopinea	0.51	3.0							Poa labillardieri	0.95	4.0
											Lomandra longifolia	0.95	2.0
											Glycine clandestina	0.87	1.8
											Desmodium varians	0.85	1.9
											Pteridium esculentum	0.79	2.1
2	10	Eucalyptus obliqua	0.80	3.5									
		Eucalyptus laevopinea	0.60	2.8							Poa labillardieri	1.00	3.0
											Lomandra longifolia	1.00	3.3
											Desmodium varians	1.00	2.0
											Glycine clandestina	1.00	2.0
											Hydrocotyle acutiloba	1.00	1.9
3	2				Eucalyptus nobilis	1.00	2.0	Eucalyptus nobilis	0.50	1.0			
											Cyperus lucidus	1.00	3.5
											Juncus sarophorus	1.00	3.0
											Poa labillardieri	1.00	3.0
											Hydrocotyle peduncularis	1.00	2.5
											Juncus pauciflorus	1.00	2.5
4	6	Eucalyptus saligna	0.83	3.0	Eucalyptus saligna	0.50	2.3	Eustrephus latifolius	0.67	1.5	Hydrocotyle acutiloba	1.17	2.0
		Eucalyptus laevopinea	0.50	3.0	Acacia maidenii	0.50	2.0	Geitonoplesium cymosum	0.67	1.5	Viola hederacea	1.00	2.0
					Eucalyptus laevopinea	0.50	2.0	Dioscorea transversa	0.67	1.3	Hibbertia scandens	1.00	1.7
								Helichrysum rufescens	0.50	1.3	Oplismenus imbecillus	1.00	1.7
								Clematis aristata	0.50	1.0	Pteridium esculentum	1.00	1.7

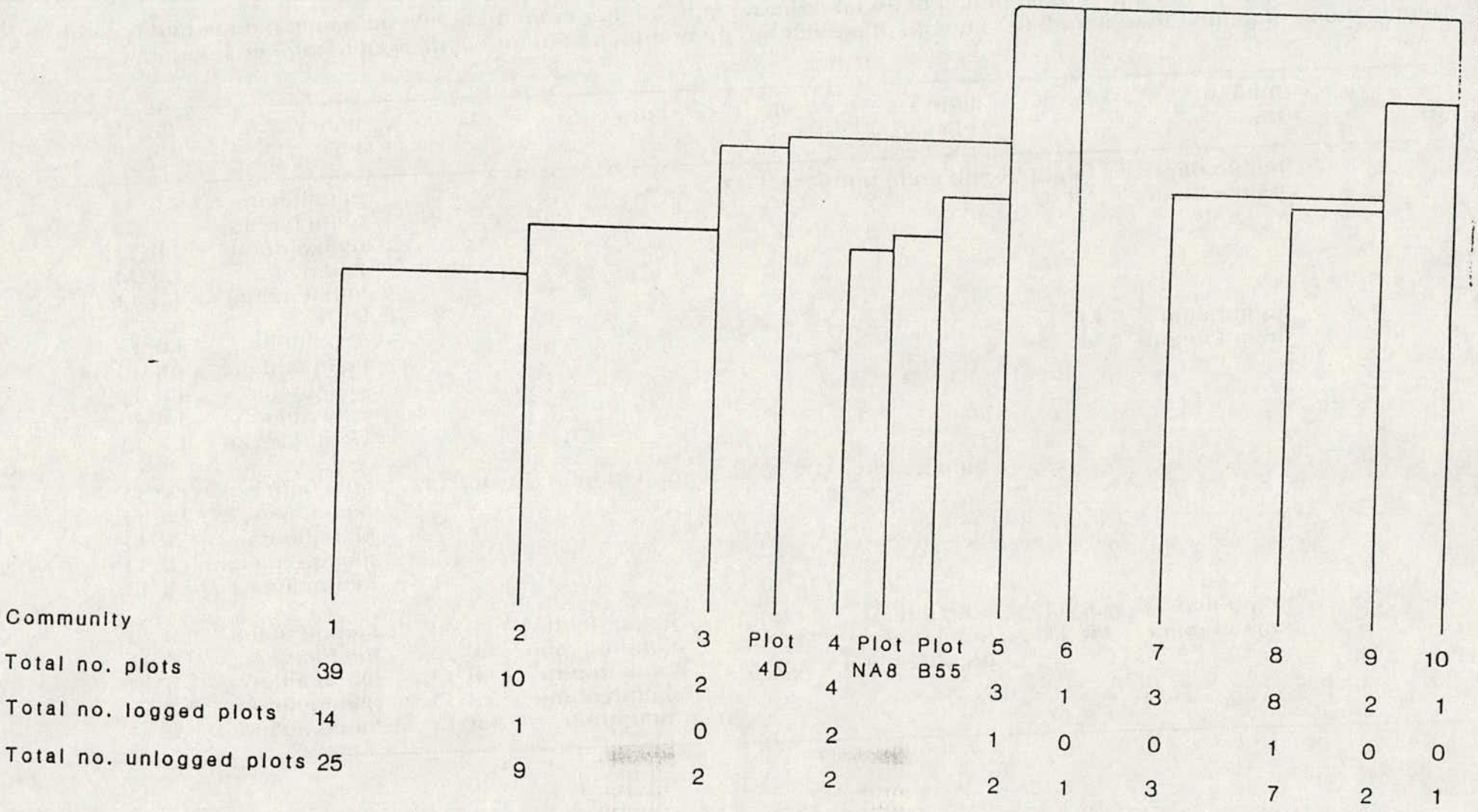


Figure 2. Dendrogram resulting from FUSE at 13 group level, using Bray-Curtis coefficient of dissimilarity and beta=0 Plots 4D, NA8 and B55 are regarded as anomalous or transitional.

Difficulties were experienced with the following species or groups, mostly due to lack of suitable material:

Acaena novae-zelandiae No fertile material was available. Other species may have been included.

Baeckea sp. aff. *diosmifolia* A single population near plot CR1. Although very similar to typical *B. diosmifolia*, plants were growing in an unusual habitat (dry shrubland in contrast to the usual wet heath) and possessed distinctive bright orange, "woolly" bark. The taxonomic and conservation status of this population requires further investigation.

Baeckea sp. aff. *virgata* Specimens collected represented an extreme form of this very variable species which may eventually deserve separate specific status. The form is widespread in north-east NSW and is often locally common on rock outcrops, and even if taxonomically distinct is unlikely to be of conservation significance.

Carex appressa/declinata Some sterile material may have been incorrectly assigned.

Galium spp. Except for the distinctive *G. binifolium*, all Galium material has been aggregated pending specialist determination.

Gonocarpus humilis Most of the material was sterile and it is possible that records of this species include *G. tetragynus*.

Haloragis ?serra Only a few small plants were found. It was not possible to unequivocally determine whether these belonged to *H. serra* or *H. exalata* in the absence of fertile material.

Hibbertia diffusa This species occurred only as a small population near Smiths Mount.

Hydrocotyle acutiloba/peduncularis This genus requires revision. Some records were difficult to assign to a species.

Poa labillardieri/sieberiana Some specimens may have been incorrectly assigned to either of these species.

Pterostylis decurva This species exhibited considerable variation in the area. Some specimens approached *P. abrupta*.

Ranunculus plebeius Flowering material was rare and records of this species could include *R. lappaceus*.

2.6 Data analysis

Floristic data were classified into vegetation communities using a numerical hierarchical agglomerative classification process, using the Bray-Curtis association measure on percentage cover and a flexible UPGMA sorting strategy (part of 'FUSE') with beta = 0.0 (Belbin 1988). Although this provides a repeatable and explicit method of defining communities, there are a number of critical decisions required which are essentially subjective and which may substantially affect the final community composition. The most important of these are the choice of beta and the

choice of an appropriate level in the dendrogram to define communities. A beta value of zero was chosen to minimise distortion and most realistically reflect actual associations. Combined overstorey and understorey data were analysed to yield a total vegetation community classification. Species with a combined cover code over all plots of ≤2 were found to not contribute significantly to the result of the analysis and were excluded from the final analysis.

3. RESULTS

3.1 Floristics and vegetation communities

A total of 447 vascular plant taxa (431 native and 16 naturalised) was recorded from the survey area. These are listed, with authorities, in Appendix 1.

3.1.1 Floristic communities

Floristic survey data from the 76 plots have been classified into ten vegetation communities. Figure 2 is the dendrogram resulting from the numerical classification, cut off at the 13 group level. Three of the 'groups' are single plots which are considered either anomalous or transitional and not representative of a particular community type. The ten communities are briefly described below. Within each floristic community, the distribution of plots across the forest type map units is indicated. Table 2 lists the major characteristic species of each height stratum in each community. Table 3 lists altitude, canopy cover for each stratum, maximum canopy height and floristic richness for each community. Appendix 2 shows the frequency of occurrence of each species in each community.

ROY 1. Mid-altitude grassy forest.

This is by far the most extensive community type throughout the area, occurring over a broad range of habitats, on both sedimentary and basalt geology, from 400m to 1000m altitude. On a broad scale, there is a remarkable uniformity of structure and floristics of the understorey, and variations in understorey floristics do not appear to be related to overstorey structure or floristics. This community includes open forest and tall open forest, with canopy height between 25m and 50m. The understorey is typically grassy with a poorly developed or non-existent shrub layer. *Poa labillardieri* is usually dominant, often with *Imperata cylindrica*, *Lomandra longifolia* and *Pteridium esculentum*. Other frequent and widespread, but less abundant species include *Desmodium varians*, *Glycine clandestina*, *Dianella caerulea*, *Dichondra repens* and *Rubus parvifolius*. On a scale of tens of metres, small patches characterised by ground cover species typical of swampy sites (e.g. *Carex appressa*, *C. longebrachiata*, *Cyperus lucidus*) occur in small drainage depressions in a mosaic with more extensive drier site species.

1. INTRODUCTION

This report presents the results of a flora survey undertaken in Mount Royal Management Area on the southern slopes of the Barrington Tops plateau in New South Wales. The field work was carried out by D. Binns, T. Brassil, W. Chapman, R. Sergeant and P. Murphy, during September 1990 and February-March 1991.

2. METHODS

2.1 Plot Location

Floristic data were derived from a series of non-permanent plots established within the study area. Plots were initially marked on a 1:25 000 topographic map and their positions transferred to the field as accurately as possible using topographic features.

Plot points in previously unlogged areas were stratified primarily by vegetation type, on the basis of a map of forest types ('Royal Milli' types) previously prepared from aerial photograph interpretation with extensive field checking (FC NSW unpubl. map). For forest types which occurred in two or more discrete patches, a minimum of two plots was randomly located per forest type stratum. More plots were located in more extensive types, up to a maximum of five. A single plot was located in each forest type mapped as only a single stand. For each of the five most extensive types, several plots were also located in previously logged areas. Sampling intensity was higher in the essentially unlogged Davis Creek catchment and the partially logged eastern part of Carrow Brook catchment. Fal Brook catchment and the western side of Carrow Brook catchment have been mostly logged and were less intensively sampled. Plots were located to sample each geology type in the area.

In the field, plots were positioned as far as possible within a relatively homogeneous patch of vegetation. The standard size was a 50m x 20m (0.1ha) rectangle, although some habitats required a variation in size or shape to ensure homogeneity within one plot e.g. longer or narrow plots were used for riparian vegetation, and smaller plots for vegetation of restricted extent. A total of 76 plots were surveyed during the present survey. Approximate locations are shown in Figure 1. Table 1 shows the distribution of sample plots among mapped vegetation units and catchments.

2.2 Floristic and vegetation structural data

All plant species which could be distinguished within a plot were recorded and identified as far as possible to species level. Vertical heights of vegetation strata were subjectively defined and recorded for each plot. Stratum limits of 0-1m, 1-6m, 6-20m and 20-35m and >35m were used as a guide for the coding of structural data, even though actual heights were recorded.

Cover codes, based on projected canopy cover, were estimated for each species within each vertical stratum. Where a species occurred in more than one stratum, an overall cover code for the plot as a whole was also recorded. Codes are as follows:

Cover Code	Projected Canopy Cover
1	< 5%, few individuals
2	< 5%, any number of individuals
3	6-25%
4	26-50%
5	51-75%
6	> 75%

The locations of any occurrences of significant species noted while traversing the area, additional to those occurring in plots, and any species not previously recorded in plots, were also recorded.

The map unit in which each plot was located was recorded and a subjective assessment made of the forest type (Anon. 1989) to which the vegetation would be most appropriately allocated.

2.3 Habitat data

At each plot, slope (in degrees), altitude, aspect, topographic position, drainage, percentage cover and particle size of surface rock and cover of outcropping bedrock were recorded. Any other unusual feature was also recorded.

2.4 Limitations

Field work was carried out in early spring and late summer. Some ephemeral species may have been overlooked, and summer dormant geophytes, including most Orchidaceae and many Liliaceae, would have been generally overlooked during the second part of the survey due to the absence of active growth. Although the area was traversed comprehensively, the survey was not exhaustive and further species would be recorded with additional effort.

2.5 Taxonomy and Nomenclature

Taxonomy and nomenclature follow the National Herbarium of N.S.W. This is mostly as published in Jacobs and Pickard (1981), Jacobs and Lapinpuro (1986) or Harden (1990,1991), whichever gives the most recent treatment.

Table 1. Areas (ha) of mapped vegetation units and stratification of flora survey plots, Mount Royal N.A.

Map Unit	Approx. area (no. plots) Davis Creek	Fal Brook	E.Carrow Brook	W.Carrow Brook	Total area	Total No. plots
Rb	17(1)	-	-	-	17	1
Rm'/Rm-	12(1)	138(3)	113(3)	382(2)	705	9
Rs	16(2)	85	38(1)	120(1)	259	4
S	-	-	1	26	27	0
Yh	1	10	21(1)	45	77	1
Yf	11	19	1	1	32	1
Yl	-	-	11(1)	3	14	1
Ma	-	125	-	54	179	0
Ma'	422(10)	1621(6)	179(4)	737(2)	2959	22
Ma-	145(2)	92(1)	86(1)	72(1)	395	5
Mb'	42(2)	1	-	-	43	2
Mb-	8(1)	-	-	-	8	1
Mc'	-	456(1)	8(1)	131(1)	595	3
Mc-	26(2)	84(2)	170(1)	36(1)	316	6
Me'	12(1)	-	-	-	12	1
Me-	93(3)	-	-	-	93	3
Mg-	4(1)	-	-	-	4	1
Db	-	25	88(3)	104	217	3
Dl	133(3)	163	214(3)	130(1)	640	7
Gm	45(2)	17	-	-	62	2
Cn	2(1)	4	7	8	21	1
Cr	-	-	-	9(1)	9	1
Ca	4	3	2	-	9	0
Swamp	3(1)	-	-	-	3	1

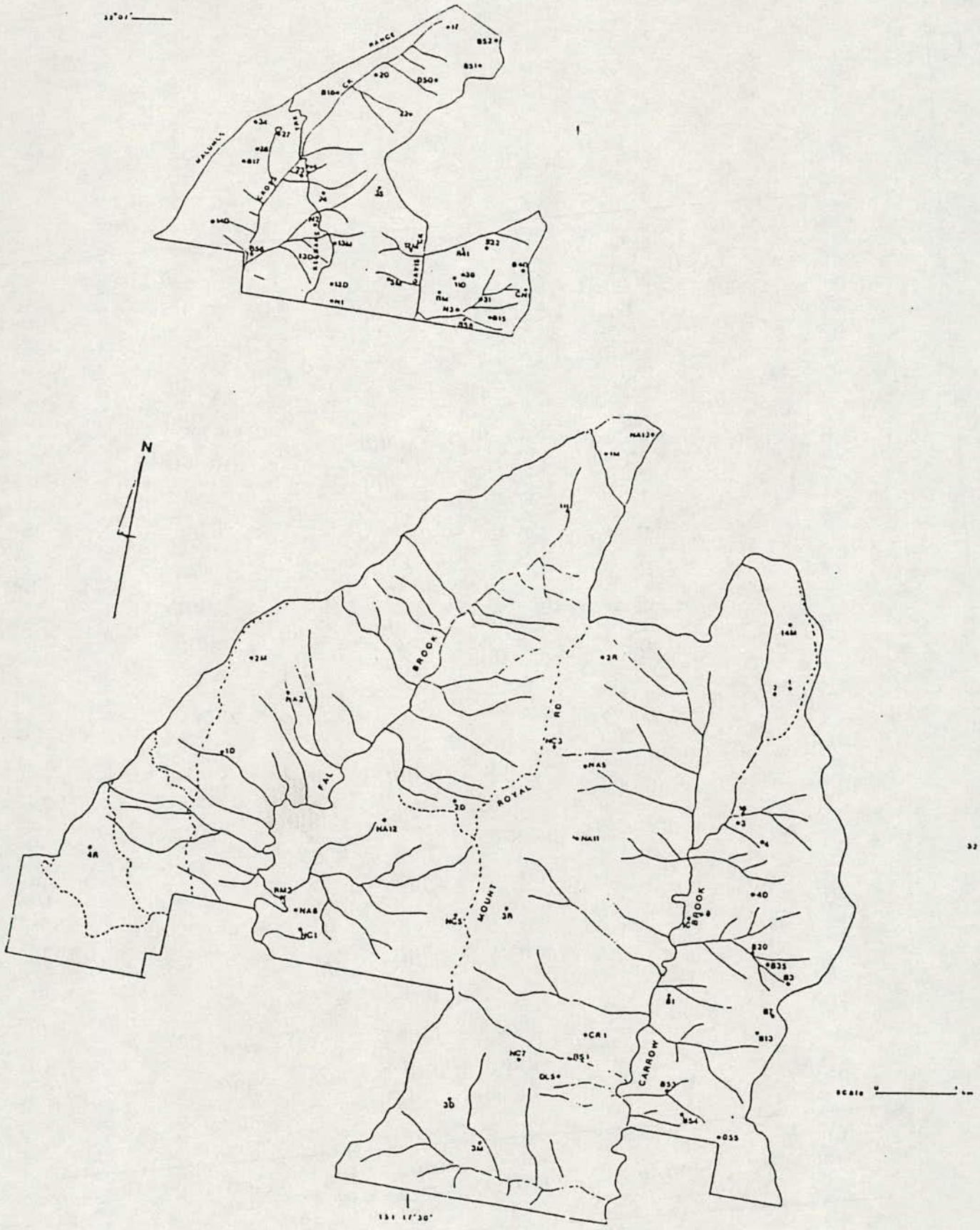
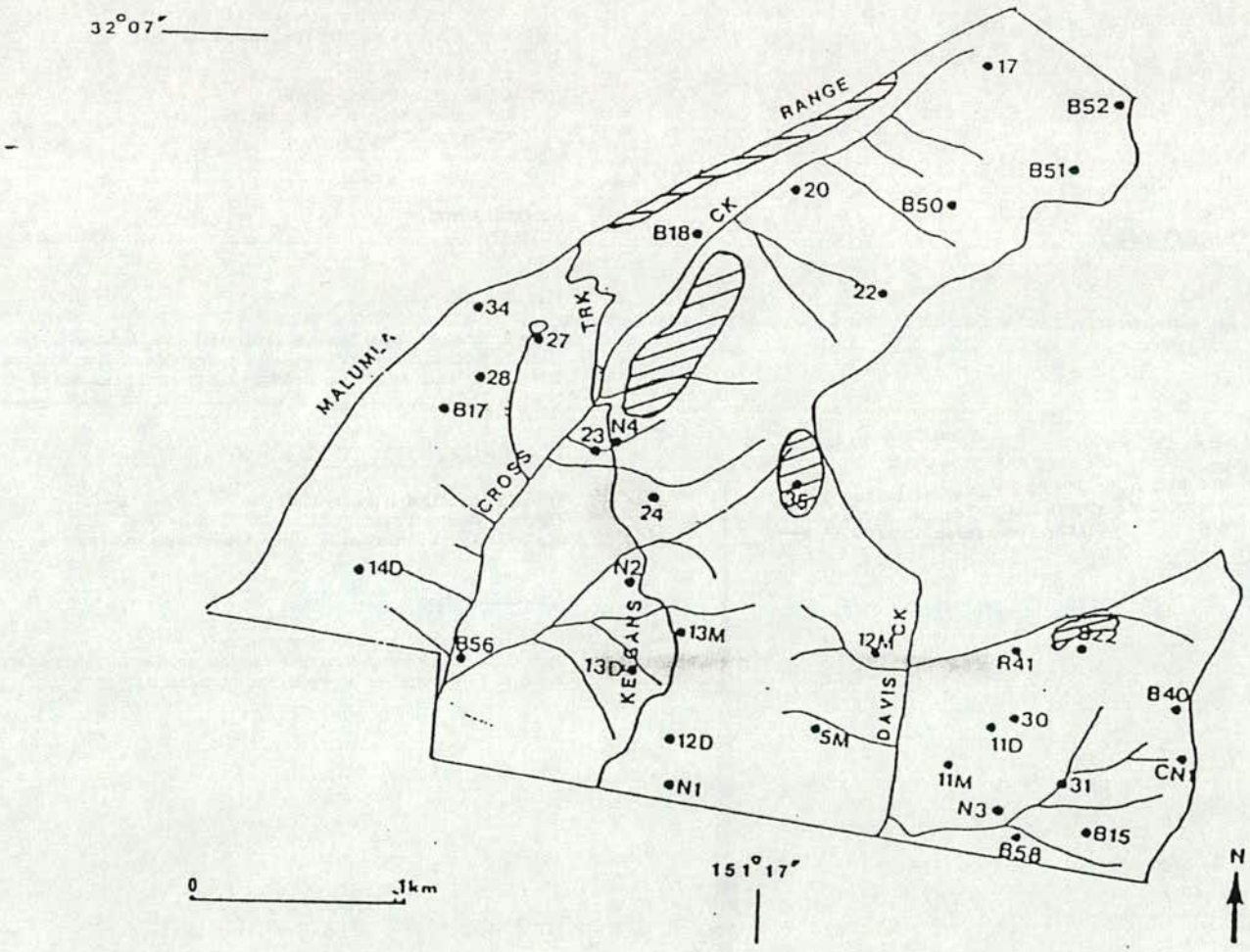


Figure 1. Flora survey Mount Royal M.A.

Approx. locations of survey plots


32°07'
RANGE
17
B52
B51
20
B50
B18
CK
22
34
27
TRK
MALUMLA
28
B17
23
N4
CROSS
24
35
14D
N2
B56
13M
12M
CK
R41
B22
B40
13D
KEEBAHS
DAVIS
30
11D
12D
5M
11M
31
CN1
N1
N3
B15
B58
0
1km
151°17'
N

from p23

FLORA SURVEY

MOUNT ROYAL MANAGEMENT AREA

D. Binns

June 1991

This report will be published as part of:

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TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

MT ROYAL MANAGEMENT AREA, FORESTRY COMMISSION OF N.S.W. ENVIRONMENTAL IMPACT STATEMENT (EIS) and FAUNA IMPACT STATEMENT (FIS).

SUMMARY OF OBJECTIONS

NOTE: Send objections to the EIS/FIS to the Forestry Commission, Locked Bag 23, Pennant Hills, NSW 2120, to be received by November 17th. Submissions should be clearly labelled Mount Royal EIS/FIS, and should demand that the Minister for Planning not allow the logging to proceed and the Director of National Parks and Wildlife Service should not issue Fauna Licences for the operations. The remaining Mt Royal old growth forests should be incorporated into the Barrington Tops National Park which adjoins. The Forestry Commission will forward copies of letters and submissions received to the Department of Planning and the NPWS.

1. New legislation now requires the Forestry Commission to prepare a FIS regarding impacts on fauna of logging operations in order to obtain a Fauna Licence from the NPWS with respect to proposed operations. The FIS is included in the EIS. The EIS and FIS are not independent studies, but are undertaken and prepared by the Forestry Commission themselves. Consequently they are not objective assessments of likely environmental impacts and they **always** conclude that the proposed logging should proceed, regardless of the evidence. The lack of honesty and objectivity and proper scientific rigour of these assessments is responsible for their most basic errors and deficiencies, and is a major basis of objection to the EIS and the FIS.

2. The EIS and FIS state that the **lack of pre-logging data,** including even adequate data on past logging methods, and "substantial differences between major environmental features of previously logged and unlogged areas" in the Management Area, **means that it is not possible to assess the impacts** of the proposed operations on flora or fauna. In other words, the EIS and FIS admit there is insufficient data to support their conclusions that impacts of the proposed operations are not likely to be significant!

3. The EIS misrepresents the proposed operations as "selective logging", and does not discuss or attempt to assess the impacts of the proposed **intensive, integrated sawlog/pulplog harvesting.** Consequently, insofar as impacts of logging operations are considered in the EIS, the assessment and conclusions do not apply to **the proposed operations.**

4. Apparent errors and anomolies in the **site selection** upon which the flora and fauna survey plots were based cause the difference between the comparative value as fauna habitat of logged and unlogged forest in the area to be significantly understated. Consequently conclusions drawn in the EIS and FIS concerning the likely impacts of logging on certain species of fauna, most notably arboreal mammals, are unsound. This is perhaps **the** most fundamental source of error in the survey methodology, which invalidates conclusions drawn in the FIS and the EIS.

5. Even without correcting for these errors, the Fauna Survey Census found that 80% of the Yellow-bellied Gliders, all the Koalas, 60% of the Greater Gliders and 80% of the Brushtail Possums recorded in the survey were in the unlogged forest plots. Consequently the finding of the EIS that logging impacts are not likely to be significant is not even consistent with the data in the fauna survey with regard to these species.

6. If this is so it would appear that the impacts of logging on other species, such as Owls, is also likely to be significant.

7. The EIS and the FIS make a number of **false and misleading claims** about measures proposed to conserve flora and fauna:

(a) the EIS suggests a significant area has been excluded from logging as part of special "safeguard measures" to conserve species. In fact the difference between the area excluded from harvesting by the routine prescriptions in the Management Plan and the area now proposed to be excluded is negligible.

(b) the "reserves" are in fact temporary Preferred Management Priority classifications which do not provide the legal protection afforded, for example, to Flora Reserves. It is misleading to call them "fauna reserves".

(c) the "safeguard measures" are clearly and demonstrably inadequate to conserve species of fauna. The "reserves" are absurdly small and the "corridors" are merely rainforest filter strips unsuitable for many species - it is misleading to call them "wildlife corridors".

(d) the EIS omits to state explicitly that logging is permitted in filter strips; since much emphasis is placed on the value of these strips as refuge and corridor, this is a significant and misleading omission.

(e) the Fauna Impact Statement (FIS) is unjustifiably complacent about likely logging impacts and routinely draws inadequately supported conclusions - for example: "Food resources for this species (Glossy Black Cockatoo) are expected to be either unchanged or enhanced by logging"; "the mosaic of logged and unlogged areas and reserved areas should ensure its (Tiger Quoll's) survival"; "the development of a grassy understorey under a more open canopy would be expected to favour this species (Rufous Bettong); "In the long term, disturbance due to logging and fire is thought to increase habitat for grazers and browsers by increasing the productivity of the understorey layer. After logging, as thicker regrowth replaces grassy undertorey, a number of grazers such as Red-necked Wallabies may decline relative to browsers, such as Swamp Wallabies"; "The fact that it is found in logged areas suggests that forestry pratices may not place (Hastings River Mouse) at risk. Its preferred habitat, near creek banks, will not be disturbed by logging machinery;" "The Mount Royal area has been subject to the same fire regime as is scheduled by the Forestry Commission for at least 100 years. Therefore, the impact of prescribed burning in the area is thought to be small"; "no species will be eliminated or severely reduced in populaton size over the entire area... and where there is an indication that resources from old trees are required, management plans have been formulated to retain these resources;" "in conjunction with nearby reserves, the overall effect of forestry operations will not result in permanent reduction in the distribution of any endangered wildlife species."

(f) There is insufficient evidence presented to support these conclusions; material presented is inconsistent (for example, it is asserted that logging will produce a grassy understorey, then that it will lead to the replacement of grassy understorey by thicker regrowth); and research studies of the impacts of logging on fauna contradict these conclusions. The FIS is, quite simply, a dishonest and biassed attempt to justify logging.

8. The EIS claim that standard erosion mitigation prescriptions will ameliorate impacts on erosion and water quality is not supported by evidence and it would appear that such impacts have been and will be highly significant.
9. The impacts of frequent burning and grazing are not adequately assessed; studies and other evidence suggest the impacts of these to be significant.

10. The EIS does not attempt to address the cumulative impacts of successive cutting cycles, and therefore is inadequate as an assessment of likely medium to long-term environmental impacts.
11. Only two studies using pre- and post-logging survey data have been undertaken to assess the impacts of logging in NSW forests. Both studies found significant impacts, and consequently the EIS makes **no reference whatsover to these studies.** Since the major purpose of the EIS is to assess environmental impacts, this is a major deficiency.
12. A growing body of literature exists reporting **studies into impacts** of logging operations and aspects of management such as burning and grazing on forest ecosystems, flora and especially fauna. There is scarcely a study from this literature reporting adverse impacts cited in the EIS. Most are not mentioned at all, or even cited in the EIS Bibliography or the FIS references. This is further evidence of lack of objectivity and proper scientific diligence.

For further information write or phone: North East Forest Alliance, Hunter Region P.O. Box 9 Singleton 2330. Phone: (065) 77.3105 Donations towards legal and campaign expenses are needed and much appreciated. **Please reproduce/circulate this document.**

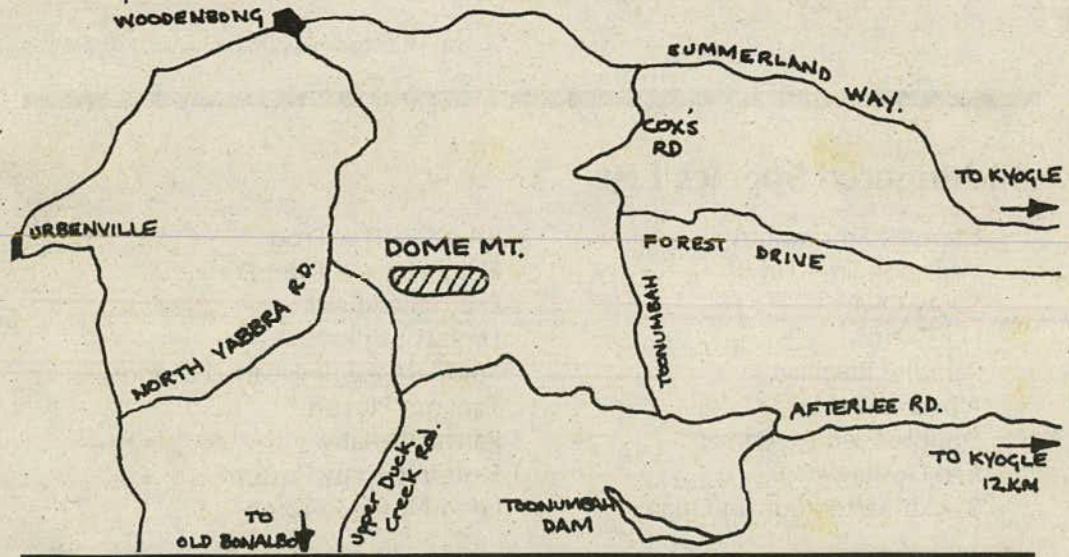
The likely Environmental Impact of Logging in the Dome Mountain Area

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 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 & stability
- extensive soil compaction
- an increase in erosion
- altered streamflows
- degradation of aquatic habitats
- 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 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



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by Black Rainbow

THE DOME MOUNTAIN AREA

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.

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 inaccessibility have resulted in extensive stands of well developed old-growth forests, within which diverse flora and fauna abound.

The Dome Mountain Area is particularly significant because:

- *IT SUPPORTS* over 1000 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 is 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.
- *AT LEAST 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.
- *IT SUPPORTS* one of the largest and most westerly populations of the threatened Marbled Frogmouth remaining in N.S.W.
- *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 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.

Faunal Values of the Dome Mountain Area

The Dome Mountain area is one of special faunal significance. Many sub-tropical rainforest and wet sclerophyll forest dependent vertebrates including several endangered species occur in the area at higher densities than anywhere else in the state. Dome Mountain is at the centre of the N.S.W. distribution of three of the state's rarest birds.

Incomplete information coupled with only cursory inspections ensure the extent of Frog and Mammal Fauna in the area is poorly known. This is consistent with Forestry Commission statements that they had not undertaken any faunal assessments in the area, nor did they intend to do so. Despite this there is little doubt that the area would be of special significance for a number of restricted species.

"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 deficiency 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

Endangered Species List

Marbled Frogmouth
Wompoo Fruit Dove
Sooty Owl
Noisy Pitta
Paradise Riflebird
Alberts Lyrebird
Double-Eyed Fig Parrot
Red Goshawk
Blackbreasted Button-Quail
Whirring Tree Frog
Fleay's Barred River Frog
Leaf Tailed Gecko
Legless Skink
Southern Angle Headed Dragon
Topknot Pigeon
Parma Wallaby
Eastern Pygmy Possum
Long-Nosed Potoroo

SF

INGALBA. 440, 442, 446, 447
449, 445, 434, 470

BELLINGER R 102.

BUCKRABENDINNI 376

GLADSTONE 242

IRISHMAN

LITTLE NEWRY

MISTAKE

NAMBUCCA

NEVER NEVER

NEWRY

OAKES

PINE CK

SCOTCHMAN

TAUCETI

THUM CK

TUCKERS KNOB

RAPIC

INGALBA 439, 447, 446
31 442 445
434

376

242

STATEMENT OF CLAIMS FOR PAYMENT
HCV STUDY, N.E. NSW

Claimant:
Fortnight ending:

Item	Details	Amount
Consultancy fee	Date(s) worked Hours	
Telephone/fax		
Post/photocopy		
Other materials		
Purchase of information		
Travel	.....km @ 20 C/km on (dates)	
Photography		
Total	for fortnight ending / /	

Qualifying comments:

Signature of claimant:

Approved by regional coordinator ..../..../94

Approved by State coordinator ..../..../94