

BORDER RANGES

BACKGROUND PAPER

SECTION B

INTERDEPARTMENTAL COMMITTEE

TO INVESTIGATE

MANAGEMENT POLICY FOR

THE BORDER RANGES AREA

BACKGROUND PAPER

SYDNEY
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Border Ranges Background Paper

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1. Interdepartmental Committee

1.1 At its Cabinet meeting on 3rd August, 1976, the N.S.W. Government agreed to set up an interdepartmental committee to investigate the management policy for the Border Ranges area, for the purpose of preparing a report to Cabinet of relevant employment, environmental and economic aspects.

1.2 The committee was to consist of nominees of the Ministers for Lands and Environment, Local Government and Planning, Conservation and Water Resources, and Decentralisation and Development.

1.3 As a result of a subsequent adjustment of Ministerial portfolios, the Ministers nominating representatives to the committee changed slightly. The Ministers and their nominees on the committee were:

Minister for Planning and Environment: nominee, Dr. R. Yardley,
Applied Sciences Section, Planning and Environment Commission.

Minister for Lands: nominee, Mr. D. A. Johnstone, Director,
National Parks and Wildlife Service.

Minister for Decentralisation and Development: nominee, Mr. Bryan
Talty, Department of Decentralisation and Development.

Minister for Conservation and Water Resources: nominee, Mr. J. L.
Henry, Commissioner for Forests.

Mr. Henry was appointed convenor and chairman of the committee, and the Forestry Commission provided secretarial support for the committee.

2. Background to a Controversy

2.1 "Border Ranges" is a name that appears to have no circumscribed definition, but that is applied generally to the broken, mountainous land along and adjoining the eastern section of the boundary between N.S.W. and Queensland. In this region the State border runs along a major divide formed by the McPherson Range in the east and by the Great Dividing Range westwards from Wilson's Peak. Much of the divide is of volcanic origin, and it contains spectacular peaks, broad plateaux, sheer cliffs and an apparent confusion of associated ridges and ranges running to both the north and south. It is an area of high rainfall, providing the headwaters for a number of major streams - the Nerang, Coomera, Albert, Logan and Condamine in the north; the Tweed, Richmond and Clarence in the south.

2.2 Rainforest, often of particular luxuriance, covers much of the range country and provides habitat for a fauna that is quite distinct from that of the more widespread eucalypt forests and woodlands, and that contains a number of species apparently unique to this region. The rainforest also contains many species of trees with valuable timbers, satisfying specialty purposes for which suitable alternatives are not readily available. The fertile rainforest soils have been sought, and in many places developed, for agricultural use.

2.3 Though the higher ranges do not appear to have been much used by the tribal aborigines ⁽¹⁾, the foothills and adjacent lowlands apparently supported a significant population of aborigines before the coming of the white man, and some of the descendants of the original inhabitants lay claim to parts of the area for their special use.

(1) Arthur Groom. "One Mountain after Another". Angus & Robertson, Sydney, 1949 (Chapter III).

- 2.4 The region thus can be seen to possess many particular values - its outstanding scenic and recreational attractions; its biological significance; its importance as the catchment for major river systems; its valuable timber resource; its potential for agricultural development; its historical interest to certain people of aboriginal descent. It is from the real or apparent conflict between these values and uses that controversy has developed.
- 2.5 Such landuse controversy in the region is hardly new. Proposals to establish a national park on one of the northern plateaux, the Lamington Plateau, were first voiced in 1896 and faced strong opposition from settlement interests before the Park was established in 1915. In N.S.W. agitation for State Forest on Acacia Plateau to be revoked for farm settlement in the nineteen thirties led the Forestry Commission to introduce a policy of planting the native rainforest conifers, Hoop and Bunya Pine, on logged-over rainforest sites - it being considered at the time that silvicultural management of the rainforest was not feasible.
- 2.6 Unlike Queensland, where many of the generally more extensive plateau areas were indeed cleared for settlement, on the southern side of the border these areas mostly remained under forest cover and, with other lands along the border and adjoining ranges, were dedicated as State Forest within a year or so of the establishment of the Forestry Commission of N.S.W. Indeed State Forests No.'s 1 (Koreelah, originally dedicated as Acacia Creek and Koreelah State Forest) and 2 (Beaury, originally dedicated as Mandle and Beaury State Forest) are located in this general area. Logging had occurred within these forests well before their dedication as State Forest, but it was not until the nineteen forties, with the introduction of mechanical logging systems and improved transport, that any major timber harvesting commenced in the higher rainforest plateaux of the Border Ranges.
- 2.7 Proposals for a national park on the N.S.W. side of the border appear to have been first publicly voiced about 1949 and were raised again in 1969 by the Kyogle Community Development Association and Chamber of Commerce.
- 2.8 During 1970 the Parks and Reserves Scientific Committee, which had been established several years earlier by the then Minister for Lands, the Hon. T. L. Lewis, M.L.A., to advise him on the need for parks and reserves, examined the creation of national parks and comparable reserves on the North Coast of N.S.W. The Committee's subsequent report included a lengthy write-up covering the possible establishment of an interstate park on the McPherson Range, the Minister having previously indicated his particular interest in the establishment of an interstate park. The Committee's report was confidential to the Minister, but a copy was "leaked" to the Press in January, 1976, and the relevant extract from the report is attached as Appendix 1.
- 2.9 A more forcible expression of support for the creation of a national park in the area developed in 1972-73 with the establishment of the Border Ranges Preservation Society. The creation of the Society coincided with, and was possibly sparked by, the construction of an access road, to be used for logging, on to the Tweed Range and Wiangaree State Forest. The Society pressed for the establishment of a national park over Wiangaree State Forest, and later extended its campaign to include other areas of State Forest and private land further west along the McPherson Range.
- 2.10 The 1972-73 campaign coincided with a by-election for the State seat of Byron, and for a short period the national park proposal became an election issue, attracting a statement of support from the then Leader of the Opposition (the Hon. P. D. Hills, M.L.A.), who subsequently expressed his support for existing forest management in the area.

- 2.11 With a grant from the Commonwealth Government, the Border Ranges Preservation Society commissioned a study on the national park potential of the area by Urban Systems Corporation Pty. Ltd. The report of this study, "Border Ranges Proposed National Park study," was released in the latter half of 1975.
- 2.12 The then Minister for Lands and Forests, Mr. J. M. Mason, M.L.A., referred this report and the whole question of the future management of the forests in this area to a committee of backbench Government Members for examination. The committee was convened by Mr. J. H. Brown, M.L.A., and had as its members the Hon. F. N. Duncan, M.L.C., Mr. K. R. Rozzoli, M.L.A., and Mr. R. B. Duncan, M.L.A. The committee reported to the by then new Minister, Mr. C. M. Fisher, M.L.A., in March, 1976, and had as its first recommendation "that all State Forests in the Border Ranges region continue under the multiple use management of the Forestry Commission". (The full recommendations of this committee are given in Appendix 2).
- 2.13 Apparently before the Government had seriously considered this matter any further the State Elections intervened, with the resultant change of Government in May, 1976.
- 2.14 The question of a national park in the area was raised at the Annual State Conference of the Australian Labor Party in June, 1976. The topic was subject to various motions and amendments, and it appears that the resolutions ultimately passed by the Conference, and becoming the platform of the Party on this matter, were as follows:
- "7.1 The Border Ranges have and are continuing to provide a significant source of regional and local employment arising from the supply of timber from the State Forests in the ranges. The State Forests in the Border Ranges are presently controlled by the Forestry Commission who have adopted management commitments and constraints designed to maintain or re-establish the forests preserving native flora and retaining rainforests in a healthy and viable condition. The continued management of these State Forests under the Forestry Commission in supplying timber is essential in ensuring continuing employment in the area and meeting industry needs.
- "7.2 Deleted by Conference.
- "7.3 That the N.S.W. Forestry Commission be encouraged to purchase previously cleared land contiguous with the proposed Park for Hoop Pine plantations to provide alternate supplies for the local timber industry.
- "7.4 That until plantation forests in the area are in a position to be managed for timber production, logging be permitted to continue within Wiangarie State Forest. Before any changes are made to existing management practices within Wiangarie State Forest, an inquiry should be undertaken to ensure:
- "7.4.1 The maintenance of full employment within the area in existing industries or in suitable alternative local industries;
- "7.4.2 That the local timber industry is structured so as to ensure its long term economic viability;
- "7.4.3 That measures are undertaken to alleviate local pockets of rural poverty as revealed in the Henderson Inquiry."
- 2.15 The proposal for the establishment of national park in the Border Ranges area generated considerable support from environmental organisations, including the Australian Conservation Foundation

which devoted the August, 1976, issue of its journal, "Habitat", to this matter. The matter also prompted the Royal Society of Queensland and the Australian and New Zealand Association for the Advancement of Science (ANZAAS) to organise a symposium on the Border Ranges, "A Land-use Conflict in Regional Perspective," at Binna Burra, adjacent to the Lamington National Park, in June, 1976.

- 2.16 In the light of this continuing controversy, together with an approach by the Forestry Commission for Ministerial approval for the construction of a major logging and access road on to Levers Plateau, in Roseberry State Forest, the Government decided on the 3rd August, 1976, that any construction of the road should be deferred until the future management policy for the Border Ranges area had been determined. To this end the interdepartmental committee was established to advise the Government on this matter. A copy of the Premier's news release on this decision is attached as Appendix 3.

3. The Environment of the Border Ranges

3.1 Whilst the term "Border Ranges" has been applied generally to the mountainous area extending along and on either side of the N.S.W./Queensland border from near Point Danger to the northern end of the New England district, some 175 km inland, the region that has been the particular subject of the controversy of recent years has been confined to that section of the Ranges forming the northern catchment of the Richmond River - the section lying between the Tweed and Richmond Ranges, and containing Wiangaree, Roseberry and Mt. Lindesay State Forests. Although there have been some suggestions from local environmental groups that the scope of the enquiry should be extended to include the Nightcap Range area, near Lismore, this appears to be completely beyond the intention of the Government's decision of 3rd August, 1976, and this paper will, as far as practicable, confine its attention to the region containing the northern headwaters of the Richmond River. The three State Forests in this region have an area of 330 square km.

3.2 Geology and Topography

3.2.1 Expressed in simple terms, the Border Ranges area is located above a Mesozoic (mostly Jurassic) basin, containing essentially horizontally bedded sandstone, conglomerate, shale, coal measures and other related sediments.

3.2.2 In the east, and outcropping in the Tweed Valley, these Mesozoic sediments overlie much older Palaeozoic Silurian deposits which have been heavily metamorphosed and which contain greywacke, slate, phyllite and quartzite.

3.2.3 About 20 million years ago, during the Tertiary Era, the area was the scene of massive volcanic activity. In the east this activity was centred around what is now Mt. Warning, which remains as the plug-like remnant of the central lava vent chamber of the Tweed shield volcano, while to the west a similar shield volcano was centred on Focal Peak, near Mt. Barney in Queensland.⁽¹⁾ A number of other volcanic vents also occur in the vicinity and contribute to the distinctive landforms of the area.

3.2.4 This volcanic activity included massive outpourings of lavas from these vents. In the study area the flows extended both westwards from Mt. Warning and eastwards from Focal Peak, meeting in the general vicinity of Kyogle and dipping gently away from the source vents.⁽²⁾ These flows form the plateaux along and adjoining the Border Ranges, extending well west of the study area. The plateau surfaces of Wiangaree State Forest and Lamington National Park immediately to its north originate from the Mt. Warning vent, while the volcanic material on Roseberry and Mt. Lindesay State Forests emanate from the more westerly vents.

3.2.5 The basalts from Focal Peak are older than those from Mt. Warning and of somewhat different chemical composition, so that the krasnozems on parts of Roseberry State Forest (e.g. Lever's Plateau) have a different origin from those of Wiangaree State Forest and the Lamington National Park.

(1) J.A. Ross. The Focal Peak Shield Volcano. Proc. Roy. Soc. Qld. 85; pp. 111-117. 1974

(2) N.C. Stevens. Geology and Landforms. Paper to Border Ranges Symposium, Binna Burra, June 1976.

- 3.2.6 Associated with these flows were other, more acidic lavas, chiefly of rhyolite. This is widespread in parts of the west of the study area, where it apparently flowed from Mt. Gillies (north of Mt. Lindesay) and possibly from Mt. Glennie and other nearby vents. These acidic lavas have produced on Roseberry State Forest a two-tiered plateau, with Levers Plateau to the east composed of basalt at an elevation of 650-700 m while further west these flows are overlain by rhyolite to form a second plateau on Mt. Glennie at 850-950 m.
- 3.2.7 The plateaux along the Border Ranges range up to over 1000 metres in altitude, with relatively flat or gently undulating surfaces and steep to precipitous, deeply dissected margins. Both in the head of the Tweed Valley and in the western extremity of the study area at the head of the Richmond River erosion has exposed the underlying Mesozoic sediments. In the upper Richmond Valley, Mt. Lindesay rises out of the Jurassic shales and sandstones, its spectacular peak (1194 m) composed of a residual basalt capping.
- 3.2.8 In the east of the study area lies the largest of these plateaux, occupied by the Lamington National Park north of the border and Wiangaree State Forest to the south. The east of the plateau is marked by an escarpment that drops steeply into the Tweed Valley and that is shaped like an arc centred on Mt. Warning. The N.S.W. section of the plateau extends westwards along the McPherson Range towards Mt. Gipps (755 m), with a much dissected margin where the various tributaries of the Richmond River (Horseshoe, Fawcett, Collins, Warrazambil, Lynch's, Sheepstation, Brindle and Grady's Creeks) have cut back into the plateau. Waterfalls occur at the points where a number of these streams leave the plateau.
- 3.2.9 West of this plateau, where the railway line to Brisbane crosses the border at the Richmond Gap, the border range drops to a low saddle with an altitude of 360 m.
- 3.2.10 On the Queensland side of the border there is a steep drop from the crest of the McPherson Range in the vicinity of the Richmond Gap, and this sharp fall continues along the northern side until the Range itself is suddenly again reduced to less than 500 m in altitude between Glennies Chair and Mt. Lindesay.
- 3.2.11 The N.S.W. side of the border in this region is more rugged. There are several relatively small plateaux, of which the largest is Lever's Plateau, along or close to the border, and these are interspersed with high and rugged ridges and steep sided, winding valleys. In the rhyolitic areas, this particularly resistant rock has produced many cliff faces. Major creeks draining this area, which is occupied along the border by Roseberry State Forest, are Long, Findon, Sawpit and Terrace Creeks. These creeks all flow together to join the Richmond River near Old Grevillia (about 5 km downstream from the present village of Grevillia). This section of the border extends west to Glennies Chair (966 m).
- 3.2.12 Lever's Plateau is a triangular shaped area covering about 1000 ha. In the north it abuts the border, providing fine views across the steep and cleared northern slopes into the Logan Valley and westwards to Mt. Barney. On the east it drops steeply into Long Creek and on the southwest into Findon Creek. Its average altitude is about 700 m, compared with a range of from about 700 to 1000 m on the plateau of Wiangaree State Forest.
- 3.2.13 Mt. Glennie, or Glennie's Chair, is the highest point in this section of the study area, forming a dominant feature with long leading ridges from the east, very steep drops to the south and west and cliff faces around much of the highest parts. It is surmounted by a small plateau with an area of about 250 ha above an altitude of about 850 m.
- 3.2.14 From Glennie's Chair the McPherson Range drops sharply away into a

gap where the land slopes gently to both north and south. Arising from the centre of this gap is Mt. Lindesay, with sheer cliffs standing above the steep talus slopes, and at the west the land slopes gently up to an altitude of about 600 m where the Richmond Range, the divide between the Richmond and Clarence Rivers, heads south from the McPherson Range. The headwaters of the Richmond River itself lie in this angle between the two ranges. Westwards from here the Border Range once more rises to above 1000 m and the country becomes rugged and broken, with basalt again topping the higher peaks.

- 3.2.15 South of the area described in para. 3.2.8 - 3.2.14 the various streams flow into the Richmond River, here normally a narrow, fast-flowing stream that winds eastwards through a mostly relatively narrow but flat-bottomed valley until its junction with Grady's Creek near The Risk. Here the Richmond River swings southwards and passes into a progressively much wider valley as it passes through Wiangaree and Kyogle on its way towards Casino. On the south side of the upper reaches of the Richmond River the land again rises steeply on to offshoots from the Richmond Range, again with a series of basalt plateaux present.

3.3 Hydrology

- 3.3.1 Areas immediately east of the study area drain into the Tweed River; those to the west into the Clarence River; and those to the north into the Albert and Logan Rivers. The study area itself drains completely into the Richmond River, with the main tributaries arising in this area being those listed in paras. 3.2.8 and 3.2.11, above.
- 3.3.2 The figures in Table 3.1 provide a measure of stream flow from the areas, with the figure for Wiangaree Bridge being a reasonable estimate of flow from the whole study area.

Table 3.1

Stream Flow - Upper Richmond Valley

(adapted from Stream Gauging Information - Australia - December 1969; published by Aust. Water Resources Council, Canberra, 1971).

<u>Stream</u>	<u>Station</u>	<u>Catchment</u> <u>Area</u> (sq.km)	<u>Annual Discharge</u> (4) (1000 Ml)		
			<u>Mean</u>	<u>Max</u>	<u>Min</u>
Richmond R. (1)	The Risk	570	298	850	50
Lynch's Creek (2)	Wiangaree	116	123	268	39
Richmond R. (3)	Wiangaree Bridge	705	376	1140	102

Note (1) This reading includes all tributaries westwards from, and including, Sheepstation Creek, together with several streams entering from south of the Richmond River (outside study area).

(2) This includes Collins, Warrazambil and Lynch's Creek water.

(3) This would seem to be a fair estimate of flow from the study area. It excludes Fawcetts and Horseshoe Creeks, but includes water from south of the study area.

(4) Discharges have been recorded over differing periods of years.

- 3.3.3 By comparison, the estimate of flow from the whole Richmond River system, with a catchment area of 6950 km², is 2 000 000 Ml (1.6 million acre feet).⁽³⁾ The study area, representing about 10 per cent of the total catchment area, provides in the order of 20 per cent of the total stream flow.

3.4 Climate

- 3.4.1 The study area is poorly supplied with weather records, and indeed there are no permanent stations within the area and most stations in the adjacent region are located in the valley bottoms, whereas the area of concern consists of mountains rising to above 1000 m. Table 3.2 provides figures for three stations in the adjacent region.
- 3.4.2 Roseberry Nursery is located on the banks of the Richmond River immediately to the south of the study area and centrally located to it. The valley bottom is prone to severe winter frosts, though temperatures generally would be warmer than at higher altitudes. Rainfall also is substantially lower at the nursery than at higher elevations: Toonumbar State Forest headquarters, distant only 5 km from Roseberry Nursery but some 250 m higher in elevation, reputedly receives an average rainfall 450 mm higher than the Nursery.⁽⁴⁾
- 3.4.3 Whian Whian State Forest is located on the south edge of the Tweed shield volcano, about 25 km from Lismore. It is probably the wettest station in N.S.W., yet periodic measurements on the range above the station, about 6 km distant and 300 m higher, suggest that the rainfall there is some 500 mm higher than at Whian Whian State Forest.
- 3.4.4 Mt. Tamborine is a basalt plateau, supporting rainforest, located on one of the northern arms of the Border Ranges, in Queensland.
- 3.4.5 Besides the local correlation between rainfall and elevation, rainfall tends to be higher in the east of the study area and to drop off towards the west. Along the crest of the Tweed Range, the annual precipitation may well be in the order of 3.5 m, and the range is frequently clothed in mist and cloud. Over most of the plateau of Wiangaree State Forest rainfall is probably in the order of 2000 mm a year; on Lever's Plateau somewhat lower; and in the gap at the base of Mt. Lindesay down to about 1000 mm.
- 3.4.6 Temperatures on the plateau tops may average about 2°C less than at Whian Whian State Forest. Snow is an exceptional, but not unknown, feature along the higher points of the range.

3.5 Soils

- 3.5.1 As is generally the case, the soils in the study area are determined particularly by the geology and climate of the site.
- 3.5.2 Over most of the area the soil parent material has been influenced by the widespread basalt flows. At the lower elevations even where the basalt does not form the immediate substrate (e.g. near the base of Mt. Lindesay), its enriching influence is significant.

(3) Review of Australia's Water Resources, 1963. Aust. Water Resources Council, Canberra, 1965.

(4) D.N. Munns. "Soil of the ... Upper Richmond Valley." B.Sc.Agr. (Hons.) Thesis, University of Sydney, 1953.

Table 3.2

Meteorological Data - Border Ranges Area

(from Climatic Averages - Australia; Bur. of Meteorology, Canberra, 1975)

Roseberry Forestry Nursery Alt. 152.4 m

	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>	<u>Year</u>
Mean Max. Temp.	29.8	29.3	27.7	25.8	21.7	19.5	19.3	20.7	24.2	26.5	29.4	29.4	25.3°C
Mean Min. Temp.	18.3	17.8	16.2	13.7	9.4	7.4	4.4	5.8	9.3	12.7	14.4	16.5	12.2°C
Rainfall	150	188	162	73	63	94	63	44	38	82	81	137	1175mm

Whian Whian State Forest Alt. 381.0 m

Mean Max. Temp	25.7	25.3	23.8	22.1	18.5	16.5	15.5	17.0	20.5	22.7	26.0	24.1	21.5°C
Mean Min. Temp.	16.7	16.3	14.9	13.0	9.5	8.2	5.8	6.8	8.8	12.1	13.4	15.5	11.8°C
Rainfall	352	382	318	189	155	194	146	103	74	149	135	191	2388mm
Raindays	15	18	18	14	11	11	8	8	11	10	10	13	147 days

Mt. Tamborine, Q. Alt. 525.8

Mean Max. Temp	25.8	25.5	24.6	22.9	19.9	17.8	17.0	18.4	20.5	22.7	24.4	25.5	22.1°C
Mean Min. Temp.	17.2	17.2	15.9	14.2	11.1	9.3	7.9	8.7	10.5	12.9	14.8	16.1	13.0°C
Rainfall	237	218	195	118	103	105	96	57	60	96	112	154	1551mm
Raindays	14	14	15	12	10	9	9	7	8	10	11	12	131 days

3.5.3 The basalt and the high rainfall have combined to produce deep krasnozem (red loam) soils of generally high fertility over much of the area, while in the lower rainfall valleys black soils, related to prairie soils, are to be found.

3.5.4 By contrast the higher altitude rhyolite flows have produced shallower, less fertile yellow clay soils, as occur on Mt. Glennie.

3.6 Vegetation

3.6.1 There is no detailed vegetation map of the study area, though sections of the area have been mapped for forest cover in some detail by the Forestry Commission. A map purporting to show vegetation cover was included in the Urban Systems "Proposed National Park Study". This was taken from a Forestry Commission State-wide inventory.⁽⁵⁾ Whilst this inventory provided accurate figures of forest cover for the State as a whole, and the resultant map provided an invaluable guide to vegetation patterns over the State as a whole, the use of the data over such a limited area is extremely misleading.

3.6.2 1:50,000 military maps of the area are marked to show "forest, medium" and "forest, rain" (essentially a split between eucalypt forest and rainforest), but botanically the marking is not particularly accurate since eucalypt stands with a dense understorey are marked as "forest, rain."

3.6.3 Notwithstanding the absence of a map of the vegetation of the area generally, the pattern of vegetation can be fairly simply described and understood.

3.6.4 At the time of European settlement the area would have been almost entirely forested. As is the case over much of eastern Australia, the forest vegetation consisted of two major elements which were frequently in active competition for occupancy of the same land. One element, typified by the presence of Eucalyptus and Casuarina spp. was autochthonous; the other, characterised by most species found in the rainforest, was of mixed Malaysian and Antarctic origin. In general the rainforest element requires ample moisture and soils of at least moderate fertility for its development, while the Australian element has wider tolerances. However, throughout virtually the whole of the study area conditions are suitable for the development of both (or either of) these major vegetation forms.

3.6.5 The competition between the elements is determined under these circumstances largely by disturbance. An absence of disturbance, such as that caused particularly by fire, will favour the spread and maintenance of rainforest, whose dense cover precludes the regeneration of the light demanding eucalypts and their associates. By contrast periodic disturbance by fire exposes the soil and favours the spread and growth of eucalypt forest.

3.6.6 In the most favoured areas with deep, fertile soils, high rainfall and frequent mist it is difficult to imagine fire ever occurring, though there is evidence that in fact under exceptional conditions it may occur. Such sites, including the Wiangaree and Lever's Plateaux, tend to carry permanent and well developed rainforest. On the other hand the valleys, with their lower rainfall and pronounced dry season (note the very low spring rainfall for Roseberry Nursery in Table 3.2), are much more liable to be burnt, and the resultant

(5) For. Comm. Tech. Paper No. 28: "Forins - Forest Resource Inventory of the State, 1971-72"

fires are likely to sweep up the steeper slopes - particularly those on the hotter, drier, northern and western exposures. The pattern between the two vegetation elements is constantly changing, and to this day in the study area there are sites where rainforest is actively invading eucalypt stands following a prolonged period of freedom from fire, and other sites where patches of eucalypt regeneration have appeared following the incursion of a relatively recent fire into the margin of a well established rainforest stand. Over much of the study area the resultant vegetation pattern is unusually dynamic, and vegetation maps showing the eucalypt forest/rainforest boundary should be regarded as having temporal significance only. They do not in most cases portray permanent boundaries, since these do not exist.

- 3.6.7 The widespread occurrence of rainforest in this area is one of the major reasons for proposing that the area should become a national park, and Chapter 5 will look rather more closely at the general nature and distribution of rainforest in N.S.W.
- 3.6.8 Rainforest is not a single, though variable, type of vegetation. Even within the relatively limited extent of the study area there are a number of distinct types of rainforest present, each with a characteristic appearance and composition. Each also is capable of very substantial internal variation.
- 3.6.9 Probably the most significant type of rainforest in the study area is the subtropical rainforest (notophyll vine forest of L.J. Webb). and it differs only in degree from the more luxuriant forms of tropical rainforest (see profile diagram; fig. 3.1). It is mixed in composition, with the Booyongs (Heritiera trifoliolata and H. actinophylla) and Yellow Carabeen (Sloanea woollsii) among the more numerous and obvious tree species. A detailed study made by the Forestry Commission on Wiangaree State Forest about 1959 over an area of 3.9 ha showed the presence of 66 species of trees (stem diameter at breastheight of 10 cm or greater) from 31 plant families on the study plot. Average stocking was 460 stems/ha, with a basal area of 46 m²/ha. Some features of the composition of the plot are shown in Table 3.3. Besides the trees, additional species were present as shrubs, herbs, palms, vines and epiphytes. Rainforest substantially similar to this occupies most of the Wiangaree Plateau (about 10 000 ha) and of Levers Plateau (about 1000 ha), part of the upper talus slopes of Mt. Lindesay, other smaller basalt plateaux in the area (e.g. east of Long Creek on Roseberry State Forest), and in smaller stands on favoured sites through much of the higher elevation country in the study area. Species lists (probably incomplete in all cases) for the subtropical rainforest stands on Flora Reserves established on Wiangaree (Grady's Creek F.R.), Roseberry (Levers Plateau F.R.) and Mt. Lindesay State Forests are given in Appendix 4.
- 3.6.10 Although there is a broad similarity between the composition of these subtropical rainforest stands in the study area, there are also differences. The Wiangaree study plot has a higher content of Cunoniaceae than is usual, and over the Wiangaree Plateau the stands towards the west, and in the lower slopes, tend to be taller in height than those on the more exposed ridges further east. Differences between Wiangaree and the stands further west may reflect the lower altitudes, lower rainfall and different basaltic composition of the western occurrences. Nonetheless the available information suggests that all of these subtropical rainforest occurrences at the higher elevations are best regarded as belonging to a single, but variable, floristic community. (Some Forestry Commission surveys in this area have recognised and mapped up to six or more different "types", depending on variations in the local dominance of the more common species. These types probably have limited validity, although real variations do occur: some of these, apparently related to minor topographic changes, were evident within the 3.9 ha study plot mentioned above.)

Table 3.3

Subtropical Rainforest Study Plot - Wiangaree State Forest

(Details from Forestry Commission of N.S.W.)

Location: Towards head of Sheepstation Creek; southerly aspect.

Area: 3.9 ha (9.6 acres).

A. Most Numerous Tree Species (Total Tree Species present, 66).

<u>Species</u>	<u>% Total No. Stems</u>	<u>% Total B.A.</u>
Ackama paniculata	18.6	22.6
Doryphora sassafras	7.9	3.9
Sloanea woollsii	6.9	14.5
Heritiera trifoliolatum	6.8	13.3
Geissois benthami	6.1	9.2
Baloghia lucida	5.7	1.7
Cryptocarya erythroxylon	4.6	4.7
Sloanea australis	4.2	1.6
Orites excelsa	4.0	3.2
Planchonella australis	3.4	2.1
Dysoxylum fraseranum	2.0	5.5

B. Relative Importance of Families (Total Present, 31).

<u>Family</u>	<u>No. Tree Species</u>	<u>% Total Stems</u>	<u>% Total B.A.</u>
Lauraceae	9	9.4	8.1
Rutaceae	6	3.9	2.2
Proteaceae	4	5.3	3.7
Sapindaceae	4	1.1	0.6
Myrtaceae	4	2.0	1.6
Escalloniaceae	3	3.0	1.1
Meliaceae	3	3.1	6.1
Elaeocarpaceae	3	11.2	16.5
Sterenliaceae	3	10.1	16.2
Monimiaceae	2	8.0	3.9
Cunoniaceae	2	24.7	31.8
Rubiaceae	2	2.0	0.4

3.6.11 On parts of Wiangaree State Forest, as well as in adjacent parts of the Lamington National Park and again just west of the study area on Donaldson State Forest, stands of cool temperate rainforest dominated by ancient, veteran stems of Negrohead Beech (Nothofagus moorei) are found. These occur along some of the highest, perhumid ridges close to the Tweed escarpment and also fringing some of the nearby streams. A species list for this community, from the Grady's Creek Flora Reserve on Wiangaree State Forest, is given in Appendix 5. Probably because of the generally higher elevations there, this community is rather better developed in the Lamington National Park than on Wiangaree State Forest.

3.6.12 Nothofagus moorei is the only native species of the Northern Hemisphere Oak and Beech family (Fagaceae) in N.S.W. or Queensland. Other species in the genus occur in New Guinea, Victoria, Tasmania, New Zealand and southern South America. N. moorei is here close to its northern limit, and is found discontinuously southwards in similar high altitude, moist sites to the Barrington Tops. In the more southerly locations it appears as a moderately aggressive species well suited to its environment, but in this northern occurrence it appears as a relic of

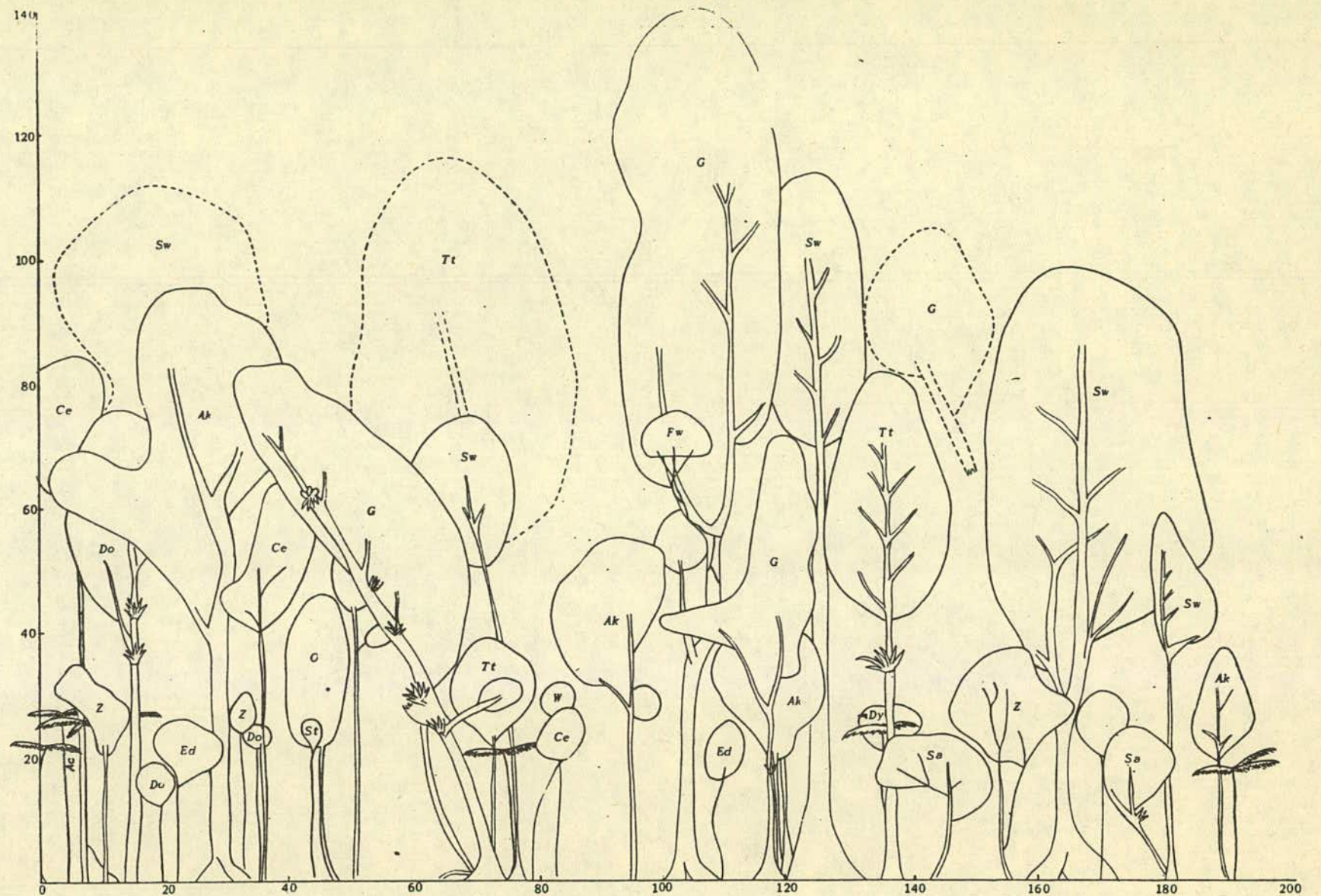





Figure 3.1—Profile Diagram of Subtropical Rainforest, Wiangaree State Forest. (Transect 200 ft. long by 25 ft. deep, stems under 20 ft. high omitted. Scale: 1 inch = 20 feet.)

Key to Species Symbols: Ac, Archontophoenix cunninghamiana; Ak, Ackama paniculata; Ce, Cryptocarya erythroxylon; Do, Doryphora sassafras; Dy, Dysoxylum fraserianum; Ed, Endiandra discolor; Fw, Ficus watkinsiana; G, Geissois benthami; O, Orites excelsa; Sa, Sloanea australis; St, Stenocarpus salignus; Sw, Sloanea woollsii; Tt, Tarrietia trifoliolatum; V, Vesselowskyia rubifolia; W, Wilkiea austroqueenslandica; Z, Zanthoxylum brachyacanthum;

Note: *Tarrietia* is now *Heritiera*

Zanthoxylus is now *Fagara*

 *Cyathea leichhardtii*;
 *Asplenium nidus*;
 *Platycerium bifurcatum*.

Dotted lines indicate trees with crowns within the transect but their bases outside.

some previous era, with little signs of seedling regeneration and with the younger, but still apparently old, stems mostly occurring as coppice round the base of some old, and now often decayed, stem. Although N. moorei itself is absent from Mt. Glennie, some of the species commonly associated with it further east are common in parts of this small plateau rainforest. These include the Hairy Tree fern (Dicksonia youngiae) and the small flowering epiphyte, Fieldia australis.

- 3.6.13 Somewhat intermediate between subtropical rainforest and cool temperate rainforest in its structural complexity and the number of species present is warm temperate rainforest. Over most of its area of occurrence in N.S.W. this is typified by a dominance of Coachwood (Ceratopetalum apetalum), and it usually occurs on rather less fertile soils than those required for the development of subtropical rainforest under otherwise generally similar environmental conditions.
- 3.6.14 Although Coachwood is absent from the study area, stands that possess the characteristics of warm temperate rainforest occur on the rhyolitic soils in parts of the western section of Roseberry State Forest, and particularly on the Mt. Glennie plateau. These stands tend to be dominated by Crabapple (Schizomeria ovata) and Callicoma (Callicoma serratifolia), with Water Gum (Tristania laurina) becoming locally dominant on the more shallow soils.
- 3.6.15 Coast or White Banksia (Banksia integrifolia) occurs in the eucalypt forest stands adjoining these warm temperate rainforest communities, and may be found as large trees within the rainforest. An unusual rather open thicket of moss-festooned Crabapple and White Banksia, growing immediately beneath the cliff line at the top of the talus on Mt. Lindesay, appears to represent a depauperate form of this community, while the presence of Crabapple as a fairly common component in the subtropical rainforest close to the north western corner of Lever's Plateau probably reflects some residual influence of a now eroded rhyolite capping in this vicinity.
- 3.6.16 In the lower altitude sites towards the Richmond River conditions are less favourable for rainforest though, in the absence of fire, it will develop in the area. In these areas its typical appearance is as dry or monsoon rainforest, with a relatively low, dense canopy from which protrude scattered, taller, xerophytic and often semi-deciduous trees (see Fig. 3.2, from such a stand on Unungar State Forest immediately south of the study area near Mt. Lindesay). The main canopy is rich in species of Euphorbiaceae and Sapindaceae, and overstorey trees include Flindersia spp. (Native Teak, Yellowwood, Cudgerie), Brachychiton spp. (Flame Tree, Lacebark), and Hoop Pine (Araucaria cunninghamii).
- 3.6.17 Stands of this type occur on the lower slopes of Mt. Lindesay and on some of the lower parts of Roseberry and Wiangaree State Forests, while similar stands, often lacking the overstorey, are widespread on many of the steeper, but sheltered, slopes in the Roseberry State Forest area. Some good examples occur in the catchments of October and Sawpit Creeks where, among the relatively rare species in N.S.W., occur such species as Flindersia collina, Ailanthus triphysa, Atalaya virens, Planchonella pohlmiana and Premna lignum-vitae. This area also contains the only known location in N.S.W. of the Queensland shrub, Pavetta australiensis, and one of the few known occurrences of the endangered species, Owenia cepiodora.
- 3.6.18 The invasion of subtropical rainforest into eucalypt forest or on to severely burnt land often, in its earlier stages, involves species otherwise characteristic of the dry rainforest. However in these cases the succession proceeds further so that ultimately many of these pioneering species are themselves excluded from, or are rare in, the final mature subtropical rainforest. Hoop Pine is one species that occurs as a regular, permanent and often frequent constituent of dry

rainforest, that is also commonly found along the invading margin of subtropical rainforest, but that is rare in mature subtropical rainforest.

- 3.6.19 The northeastern sector of Levers Plateau is notable for the high stocking of mature stems of Hoop Pine. Over most of the area involved these are almost certainly relics of some past major disturbance, most probably a severe fire that swept up the precipitous scarp from the Logan Valley and then penetrated into the plateau-top rainforest under unusually severe bushfire conditions. By contrast Hoop Pine still surviving on the slopes leading from Long Creek up on to Levers Plateau appear to be in dry rainforest stands. The significance is that, on the plateau the pine stands appear to be a relatively ephemeral feature that will gradually disappear in any quantity in the absence of further major disturbance, whereas on the slopes the pine is probably a permanent, regenerating feature of the forest vegetation.
- 3.6.20 One further major type of rainforest has occurred in or close to the study area. This is a distinct form of subtropical rainforest growing as a gallery stand along the banks of the main streams in the valleys, and dependent for its occurrence and composition on the presence of the watercourses. These stands were mostly cleared away in the early days of European settlement, since they occupied some of the best alluvial sites. However remnants are still present along the upper Richmond River and on the lower reaches of its larger tributaries, the largest and best of these remnants being Moore Park, a Council-controlled reserve near the junction of Findon Creek and the Richmond River a few kilometres upstream from Roseberry Nursery. Among the more common tree species in these riverain stands are Castanospermum australe (Black Bean), with its large, water-distributed seeds, Grevillea robusta (Silky Oak) and Podocarpus elatus (Brown Pine). Toona australis (Red Cedar) was originally plentiful in these stands, though few survived the earliest years of settlement. The Moore Park stand is notable for possessing one of the largest specimens of strangling fig in the State: this Greenleaved Moreton Bay Fig (Ficus watkinsiana) has a total height of about 53 m, a crown spread of 33 m, and a breast height diameter around buttresses of 5.6 m.
- 3.6.21 A number of distinct eucalypt forest types also occur in the study area.
- 3.6.22 The lower valleys, away from the gallery rainforest stands, originally apparently carried a tall, open woodland stand of Eucalyptus tereticornis (Forest Red Gum) interspersed with smaller trees of Tristania suaveolens (Swamp Turpentine) and Angophora subvelutina (Broadleaved Apple), while the gallery rainforest gave way, along the river banks and gravel islands, to local stands of Casuarina cunninghamiana (River Oak) with Melaleuca bracteata and the beautiful Callistemon viminalis (Weeping Bottlebrush).
- 3.6.23 In the drier valleys away from the river flats is a tall woodland of E. moluccana (Grey Box) and E. tereticornis, with E. siderophloia (Northern Grey Ironbark) and one of the rare occurrences of E. melliodora (Yellow Box) on the coastal side of the main divide. With increasing rainfall (as noted previously, here usually associated with higher altitude) these stands grade into a wet sclerophyll forest dominated by E. moluccana, the northern form of E. punctata (Northern Grey Gum - previously known as E. major), and E. eugenioides (Thinleaved Stringybark), and then to stands of E. microcorys (Tallowwood) and E. saligna (Sydney Blue Gum). Where rainforest invasion occurs, it is typically by dry rainforest in the case of the E. moluccana stands and by subtropical rainforest with the E. microcorys-E. saligna.

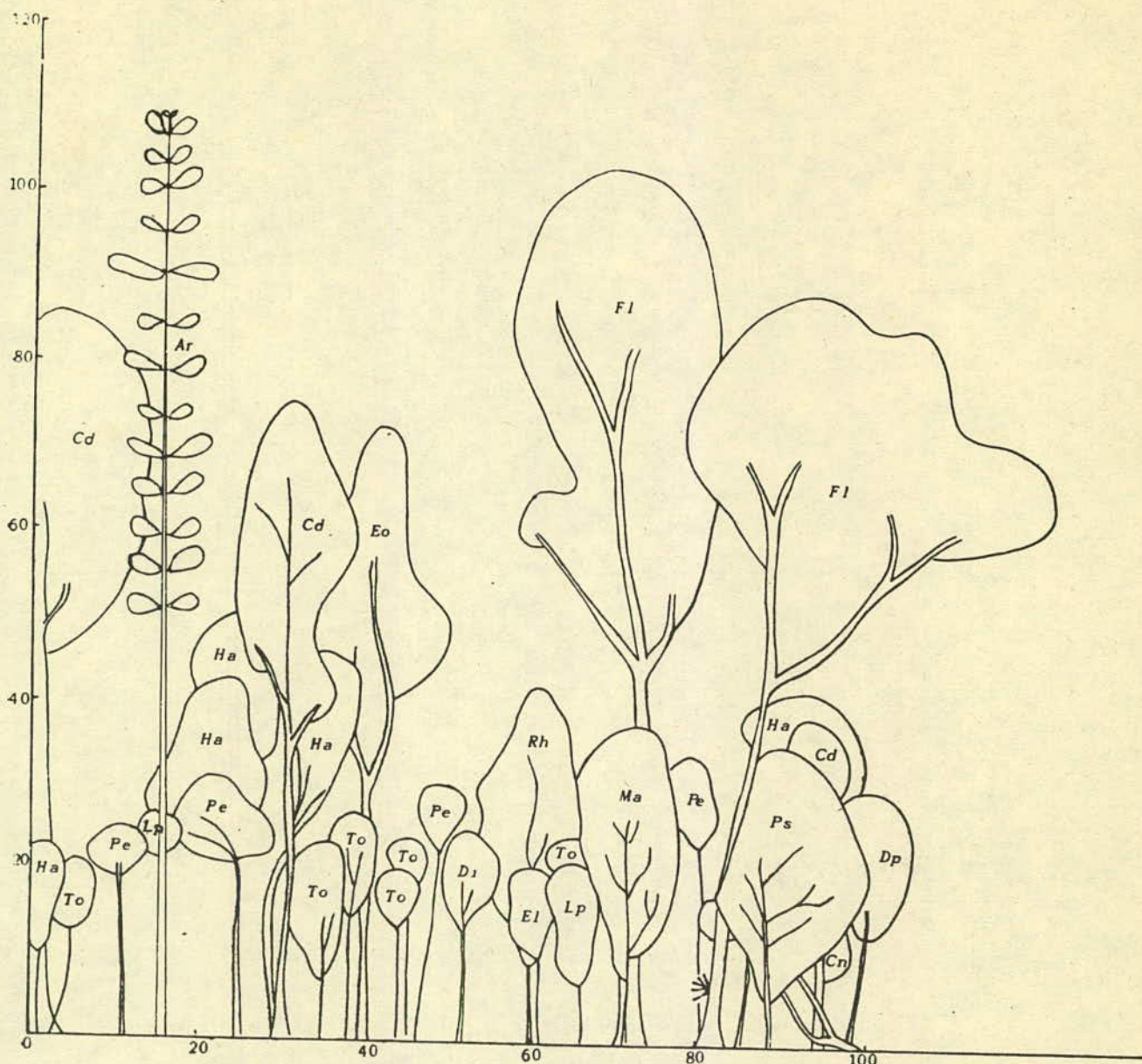


Figure 3.2—Profile Diagram of Dry Rainforest, Unumgar State Forest. (Transect 100 ft. long by 25 ft. deep, stems under 20 ft. high omitted. Scale: 1 inch = 20 feet.)

Key to Species Symbols: As for figure 3.2, plus Ar. *Araucaria cunninghamii*; Cd, *Celastrus disperma*; Cn, *Capparis Nobilis*; Di, *Diospyros pentamera*; Dp, *Denhamia pittosporoides*; El, *Elattostachys nervosa*; Eo, *Elaeocarpus obovatus*; Fl, *Flindersia australis*; Ha, *Hemicyclia australasica*; Lp, *Laportea photiniphylla*; Ma, *Mallotus philippinensis*; Pe, *Polyscias elegans*; Ps, *Pseudomorus brunoniana*; Rh, *Rhysotoechia bifoliolata*; To, *Toechima tenax*.

- 3.6.24 The steep valley sides carry often rather open communities of E. siderophloia, E. crebra (Narrowleaved Ironbark), E. propinqua (Smallfruited Grey Gum), E. gummifera (Bloodwood), E. microcorys, E. melliadora and some other species, including (near Border Loop and close to the junction of Findon and October Creeks) the only known occurrences of E. tessellaris (Carbeen or Moreton Bay Ash) on the North Coast. (This species is common on the Queensland side of the border, and also occurs in the Narrabri-Moree area).
- 3.6.25 E. grandis (Flooded Gum) appears in a few stands along the upper Richmond River (e.g. in the narrow "Richmond Gorge", just upstream from the village of Grevillia) and also in some moist sites, often associated with E. microcorys-E. saligna stands (e.g. on the Lynch's Creek access road to Wangaree State Forest). The similar looking, though not closely related, E. dunnii (Dunn's White Gum) has its only known occurrence in the study area along Terrace Creek, though it is fairly common slightly further west, over the Richmond Range on Donaldson State Forest.
- 3.6.26 Also associated with E. microcorys-E. saligna stands is Tristania conferta (Brush Box) which often appears as large remnants within mature subtropical rainforest (e.g. along Wangaree Forest Way near Sheepstation Creek Flora Reserve).
- 3.6.27 E. andrewsii ssp. campanulata (New England Blackbutt) is common along high, exposed, shallow-soiled ridges in much of the adjoining region, and has a number of occurrences in the study area. These include along the upper rim of the Tweed escarpment on Wangaree State Forest, where it occurs as large diameter, gnarled trees along this very exposed lip; on the summit of Mt. Gipps; and in a fringe along the border from west of Lever's Plateau to Mt. Glennie.
- 3.6.28 Several other species of eucalypts, apparently confined in the study area only to the higher parts of Mt. Glennie, have recently been collected. These include Blue Mountains Ash (E. oreades), which extends discontinuously from the Blue Mountains north to Mt. Warning, the Lamington National Park and Springbrook (Qld.); Roundleaved or Brown Gum (E. deanei), another tableland species occurring from the Blue Mountains to the Stanthorpe (Qld.) district, but not previously recorded so far east in northern N.S.W.; and the mountain mallee, E. approximans, which occurs in a few parts of the New England Tablelands, as well as on Mt. Barney and the Lamington National Park.
- 3.6.29 Besides the tree-dominated communities, the study area contains a few local plant communities lacking tree cover. These include scrub and heath on the summit of Mt. Lindesay, the mallee on Mt. Glennie, and some grassy "balds", sometimes supporting large specimens of Grass Tree (Xanthorrhoea sp.), on some of the steeper slopes out of the valleys. These are probably maintained free of trees by repeated burning. One such area, carrying only scattered Banksia integrifolia, lies on the 4-wheel drive track on the southern edge of Levers Plateau.
- 3.6.30 As indicated previously, the study area contains the geographic limits of a number of trees and shrubs, including Eucalyptus deanei, E. dunnii, E. melliadora, E. tessellaris and Pavetta australiensis, and it also carries certain rare or unusual species. As far as has been possible to determine, the study area contains no plant species that are restricted only to this area, though what may prove to be a new species of the family Escalloniaceae has recently been collected on Mt. Glennie.
- 3.6.31 It is again stressed that the vegetation pattern of the area is rather complex and is marked by an unusual degree of dynamism.

Whilst rainforest occupies some extensive tracts, the eucalypt forest, though probably more widespread than the rainforest, contains frequent patches of immature rainforest as an understorey or in gullies, ravines or on sheltered slopes, and these provide both foci for rainforest expansion and important diversity for wildlife habitat.

- 3.6.32 The dynamism is not confined to the eucalypt forest/rainforest boundaries, but exists within the forest communities as individual trees or stands regenerate, develop, reach maturity and finally die, to repeat the cycle. Sometimes events other than fire can cause this cycle to occur on a spectacular scale. In adjoining areas, and almost certainly within the study area itself, cyclones occasionally destroy trees over many hectares, while within the Grady's Creek Flora Reserve a landslide in 1975 resulted in some 50 ha of subtropical rainforest collapsing - and led one national park protagonist to accuse the Forestry Commission of practising clear felling in the area.
- 3.6.33 Besides the dynamism of the vegetation in this area, it has been suggested that the area, with its elevated plateaux and closely adjacent low saddles, has provided an important route for the migration of vegetation, enabling tableland eucalypt forest and temperate rainforest elements to move east from the Northern Tablelands, while dry rainforest species have moved south from Queensland through the saddles and subtropical rainforest elements have come in from the east.

3.7 Fauna

- 3.7.1 The fauna of the study area is a rich and diverse one.⁽⁶⁾ There are two main reasons for this. These are:

- (1) A large number of distinct types of habitat occur within a relatively small area here.
- (2) The Border Ranges lie within the transition zone of Torresian (northern) and Bassian (southern) faunal regions.

Calaby⁽⁷⁾ surveyed the mammal fauna of the upper Richmond and Clarence Rivers. This area includes the three State Forests under discussion. Calaby notes of his study area "The richness of the mammal fauna in both species and numbers in the area surveyed is remarkable; it is the richest in species ever reported from any area of comparable size in Australia". Wheeler⁽⁸⁾ described the avifauna of Lamington National Park and adjacent lands. In the period 1968-1970, 168 species of birds were recorded there. This represents about one quarter of all known species of birds in Australia. Similarly Frith⁽⁶⁾ cites Trudgeon as having recorded 207 species of birds for the Border Ranges and surrounding districts. Data on other groups of animals are less complete, but are discussed below.

(6) H.J. Frith: Wildlife, in "The Border Ranges - a land use conflict in regional perspective," 13-20. Roy. Soc. Qld., 1976.

(7) J.H. Calaby: Mammals of the Upper Richmond and Clarence Rivers. CSIRO Div. Wildl. Res. Tech. Paper No. 10, 1966.

(8) W.R. Wheeler: The birds of "Green Mountains". Aust. Bird Watch, 4(8): 257-269, 1973.

- 3.7.2 All the species of mammals recorded by Calaby⁽⁷⁾ can be extrapolated to the three State Forests with little reservation. Calaby himself (personal communication) considers that the only species for which extrapolation may not be justified is the Rock Wallaby (Petrogale pencillata). However the Rock Wallaby is not uncommon in Lamington National Park. A recent preliminary survey of mammals in the area by National Parks and Wildlife Service and Forestry Commission officers turned up 25 species of mammals on Lever's Plateau alone (bats were not surveyed), compared with 33 recorded by Calaby (exclusive of bats). Three of the species recorded in this recent survey were not recorded by Calaby. The species recorded in this survey are listed in Appendix 6.
- 3.7.3 Several species of mammals reach the known limits of their distribution in the study area. These are: Dusky Marsupial Mouse (Antechinus swainsonii) which, until recently, was only known from south of Dorriggo; Potoroo (Potorous tridactylus); Parma Wallaby (Macropus parma) which was first recorded from the area during the recent survey; and the Black Flying Fox (Pteropus gouldii) which is found northwards from the Border Ranges.
- 3.7.4 The recent identification of the Parma Wallaby in the study area is an important one, although several populations of this macropod have been discovered in northern New South Wales in the last few years. A little known native rodent, the Eastern Chestnut Native Mouse, (Pseudomys gracilicaudatus) was trapped on Lever's Plateau in July, 1977. This species has not been recorded from southern Queensland since 1958, despite intensive rodent surveys.⁽⁹⁾ Only a few small, isolated populations of this rodent are known from New South Wales e.g. at Myall Lakes, Bonnie Hills and Brisbane Water National Park.
- 3.7.5 The number of species of mammals which are obligately dependent on rainforest habitat for their survival in the study area is relatively low. Calaby⁽⁷⁾ lists 6 species of mammals for which rainforest is optimum habitat. These are: Short-eared Possum (Trichosurus caninus), Ringtail Possum (Pseudocheiridis peregrinus), Black-striped Wallaby (Macropus dorsalis), Red-necked Pademelon (Thylogale thetis), Red-legged Pademelon (Thylogale stigmatica) and Bush Rat (Rattus fuscipes). Three other species occurred in rainforest; these are Echidna (Tachyglossus aculeatus), Tiger Cat (Dasyurus maculatus), and Short-nosed Bandicoot (Isodon nasuta). During the recent fauna survey of the area, additional species were trapped in the rainforest. These were: Fawn-footed Melomys (Melomys cervinipes), which was confined to rainforest; Brindled Bandicoot (Perameles macrourus); and Brown Marsupial Mouse (Antechinus stuartii). The Dusky Marsupial Mouse has recently been trapped in cool temperate and subtropical rainforest in Lamington National Park: this species evidently seldom ranges outside rainforest habitat in this area.
- 3.7.6 The Flying Foxes form another group of mammals which depend on rainforest for their continued survival. In the warmer months, the Grey-headed Flying Fox (Pteropus poliocephalus), the Little Red Flying Fox (P. scapulatus), and the Black Flying Fox (P. gouldii) gather in large camps in the rainforests of the area. Although much of their feeding is done in sclerophyll forest, the closed canopy of the rainforest provides an essential refuge from predation during the daytime.
- 3.7.7 A further feature of mammalian fauna of the study area, is the general absence of exotic species. The only sighting in the recent survey was a solitary Feral Cat (Felis cattus) on the main road through Wiangaree

(9) J. Covacevich & A. Easton: Rats and mice in Queensland. Qld. Museum Booklet No. 9, 1974.

State Forest. An extensive trapping programme on the plateau areas failed to reveal either the Black Rat (Rattus rattus) or the House Mouse (Mus musculus). There can be few places elsewhere in New South Wales where this is the case.

- 3.7.8 This rich and diverse mammalian fauna depends upon the existence of appropriate habitats. Disclimax communities are evidently essential habitat for certain mammals. Thus, the Eastern Chestnut Native Mouse and the Swamp Rat were only trapped on the grasslands on Lever's Plateau. Likewise, records of the Rufous Rat-Kangaroo (Aepyprymnus rufescens), the Potoroo, the Black-striped Wallaby (Macropus dorsalis) and the Pretty-face Wallaby (Macropus parryi) were confined to the vicinity of this grassland. The maintenance of these grasslands, which in turn appear to depend upon periodic burning, would seem necessary for the continued existence of these species in the area.
- 3.7.9 Most of the 168 species of birds recorded by Wheeler⁽⁸⁾ in Lamington National Park would occur in the study area. Like the mamalian fauna, the avifauna is very rich here. This species richness is due to the large number of habitats present in the study area, since habitat fidelity is particularly marked in birds. For example the Olive Whistler (Pachycephala olivacea) and the Rufous Scrub-Bird (Atrichornis rufescens) seldom occur outside cool temperate rainforest dominated by Negrohead Beech (Nothofagus moorei) in the McPherson and Tweed Ranges: the Wompoo Pigeon (Ptilinopus magnifica), Purple-crowned Pigeon (Ptilinopus superbus) and Paradise Rifle Bird (Ptiloris paradiseus) are primarily birds of the subtropical rainforest, while the Black-breasted Quail (Turnix melanogaster) and the Brown Pigeon (Macropygia amboinesis) exploit disclimax rainforest. A large number of species of birds are dependent on rainforest habitat in New South Wales. Frith⁽⁶⁾ states that "of the birds listed for the Border Ranges ... 54 species are usually found in rainforest and 123 species are usually found in sclerophyll forest. Among these, 31 species are virtually restricted to rainforest, and 86 species to sclerophyll forest."
- 3.7.10 Whilst no species of birds are confined to the Border Ranges, the area comprises a large proportion of the distributions of several species. These are the Albert Lyrebird (Menura alberti), Rufous Scrub-Bird, Marbled Frogmouth (Podargus ocellatus), and the southern race of the Fig Parrot (Popsitta diopthalma coxeni). The southern race of the Fig Parrot has only been reliably recorded twice in the last 10 years, both times in the rainforests of northeastern New South Wales, (Bonalbo and Murwillumbah). Likewise, there have only been a handful of sightings of the Marbled Frogmouth in the last few years. Marbled Frogmouths have only been collected or identified in rainforests at Dorriggo, Bellingen, Woolgoolga, and Lismore, in New South Wales.
- 3.7.11 The Border Ranges are probably the last major stronghold in this State for a number of other species of birds. Included in this category are the Wompoo Pigeon, the Red-crowned Pigeon (Ptilinopus regina), the Noisy Pitta (Pitta versicolor) and the Paradise Rifle Bird. Several other species of birds reach their known distribution limits in the Border Ranges. These are the Olive Whistler, Northern Yellow Robin (Eopsaltria chrysordioa), Buff-breasted Scrub-Wren (Sericornis frontalis laevigaster), and the Black-breasted Quail. The last species mentioned is very rare throughout its distribution.
- 3.7.12 The habitats of the Border Ranges, in particular the rainforest component, provide an important stepping stone for species with north-south migration patterns, or for nomadic species. Examples of north-south migrants which are primarily birds of the rainforest, are the Koel (Eudynamys scolopacea) Brush Cuckoo (Cacomantis variolosus) and Noisy Pitta.
- 3.7.13 Arboreal species of frugivorous pigeons occur in the rainforest of the Border Ranges. These are the Red-crowned, Purple-crowned, Wompoo, Topknot (Lopholaimus antarcticus), White-headed (Columba norfolciensis)

and Brown Pigeons. Two species of frugivorous pigeons which feed on the ground are also present. These are the Wonga (Leucosarcia melanoleuca) and Green-winged (Chalcophaps indica). The conservation status of these birds has been discussed by Frith⁽¹⁰⁾. While some have adapted fairly well to the changes wrought by settlement (e.g. White-headed Pigeon, in many districts now relies on cornstubble and introduced Camphor Laurel for much of its food) others have been less resilient. They rely on the presence of suitable food being available throughout the year - Bangalow Palms, various native laurels, figs, fleshy-fruited Myrtaceae, etc. Any practice that interrupts the continuity of this food availability could seriously deplete populations of these birds, or others dependent on similar sources of food in the rainforest. In this context it is important to realise that the trees of the lower altitudes (e.g. Lynchs Creek altitude 350 metres) fruit somewhat earlier than the same species on the plateaux (e.g. Wiangaree Plateau 1000 metres). According to Hopkins Bioclimatic Law, there is retardation of about 4 days for each 100 metres in altitude. This means a discrepancy of some 4 weeks between the fruiting of the lowland and the plateau trees. Such a discrepancy may well constitute a vital link in ensuring continuity of food for frugivorous birds.

Frith⁽⁶⁾ states "The nomadic movements of Topknot Pigeons following the fruiting cycle of various trees involve population shifts, at times, from the highest to the lowest forests. It is possible that close study will reveal that some species are quite dependent on different altitudes or different forest types at different times of year".

- 3.7.14 Frith⁽⁶⁾, referring to Cogger⁽¹¹⁾, notes that 90 ± 5 species of reptiles, and 39 ± 3 species of amphibians could be expected to occur in the Border Ranges. This represents about one fifth of the total number of species of herpto-fauna which have been recorded from Australia.
- 3.7.15 Of particular interest is the Pouched Frog (Assa darlingtoni) which rears its young in brood pouches. This frog is only known from the rainforests of the Border Ranges and adjacent mountains. Two other frogs of the rainforest are Loveridge's Frog (Philoria loveridgi) and a tree frog (Litoria cooloolinsis). These species have only been recorded from the Border Ranges and nearby rainforests.
- 3.7.16 A poorly-known species complex of rainforest skinks, at present referred to as Sphenomorphus murrayi, has the major part of its distribution in the Border Ranges. Until more exhaustive surveys of the region are conducted, the taxonomic status of this group will remain unclear. Several other groups of rainforest skinks occur in the area. Three genera, whose distributions are centred on the area, are Anomalopus, Lampropholis and Anotis. The Border Ranges also comprise a major part of the known distribution of the Southern Angle-headed Dragon (Gonocephalus spinipes), another rainforest lizard.
- 3.7.17 It should be emphasized that the Border Ranges have never been extensively collected for herpto-fauna. Recent detailed surveys of amphibia and reptiles in central Queensland rainforests turned up a number of species new to science^{(12),(13)}. This may well prove to be the case in the Border Ranges after future surveys.
- 3.7.18 In general, little is known of the invertebrate fauna of Australian rainforests. However, much data has recently been collected on several groups of invertebrates by the Australian and Queensland Museums^{(12),(13)}

(10) H.J. Frith: "Wildlife Conservation". Angus & Robertson, Sydney, 1973: pp. 220-228.

(11) H.G. Cogger: "Reptiles & Amphibians of Australia." Reed, Sydney. 1975.

(12) J. Broadbent & S. Clarke. A faunal survey of East Australian Rainforests. Interim Report, Aust. Mus., Sydney, 1976.

(13) "Fauna of Eastern Australian Rainforests, II" (J. Covacevich, ed.) Qld. Mus., Brisbane, 1977.

3.7.19 Traditionally, butterflies are the first group of invertebrates to be studied in detail in any new area. In Australia 364 species have been described of which 305 species (84%) occur in the tropical and sub-tropical Torresian province compared with 186 species (51%) from the temperate Bassian province.⁽¹⁴⁾ The overlap of Torresian and Bassian fauna in the Border Ranges is the main reason for the richness of the butterfly fauna which occurs there.

3.7.20 The Border Ranges represent the southern limit of the distribution of a large number of species. Notable amongst these are the following:

Richmond River Birdwing (Ornithoptera priamus richmondia). This race of the Cairns Birdwing (O.P. euphorion) is only found in the vicinity of the Border Ranges, as far south as the Clarence River. In New South Wales it is common only in Wiangaree State Forest, where its larvae feed on the vine Aristolochia praevenosa.

Big Greasy (Cressida cressida cressida). This swallowtail butterfly is restricted in New South Wales to the rainforests north of the Clarence River. Host plant for the larvae is Aristolochia praevenosa.

Capaneus Butterfly (Papilio fuscus capaneus)- Another swallowtail, restricted in New South Wales to the rainforests of the far north. Host plants for the larvae are certain Rutaceae, including Microcitrus australasicus, Halfordia kendack and Zanthoxylum brachycanthum.

Four-bar Swordtail (Proographium leiostheus). This swallowtail is found as far south as Dorrigo, but is rare in New South Wales. It has been recorded from Lever's Plateau. Host plant for larvae is Rauwenhoffia leichhardtii.

Pale Green Triangle (Graphium euryplas lycaom). Another rainforest swallowtail which is only found in New South Wales north of the Richmond River. Host plants are Rauwenhoffia leichhardtii, Polyalthia nitidissima, Diploglottis australis.

Regent Skipper (Euscheomon rafflesia rafflesia). This species occurs south to Port Macquarie in rainforest habitat. Host plants are Wilkiea spp., and Tristania conferta.

It will be noted that most of these species of butterflies depend on one or a few species of plants as a source of food for the larvae.

3.7.21 Specific data on other groups of invertebrates are scanty. However it is clear that many species have very precise habitat requirements. For example, Australia's largest weevil (Eurhampus fasciculatus), an animal 50mm in length, feeds solely on rotting logs of Hoop Pine (Araucaria cunninghamii). The present lack of knowledge of rainforest invertebrates is reflected in results of the recent surveys conducted by the Australian and Queensland Museums. Of 92 species of molluscs recorded from central Queensland 39 species (42%) were new to science. Similarly, of the several hundred species of spiders collected from rainforests of New South Wales and Queensland, some 60% of the species were previously undescribed.

3.8 Aboriginal and Archeological Sites

This topic is dealt with in the separate document, prepared by the National Parks and Wildlife Service and presenting the case for a National Park in the area.

(14) L. Willan. Arthropods of the rainforest. Parks and Wildl. 2(1), 59-65, 1977.

used for other purposes, including beekeeping, grazing and recreation. These uses are examined further in Chapter 8.

- 3.9.8. One further use of the forested areas is for the preservation of examples of the natural environment. To this end four Flora Reserves have been notified in the State Forests within the study area:

Sheepstation Creek F.R. No. 79945 (Wiangaree S.F.) 162 ha. Particularly fine example of subtropical rainforest.

Mt. Lindesay F.R. No. 79950 (Mt. Lindesay S.F.) 117 ha. The N.S.W. side of this peak, including cliffs and upper slopes below the cliffs.

Grady's Creek F.R. No. 79983 (Wiangaree S.F.) 1500 ha. The upper catchment of Grady's Creek, adjoining Queensland border. Essentially untouched subtropical rainforest, with Negrohead Beech occurring on the higher ridges and to some extent along the creeks.

Lever's Plateau F.R. No. 79987 (Roseberry S.F.) 55 ha. Hoop Pine dominated subtropical rainforest.

- 3.9.9 Other preserved forest areas are fairly widespread in the districts adjoining the study area. North of the area, and immediately adjoining Grady's Creek Flora Reserve, lies the extensive Lamington National Park (19500 ha). To the east, and also adjoining Lamington National Park, is the Limpinwood Nature Reserve (2400 ha), while several small, so far unofficially preserved areas are located in Mebbin State Forest, which lies immediately east of Wiangaree S.F. along and at the foot of the Tweed Range. On Toonumbar S.F., south of the Richmond River, is the Long Creek Forest Preserve, of 36 hectares. West of the study area State Forests extend along the Border Range for another 40 or so kilometres. These adjoin Mt. Barney N.P. (5000 ha) and include the Mt. Nothofagus Flora Reserve (650 ha) on Donaldson S.F. and the Trough Creek (30 ha), Mt. Wilson (75 ha) and Mt. Clunie Forest Preserves (240 ha), all on Koreelah S.F. and intended for subsequent Flora Reserve notification. Rather more remote, but in the general region, is Flora Reserve No. 62253 (705 ha) on Beaury S.F., while still more distant are the Mt. Warning National Park (2100 ha) and three Flora Reserves on Whian Whian S.F. (total area of these Reserves is 680 ha). Rainforest is a significant feature of the vegetation in all of these preserved forest areas.

4. The Social Environment

4.1 The population actually resident in the study area is slight, but the social significance of the area extends far beyond this immediate area. For example, timber obtained from the State Forests in the area is processed mainly at mills located at Murwillumbah, outside the study area, and at Grevillia, on the southern boundary of the area. Most workers at Grevillia live in Kyogle, from and to which they travel each day. The local Forestry Commission administration, many of the forest workers, and the local shire council are also based at Kyogle, to the south of the study area, and this is the market centre for the area of immediate concern.

4.2 Preliminary figures from the June, 1976, Census put the population of Kyogle Shire at 8102, and of Tweed Shire (which includes Murwillumbah) at 27,525. Numbers registered as unemployed in the two shires at 29th October, 1976, were:

Kyogle 350

Tweed 845

4.3 Aspects of the social environment of this area were included in a paper presented to the Border Ranges Symposium last year (see para. 2.15) Extracts from this paper ⁽¹⁾, with negligible amendment, form the remainder of this Chapter. Statistics used in the following paragraphs predate those given in para. 4.2, but appear in no way to conflict with the more recent trends.

4.4 The discussion area falls within the North Coast region of New South Wales, one of eleven such regions defined by Government for administrative purposes. The region is generally bounded by the State border in the north, the South Pacific Ocean in the east, the Wang Wauk River in the south and the Great Dividing Range in the west. If one accepts this definition of regional boundaries for planning purposes, then it appears logical to further sub-divide it into three sub-regions, viz:-

- (a) the Richmond-Tweed to the north;
- (b) the Clarence; and
- (c) the Hastings;

each centred on major coastal river basins. The Richmond-Tweed Sub-Region is made up of nine Local Government areas, with the current discussions area, as far as New South Wales is concerned, falling within the shires of Kyogle and Tweed.

4.5 In the intercensal period 1966-1971, the population of the region grew by 9,267 from 212,539 to 221,808. It is estimated that the regional population in 1973 was 227,000 and that by 1985 it will increase to somewhere in the vicinity of 246,500. About 70% of this population is expected to be located in towns with a population over 2,000 and these towns will probably account for most of the population increase. Of these, on present indications, towns in the Richmond-Tweed sub-region such as Kyogle, Murwillumbah and Casino, are likely to remain relatively static, with the largest centre of Lismore and the more prominent coastal towns of Tweed Heads and Ballina accommodating most of the sub-region's share of this growth. Nevertheless, the continued decline of regional population growth rate compared with that of the State (presently 0.85% compared with 1.4% per annum respectively) continues to be of concern.

4.6 Economic activity in the region, particularly the Richmond-Tweed sub-region, is heavily dependent on primary industry as highlighted in Table 4.1. The dependence of the region on activities associated

(1) Peter Standen: "A Planning Perspective - the N.S.W. Position".

with primary industry is further emphasised by the fact that most of the manufacturing activity in the region relates to the processing of primary products. A further feature of the structure of industrial activity in the region is the narrow range of primary industry activity in which the region specialises. For example, more than half of the persons engaged in agriculture activity are employed in the dairy/beef industry or fruit growing. As is shown in the Henderson Poverty Report, the income earning opportunities available to many dairy/beef farmers in the North Coast Region are extremely limited.

Table 4.1

Labour Force by Industry Sector (Percent) (1971 Census)

Industry Sector	N.S.W.	Northcoast Region	Richmond-Tweed Sub-region
Agriculture, Forestry and Fishing	5.9	19.6	22.5
Mining	1.4	1.5	1.5
Manufacturing	24.8	13.4	12.5
Tertiary	67.9	65.5	63.5
	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

4.7 It is noteworthy that, in general, the centres experiencing growth in manufacturing employment are also those that are continuing to enjoy population growth with the converse applying in those centres where population growth has been below the State average. Kyogle Shire, which has particular relevance to the discussion area has a population of 8,750 and workforce of 3,289, of which 38% falls within the agriculture, forestry and fishing category (1971 census). Unemployment in the Shire at December 1975 was approximately 14%.

4.8 Another important element of economic activity in the region is tourism. The study "Tourism and the North Coast Region", released by the N.S.W. Department of Tourism in May 1975, indicates that nearly 1.7 million persons visited the Region in 1973-74 and spent nearly \$36 million, with 79% of these coming from within N.S.W. including 36% from Sydney. 317,000, or 19%, of the regional total visited the Richmond-Tweed sub-region. By comparison, 1.145 million persons visited the Gold Coast in 1973-74, with 80% of these coming from Queensland.

4.9 The relevant characteristics of the region may be summarised as follows:-

- (a) Population growth rates below the National and State average arising chiefly from the loss in population through migration to other parts of Australia.
- (b) Economic activity concentrated in the depressed primary production area and in the processing of produce derived from that production.
- (c) Limited job opportunities for both males and females which contributes to the movement of population from the region.

- (d) Growth in manufacturing industries is limited and restricted to the few towns which are maintaining a population growth rate relative to the State average.
- (e) Limited potential for increase in tourist activities because of competition to the north and the south and the lack of an appropriate population base.
- (f) High degree of dependence on the capital cities for higher order tertiary facilities (Richmond-Tweed sub-region to Brisbane).
- (g) Continued growth of Brisbane with possible creation of some pressure for development in the Tweed Valley and adjacent areas.
- (h) Existing planning control is generalised, tends to be negative and does not reflect any firm planning and development objectives for the region or the discussion area.

5 Rainforest

- 5.1 Rainforest in Australia has been the subject of a number of popular, but fairly authoritative, articles in recent years (1), (2), (3), (4), (5), reflecting in no small measure the current appeal of rainforest as a natural history topic.
- 5.2 The following extract from the Forest and Timber article provides both a general description of rainforest and highlights some of the factors in its appeal:

"Rainforest, the tropical jungle of popular imagination, is in fact one of the most important kinds of vegetation on our planet.

"For 60 million years it has been a centre of evolutionary activity and is the home of unusual plants, strange creatures, primitive tribes, source of many of the world's most beautiful timbers, of species that changed the course of history, of drugs, resins, and other products, and a reservoir for some of the world's most dangerous diseases.

"The factual definition of a rainforest is: "A dense community of moisture-loving trees; mainly of evergreen, broad-leaved species; usually with the trees arranged in several layers; and containing vines, epiphytes, buttressed stems, stranglers, and other life forms".

"In reality the rainforest is much more than this.

"It is shaded coolness in the summer noon; subdued greenness highlighted with brilliant sunflecks; the lost-child-call of the Cat Bird, the black-and-gold flash of the Regent Bower Bird and the heaped leaf-mould nest of the Brush Turkey. It is the apparently solid wall of vegetation along a roadside and the surprisingly open forest stand beyond; it is grey and green lichens mottled on a buttressed tree trunk or orchids and ferns growing in the tree tops; a scarlet toadstool on the ground or a great loop of vine swinging low between two trees.

"It can also be the virulent Stinging trees on the rainforest margin; the barbed Lawyer Cane waiting to snare the passer-by; the poisonous ticks and blood-sucking leeches; and a variety of other less pleasant residents!

"Rainforest reaches its finest development in the world's equatorial zone, where constant warmth and ample rainfall provide almost ideal conditions for luxuriant plant growth and extends into the subtropics in favoured sites. It also occurs in a somewhat different form in some temperate lands.

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- (1) "Introducing Rainforest." Forest and Timber, Autumn, 1973, pp. 1-16.
- (2) Rainforest issue of Wildlife in Australia, 10, 1973, pp. 65-91.
- (3) Rainforest section of Australia's Wildlife Heritage, Nos. 32-37, pp. 993-1184.
- (4) "Inside our Rainforests," Ecos, 6, 1975, pp. 3-12
- (5) Rainforest issue of Parks & Wildlife, 3(1), 1977.

"In all, it covers an estimated 4½ to 5 million square miles of the earth's surface."

5.3 In particular, in the Australian context, rainforest contrasts strongly with the far more widespread eucalypt forest communities.

5.4 As indicated previously (para. 3.6.8), rainforest in N.S.W. and southern Queensland is not just a single, but rather variable and complex form of vegetation. It in fact consists of a number of distinct forms, each with its own characteristic structural features and botanical composition.

5.5 Four such major forms of rainforest, subtropical, dry, warm temperate and cool temperate, occur in this region of Eastern Australia, and within each of these a number of different types, exhibiting different patterns of floristic composition, can be recognised⁽⁶⁾. Each of these in turn can show great variations in structure and composition over short distances. The occurrence of the different forms and types of rainforest is a reflection of changes in the forest environment - of moisture availability, temperature, soil conditions, historical events and so on. As previously discussed (para. 3.6.5), within areas favourable for the growth of rainforest, the pattern of rainforest and eucalypt forest is largely determined by the history of past disturbance, particularly by fire; the pattern is an unusually dynamic one.

5.6 Rainforest subforms in N.S.W.

5.6.1 Subtropical rainforest is clearly related to rainforest in the tropics, closely resembles some of the more luxuriant forms of tropical rainforest and is largely derived from this. It has a complex structure with a number of fairly distinct storeys of trees and shrubs. Stem buttressing is common on the larger trees; heavy vines and large vascular epiphytes (e.g. Staghorn and Birdsnest Ferns, orchids) are frequent. It has a very mixed composition (see Appendix 4) with usually no clear dominant species, though Booyongs (*Heritiera* spp.) are normally among the more strongly represented species. Many of the larger tree species yield valuable and important specialty timbers. The species present are largely of Malaysian (tropical) affinities, though the Antarctic floristic element may be quite strongly represented. Subtropical rainforest occurs on soils of high fertility under conditions of fairly abundant moisture supplies.

5.6.2 Dry rainforest in its most typical form is derived from subtropical rainforest under conditions of reduced moisture availability. (As noted previously similar stands may also represent the pioneering phase of subtropical rainforest - see para. 3.6.18). It consists of a dense but relatively low storey of small trees, including many species of Sapindaceae and Euphorbiaceae, often with numerous vines but few vascular epiphytes. In the more suitable sites there is a somewhat scattered overstorey of deciduous (e.g. *Brachychiton discolor*, Lacebark), semideciduous (e.g. *Flindersia australis*, Native Teak or Crow's Ash) or xerophytic (e.g. Hoop Pine) trees, many of these being of high commercial value. Botanical composition is almost entirely from the Malaysian floristic element.

5.6.3 Warm temperate rainforest often appears in similar localities to subtropical rainforest but on soils of markedly lower fertility (e.g. on the Dorrigo Plateau). Its structure is simpler than subtropical rainforest, with usually only two tree storeys, little buttressing and fewer vines and vascular epiphytes. The composition is chiefly

(6) "Forest Types in N.S.W.". For. Comm. of N.S.W. Res. Note No. 17, 1965.

from the Antarctic floristic element, though the Malysian element may be well represented. Although composition is still mixed, there is usually a fairly clear dominance by a single species, Ceratopetalum apetalum (Coachwood), or by this and an associate such as Schizomeria ovata (Crabapple or White Birch) or Doryphora sassafras (Sassafras). As indicated in para. 3.6.14, warm temperate rainforest dominated by Crabapple occurs on Mt. Glennie.

- 5.6.4 Cool temperate rainforest is of still simpler structure and composition, with often only a single storey of rather large trees, rare buttressing and few heavy vines or large vascular epiphytes (though in some stands the epiphytic Beech Orchid, Dendrobium falcorostrum, may be common). Botanical affinities are clearly Antarctic and there is a clear dominance of one species. In northern N.S.W. the dominant is invariably Negrohead Beech (Nothofagus moorei) and in the south Fucryphia moorei (Pinkwood). Similar stands in Victoria and Tasmania are dominated by Myrtle Beech (Nothofagus cunninghamii). This form of rainforest occurs in cool, perhumid sites: in northern N.S.W. it occurs discontinuously from the McPherson Range to the Barrington Tops, at altitudes usually above 800 m and extending up to 1600 m on Point Lookout.

5.7 Rainforest Areas

- 5.7.1 The areas of different major forest types in Australia were estimated for the Forestry and Wood-based Industry Development Conference (FORWOOD), held in Canberra in 1974). Out of a total forest area of 42.5 million hectares in the Commonwealth (15.5 million ha in N.S.W.), rainforest totalled 1 861 000 ha⁽⁷⁾:

Queensland	1 068 000 ha
N.S.W.	300 000
Tasmania	456 000
Northern Territory	37 000

(Rainforest also occurs to a limited extent in Victoria, but was not separately recorded). From the surveys carried out in anticipation of this Conference, the area of rainforest in southern Queensland was determined as 192 000 ha⁽⁸⁾.

- 5.7.2 For N.S.W., areal extent of rainforest in different geographic regions and land tenures was as shown in Table 5.1a⁽⁸⁾, while Table 5.1b provides a breakup by the major rainforest forms⁽⁹⁾.
- 5.7.3 Rainforest occupied five major areas in N.S.W. at the time of European settlement, though stands, sometimes of significant individual extent, were widely distributed beyond these five centres through the coastal and escarpment districts. The five major centres were:

(7) Australian Forestry Council: Report of the Forestry and Wood-based Industries Development Conference, Canberra, 1974.

(8) FORWOOD: Report of Panel 2: Forest Resources, Canberra, 1974.

(9) Forest Resource Inventory of the State, 1971-1972. For. Comm. of N.S.W.. Tech. Paper No. 28, 1976.

Table 5.1

Rainforest Occurrence in N.S.W., June, 1971

(a) By Geographic Region and Tenure (hectares)

<u>Region</u>	<u>State Forest</u>	<u>Nat. Park*</u>	<u>Other Public</u>	<u>Private</u>	<u>Total</u>
Casino	46 700	7 500	-	9 800	64 000
Coffs Harbour	36 900	6 800	6 800	18 100	68 600
Glen innes	10 500	1 500	16 600	3 800	32 400
Wauchope	24 100	-	14 300	12 800	51 200
Dungog	13 500	3 000	15 000	18 800	50 300
Gosford	-	700	4 500	800	6 000
Nowra	3 800	3 800	7 500	12 000	27 100
Eden	700	-	-	-	700
Total	136 200	23 300	64 700	76 100	300 300

* National Park category used here includes publicly-owned land permanently reserved for purposes other than timber production, e.g. certain water catchments, Nature Reserves, etc.

(b) By Rainforest Form and Tenure (hectares)

<u>Tenure</u>	<u>Sub-tropical</u>	<u>Dry*</u>	<u>Warm Temperate</u>	<u>Cool Temperate</u>	<u>Total</u>
State Forest	30 000	59 000	37 000	10 000	136 000
Nat. Park	8 000	5 000	2 000	3 000	18 000
Vac. Crown Land	1 000	20 000	9 000	8 000	38 000
Leasehold-State	1 000	25 000	-	-	26 000
Leasehold-Pte.	-	8 000	-	-	8 000
Pte. Industrial	-	-	1 000	-	1 000
Private	5 000	44 000	6 000	13 000	68 000
Other Forested	-	2 000	3 000	1 000	6 000
Total	44 000	163 000	58 000	34 000	301 000

* The category "Dry Rainforest" includes various depauperate rainforest stands of no commercial significance and areas of vine scrub, as well as the more strictly defined dry or monsoon rainforest stands.

1. Richmond-Tweed Centre, including the "Big Scrub" and the forests of the Border Ranges. Rainforest in this centre, which includes the current study area, was mostly subtropical and dry. The Big Scrub itself was mostly cleared away last century, but this centre still retains the largest extant expanse of rainforest in N.S.W.
2. Dorrigo Centre, extending round the head of the Bellingen River. Warm and cool temperate and subtropical forms all present. Most of the subtropical stands, and a significant section of the warm temperate rainforest stands, on the Dorrigo Plateau have been cleared for settlement.
3. Hastings Catchment. Mostly warm temperate and subtropical, but extensive stands of cool temperate present - including probably largest single occurrence of this form. Some areas destroyed for farming (Comboyne and parts of Bulga Plateau), but most areas still exist.

4. Barrington Tops and Foothills. Cool temperate on the tops and upper slopes, giving way to subtropical on the foothills. Mostly still exists.
5. Illawarra. Only small remnants now remain. Subtropical and warm temperate.

- 5.7.4 Other significant occurrences of rainforest at the time of European settlement included the alluvial flats of the major coastal streams north from the Shoalhaven and patches along the escarpment, particularly to the west of the Clarence River, with numerous smaller occurrences throughout the coastal and escarpment districts.
- 5.7.5 It is estimated that there were about 1 million hectares of rainforest in N.S.W. at the time of European settlement, so that about 30 per cent of the original area still exists, though in a number of instances the rainforest remnants have been subject to heavy logging. This percentage is slightly less than the percentage of forest generally still remaining in N.S.W. from the time of European settlement: 15.5 million ha from an original forested area of about 45 million ha, or about 35 per cent.

5.8 Rainforest Conservation

- 5.8.1 As indicated in Table 5.1b, it was estimated that in 1971 the area of rainforests in the National Park System of N.S.W. was about 18 000 ha. Since that time a number of rainforest areas have been added to the Park system either from Crown lands (e.g. Werrikimbe N.P.) or by re-vocation of State Forest (e.g. Dorrigo N.P. extensions). The current area of rainforest on National Park is not reliably known, and the Forestry Commission has recently seconded an officer to National Parks and Wildlife Service to assist in elucidating this matter. However the total area could be in the order of 25 000 ha. Park Service areas containing significant stands of rainforest include the following sites:

Barrington Tops National Park	16 300 ha total area
Dorrigo N.P.	3 600
Gibraltar Range N.P.	15 500
Mt. Warning N.P.	2 100
New England N.P.	23 300
Werrikimbe N.P.	11 600
Boorganna Nature Reserve	380
Georges Creek N.R.	1 200
Limpinwood N.R.	2 400
Mt. Seaview N.R.	190
Stotts Is. N.R.	140

- 5.8.2 The Native Forest Preservation programme of the Forestry Commission (10) has resulted in a substantial number of rainforest stands being set aside and preserved from future man-caused disturbance. Out of 36 Flora Reserves notified under the Forestry Act some 24, with a total area of 7300 ha, contain significant or critical areas of rainforest. Among the less formally preserved "Forest Preserves", which in virtually all cases are intended for Flora Reservation notification in due course, some 30 sites, with a total area of over 4000 ha, contain a significant rainforest content.
- 5.8.3 The much acclaimed review (11) by Prof. R.L. Specht and associates of the conservation status of major plant communities in Australia lists the conservation status of subtropical, warm temperate and cool temperate rainforest in N.S.W. in their usual height range (10m and over), as being "excellent". Among the major rainforest ("closed-forest" in the terminology of the review) communities in N.S.W., only dry rainforest is regarded as having a poor conservation status.

(10) "Preserving Forest Areas" and "Forest Preserves of N.S.W." Forest and Timber 10(1), 1974

(11) R.L. Specht, E.M. Roe and V.H. Boughton. "Conservation of Major Plant Communities in Australia and Papua New Guinea." Aust.J.Bot., Suppl.Series No.7, 1974.

5.9 Rainforest on State Forests

- 5.9.1 As indicated in Table 5.1, the area of rainforest within State Forests in N.S.W. was about 136 000 ha in 1971. This area would now be slightly different as a result both of the revocation of some areas by State Forest for transfer to the National Park system and of the dedication of some new areas. The area of State Forest includes the area of Flora Reserves. The total area of State Forests in N.S.W. is 3.2 million ha: rainforest thus amounts to about 4 percent of the total State Forest estate.
- 5.9.2 The attitude of the Forestry Commission to the management of these rainforest stands has been recently stated in the Commission's indigenous forest policy ⁽¹²⁾, and the relevant extracts from this policy are given in Appendix 7. In brief, the Commission indicates its appreciation both of the various non-material benefits that rainforest can provide and of its role as the producer of certain potentially high value specialty timbers. Its aim is to reduce timber harvesting in rainforest to the periodic selective harvesting of specialty timbers, while retaining other rainforest values at a high level. Because of existing market commitments, rainforest logging in some areas is currently at a rate above the sustained yield level, and in a few cases necessitates logging at a heavier rate than is desirable for the maintenance of an acceptable rainforest structure.
- 5.9.3 Rainforest occurs in the eight coastal Forestry Districts and in Glen Innes Forestry District. At this stage the Forestry Commission has virtually phased out rainforest logging operations on State Forests in the Eden, Bateman's Bay, Newcastle, Taree and Kempsey Forestry Districts, and in most of the Glen Innes District. Rainforest logs may on occasions be obtained in these districts, for example in the course of clearing for roads or from hardwood (essentially eucalypt) logging operations in stands where there is a rainforest component beneath the eucalypts, but there is now little or no commitment by the Forestry Commission to supply "brushwoods" (rainforest timbers) to local mills, and such supply is as far as practicable avoided.
- 5.9.4 Commitments to maintain supplies of rainforest timbers to local mills continue in the Wauchope, Coffs Harbour and Casino Forestry Districts and in the Armidale Subdistrict of Glen Innes District. The Armidale operation is currently being reexamined by the Forestry Commission. At Coffs Harbour and Wauchope the operations are still at a more intensive level than the Commission would prefer - in the case of Wauchope, partly because of the inclusion of substantial areas of commercial quality rainforest in the Werrikimbe National Park. At Casino rainforest logging operations centre around the mills that are involved in the current study area, though the operations cover a much wider area than the current study area: aspects of these operations will be examined further in Chapters 6 and 10.
- 5.9.5 The method of determining the royalty or stumpage value of rainforest timbers will be examined in Chapter 6.

5.10 Subtropical Rainforest

- 5.10.1 One of the more frequent arguments in favour of establishing a national park within the study area reaches around the fact that this region generally "includes the largest tracts of prime virgin sub-tropical rainforest left in Australia and possibly in the world" ⁽¹³⁾

(12) "Indigenous Forest Policy." Forestry Commission of N.S.W., 1976.

(13) Alex Colley: "The Case for the Border Ranges National Park." Habitat 4(3), 1976.

For this reason a few further comments about subtropical rainforest seem warranted.

- 5.10.2 The general features of this rainforest subform have been outlined previously (para. 5.6.1); the botanical composition of three stands in the study area is listed in Appendix 4; and features of the composition are discussed in section 3.6, and particularly in paras. 3.6.9, 3.6.10, 3.6.18 and 3.6.32. The fauna of the subtropical rainforest has been dealt with in the comments under section 3.7.
- 5.10.3 Subtropical rainforest is, as previously indicated, very similar to much of the rainforest found in the tropics, e.g. in North Queensland, New Guinea, Malaysia, but is less rich in species and rather simpler in structure and appearance⁽¹⁴⁾. Subtropical rainforest, essentially similar to that along the McPherson Range, is found in eastern Australia from north of Bundaberg down to about the Manning River district. Southwards from the Manning its composition changes (e.g. the Booyongs no longer occur), and further north in Queensland it merges into truly tropical rainforest. Within this zone where the Booyong-dominated rainforests occur, there are further differences. For example at the lower altitudes White Booyong (*Heritiera trifoliolata*) tends to predominate and there are often a number of *Flindersia* spp. present, such as Silver Ash, Yellowwood and Crows Ash, while at the higher altitudes Black Booyong (*H. actinophylla*) is more common, the *Flindersias* are less common, and Yellow Carabeen often occurs frequently.
- 5.10.4 Rainforest of these types is reasonably common in southern Queensland and northern N.S.W. Apart from the fairly massive occurrences on both sides of the McPherson Range and the adjacent ranges, there are sizeable occurrences in the Bundaberg district and in the Gympie-Imbil area, as well as on various basalt uplands (e.g. Bunya Mountains, Cunningham's Gap) in Queensland. There are nearly 200 000 ha of rainforest in this region of Queensland and much of this would be of the subtropical type: probably 100 000 ha or more.
- 5.10.5 Table 5.1(b) shows some 44 000 ha of subtropical rainforest for N.S.W. so that the total area in eastern Australia would be in the order of 150 000 ha.
- 5.10.6 The major N.S.W. occurrence is in the Border Ranges area, extending west to Acacia Plateau (Koreelah State Forest), south along various side ranges (Yabbra, Beaury, Richmond Range, Toonumbar State Forests), and in the Nightcap Range area (Whian Whian and Goonimbar State Forests), to the south east. Another fairly extensive occurrence (including the Willowie Scrub of 3500 ha, containing both subtropical and warm temperate rainforest) lies west of the Clarence River, in the Ewingar S.F./Washpool S.F./Gibraltar Range N.P. area. South again it occurs around the Bellingen River catchment (Bellingen River S.F./New England N.P./Dorrigo N.P.), with small occurrences on basalt "blows" in the area both north and south: many of these occurrences are now included in the Forestry Commission's Native Forest Preservation programme (para. 5.8.2). Subtropical rainforest is found on basaltic and other fertile soils of the Hastings River catchment, though the main extant rainforest occurrences in this region are of different types. Small patches are found further south, towards Wingham and Bulahdelah, and beyond this zone the subtropical rainforest has a somewhat different composition, lacking in particular the Booyongs. Subtropical rainforest of this southern type called by the Forestry Commission⁽¹⁵⁾ the Crabapple (*Schizomeria ovata*) - Sassafras (*Doryphora sassafras*) - Corkwood (*Ackama paniculata*) - Silver Sycamore (*Cryptocarya glaucescens*) type, occurs commonly on the foothills of the Barrington Tops and in some of the remnants in the Illawarra district.

(14) G.N. Baur: "Ecological Basis of Rainforest Management." For. Comm. of N.S.W., 1968.

(15) For. Comm'n of N.S.W. Res. Note No. 17, "Forest Types in N.S.W."

6. The Timber Industry in the Study Area

- 6.1 Because forest management provides the basis for a viable timber industry operating under sustained yield, it might seem logical to consider forest management before looking at the nature of the local timber industry. However in reality, in the Border Ranges district as in many other parts of N.S.W., the timber industry was in existence well before any efforts were or could be made to introduce management to the local forests, and the pattern of this industry has had considerable significance on the subsequent development of forest management in the district.
- 6.2 Under Sections 28 and 29 of the Forestry Act, 1917, anyone operating a mill for the sawing and treatment of timber in N.S.W. must hold a sawmill licence issued by the Forestry Commission. Such a licence is necessary whether the timber to be processed is coming from Crown or private sources.
- 6.3 Mills that have received rights to a regular allocation of timber from Crown sources (i.e. from State Forests, Timber Reserves, vacant Crown lands and certain Leases) have always been allowed by the Forestry Commission to trade in these rights, so that the transfer of a mill licence from one person or company to another will normally carry with it the continuing rights to any Crown timber formerly attached to that licence. Obviously these rights, providing the licensee with a continuing supply of raw material for his plant, may have a substantial commercial value.
- 6.4 Stumpage Appraisal
- 6.4.1 Timber from Crown sources in N.S.W. is usually sold on a residual stumpage basis. In theory this is determined by deducting from the market price of sawn timber in some appropriate centre all the costs associated with harvesting, snagging, hauling, processing and transporting the timber. The residual stumpage is the rate per cubic metre for the standing tree in the forest, before any of these harvesting and processing costs have been incurred. The system is intended to allow all mills in the State to compete fairly, those located close to market or with other particularly favourable circumstances paying higher royalties than those less favourably situated. It was also intended to foster the use of poorer quality logs and less desirable species.
- 6.4.2 In reality the starting point for the calculation is determined from time to time by the Forestry Commission, in the case of rainforest timber from the study area the base rate being that imputed to certain species sawn, free in yard, in Brisbane. From this price deductions are made to give the mill door log value (MDLV), which is the value per cubic metre of a log delivered to the mill, ready for sawing. So long as the base rate remains unaltered, the MDLV will be a fixed value for that particular mill. The MDLV may, incidentally, be calculated for a site other than that where the mill actually is located if, in the view of the Forestry Commission, the calculated site appears more logical and confers some resultant financial advantage on the State.
- 6.4.3 For each new compartment or other area to be logged, a separate stumpage appraisal is calculated, starting from the MDLV and allowing for such items as felling (the cost of which will vary with the volume of timber per hectare, the density of undergrowth, the topography, and so on), snagging and the haulage of the logs from the forest to the mill. A sample stumpage appraisal, based on a mill site at Wiangaree village and logging in a compartment of Wiangaree State Forest, is attached as Appendix 8.

- 6.4.4 Some species of timber are intrinsically more valuable than others, and large logs are more valuable than a similar volume of small logs because of the ease of handling and the opportunity for a greater recovery. For these reasons rainforest species are classified into four species groups (A, B, C, D) and into 5 size groups, based on the centre diameter of the log. The base stumpage rate calculated for rainforest logs, and demonstrated in Appendix 8, applies to Group B logs, of 60 to 79 cm centre diameter under bark. Larger logs and Group A logs will attract an additional stumpage margin over the base stumpage rate, and logs of smaller size or lower species group will attract a negative margin. Rainforest species groups are shown in Appendix 9, and the species and size margins in Appendix 10. For the area used in the stumpage appraisal example in Appendix 8, a large Group A log would bring a royalty of \$17.20 per m³, and a small Group D log \$6.55 per m³, less any deductions allowed for defect. No logs are sold at less than a minimum rate of 50 cents* per cubic metre, and mills have the option of accepting or rejecting logs at this minimum rate. (A generally similar system applies to hardwood logs).
- 6.4.5 Five species of special value are known as the "Red Cedar Group" and have a margin of \$33 per m³ over Group B species. These species are not normally sold unless the purchaser has a specific reason, accepted by the Forestry Commission, for seeking them.
- 6.4.6 Although the starting point for stumpage appraisal (in the case of the example in Appendix 8, \$146.40) theoretically relates to the market price of sawn timber in the particular market, it is in fact a figure periodically determined by the Forestry Commission with a view to bringing to the Commission a certain calculated income. The current base timber prices for various types of forest produce are published each year in the Commission's Annual Report.
- 6.4.7 These values obviously have an effect on the ultimate price of timber: an increase in these base timber prices results in higher royalties and can be expected to produce a higher sale price for the final product. Because most of the timber produced in N.S.W. is used in the building industry, and variations in its price can thus have noticeable effects on, for example, the cost of new housing, Governments of all political persuasions in N.S.W. have sought to keep stumpages down. In effect the Government, through the Forestry Commission, has deliberately subsidised the home-builder, and in the process other timber users, by a low royalty policy.
- 6.4.8 This policy has been reinforced by the fact that a significant increase in the price of locally produced timber would place this product in an unfavourable position compared with imported timber, and this in turn could lead to the shutting down of mills and increased unemployment.
- 6.4.9 At the same time it might be argued that, whereas a low royalty policy is a legitimate ploy for those species whose major use is as a basic building material, e.g. the native hardwoods and plantation pines, the policy has less justification in relation to specialty timbers such as many of those from the rainforest. This point was touched upon in the acclaimed report on the multiple use of forests, prepared for the 1974 FORWOOD Conference⁽¹⁾. In discussing the management of rainforest in Australia, this report states: "The Panel would particularly point out that many rainforest trees have timbers that are especially suitable for certain purposes, and it would urge on forest managers the desirability of ensuring that these timbers are

* Being raised to 54 cents from 1st September, 1977.

(1) FORWOOD: Report of Panel 3, "Multiple Use of Forest Resources", 2nd edition, Canberra, 1975.

directed towards their specialty and high-value uses. Rainforests in the Australian scene have high value, present or potential, for many benefits besides timber production, and these values should not be prejudiced, even in the short term, for the sake of unnecessary timber sales." It could be argued that a high royalty policy on rainforest timbers would go far towards achieving both this aim and the expressed policy of the Forestry Commission towards rainforest management (see para. 5.9.2), though it would not, of course, overcome the immediate problem of likely mill shut-downs and unemployment.

6.5 Allocations of Crown Timber

- 6.5.1 Prior to 1951, allocation of timber from Crown sources to the various mills that had previously acquired a right to such timber was made on the basis of available logging areas: the mill, in effect, had the rights to the timber growing within a specified area. However, as the demand for timber increased, this created a difficult and anomalous situation. Some mills had large areas allocated to them, carrying a considerable volume of timber, whereas many other mills were far less fortunate.
- 6.5.2 The Forestry Commission therefore decided to allocate future supplies on the basis of an annual quota, the Commission determining from which area the annual quota was to be obtained. The mill would thus have rights to a volume, not to a specific area. This led to greater flexibility in management and a more equitable distribution of Crown timber amongst the mills to which the Commission had longstanding commitments.
- 6.5.3 The Commission also endeavoured, wherever practicable, to assist private sawmills which lacked rights to Crown sources of timber, by making parcel sales of Crown timber to them. Such parcel sales might, for example, relate to an area of forest of difficult access, and for that reason unattractive to mills with Crown rights, or to small logs, remaining on a site intended for clearing, after a Crown mill had already operated there.
- 6.5.4 The quota system was introduced in 1952-53, with each mill operating on Crown sources being allowed a maximum annual log input. This annual quota could be varied from year to year, though in practice it has tended to be static unless peculiar circumstances intervene. Such peculiar circumstances might be a reassessment of a forest area under sustained yield management, revealing that an adjustment of the annual cut, either up or down, was necessary. In an extreme case it might be the exhaustion of available timber supplies from a forest area not under sustained yield management.
- 6.5.5 The initial volume allocated to mills as their Crown quota was based on the average annual cut of Crown timber over the previous three years. It originally included all log volumes, irrespective of size, but in 1956-57 the system was reviewed to exclude all logs sold at minimum rates (see para. 6.4.4). The system was further varied in 1956-66 to provide for quarterly quota control, as it had been found that some mills exhausted their annual quota early by heavy cutting, and then attempted to place on the Commission the onus for the resultant closure of the mill.
- 6.5.6 It will be appreciated that the introduction of Crown quotas bore no relationship to the capacity of the particular forest areas for sustained yield timber production. In some cases the quotas were below the allowable cut or, quite fortuitously, were at a similar level. Elsewhere the quotas were substantially above the level that the local forests could indefinitely sustain. In such cases the forests were being overcut, and ultimately some reduction in cut, or the transfer of timber supplies from some other source, or even a

complete cessation of logging and the closure of mills, would be inevitable. Where cessation of logging occurred there would be a hiatus while the regrowth on the forests grew to commercial size, and at that time harvesting could recommence, hopefully this time at a level which the forests could indefinitely sustain.

- 6.5.7 The quotas allocated to mills in the Kyogle Forestry Subdistrict (Kyogle Management Area), which includes the study area, were substantially above the allowable cut for sustained yield.

6.6 Sawmilling Industry in the Kyogle Management Area

- 6.6.1 The study area and adjacent regions have had a long association with the timber industry, dating back to the cedar-getters who worked last century in the gallery rainforest stands (see para. 3.6.20) along the Richmond and its larger tributaries, and who subsequently ventured into many of the more remote forest areas in search of the "red gold". An old cedar-getter's track, for example, ascended on to the plateau of what is now Wiangaree State Forest close to the present day line of the main Lynch's Creek access road.
- 6.6.2 Sawmilling was well established in the area by early this century, and a number of the sawmills which received licences shortly following the passage of the Forestry Act in 1916 have, by the subsequent transfer of licences and of timber allocations, had an influence on the local mill ownership patterns and Crown quotas of to-day. An outline of these various transactions is given in Appendix 11.
- 6.6.3 As indicated in Appendix 11, four sawmills now have rights to some Crown timber in the study area: Munro and Lever Pty. Ltd., Standard Sawmilling Co. Pty. Ltd., James Hurford and Co. Pty. Ltd.; and M. Hogan. These mills have between them annual unrestricted quotas of 27 460 m³ relating to the Kyogle M.A., plus further allocations of 7530 m³ limited to specified compartments in the Management Area. The total annual allocation is therefore 34 990 m³.
- 6.6.4 Munro and Lever Pty. Ltd. is a subsidiary of the Brisbane-based firm, Carricks Ltd. It operates a sawmill and veneer mill at Grevillia, having recently centralised all its activities at Grevillia. While some staff live in Grevillia village and the nearby district, most employees travel daily from Kyogle, a distance of about 30 km. The mill has a quota of 17 850 m³ of all species from the Kyogle M.A., together with two annual allocations of 2200 m³ and 2910 m³ from specified areas in the Management Area, and these Kyogle sources would represent about 75 per cent of its total input. Staff employed by the company number about 180:

Sawmill	78
Veneer and plymill	82
Logging crews	23

About 40 per cent of the mill's intake is rainforest species, including Hoop Pine. The mill has a traditional option on all natural Hoop Pine supplies in the Casino Forestry District, these being used predominantly for veneer production. Hardwood supplies are mostly sawn into boards and scantling for general building purposes, but a significant amount of ironbark and the other more durable hardwoods is sawn into girders and decking for bridge orders. The major use of the rainforest species is for veneer production, but substantial volumes are sawn for use as mouldings, furniture and general building timber.

- 6.6.5 Standard Sawmilling Co. Pty. Ltd. operates a large mill at Murwillumbah. This mill has an unrestricted quota of 9610 m³ from the Kyogle M.A. About 40 per cent of the mill's timber supplies come from Kyogle M.A. Staff numbers about 120 in full-time employment.

Hardwood is normally cut into building timber. The company has developed the production and sale of laminated products marketed as "Stabel Frame" and "Stabel Beam", and special equipment has been installed at the mill for this production. These products require the use of rainforest species, and in recent years virtually all the intake received by the company from Kyogle M.A. has been of rainforest timber. The company has been recently endeavouring to obtain reliable supplies of suitable rainforest timbers from abroad (particularly Papua New Guinea and Western Samoa).

- 6.6.6 James Hurford and Co. Pty. Ltd. has a mill at Lismore. Most of its timber supplies are obtained from other areas, but it holds an allocation of 800 m³ a year from a specified part of Wiangaree S.F.
- 6.6.7 M. Hogan operates a mill near Kyogle, relying essentially on private sources of supply, but holds an allocation of 1620 m³ from a section of Wiangaree S.F. The mill employs about 15 people. The Crown area has not recently been worked.
- 6.7 Other Forest Products. Forests provide for many uses besides timber production, and some of these will be examined in Chapter 8. These uses include the production of forest products other than timber: these are often called "minor forest products". At the present time these minor products are of little significance in the study area. Until a year or so ago there was some harvesting of the foliage of *Duboisia* (one of two quite separate rainforest trees also known as "Corkwood" - *Duboisia myoporoides*), for the extraction of drugs used for the treatment of travel sickness and of certain eye conditions. This is a rainforest plant that occurs commonly in disturbed sites, e.g. along roads and logging tracks in the rainforest. However following the closure of the local processing plant at Lismore the harvesting of *Duboisia* leaf has ceased in the area. There is a small local supply of certain protected plants of horticultural interest (e.g. epiphytic orchids and ferns), which may be sold from State Forests if the particular plants would otherwise be destroyed because of forestry operations. There is also some minor collection of seed from rainforest plants for propagation.

7. Forest Management Operations

7.1 Responsibilities of the Forestry Commission

7.1.1 The Forestry Act, 1916, which established the Forestry Commission of N.S.W., gave no clear indication of the Commission's objectives until amendments to the Act were passed in 1972, though the Act had always emphasised the role of forests for the production of timber.

7.1.2 The 1972 amendments included a new section (8A) which defined the Commission's objects as:

- "(a) to conserve and utilise the timber on Crown-timber lands to the best advantage of the State;
- (b) to provide adequate supplies of timber from Crown-timber lands for building, commercial, industrial, agricultural, mining and domestic purposes;
- (c) to preserve and improve, in accordance with good forest practice, the soil resources and water catchment capabilities of Crown-timber lands;
- (d) to encourage the use of timber derived from trees grown in the State; and
- (e) consistent with the use of State forests for the purposes of forestry and of flora reserves for the preservation of the native flora thereon -
 - (i) to promote and encourage their use as a recreation; and
 - (ii) to conserve birds and animals thereon."

7.1.3 These objects in effect spelt out what the Forestry Commission had for many decades regarded as its broad aims, and they tended again to place some stress on the provision of timber from the State's forests as a primary objective of the Commission.

7.1.4 Land is vested under the control of the Commission as State Forest and Timber Reserve, and in most, though not all, cases these lands have been dedicated or reserved primarily because of their value for the present and future production of timber. The Commission also controls the harvesting of timber from Crown lands and from most forms of Leasehold land.

7.1.5 The Commission has been active in the review of lands under its control and, excluding areas in and adjacent to the Kosciusko National Park more than 90 000 ha of State Forest and more than 30 000 ha of Timber Reserve have been, or are in the process of being, revoked with a view to their transfer to the National Parks and Wildlife Service. At the same time the Commission has been involved in its own Native Forest Preservation programme, which has resulted in some 20 000 ha of State Forest having been set aside as scientific reference stands. Many other areas have been set aside separately with minimal disturbance for recreational and aesthetic purposes.

7.1.6 At June, 1976, the area controlled by the Forestry Commission was 3 219 000 ha of State Forest and 375 000 ha of Timber Reserve.

7.1.7 Over most of the period of its existence the Forestry Commission has used individual State Forests as the basis for forest management and for the keeping of statistics on production, expenditure, etc. State

Forests themselves are subdivided into compartments, which in the native forests of the coastal districts generally range in size from about 50 to 500 ha, with an average size probably in the order of 150 ha. However over the past two decades, with the increasing amalgamation of sawmills with Crown quotas, the greater centralisation of milling facilities, and the ability to obtain logs from greater distances, the Commission has tended to group State Forests and other Crown-timber lands together for management purposes into larger Forest Management Areas, usually though not invariably coinciding with the local Forestry Commission subdistrict boundary.

7.2 Kyogle Forest Management Area

7.2.1 The State Forests of the Kyogle Forestry Subdistrict have been grouped together for management and statistical purposes into the Kyogle Forest Management Area (Kyogle M.A.).

7.2.2 The Kyogle M.A. contains all or part of seven State Forests lying generally in the upper catchment of the Richmond River. These State Forests are:-

Mt. Lindesay No. 542	3 393 ha	Dedicated	1917
Richmond Range No. 610 (pt.)	2 712		1918
Roseberry No. 608	15 177		1917
South Toonumbar No. 753	205		1920
Toonumbar No. 343	10 355		1917
Unungar No. 540	4 281		1917
Wiangaree No. 358	14 465		1917
Total area	50 788 ha		

Included within this area are four Flora Reserves (see para 3.9.8) with a total area of over 1800 ha, and the Toonumbar Hoop Pine plantation (218 ha). (The plantation is excluded from the management area for planning purposes.) The management area also contains nearly 2000 ha of other Crown-timber lands - Leasehold, vacant Crown land, Timber Reserve and private lands where the Crown's former timber rights have been reserved under profit à prendre.

7.2.3 The management area is administered from the Forestry Office located in rented premises in Kyogle. Forestry staff for the area numbers 17: 2 professionally trained foresters, a clerk, a typist and 13 employees.

7.2.4 A working plan for the Kyogle M.A. is currently in a late stage of preparation.

7.2.5 The management area contains approximately equal areas of rainforest and hardwood (eucalypt and similar) forest types.

7.2.6 The history of logging in the area is one of gradually increasing control by the Forestry Commission, from a period when prime logs only were selected by the millers, through imposition of girth limits to retain the immature stems, and the introduction of the stumpage appraisal (see para. 6.4) to foster the use of less desirable species and more faulty logs. Selective logging prior to about 1960 resulted in the cutting of preferred species in areas of easier access and topography, so that areas logged, in both rainforest and hardwood forest, often still carried merchantable timber which, from the viewpoint of future tree growth on the area, would have been better removed, together with isolated unlogged sections.

7.2.7 By the 1930's logging had covered most of the more readily accessible forest areas, and was moving on to the higher slopes, shelves and the edges of the large upland plateaux. Some ingenious logging systems, including flying foxes and "roll overs", were devised during this period, but in most cases successful and sustained harvesting in the more remote

parts was delayed until reliable roads were constructed. Probably the most successful penetration of the more remote areas was along Munro and Lever's Long Creek tramline which tapped much of the Long Creek basin, including the eastern slopes of Levers Plateau. Contrary to some recent reports, the principals of this company were never regarded by the Forestry Commission staff in the region as showing any reluctance to shift operations on to Levers Plateau, and indeed they were thwarted in this regard only by topography and the desire of the Forestry Commission to defer logging on the plateau until more reliable access could be provided.

- 7.2.8 From the 1940's a series of major roads were built by the Forestry Commission, or under its direction, on to some of the plateaux in the management area. These included Cox's Road, on to parts of Toonumbar and Unumgar S.F.s in late forties/early fifties; the Lynch's Creek Road, on to the western section of Wiangaree S.F. in about 1961; and the Tweed Range Road, on to the eastern part of Wiangaree in 1972.
- 7.2.9 Tree marking by Commission staff, to indicate which trees were to be removed in harvesting and which should be retained, was introduced into hardwood stands in the Kyogle M.A. in 1960 and into rainforest stands in 1962. This had the effect of transferring effective control of the forest harvesting to the Forestry Commission.
- 7.2.10 Yields of timber and the proportion in the major species groups from the Kyogle M.A. since 1937 are shown in Table 7.1.

Table 7.1

Timber Yields - Kyogle M.A., 1937-75

<u>Period</u>	<u>Av. Annual Yield</u>	<u>Percentage Composition</u>		
		<u>Hardwood</u>	<u>Rainforest</u>	<u>Hoop Pine</u>
1937-45	19 420 m ³	27	26	47
1945-55	19 395	48	50	2
1955-65	26 645	54	42	4
1965-75	31 000	52	45	3

7.3 Hardwood Silviculture

- 7.3.1 Eucalypt and related forest types make up about 55 per cent of the Kyogle M.A., with the moister types (e.g. Tallowwood-Sydney Blue Gum, Flooded Gum and Brush Box types) contributing about 25 per cent, and the drier types (e.g. Grey Gum-Grey Box and Ironbark types) about 30 per cent. The hardwood types are less significant in the study area (Wiangaree, Roseberry and Mt. Lindesay S.F.s) than in the management area as a whole.
- 7.3.2 Treatment in these types aims to encourage regeneration in the moist types following logging, if necessary by limited planting of Blue Gum and Flooded Gum on sites of reasonable topography. On the drier types, where regeneration usually is obtained without difficulty, useless competing stems are removed in a culling operation where these are interfering with the growth of trees which are capable of producing trees of sawlog size over the next 30 years.

7.4 Rainforest Silviculture

- 7.4.1 Aspects of the history of efforts to manage rainforest stands in N.S.W. have been described elsewhere⁽¹⁾.

(1) "Silvicultural Practices in Rainforests of Northern N.S.W." For. Comm. N.S.W. Res. Note No. 9, 1962.

- 7.4.2 Briefly, it was long believed that, with the few exceptions, rainforest areas could not be managed for long term timber production. Important among the exceptions were certain dry rainforest stands, where it was believed possible to maintain a productive Hoop Pine component. In the Kyogle M.A. freeing treatments have been carried out in dry rainforest to release young Hoop Pine stems since the mid-1930s, and since the late 1950s Hoop Pine seedlings have been planted along snig tracks and in other localised openings in logged dry rainforest stands in order to increase the valuable Hoop Pine component.
- 7.4.3 However in most rainforest areas it was considered impractical to maintain timber production, and the policy from the 1930s up until the mid-1950s was to log these stands as heavily as possible, recovering all merchantable stems, and then ultimately to clear away the remaining growth and plant Hoop Pine on the cleared rainforest site. In this way over 1300 hectares of plantation of native Hoop Pine and of its Queensland relative, Bunya Pine (*Araucaria bidwillii*) were established in the Casino forestry district, including over 200 ha on Toonumbar S.F., in the Kyogle subdistrict. Rising costs led to the cessation of the plantation programme in 1954, while at about the same time the Forestry Commission undertook a programme of ecological and silvicultural research into the rainforests of northern N.S.W., with a view to developing suitable alternative management practices.
- 7.4.4 As a result of these studies, selective logging of the subtropical rainforest areas in the Kyogle M.A. was introduced in 1962, the logging being controlled by tree-marking carried out by Forestry Commission staff. As experience has been gained in this technique, the system has been modified in various ways.
- 7.4.5 This selective logging system deliberately aims to retain a 50 per cent canopy cover, and to maintain the full species diversity in the remaining stand. Where the canopy is already naturally sparse, few or no trees are removed, whereas in sites where the canopy is complete up to half the upper canopy cover may be removed in logging. The trees to be removed are selected and marked by the Commission's staff, and the operation is carefully controlled to ensure that only the marked trees are removed and that damage to the remaining trees - and it is inevitable that some damage will occur - is kept to the lowest practicable level.
- 7.4.6 Unlogged strips are retained along permanent watercourses and usually also along the major access roads. Following the completion of logging in an area, the logging tracks are drained to reduce the risk of erosion, and at times some enrichment planting of seedlings of Hoop Pine and other rainforest species may be carried out along logging tracks and on log dump clearings.
- 7.4.7 The general silvicultural and ecological effects of this system will be examined in greater detail in Chapter 9.
- 7.4.8 Because a significant proportion of each compartment is left unlogged for one reason or another, it is difficult to obtain accurate figures of yield from this system of logging. However yield from the selective logging appears to have ranged between 30 and 50 m³/ha in recent operations, with an average of about 35 m³. By comparison, one area experimentally logged in Wiangaree S.F. to remove all commercial timber yielded 124 m³/ha of merchantable timber: this particular area was however regarded as being of higher quality than the stands logged in the last few years. The total volume of standing trees larger than 10 cm diameter at breast height in these stands appears to vary between 150 and 300 m³/ha, with 200 m³/ha probably being on the high side for recent logging areas. Such volumes include trees both of below merchantable size and of a quality that renders them unmerchantable, regardless of size. In general terms the logging operations probably remove about 50 per cent of the standing merchantable volume, with the remaining 50 per cent including many trees which have been left because of their small size, short log length, heavy crowns or low or dubious level of merchantability.

7.4.9 Almost all rainforest trees making up the upper forest canopy are commercially acceptable, except for Strangler Figs (*Ficus* spp.) and Giant Stingers. However the Forestry Commission decided some years ago as a matter of policy that stands of Negrohead Beech would not normally be subjected to logging in State Forests. (In a few sites only some selective harvesting of species associated with Negrohead Beech may be carried out: this does not apply in the Kyogle M.A.) There is however not an embargo on the felling of Negrohead Beech, and occasional trees may be felled and subsequently marketed from road clearings or from individual stems found growing remote from the actual Beech stands.

7.4.10 The proportion of different species obtained as a result of rainforest logging in the Kyogle M.A. from January, 1972 to June, 1976 is shown in Appendix 12. These records cover the whole period from the introduction of detailed records of individual species production. Because the period includes the change from imperial to metric log measure, with some associated problems in converting one unit to the other, the total volume produced for each species may not be absolutely accurate, but the volume involved over the 4½ years is in the order of 90 000 m³.

7.5 Uses of Rainforest Timbers

7.5.1 The general products obtained from rainforest logging in the Kyogle M.A. have previously been indicated in para. 6.6. Also as previously indicated, many rainforest timbers have specialty purposes, and alternative sources to meet these purposes are frequently non-existent or difficult to find within Australia, and likely to be increasingly limited from overseas sources. In the long term, possibly the strongest argument in favour of continuing to manage areas of rainforest for, among other things, the continued production of timber is to ensure that timbers to meet these specialty purposes will continue to be available, and this philosophy clearly underlines the policy of the Forestry Commission towards rainforest management (see para. 5.9.2 and Appendix 7).

7.5.2 Details of these specialty uses will be found in various books and other publications dealing with native timbers, such as those of Bootle ⁽²⁾ and Boas ⁽³⁾. All the species listed in Appendix 12 are discussed, for example, by Bootle (though in a number of cases using different "common" names), while in the detailed list of wood uses given by Bootle many specific uses of rainforest timbers are given. A summary of these, relating to the first four timbers in Appendix 12, is given in Appendix 13: these merely give an indication of the special use to which many rainforest timbers are suited.

7.6 Resources of Kyogle M.A.

7.6.1 As previously indicated, the allocated quotas from the Kyogle M.A. were determined on the basis of cutting levels at a time when sustained yield management of most forms of rainforest was considered impracticable and when the Forestry Commission was seeking to have the rainforest in many sites cut as heavily as possible with a view to the land then being used for the establishment of potentially highly productive Hoop Pine plantations. (The significance of Hoop Pine plantations will be examined in Chapter 10.)

7.6.2 As a result, the level of cutting in Kyogle M.A. has for a long period - well in excess of a quarter of a century (see Table 7.1) - been

(2) K.R. Bootle: "The Commercial Timbers of N.S.W. and Their Use". Angus and Robertson, Sydney, 1971.

(3) I.H. Boas: "The Commercial Timbers of Australia." C.S.I.R., Melbourne, 1947.

substantially above the level that could reasonably be sustained in perpetuity. In effect forest capital has been used at a rate far beyond that being produced by new growth on the forest trees.

- 7.6.3 Obviously such a state cannot continue indefinitely. In due course the available timber resource will be exhausted, and there must then follow a period of little or no logging while growth in the forests allows the volume to recover to a level that will again sustain commercial harvesting operations - hopefully at a rate that could then be sustained indefinitely.
- 7.6.4 Because logging in the rainforests and in most hardwood forest areas of the Kyogle M.A. is on a selection system, most areas that have been logged still carry significant volumes of merchantable timber.
- 7.6.5 For example, assessments on five separate logging areas on Wiangaree and Toonumbar S.F.s, following routine selective logging, showed that remaining merchantable stems larger than 120 cm girth (about 40 cm diameter) carried a volume of from 50 to 90 m³/ha, though much of this volume was in stems individually less than 1.7 m³. This volume is theoretically still available for cutting, but only by completely sacrificing the benefits that led to the introduction of selective logging in the first place and by delaying indefinitely - probably by a matter of centuries - any chance of ultimately managing the rainforest stands for sustained yield timber production. The Forestry Commission has indicated that it would strongly oppose such action.
- 7.6.6 On the basis of current logging systems, the Forestry Commission in 1976 estimated that the following volumes of available timber remained in the Kyogle M.A.:

	Hardwood	Rainforest	Hoop Pine	Total
Quota (see Section 6.6.3)	110 900	118 400	26 600	255 900 m ³
Allocated Areas	9 600	8 100	-	17 700
Total	120 500	126 500	26 600	273 600 m ³

These figures were not based on detailed assessment or inventory, but nonetheless represent informed estimates by experienced local staff, and are considered to be of the right order of magnitude, even if not completely accurate.

- 7.6.7 On the basis of these figures, it was calculated that the standing timber resources of the Kyogle M.A. would sustain harvesting operations at the current level, and of a similar form to those currently under way, for about another 10 years. The State Forests within the study area alone would sustain harvesting at the present level for about 7 years, with Levers Plateau contributing about 2 years of this total (and providing most of the Hoop Pine). The Forestry Commission would not, however, normally seek to concentrate all local logging operations in the one area in this way: plans for the logging of Levers Plateau, for example, envisaged this area being logged concurrently with operations elsewhere in the management area, with operations on Levers Plateau extending over 5 or more years.
- 7.6.8 If all areas remain available for logging, and if harvesting continues at the same rate as, and on a similar basis to, that at present, the available timber resources of Kyogle M.A. will be exhausted by about 1986. A reduction in the rate of cut, or a heavier level of cut, would allow harvesting to continue for a longer period; the withdrawal of part of the forest resource would force an earlier cessation to logging. Various combinations of these alternatives are of course possible.

7.7 Unlogged Areas

- 7.7.1 The estimates of remaining volume, discussed above, are based on those areas considered suitable for logging and practicable to log.
- 7.7.2 A significant area of State Forest within the study area has been excluded from these calculations because it is considered as being unloggable. Such areas include the existing Flora Reserves, creekside and certain roadside strips, Negrohead Beech stands, areas of excessive steepness or rockiness, and sites where the costs of providing access would be far in excess of the value of timber made available.
- 7.7.3 Estimates of these unloggable areas on the three State Forests in the study area are:

<u>State Forest</u>	<u>Total Area</u>	<u>Flora Reserves</u>	<u>Other Unloggable Areas</u>
Wiangaree	14 465 ha	1662 ha (11.5%)	4 374 ha (30.2%)
Roseberry	15 177	126 (0.8%)	5 469 (36%)
Mt. Lindesay	3 393	178 (5.2%)	265 (7.8%)
Total	33 035 ha	1966 ha (5.9%)	10 108 ha (30.6%)

Within the study area about a third of the State Forest area would not be logged for various reasons. Whilst much of this area is excluded by physical constraints, the Flora Reserves on Wiangaree and Roseberry S.F.s contain a large volume of potentially readily accessible timber. The Grady's Creek Flora Reserve alone probably contains half as much accessible rainforest again as does the whole of Levers Plateau, or about 3 more years' logging at the current rate.

7.8 Financial Considerations

- 7.8.1 For many years the Forestry Commission has had a substantially greater annual expenditure than it has had income, and about two years ago, under the influence of inflation, the gap between the two widened still further to an alarming degree. For 1975-76 the Commission's total revenue was \$12,680,000, and its total expenditure \$32,840,000.
- 7.8.2 With an organisation like the Forestry Commission the expenditure includes what are in effect both capital investment (e.g. in silvicultural treatment, plantation establishment) and annual maintenance charges. If the bulk of the expenditure is in the form of capital investment, a large gap between revenue and expenditure will not necessarily indicate that the organisation is operating at a loss.
- 7.8.3 In addition, besides being in part a commercial organisation, through the production and sale of timber and other forest products, the Forestry Commission is also a service organisation, providing advisory services, free recreational facilities, the native forest preservation programme and other related services for the benefit of the community as a whole.
- 7.8.4 Until quite recently the Forestry Commission has not attempted to separate its commercial accounts (i.e. those relating solely to wood production) from those relating to community and Government services, nor has it tried to separate capital expenditure from current charges. This position has changed over the past few years, with the Commission supplementing its normal annual expenditure and revenue statements by the introduction of a current cost accounting system. This type of accounting system is extremely complex and difficult to initiate in view of the time scale and biological components in Forestry. The N.S.W. Commission is one of the very few forest services in the world that has attempted this exercise. The system of accounting is still being evolved and definite results will probably not be available before the 1977/78 set of accounts.

- 7.8.5 For the Kyogle Forest Management Area, expenditure on works in 1975/76 amounted to \$142,400, while the salaries of Public Service officers attached to the sub-district office totalled \$42,200. Revenue in the management area over the same period was \$209,700, mostly from the sale of timber but including also income from grazing leases, apiary sites and other minor sources. When provision is made for District and Head Office overheads, the Kyogle M.A. would clearly have a somewhat larger cost than it has income.
- 7.8.6 For individual proposals to construct a road to open up forest areas for future logging, the Forestry Commission requires that an estimate be made of the revenue that will accrue as a result of the road construction, and unless there are other strong management reasons for the road being built, the estimated revenue should exceed the actual construction costs plus a 50% allowance on costs for overheads. It is realised that the figure of 50% is not a true reflection of all overheads and on-costs but it is a Ministerial directive which allowed for factors other than just financial profitability. It is obviously essential that any criteria adopted must be applied State-wide. Naturally various overheads and on-costs such as wet weather vary from road to road, but it is considered that the work involved in costing and applying these to each individual road is not justifiable as it would be time-consuming and, on a State-wide basis, meaningless.
- 7.8.7 The Forestry Commission is currently updating the basis for the apportionment of overheads. There are many alternative approaches to determining an appropriate on-cost for overheads in road construction proposals and two widely differing viewpoints have been expressed by Somerville⁽⁴⁾ and Sinden⁽⁵⁾. Somerville proposes that Head Office and administrative costs should be apportioned on a pro-rated basis to field costs, and the resultant on-cost applied to each activity proposal. Sinden proposes that the 'extra' cost an activity generates, in a large ongoing organisation such as the Forestry Commission, is the appropriate overhead on-cost to apply. Either approach may be used with justification for certain situations, so that the purpose for which the information is needed must be defined prior to choosing a method.
- 7.8.8 For the development of a decision-making formula for construction of roads, it is important to understand that the Forestry Commission is an existing and continuing organisation which provides a variety of goods and services at a variety of prices. The cost of one activity in the short term is considered to be equivalent to the savings in costs and officer time if this activity is curtailed. There is an established procedure in the Forestry Commission for the planning, investigating, surveying, designing, constructing and maintaining of roads. These roads are mostly constructed for the purpose of harvesting logs, although there are other purposes for which roads are built. The review of overhead allowances for road construction proposals is based on costing of the procedures above-mentioned within the Commission, and relating these costs to the direct road construction cost. The allowance so calculated is neither a full overhead nor a truly marginal overhead but is an overhead based on function. It is not appropriate to pro-rate all

(4) J.G. Somerville: "The economics of logging Levers Plateau". Nat. Parks Journal, Feb/Mar.1976, pp. 19-20.

(5) J.A. Sinden: "Another view of the economics of logging Levers' Plateau". Unpublished report, March, 1977.

Head Office and administrative overheads to dollars of prime activities because the Commission is an on-going organisation and also because different levels of attention are given by the organisation to the variety of activities undertaken.

7.8.9 It is considered that the decision-making formula for construction of roads should be applied as a simple on-cost, which expresses the average break-even situation, for building a logging road in the Forestry Commission. This on-cost for direct construction costs includes:

1. Survey costs
2. Works overheads
3. Supervision costs by field salaried officers
4. Marketing costs
5. Road maintenance costs
6. Head Office costs for involvement in this process.

Marketing costs are related to revenue and are deducted when construction of the road is essential for any logging to take place. Otherwise it is the increase in revenue due to the road which is compared with the cost of the road plus the other on-costs.

7.8.10 This break-even on-cost including marketing is of the order of 130 per cent on present indications. On this formula any road which generates additional revenue equal to or greater than construction cost multiplied by 2.3, is considered to be financially acceptable.

7.8.11 Interest charges have been mentioned by both Somerville and Sinden. However it is not appropriate to consider this charge in isolation in a large on-going organisation such as the Forestry Commission. The interest calculation proposed by the two authors is for an opportunity cost equivalent to the price of time. The Forestry Commission does pay debt charges on loan moneys, but these loan moneys are intended for long term capital projects such as plantation establishment and silvicultural works. Administration costs in running the Forestry Commission are provided by the State from the Consolidated Revenue Fund and do not attract debt charges. As no actual interest is involved in the on-going logging activities such as proposed for Levers Plateau, this cost has not been included in the decision-making formula.

7.8.12 For the proposed access road and supplementary logging roads on to Levers Plateau, the total cost of providing access was estimated in 1976 to be about \$180,000, including \$142,000 for the major access road and allowing for financial contributions to the Shire of Kyogle for the repair and upgrading of bridges along the shire road leading to the forest access road take-off point. The estimated royalty value of timber that would be made available for harvesting under present selective techniques as a result of this roading programme was \$700,000. Applying the estimated 130 per cent on-cost to the direct road construction cost of \$180,000 gives \$414,000, which is much less than the \$700,000 estimated revenue. On financial grounds there is no reason to reject building a road which would enable such a logging to take place.

7.8.13 The economics of construction of Levers Plateau Road should not be in dispute. On any reasonable basis this road will produce a surplus of revenue over expenditure during the period of construction and subsequent logging. What is important is that the economic tests that are applied to Levers Plateau Road are also applied to all other Forestry Commission road construction projects. Criteria other than economics can validly be used on which to base road construction approvals as alternatives on which to base decisions not to build roads. These do not, however, affect the economics of the case. In the case of Levers Plateau Road, it seems clear that the final decision must be based on other than economic grounds.

8. Other Forest Usage

- 8.1 Any forest area will serve many different purposes, and provide a range of different benefits. Most obvious of these are the direct material forest products - timber, and the other, minor forest products such as *Duboisia* leaves for medicinal use, horticultural plants, and seeds (see paras. 6.1 and 6.7). There are however many other benefits that come to the community from forests, and this is the case in the State Forests of the study area.
- 8.2 As shown previously (para. 3.3.3), these forests provide in the order of 20 per cent of the stream flow of the Richmond River, and contribute to the domestic and agricultural water supplies of settlements in the Richmond Valley. The manner in which the forests are managed may affect the quality of the water yielded to the streams and even, within certain limits, the quantity: for example treatments that cause rainfall to enter the streams speedily could possibly accentuate flooding downstream during periods of cyclonic rain. These matters will be examined further in Chapter 9.
- 8.3 Forests contain many plants besides trees, and in the more open eucalypt forests there is often a heavy ground cover of grasses and other grazing plants. These can provide a valuable source of forage not only for native herbivores (see para. 3.7), but also for domestic stock, and throughout N.S.W. large areas of State Forest are regularly made available for grazing, usually by neighbouring landholders, under Occupation Permit or longer term lease. Within the Kyogle Forest Management Area nearly 10 000 ha of State Forest are leased for grazing in this way and bring in an annual rental of about \$2,500. For the State Forests within the study area the details are:

<u>State Forest</u>	<u>Total Area</u>	<u>Grazed Area</u>	<u>Annual Rental</u>
Mt. Lindesay	3 393 ha	1 931 ha	\$ 170
Roseberry	15 177	1 838	1165
Wiangaree	14 465	778	169
<u>Total</u>	<u>33 035 ha</u>	<u>4 547 ha</u>	<u>\$1504</u>

Rainforest areas are of little or no value for grazing purposes.

- 8.4 Flowering plants provide the nectar and pollen required for honey production, and many forest plants are particularly valuable in this regard. Certain eucalypts, especially those in the group containing the ironbarks and boxes, are the source of high quality honey, and apiarists follow the flowering of these species with their hives. There are currently 25 apiary sites, with a rental value of \$500 a year, in existence in the Kyogle M.A., though none of these are at present within the study area.
- 8.5 The rainforest stands within the study area have for 20 or more years been used by the military forces for jungle training exercises, in association with the permanent facilities at Canungra. Most, if not all, troops who served in the Borneo and Vietnam campaigns received part of their preliminary training within the study area, and this experience has been very highly regarded by Army authorities. Prior to the creation of the Grady's Creek Flora Reserve in Wiangaree S.F. in 1973 most of this training was carried out on that forest, to a large extent within the area that is now Flora Reserve. Since that time the activity has been largely centred on Roseberry S.F., and particularly on the Lever's Plateau.

- 8.6 The forests of the study area contain distinctive plant communities and their associated fauna, including a number of species virtually restricted to the McPherson Range area. As shown in para. 7.7.3, about a third of the State Forests within the study area will be retained free of logging or similar disturbance. While some of this preserved area is unsuitable for logging for topographic or related reasons, much of it provides a specially retained sample of the natural conditions within the Flora Reserves, creekside reservations and roadside strips, and together these give a dispersed and largely representative example of the natural and undisturbed conditions within the study area. The effects of forest management activities on the flora and fauna will be examined further in Chapter 9.
- 8.7 Recreation
- 8.7.1 The area has great scenic attractions, supplied by the topography and associated streams and the expanse of rainforest. These provide a magnificent landscape backdrop for surrounding areas and have considerable potential for use by the tourist and recreationist.
- 8.7.2 Until recently these forested ranges have received little recreational use. Some illegal, but generally rather limited, shooting of certain protected birds, such as Brush Turkey and various pigeons, occurred; the extreme eastern edge of the study area, along the Tweed Range, received some use by bushwalkers hiking from the Richmond - Tweed district into the Lamington National Park; and the cliff-faces of Mt. Lindesay provided a suitable challenge - in one case fatal - for rock-climbers. Otherwise recreational entry into, and use of, the study area appears to have been slight.
- 8.7.3 The construction of reliable roads on to the Wiangaree Plateau made this area readily accessible to the tourist for the first time, and for a decade or so the Forestry Commission has been giving some publicity to this area as a locality well repaying a visit ^(1, 2). The resultant visitor use probably contributed to the recent controversy over the future use of this area; in turn the controversy undoubtedly generated further visits into the forest.
- 8.7.4 With the increasing use of Wiangaree State Forest for recreation, the Forestry Commission started to instal visitor facilities in appropriate parts of the forest. Picnic facilities were established just off one of the main roads where it crosses Brindle Creek in the heart of the forest, on the roadside bordering Grady's Creek Flora Reserve, and at "the Blackbutts" on the crest of the scarp overlooking the Tweed Valley; a number of walking trails were constructed, including a nature trail associated with the Brindle Creek picnic facilities and trails through the Grady's Creek Flora Reserve and aimed to link with those in the Lamington National Park; and a "forest drive" was created by the use and improvement of existing roads, providing a road trip through the forest, entering through the Lynch's Creek Road and leaving along the Tweed Range Road, and linking a number of features of particular scenic attraction or other interest.
- 8.7.5 A brochure on the forest drive has been prepared by the Forestry Commission (see Appendix 14): this is one of about 15 similar brochures so far prepared by the Commission in recent years as visitor guides to specific forest areas or forest drives.

⁽¹⁾ "Places to see in N.S.W. Forests". Forest & Timber, 5(2), p.11, 1967.
⁽²⁾ G. N. Baur: "A Bit about the Bush". Govt. Printer, Sydney; 1972, p.73.

- 8.7.6 At the same time a number of interpretative signs were installed along the drive, explaining to the visitors features of interest about the forest. The Australian Conservation Foundation subsequently criticised these as "a veritable forest of pro-logging signboards" ⁽³⁾. There are in fact five descriptive interpretative signs on this 14 000 ha State Forest, and the texts of these are given in Appendix 15.
- 8.7.7 Other specific recreational facilities in the State Forests of the Kyogle M.A. include another forest drive through Toonumbar S.F. and very attractive picnic facilities at Roseberry Nursery, close to the banks of the Richmond River.
- 8.7.8 Use of all of these recreational facilities is steadily increasing. Most recent estimates by local Forestry Commission staff are that some 8000 visitors a year are now coming to Wiangaree S.F., about 1000 a year are using the much less publicised Toonumbar forest drive, and about 5000 a year (many just travellers passing along the Kyogle - Woodenbong road) make use of the Roseberry Nursery facilities. Use of the Wiangaree facilities includes guided bus and car safari tours conducted by the Kyogle Chamber of Commerce with some assistance from the local forestry staff.

(3) A.C.F. Newsletter 8 (1), p.4, 1976.

9. Effects of Logging on the Rainforest Environment

9.1 Background to Selective Logging

- 9.1.1 The general form of logging in the subtropical rainforest stands have already been outlined in para. 7.4.5, and the effects of these harvesting operations, both in the long and short term, must be given close consideration in determining the future use of the study area.
- 9.1.2 The technique currently in use in the Kyogle Management Area has developed over the last 15 or so years. For a period prior to then the logging in many rainforest areas was very heavy and aimed to remove all saleable stems in preparation for converting the site to a plantation of the rainforest conifer, Hoop Pine. It was discovered that this heavy logging often caused remaining larger trees left standing to deteriorate in their crowns, apparently as a result of sudden and excessive exposure, and in extreme cases the trees would ultimately die. Crown die-back, as this effect was known, tended to be more severe in the cool and warm temperate rainforest stands than in the subtropical rainforest, but it nonetheless was often observed in the subtropical stands. However with more selective operations, causing a less drastic opening of the stand and exposure of the remaining trees, crown die-back ceased to be a significant factor.
- 9.1.3 Despite crown die-back, heavy logging may in certain circumstances be a most successful means of managing rainforest, and is used on a large scale in a number of overseas areas ^(1,2). Many rainforest stands in N.S.W. heavily logged during the 1940's and early 1950's now carry dense and vigorous regrowth, indicating that this treatment does not preclude the management of the stands for the continued production of rainforest timber. Indeed in the long term the production of merchantable timber by such a system - virtually a form of uniform system or clearfelling - may well be higher than from a selection system, even though under N.S.W. conditions a period of a century or so may elapse before it is again practicable to log in the regenerated stands.
- 9.1.4 On the other hand, unlike many eucalypt forest stands, the rainforest does not have to have such heavy treatment if it is to be managed for continued timber production, and other forest values - scenic, wildlife and so on - will tend to be favoured by a selection system, which has additional value in enabling the smaller, actively growing and potentially high priced stems to be retained for harvesting at a later felling.
- 9.1.5 These reasons, and particularly the favouring of other forest benefits, have led the Forestry Commission to develop a selection system for the management of subtropical rainforest stands in the Casino Forestry District. The system is not the most efficient means of producing wood from these stands, and the cost of logging is somewhat higher, and hence the return to the Forestry Commission somewhat lower (see para. 6.4.3), than would be the case with a heavier logging, but these disadvantages have been knowingly accepted by the Forestry Commission in the multiple use management of these forests, in an attempt to optimise the benefits of these forests to the community as a whole.
- 9.2 The Selective Logging Operation
- 9.2.1 Prior to logging taking place in the subtropical rainforest stands, all trees intended for removal are marked by experienced Forestry Commission staff, either a local forester or more usually a forest foreman with long experience in working in these forests.

(1) G. N. Baur: "Rainforest Treatment". Unasylva 18 (1), pp. 18-28, 1964

(2) G. N. Baur: "Ecological Basis of Rainforest Management." For. Comm. of N.S.W., Sydney, 1968.

9.2.2 The marking is carried out with several requirements in mind:-

- . At the conclusion of logging the upper forest storeys should still maintain a 50 per cent canopy cover. In places where the upper canopy is already sparse, e.g. as a result of storm damage or earlier logging, from which the canopy has not yet fully recovered, few or no trees will be marked for removal.
- . Allowance is made for the fact that there will inevitably be some damage to remaining trees during felling. Marking is somewhat lighter than is theoretically necessary to maintain a 50% canopy cover for this reason.
- . The canopy remaining after logging should as far as practicable be evenly dispersed. The canopy consists of individual tree crowns, and obviously when a tree is removed a gap will occur in the space previously occupied by that crown. Efforts are deliberately made to avoid removing a number of trees growing close together, since this would result in the creation of large openings in the canopy.
- . The species marked should as far as practicable constitute a representative sample of the composition of the local stand, but with the less common species in general being retained in the forest.
- . Particularly large and heavy crowned trees, such as many Yellow Carabeens, tend to create excessively large openings when they are felled, as a result both of the spread of the tree's crown and of the damage such a large crown will cause to neighbouring stems as it falls. Since the introduction of the selection logging system there has been an increasing tendency to retain such trees.
- . Strips extending for at least 20 metres on either side of streams, and along specified major forest access roads, are retained without any stems marked for removal.
- . Strips are also retained without logging along the tops of escarpments and specifically in the strip lying between the Tweed Range Road and the escarpment to the east, and it is intended that unlogged strips would also be retained immediately along the Queensland border (e.g. were logging to be carried out in Levers Plateau).
- . Excessively steep or rocky areas are excluded from logging.
- . In any areas where there is an overstorey component of Hoop Pine, as would be the case in any logging on much of Levers Plateau, any Hoop Pine stems considered capable of making significant further growth would be retained for a later cutting cycle.

9.2.3 Logging operations are carried out by contractors or mill employees holding Operators' Licenses issued by the Forestry Commission. Their standards of operations are closely supervised by Commission staff with a view both to minimising any environmental damage and to ensuring that the maximum level of utilisation is obtained from all trees felled. Operators who transgress these requirements may have their Operators' Licence - in effect their work permit - withdrawn.

9.2.4 It has been usual in the Kyogle M.A. for Commission staff to indicate, during their marking, the direction in which individual trees should be felled with a view to minimising any damage to the remaining stand. However it appears that there may be legal problems with this practice, making the Commission liable for any injuries that result from the faller following the Commission's instruction, and the matter is currently under review.

- 9.2.5 The operations generally are subject to the standard erosion mitigation conditions which have been developed jointly by the Soil Conservation Service and the Forestry Commission (see Appendix 17), and which are at present being introduced into all operations carried out under the control of either the Commission or the Catchment Areas Protection Board. However as indicated in para. 9.2.2, the conditions applying to rain-forest logging in the Kyogle M.A. are in a number of respects more severe than those applying in the State generally.
- 9.2.6 In a relatively recent change from previous practice, clearing for the major access roads in the rainforest has been limited to the width actually needed for the construction of the carriage-way. This and other aspects of road location and construction by the Commission are covered by the Commission's circular on the aesthetic and environmental aspects of forest road construction, attached as Appendix 18.
- 9.2.7 At the conclusion of logging all snig tracks and similar trails have cross drains established across them to prevent long runs of water, as outlined in Appendix 17. Similarly log dumps are levelled, drained and have the topsoil restored after use, and Hoop Pine seedlings may then be planted on the former dumps and along snig tracks as a means of increasing the future stocking of this valuable species.
- 9.3 Effects of Logging on Forest Conditions
- 9.3.1 A review of some of the effects of selective logging on the rainforest at Wiangaree has been published by Burgess and colleagues ⁽³⁾. Much of the data in their paper was obtained from some experimental treatment plots established by the Forestry Commission about 1964, and even the selective logging treatments in these plots differ in some respects from the routine selection system now applied in the Kyogle M.A. One major difference is in the current tendency to retain the larger crowned trees, whereas these were mostly removed in the experimental plots.
- 9.3.2 A forest area being managed for timber production will always differ in some respects from a virgin stand. Logging will periodically open up the stand, and this will be to a greater extent than would normally be expected in Nature from natural mortality except under the effects of some rare major natural disturbance, such as cyclone or landslip (e.g. see para. 3.6.32). Whilst the canopy will be restored as the remaining trees fill out their crowns and new stems grow up, to occupy the openings, on average over a period the upper canopy will tend to be somewhat more open in logged stands than in unlogged areas.
- 9.3.3 Similarly, in logged stands stems will tend to be removed as they attain merchantable maturity. As practised in the Kyogle M.A. the very large trees with widespreading crowns are now usually retained unless it is apparent that they can be felled without causing excessive damage. However the next size level down tends to provide the basis for the logs obtained in the periodic harvesting operation, and this size class will be less well represented in logged than in unlogged areas.
- 9.3.4 These are effects that will be experienced, to varying degrees and in one form or another, in any stand that is periodically used for timber harvesting, and they represent the price, if price it is, of using a forest for the production of timber. In the case of selectively logged forest areas their influence

(3) I. P. Burgess, A. G. Floyd, J. Kikkawa & V. Pattemore: Recent Developments in the Silviculture ... of Sub-tropical Rainforest in N.S.W. Proc. Ecol. Soc. Aust. 9, pp. 74-84, 1975.

on the average visitor to the area is probably identical to that recorded by the Fraser Island Environmental Enquiry (4) in relation to logging on Fraser Island:

".... the visual integrity of Fraser Island has not been adversely affected by the carefully controlled logging operations. It seems likely that most visitors to the Island - apart from experienced botanists, ecologists or foresters - would be unaware that its timber resources have in fact been exploited for over a hundred years."

9.3.5 As noted above, logging aims to cover the range of species present roughly in proportion to their frequency, but with any of the rarer species being for preference retained. Checks on a few logged plots indicates that in reality this happens. For example in the Wiangaree study plots used by Burgess, the three unlogged plots contained respectively 27, 35 and 35 species of trees larger than 20 cm diameter breast height, with an average of 177 trees per plot; by comparison the plot selectively logged to the then current system contained 33 species after logging (and still present in 1975), though the stocking was reduced to 124 trees. On similar subtropical rainforest on Edinburgh Castle S.F. (Urbenville Forestry Subdistrict, just southwest of current study area), an unlogged plot (smaller than at Wiangaree) contained 20 tree species and 123 stems; two adjacent logged plots carried 19 and 21 tree species and 60 and 75 stems.

9.3.6 In the course of logging operations it is inevitable that some damage will occur to trees remaining in the stand. A felled tree, in falling, passes past or through the crowns of neighbouring trees, which will lose some branch material. The falling tree may strike against the stem of a standing tree, which will lose some bark. The log being snigged from where the tree grew to the dump where it will be loaded on to trucks may sweep against trees growing close to the snig track, and again these may lose part of their bark. Similarly part of the understorey will be knocked down by the felling and subsequent snigging of trees. Burgess and colleagues have recorded the damage caused by selective logging in the treatment plots, using the per cent of the remaining basal area (5) as the measure of various damage categories:

No damage - trees of good form	33%
No damage - trees of poor form	8%
Bark damage - less than 0.3 lineal metres or wood showing	7%
" " - 0.3 - 1.5 " " " " "	13%
" " - 1.5 - 3.0 " " " " "	8%
" " - 3.0 - 6.0 " " " " "	<1%
" " - over 6.0 " " " " "	<1%
Crown damage - 0-25% of crown affected	4%
" " - 25-50% " " "	6%
" " - 50-75% " " "	7%
" " - 75-99% " " "	4%
Broken off below crown	9%

In general bark damage exposing more than 1.5 lineal metres of wood or crown damage affecting more than 50 per cent of the crown would be considered serious and likely to lead to protracted loss of growth or, in extreme cases, to the death of the affected tree. In the case quoted the crown damage recorded would be higher than would nowadays be expected because of the retention of the more heavily crowned trees, and indeed it was the level of damage that often followed the felling of such trees that led to the present tendency to retain these standing.

- (4) Fraser Island Environmental Enquiry: Final Report of Commission of Inquiry.
Aust. Govt. Publ. Service, Canberra, 1976.
(5) Basal area (B.A.) is the sum of the sectional areas of all the trees measured, as measured at breast height (1.3 m above ground).

Damage to the crowns and bark of trees is a very natural phenomenon, but its frequency is increased during logging operations. Supervision of harvesting operations by the Forestry Commission is usually strongly directed towards reducing such damage by careful felling and snagging, but nonetheless some increased level of damage must always be expected during logging.

- 9.3.7 Despite its luxuriance, the trees growing in rainforest do not normally exhibit high rates of growth, even though some species, particularly pioneers such as Giant Stinger (*Dendrocnide excelsa*) and Celerywood and Pencil Cedar (*Polyscias* spp.), may individually sustain very rapid growth for a period. In the virgin forest - and this applies to any virgin forest - nett useable growth over a period of years is nil. Though trees are growing and gaining in size, over the same period others in the area will die and this growth and death tend to balance each other out: "dynamic stagnation", as one internationally known rainforest silviculturist once termed it (6).
- 9.3.8 Logging, by opening up the stand, would normally be expected to allow the remaining trees to grow at a faster rate than previously since they are now in a position where competition between the trees is reduced. The figures in Table 9.1 indicate the extent to which this indeed applies in the Kyogle M.A. (The comparison in this table is not strictly valid, since the average sizes of trees in logged and unlogged plots will be somewhat different and would usually tend in consequence to be growing at somewhat different rates. It has not been possible to carry out a more accurate growth comparison, and it is considered that any errors due to this reason in the growth rates shown in Table 9.1 are in any case minor and would not significantly alter the relativities shown.) The figures show that, in the logged plots, the major species present have an average annual diameter increment in the order of 3 mm a year. By comparison, an intensively managed eucalypt stand will show an average diameter growth in the order of 20 mm a year.
- 9.3.9 Although growth plots have been used to estimate volume growth in some rainforest stands in N.S.W. (7), this has not to date been attempted in the subtropical rainforest stands - in no small measure because of the complications introduced by the large number of species present. In the study on Coachwood it was calculated that the volume increment in a previously selectively logged stand over a period of 12 years was about 5 cubic metres per hectare per annum (75 cubic feet per acre per annum). However this would be a value considerably inflated over what could be expected under routine conditions in the long term - because of the nature of the study plot, the large volume contribution made by recruits to the merchantable size range, the fact that not all of this increment was made by stems of merchantable quality, and other similar reasons. Until and unless growth analysis proves to the contrary, it would be unwise to expect a volume increment in excess of 1 m³/ha/an. from the selectively logged subtropical rainforest stands, and even this should be regarded as an optimistic estimate.

(6) G.G.K. Setten, former director of the Forest Research Institute, Kepong, W. Malaysia.

(7) "Observations on the Growth of Coachwood in a Selection Forest", For. Comm. Tech. Paper No. 2, 1963.

Table 9.1

Growth Rate Comparisons - Wiangaree State Forest

(Based on the major species which contributed 71 per cent of the stems and 74 per cent of the basal area of trees on the Wiangaree experimental study plots).

<u>Species</u>	<u>Average Annual Diameter Increment 9 yrs. of record</u>	
	<u>Unlogged Plots</u>	<u>Selective Logging</u>
<i>Ackama paniculata</i> (Corkwood)	2.0 mm	2.5 mm
<i>Heritiera</i> spp. (Booyongs)	1.6	2.9
<i>Geissois benthami</i> (Red Carabeen)	1.5	3.1
<i>Doryphora sassafras</i> (Sassafras)	0.8	2.8
<i>Sloanea woollsii</i> (Yellow Carabeen)	0.7	3.5
<i>Cinnamomum oliveri</i> (Black Sassafras)	2.7	5.2
<i>Orites excelsa</i> (Prickly Ash)	2.6	3.9
<i>Planchonella australis</i> (Black Apple)	0.6	1.3

- 9.3.10 Regeneration of the commercial species is well distributed through stands after logging. Burgess and his co-workers record 2800 seedlings per hectare up to 1.5 m in height, and over 1600 saplings per hectare of merchantable species between 1.5 m high and 10 cm in diameter, in the selectively logged study plot at Wiangaree 12 months after logging. All the saplings and a fair proportion of the seedlings could be expected to have developed from the relatively ephemeral but widespread seedlings stocking that is almost invariably present on the floor of rainforest stands, and that appears to provide the basis for most natural regeneration in rainforest following logging or silvicultural treatment. The most abundant regeneration came from *Geissois benthami* (Red Carabeen), *Ackama paniculata* (Corkwood), *Cryptocarya erythroxylon* (Pigeon-berry Ash), *Melicope australasica* (Doughwood) and *Heritiera* spp. (Booyong), with *Doryphora sassafras* (Sassafras), *Orites excelsa* (Prickly Ash), *Sloanea woollsii* (Yellow Carabeen), *Planchonella australis* (Black Apple), *Brachychiton acerifolius* (Flametree) and *Dysoxylum fraserianum* (Rosewood) also well represented. These in fact cover the more plentiful species present in the area (c.f. Table 3.3, taken from a closely adjacent area), and suggest that the regrowth will essentially reflect the composition of the original stand. Where established in local openings, the saplings of most of these species are capable of showing surprisingly speedy rates of height growth. Because of the development of this regrowth of both commercial and other species, the undergrowth of the logged stands tends to be more dense, at least in local patches, than the undergrowth of unlogged stands where there has been no recent disturbance.
- 9.3.11 Besides the regeneration of the characteristic species of the rainforest, both commercial and non-commercial, the stand opening caused by logging usually results in the appearance of typical rainforest pioneer species, whose seed is either capable of lying in the soil for lengthy periods until the soil is disturbed or else is brought in by birds. Typical pioneer species include several *Solanum* spp. (Native Tobacco, Gins' Whiskers), *Trema aspera* (Poison Peach), *Polyscias* spp. (Celerywood, Pencil Cedar, "Panax"), *Duboisia myoporoides* (Duboisia or "Corkwood"), *Omalanthus populifolius* (Bleeding Heart) and *Dendrocnide excelsa* (Giant Stinger). These tend to be a feature of the more open margins of rainforest roads. Apart from the large and long-lived Stinger they are small trees or shrubs with relatively short life expectancies, and they do not normally survive for long in the selectively logged stands except perhaps in the larger local openings such as may be created by a log dump.
- 9.3.12 The introduced weeds, Lantana and Crofton's Weed, may act in a similar manner to these pioneers. Crofton's Weed sometimes covers road verges and the cuts and fills of road construction in rainforest areas of the Kyogle M.A., but is not regarded as a problem in these areas. Lantana is a serious forest weed in many parts of the North Coast, but usually in the more open eucalypt forest stands and in some of the Hoop Pine plantations. It is absent from the higher country of the Wiangaree Plateau (though present in country on the ascent to the plateau). It has been suggested that it could prove troublesome if the lower altitude Levers Plateau were to be logged, though this has not proved the case in other stands at a similar altitude to Levers Plateau in the immediate area (e.g. in the Cox's Road logging area on Toonumbar S.F., just south of the study area).

9.4 Effects on Wildlife

- 9.4.1 A study on the effects of selective logging on bird populations has been carried out at Wiangaree by Pattemore and Kikkawa (8),

(8) Vicki Pattemore and J. Kikkawa: "Comparison of Bird Populations in Logged and Unlogged Rainforest..." Aust. For. 37 (3), pp. 188-198, 1975.

in a project sponsored by the Forestry Commission. The study basically used mist-netting for capture and release, and thus tended to emphasise the smaller birds present in the lower levels of the rainforest, though other species observed in the study areas were recorded.

9.4.2 The study involved a number of the experimental plots used by Burgess, but the major relevant comparison was between an unlogged plot, Area 1 (that referred to in para. 3.6.9 and Table 3.3) and a nearby area logged in the routine manner about 12 months previously, Area 6. (In passing, these workers give an incorrect account of this system in their paper: there is no deliberate felling of "economically useless stems" to increase canopy opening). As expected the logged plot was more open in the higher storeys than the unlogged area, but there was little difference between the foliage profiles of the understoreys of the two areas, in part due to the relatively recent time since logging: the understorey of the logged plot would be expected to become denser with time. In the study 32 species of birds were recorded from the unlogged area, with 13 species and 61 individuals being netted. By comparison 39 species were recorded in the selectively logged plot, with 17 species and 77 individuals being netted. Only one species, the Grey-breasted Silvereye, was recorded in the unlogged but not in the logged plot: this was however common in some of the other logged treatment plots. Included among the birds netted in the logged plots were two individuals of the Albert Lyrebird (see para. 3.7.10), which according to local Forestry Commission staff appears to favour recently logged areas for foraging. This species, classified as endangered fauna in N.S.W., was also recorded but not trapped in the unlogged stand. The ecological categories of birds netted in the logged and unlogged plots were surprising similar (see Fig. 9.1, C.f. Areas 1 and 6), though in general logging appears to have promoted populations of three categories of birds - tree and shrub feeding insectivores (category 1), omnivores feeding over a wide vertical range (category 3), and ground feeding insectivores (category 5).

9.4.3 Whilst not conclusive, this study suggests that no major upset of local bird populations has followed selective logging in the area.

9.4.4 Combined with the facts that more than a third of the State Forest area within the study area is excluded from logging (para. 7.7), and that the marking system aims - and apparently succeeds - in maintaining a balance between stand composition before and after logging (para. 9.3.5), and that most of the larger crowned trees, that are probably most likely to contain the hollows and crannies required by certain species, are now normally retained, this specific bird study appears to support the contention that selective logging of the type practised in the Kyogle M.A. constitutes no real threat to the maintenance of wildlife populations in the area.

9.5 Effects on Streams

9.5.1 Logging operations can affect both water yield and water quality in streams emanating from forested areas. Increases in stream discharge are proportional to both the ground cover removed and the area of catchment affected, therefore logging to 50% canopy removal in a coupe of 100 ha in a catchment whose total area is of the order of thousands of hectares can only have a minute effect on total discharge and peak flows in the main stream.

9.5.2 Investigations into turbidity levels in Wiangaree State Forest were initiated in September 1974, with sampling points established in Brindle Creek (logging in catchment) and Grady's Creek (unlogged - in Flora Reserve). Sampling has been generally on a fortnightly basis, with the samples being analysed in Sydney and their results expressed in Nephelometric Turbidity Units.

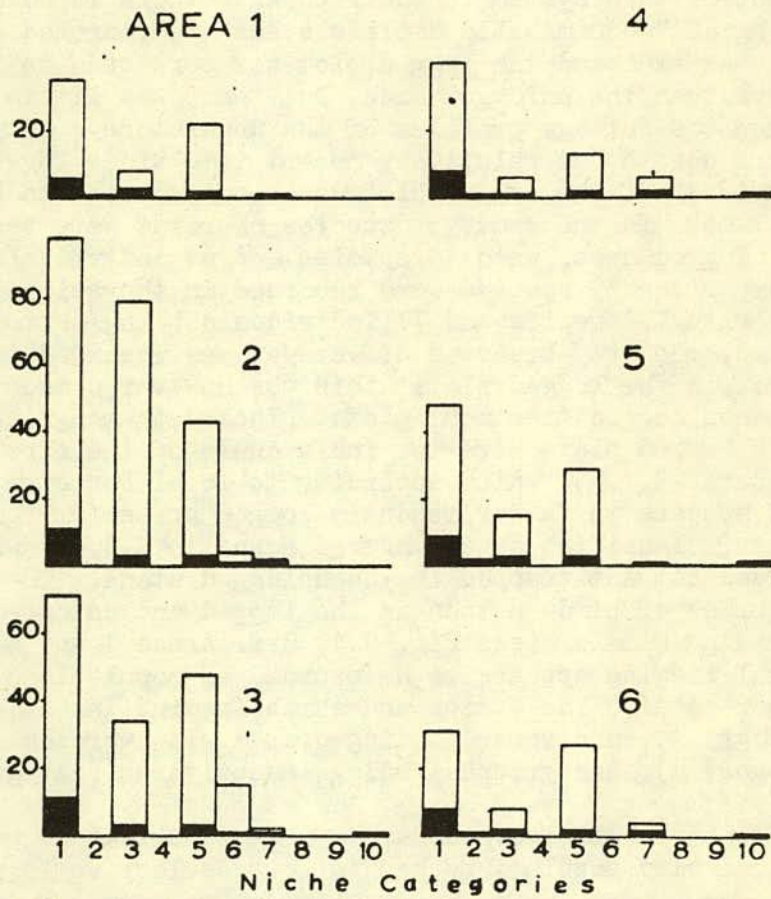


Figure 3. Comparison between Areas of the number of species (black column) and the total number of individuals (column height) of netted birds representing the categories of niche occupation: 1, tree-nesting, tree-feeding insectivores; 2, tree-nesting frugivores; 3, tree-nesting, tree-feeding omnivores; 4, small predators and large omnivores; 5, tree-nesting, ground-feeding insectivores; 6, tree-nesting, ground-feeding herbivores; 7, ground-nesting, ground-feeding species; 8, aerial-feeders, 9, large predators; 10, parasitic breeders.

Fig. 9.1 - Bird Categories - Logged and Unlogged Areas
-Wiangaree S.F.-

(from Aust. For. 37 (3), 1975.)

Area 1 : Unlogged stand.

Area 6 : Routine selective logging.

- 9.5.3 Results for those days on which samples were taken have been cumulatively added from the start of sampling and plotted as a double mass curve in Figure 9.2. Significant dates are indicated in this diagram as follows:
- A:- September 1974, logging in Brindle Creek ceased.
 - B:- July-August 1975, grading of perimeter road Brindle Creek.
 - C:- September 1975, logging about 2000 m from sample point in Brindle Creek catchment.
 - D:- April 1976, logging extended further from sample point.
 - E:- September 1976, logging completed.
 - F:- November 1976, logging near sample point in Brindle Creek catchment, completed in December 1976.
- 9.5.4 Three distinct trend lines are evident in Figure 9.2. There is a residual effect of the previous logging at the beginning of the sample period, followed by a period when no logging occurred in Brindle Creek. After C the effect of the logging in Brindle Creek is obvious. This slope is expected to change now logging has ceased.
- 9.5.5 Another way of examining the data is given in Figure 9.3. Turbidity values for Brindle Creek (C1) are expressed as a fraction of Grady's Creek (C2) for each sampling day. A five sampling running mean of these fractions was calculated and plotted versus time in the figure. The higher the C1/C2 value, the further Brindle Creek deviates from Grady's Creek. The effect of logging is evident between C and D. The relative effect of the more recent logging was greater, no doubt due to the closer proximity to the sampling point.
- 9.5.6 It should be noted, however, that the magnitude of the turbidity levels in Grady's and Brindle Creeks was low most of the time. Mean values for Grady's Creek and Brindle Creek were 1.5 NTU and 2.4 NTU respectively. These values are less than the 5 NTU recommended by water supply authorities for drinking water, and well below turbidities obtained in similar studies in East Coast hardwood forests and pine plantations.
- 9.6 Effects on Soil
- 9.6.1 Besides the possibilities of soil loss discussed above, it has been suggested that the harvesting and removal of logs from the rainforest stands represent a significant drain of nutrients from the ecosystem.
- 9.6.2 The Forestry Commission's research division, which over the years has developed an international reputation for its work on aspects of forest nutrition, is currently engaged in obtaining quantitative information on this point from Wiangaree S.F., through an examination of the nutrient status of both the soil and the wood and bark of the more commonly harvested species in the forest. It is hoped to be able to include this information as a supplement to this paper in due course.
- 9.6.3 In the meantime it might be noted that the volcanic soils in the study area are amongst the most fertile forest soils in N.S.W., with considerable depth and reserves of nutrients available for tree growth. Logging removes only some wood and usually most of the sheath of bark around the log: the foliage, which contains the bulk of the plant-held nutrients in virtually all forest ecosystems, is returned to the site in logging, and is not removed.

FIGURE 9.2

TURBIDITY COMPARISONS
WIANGAREE STATE FOREST
(Double Mass Curve - NTU)

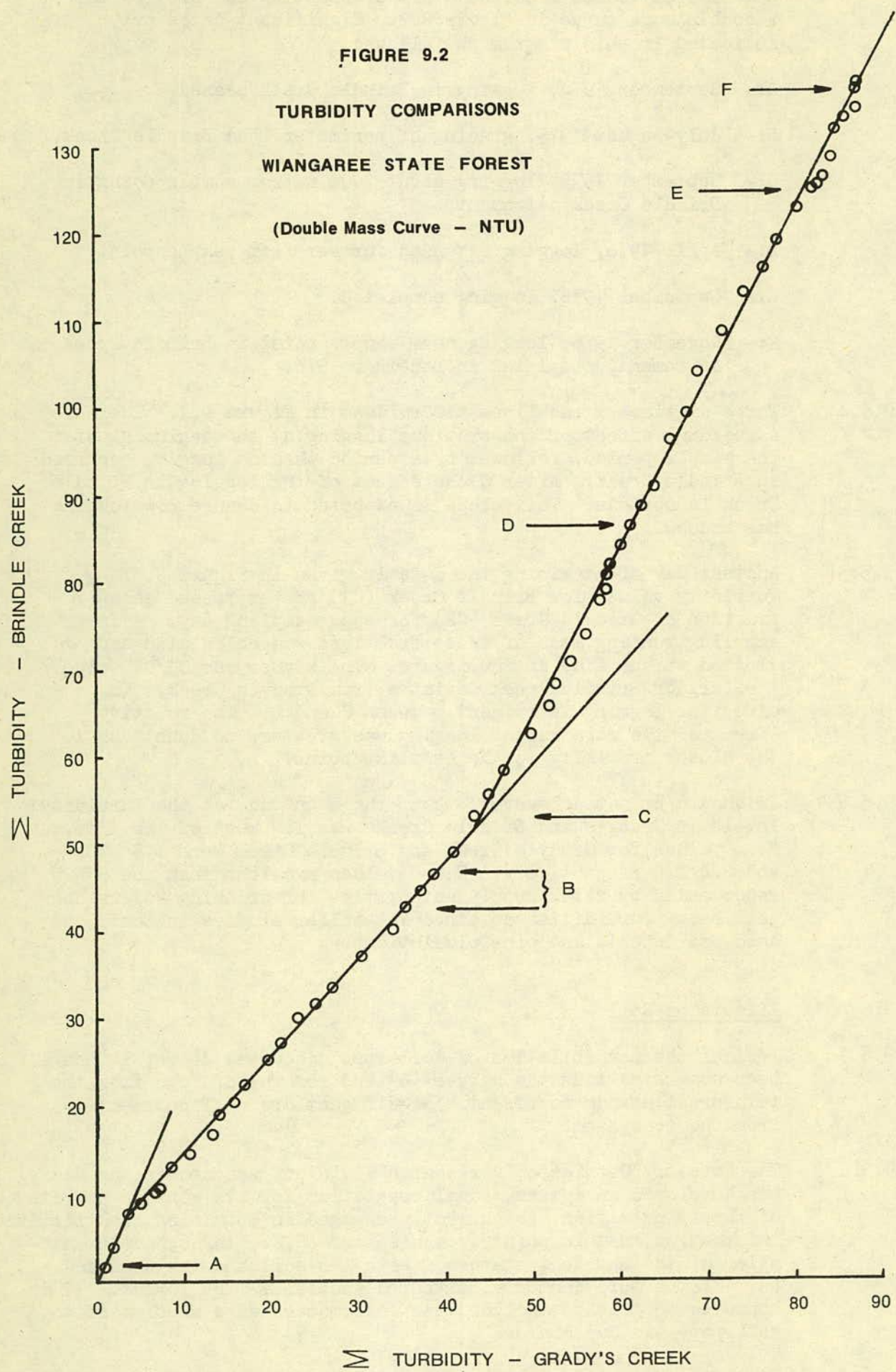
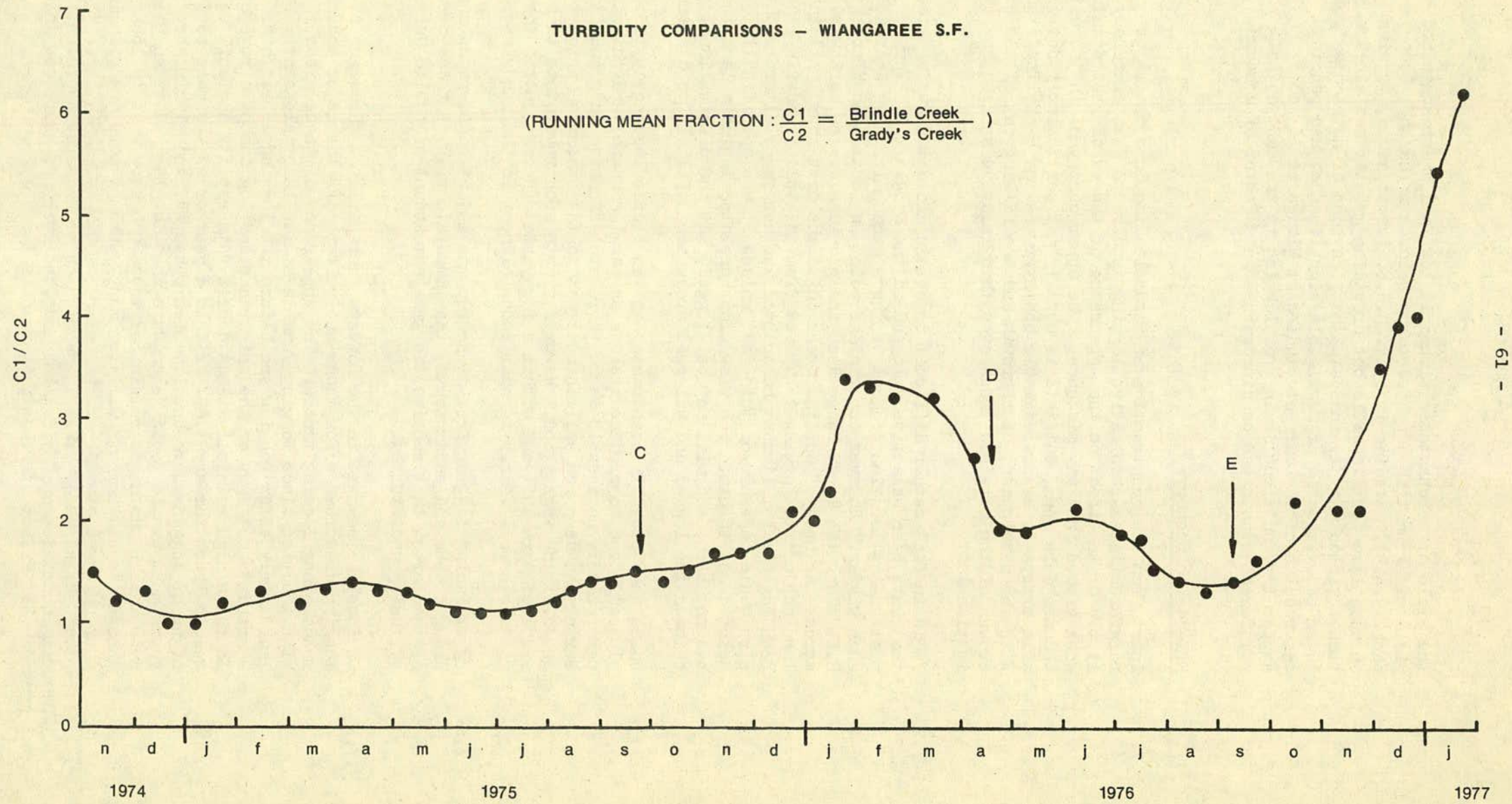


FIGURE 9.3



The yield of merchantable timber is low, and under sustained yield management is expected to be below 1 m³/ha/an. (see para. 9.3.9). Studies in other N.S.W. forest areas, growing on much less fertile soils but providing greater sustained timber yields (9,10), indicate that the loss of nutrients from these ecosystems is of negligible significance, and pending the results of the current studies at Wiangaree it would appear that nutrient drain from logging in the subtropical rainforest stands can be disregarded as a factor of concern.

9.7 Effects on Scenery

- 9.7.1 Apart from the construction of roads leading into the major rainforest areas, selective logging appears to have extremely little or no effect on the appearance of the rainforest stands when viewed from any distance. The upper canopy of the forest becomes more open, but this is usually not particularly noticeable except to a knowledgeable observer viewing a skyline stand. With the development of regrowth and the filling out of the crowns of the retained trees even this relative sparseness is in time lost.
- 9.7.2 It is in fact rather difficult to obtain distant views of areas that have been selectively logged in the Kyogle M.A. The plateau-top location of most of these areas mitigates against such vistas. However one vantage point is located on Wiangaree S.F. along the Tweed Range Road and provides a view northwards across the head of Collins Creek on to the next spur. All the land subject to logging as viewed from this point, has in fact been logged, but it must be doubted whether any visitor to the site would be aware of this fact unless it was specifically pointed out to him. The view from here also includes land that has not been, and will not be, logged, but the distinctions between the logged and unlogged areas are difficult to discern.
- 9.7.3 Roads when recently constructed on the slopes leading up to the plateaux tend to produce a slash on the landscape, and this is particularly noticeable where there are extensive cuts and fills, baring the deep red soil in contrast to the otherwise ubiquitous green of the vegetation. However plants soon revegetate these areas of bare soil and within a few years of construction the roads become a fairly inconspicuous element in the landscape.
- 9.7.4 By excluding logging from alongside the major access roads and along creeks and escarpments, the immediate view of those parts of the forest that receive the greatest amount of public use is virtually undisturbed.
- 9.7.5 Obviously elsewhere in the forests there will be the signs of logging disturbance for those who venture off the major access roads along logging tracks. The appearance of these areas varies with the time since logging, and is at its least pleasant immediately after logging and before the logging debris has started to rot away or the snigtracks and log dumps to revegetate. In these high rainfall stands debris rots rapidly and soil seldom remains bare for any time. Within a year or so the more obvious signs of logging have usually been obscured, and within about 10 years most people would be unaware that logging had taken place, even though the signs remain for those who know what to look for, though the undergrowth will for many years be more dense in logged than unlogged stands.

(9) Forestry Commission of N.S.W.: Submission to House of Representatives Standing Committee on Environment and Conservation: Softwood Inquiry. Appendix V: Effect of Pinus radiata on soils. 1975.

(10) Forestry Commission of N.S.W.: Submission to Senate Standing Committee on Social Environment: Woodchip Industry. Para. 2.2.8.7: Eden Operation: Effect on the Soil. 1975

- 9.7.6 These general observations receive support in the comments quoted previously (para. 9.3.4) in relation to selective logging on Fraser Island.

9.8 Effects on Access and Recreation

- 9.8.1 Logging and the associated activities provide access into the rainforest areas. Some of this access is basically temporary and is not maintained after logging is finished in the particular site; elsewhere all-weather roads have been provided and are maintained, not just for logging but to provide general access into the area.
- 9.8.2 In the case of Wiangaree S.F. this access has made available to the public generally a particularly fine scenic resource that is, in consequence, receiving an increasing level of recreational use (see para. 8.7). There can be no doubt that in this case the locality has developed as a recreational resource because of logging. Were it not for the timber that has subsequently been obtained, it is extremely unlikely that reliable road access would ever have been provided into this area.
- 9.8.3 This provision of access will detract from the use of the area by the bushwalking wilderness-seeker, who requires extensive tracts inaccessible except by personal exertion. However in this connection the 1500 ha of the Grady's Creek Flora Reserve on Wiangaree S.F. and the immediately adjacent 19 500 ha of the Lamington National Park would appear to go far, if not all the way, towards meeting the need for this type of recreational experience.
- 9.8.4 In terms of the numbers of people involved, it appears unarguable that the provision of road access into the area has contributed to the recreational enjoyment of a far larger number of people than it has inconvenienced through the partial loss of wilderness.

9.9 Effects on Aboriginal Sites

- 9.9.1 The only two known aboriginal sites in the study area (para. 3.8.) are major topographical features - Mt. Lindesay and Glennie's Chair. Neither feature in itself would be threatened by any forestry activities. The former, at least on the N.S.W. side of the border, is in addition included within a Flora Reserve, and the latter would appear to be well protected against any disturbance by its own innate inaccessibility.
- 9.9.2 Where aboriginal sites - or for that matter other sites of historical or local significance - are known, the Forestry Commission will discuss their preservation with the relevant authorities and then take whatever action is appropriate towards their protection.

10 Timber Resource and the Future

10.1 The Remaining Resource

10.1.1 The estimated remaining timber resources of the Kyogle Management Area are outlined in para. 7.6.6, based on current standards of harvesting. These estimates show about 274 000 m³ of available timber. Of this, 17 700 m³ is in allocated areas which, if the allocated quotas were to be cut to the full each year, would last the individual mills from about one to two years in three cases to about eight years in the fourth. The remaining 256 000 m³ is available to the two Crown quota mills.

10.1.2 These volumes exclude the Hoop Pine plantation on Toonumbar State Forest. This was assessed in 1972, when the standing volume was estimated to be 59 000 m³.

10.1.3 Of the available native forest volume in the Kyogle M.A., about two thirds is within the study area and about 30 per cent of the volume in the study area is located on Levers Plateau. Half as much as this again (about 75 000 m³) is within the Grady's Creek Flora Reserve but has been excluded from the available volume.

10.2 Commitments

10.2.1 The existing commitments by the Forestry Commission to supply timber from the Kyogle M.A. are outlined in para. 6.6.

10.2.2 Excluding the allocated areas, where the quotas exist only until the areas concerned have been completely logged to current standards, these annual quota commitments from the native forests of the management area are:

Munro & Lever Pty. Ltd.	17 850 m ³
Standard Sawmilling Co. Pty. Ltd.	9 610
Total	<hr/> 27 460 m ³ <hr/>

10.2.3 At this rate of cut, and assuming that all the State Forest areas remain available for logging, the present natural timber resources of the Kyogle M.A. will last for about another 10 years - to about 1986.

10.2.4 At that time there will remain a substantial volume of timber in the Kyogle M.A., but this would not be regarded by the Forestry Commission as available for logging. Some would be in the Flora Reserves, much would remain inaccessible for topographical reasons, and probably the greatest volume so far as the rainforest timbers are concerned would be in the selectively logged stands, where it would be accruing increment towards the time when it would be silviculturally acceptable to give these stands a further selective cut.

10.2.5 Forestry Commission officers have suggested that, at this stage, a period of about 25 years would need to elapse before regular logging could resume in the Kyogle M.A. An annual yield of between 6000 and 9000 m³ would at that time appear capable of being sustained.

10.3 Management Options - the Existing Resource

10.3.1 Excluding for the moment consideration of the plantation Hoop Pine or the possibilities of obtaining alternative or supplementary sources of timber from outside the management area - and as shall be seen, these prospects are not particularly bright - the options available give no cause for pleasure.

10.3.2 The least troublesome immediately, and in the not-too-long run probably the most painful, is to allow logging to continue at the present rate until available supplies are exhausted, when the quotas will be discontinued. This option will inevitably lead to strong representations:-

- (a) to continue logging in the previously selectively logged stands, before such logging is silviculturally desirable, and
- (b) to permit logging in the Grady's Creek Flora Reserve, which would be most economic of access and would support selective logging for a further three years or so.

The Forestry Commission would equally strongly seek to resist these representations.

- 10.3.3 This particular option would not necessarily lead to the closure of the two Crown quota mills, both of which receive part of their annual log input from areas other than the Kyogle M.A. However it would substantially reduce their operations, undoubtedly increase their costs, and lead to a significant level of retrenchment of mill employees and bush workers. Neither mill, as at present established, would appear to represent a viable economic proposition with these reduced quotas, and some major reorganisation of their operations would seem inevitable.
- 10.3.4 No less draconian, but making better sense from a purely forest management view point, would be an immediate reduction in the Crown quotas from the present level of 27 460 m³ to about 7000 - 8000 m³/annum. This would extend the existing resource to last for over 30 years, at which stage the rainforest stands first selectively logged, and many of the eucalypt forest stands, would again support a further operation. It is suggested that this represents a level of yield which the Kyogle M.A. is well capable of sustaining in perpetuity without engaging in intensive management practices. In such a case the problems associated with a sudden and drastic reduction in quota have to be faced immediately, and this would certainly appear politically impracticable.
- 10.3.5 An intermediate option would be to decrease quotas by some fixed percentage each year until the quotas had dwindled to a sustainable level. For example a 10 per cent annual reduction would reduce quotas by 2700 m³ to 24 800 m³ in the first year, by 2500 m³ to 22 300 m³ in the second year, and so on. At this rate of reduction the quotas would reduce to about 5500 m³ in about 17 years, and the currently available volume would then last about another 7 years, at which stage it might just about be feasible to maintain this level, and then subsequently slightly increase it, by starting the second cutting cycle. Various rates of decrease are of course possible, and from the viewpoint of forest management a rate rather higher than 10 per cent - say 15 per cent - would have a greater chance of success.
- 10.3.6 This option does not, of course, remove the diminution of supply, but it allows the reduction to be achieved more gradually than in either of the previous options, so that much of the inevitable manpower reduction should be achieved by natural wastage rather than by sudden retrenchment. At the same time, the companies involved have an extended period during which operations can be wound down to a sustainable level.
- 10.3.7 As discussed, all of these options assume that the forest areas regarded by the Forestry Commission as available for logging remain so available. Any significant reduction in this area will bring closer the time of logging cessation or reduce the sustainable yield, and thus substantially increase management difficulties in the area.
- 10.4 The Rainforest Need
- 10.4.1 One apparently easy option (allowing for the difficulties of all of these) would be to permit logging to continue until available supplies are exhausted, and then to close all or part of the area permanently to any further logging: as previously noted (para. 9.7), to most people the effects of logging are in any case lost from view

within a relatively short period, so that the rainforest areas would essentially retain all their values as National Park.

- 10.4.2 In this context it should be appreciated that the Kyogle M.A. represents the best area in N.S.W. to manage a rainforest resource for sustained production of rainforest timbers.
- 10.4.3 As noted previously (para. 7.5) these timbers can be used to meet many specialty purposes for which acceptable alternatives are not readily available. It is of course not essential to man's existence that they should continue to be available, any more than it is essential to have the works of a great writer or artist, but they nonetheless can contribute greatly to the quality of our life through their beauty or their value for some particular purpose. Although used for a very different end result, during World War II certain rainforest timbers played a most important role in the war effort for use in aircraft ply and rifle furniture. The concert hall of Sydney's Opera House is sheathed in ply from a rainforest species. Some of the rainforest timbers are among the most suitable available for the wood carver or whittler. It is for purposes such as these - to ensure that these timbers are available to future generations to use and enjoy - that perhaps the strongest argument exists for retaining the area as a forest managed, among other things, for the continued production of timber.
- 10.4.4 The reverse side of this argument is that there becomes some obligation to ensure that the timbers are used for these specialty purposes, rather than diverted into general purpose use for which other timbers are more readily available. It might, for example, be argued that while the lamination processes developed at the Murwillumbah mill represent a very advanced and useful development in timber utilisation and technology, the end product is largely in competition with timber products from other, more widely available sources. It therefore may not be considered a particularly wise use of what is demonstrably a relatively rare and diminishing timber resource in N.S.W. to have it used in this way.
- 10.4.5 As previously pointed out (para. 6.4.9), a change in the royalty policy towards rainforest timbers could go far towards directing the timbers into their most appropriate end uses and at ensuring that only those timbers required for such purposes were removed from the rainforest. This would be in accord with the Forestry Commission's policy towards the use of rainforest (see Appendix 7).
- 10.5 The Hoop Pine Option
- 10.5.1 There are over 1300 ha of plantation of Hoop Pine or the related Bunya Pine in the Casino Forestry District, including 218 ha on Toonumbar S.F. in the Kyogle M.A., just south of the study area. Most of this area was planted between 1940 and 1954.
- 10.5.2 The plantations were established in sites previously carrying rainforest of various types (at Toonumbar, mostly dry rainforest). These sites were logged thoroughly, the remaining unmerchantable material was then felled and burnt, and seedlings of the conifers, raised in nearby nurseries, were then planted.
- 10.5.3 Hoop Pine seedlings are slow to assume active growth. For this reason they require a lengthy and costly period in the nursery (over 2 years in the normal technique), and then have to be regularly released from the rampant growth of new vegetation on the plantation site for a number of years until they are capable of controlling or successfully competing with this. The costs of this programme are extremely high, and for this reason the plantation programme was curtailed as a routine activity in 1954, though enrichment planting in dry rainforest stands and some limited open plantation establishment has continued - the latter on a rather spasmodic basis aimed at providing employment for staff in a few sites where, for other reasons, it is necessary to maintain a labour force, and also aimed at maintaining the previously acquired skills in establishment.

- 10.5.4 On the other hand Hoop Pine yields a very valuable and versatile timber, and as the plantation grows older the stands are capable of very high rates of timber production. The plantations are capable of providing small sawlogs as thinnings from about age 25 years, though at this age the timber would possess few of the special attributes that have given Hoop Pine its special value.
- 10.5.5 Besides Toonumbar plantation, there are three plantations of Hoop and Bunya Pine in the adjacent Urbenville Forestry Subdistrict: Tooloom, Beaury (both on Beaury S.F.) and Acacia Plateau (on Koreelah S.F.). These, with Toonumbar, have a total area of 900 ha and in 1972 had an assessed volume of 242 000 m³. The available yield from these Kyogle and Urbenville plantations has been calculated as 12 020 m³ and has been allocated to Munro and Lever Pty. Ltd. at Grevillia.
- 10.5.6 The Forestry Commission has examined the possibility of undertaking a new plantation programme in the area with a view to this being able to provide timber quotas after age 25 years. In the intervening 25 years logging would aim to liquidate the existing plantation stands by cutting at a much heavier rate than is currently proposed while continuing to provide the thinning allocation of 12 000 m³. Logging would also continue to current standards on the native forest areas. In such a case the plantations could provide about an additional 5800 m³ a year over the 25 years to supplement the volumes available from the native forest (see para. 10.3).
- 10.5.7 Alternatively, if the current allocations were to be maintained at their present level for as long as possible, the liquidation of the plantations would enable this rate of cut to be maintained for a further seven or so years after the exhaustion of the available native forest supplies.
- 10.5.8 These examples indicate the nature of some of the further options available to those mentioned in para. 10.3. The important features to note are that an immediate start to planting could not provide any contribution to sawlog supplies until about age 25 years, and under no circumstances can the current allocations be maintained from the existing native forest resource in the Kyogle M.A. (let alone any reduction of this) plus the liquidation cut of the plantations. In all cases there has to be either a reduction in quota or a period during which no timber supplies will be available from either the native forests of the Kyogle M.A. or the Kyogle/Urbenville plantations.
- 10.5.9 If the native forest option, outlined in para. 10.3.4 (reduction of allocation to 7000 - 8000 m³/an.) were to be combined with that outlined in para. 10.5.6 (an additional 5800 m³/an. from the plantations over 25 years), an immediate halving of existing quota allocations would be required. However as previously, other combinations and options can be considered.
- 10.6 New Hoop Pine Plantings
- 10.6.1 The arguments in para. 10.5 assume that a new planting programme is undertaken to take over as a major, or if necessary sole, source of timber supplies in the area after a period of about 25 years.
- 10.6.2 In the past Hoop Pine plantations have virtually only been established on sites that had immediately previously been carrying rainforest. Whilst there are available some reasonably extensive areas of heavily logged rainforest that could be used for Hoop Pine planting, including about 800 ha of subtropical rainforest in the Cox's Road area of Toonumbar S.F., about 700 ha elsewhere in the Kyogle M.A., these areas are also capable, and in the process, of recovering naturally from the earlier logging, and the removal of any extensive such stands could well be criticised on environmental grounds.
- 10.6.3 Certain public suggestions (e.g. the Urban Systems report: see map 3) have called for the reforestation of much of the cleared land in the area, and particularly for the steeper slopes. The steeper slopes are not considered suitable for timber production use, and in many

cases the land, whether steep or flat, would not be biologically suitable for Hoop Pine growth in any case.

- 10.6.4 Nonetheless there are significant areas of cleared, partly cleared or scrubby land, where Hoop Pine could be grown. There would be problems with grass, which provides severe competition to Hoop Pine seedlings and which would tend to slow early growth, but this is not considered insurmountable. Similarly there could be problems resulting from the possession and planting of fragmented holdings, but again this is not insurmountable. The major problem would almost certainly be in the cost and availability of suitable properties. This has not been investigated in detail, but it appears that up to 4000 ha of suitable land could be available in parts of the Kyogle district at prices in the range of \$150 to \$350 per hectare.
- 10.6.5 In any case the planting of Hoop Pine is extremely difficult to justify on economic grounds. Establishment costs are likely to be 3 to 4 times the costs of equivalent establishment of Pinus radiata in a suitable tableland area; growth rates of the two species are comparable, with P. radiata having a slight edge; and although large Hoop Pine logs should command a price margin over P. radiata this would go little way towards redressing the economic imbalance. While funds available to the Forestry Commission are limiting, each hectare of Hoop Pine planted would represent three to four hectares of the financially and developmentally more desirable P. radiata not planted. Nonetheless, if funds were to be made available with some guarantee of continuity, a Hoop Pine planting programme could be recommenced on either forested or cleared land in the Kyogle M.A. The establishment costs for such a programme would be in the order of \$1500 per hectare, excluding any costs of land purchase involved.
- 10.6.6 Volume increments in the order of $14 \text{ m}^3/\text{ha}/\text{an.}$ could be expected from Hoop Pine plantations once these reached the stage of producing merchantable timber. Thus to maintain an annual rate of production of $20\,000 \text{ m}^3$, a total plantation area of about 1400 ha, economically located to the processing plants, would be needed.
- 10.6.7 Because, in the short term (under about 40 years), Hoop Pine logs tend to be too small for the special purposes for which the species has gained its reputation and value, there could be a case for the planting of Southern Pines (Pinus elliotii or P. taeda) to provide timber supplies during this intermediate period. These species are much cheaper to establish, less demanding of site and initially of faster growth, though they are significantly less productive of timber in the long term and they produce a useful, general purpose softwood which however lacks many of the special attributes found in larger stems of Hoop Pine.
- 10.7 Other Sources of Timber Supply
- 10.7.1 The Kyogle M.A. adjoins the Urbenville and Murwillumbah Forestry Subdistricts. Available timber in these subdistricts is already fully committed, in part to the mills with a major dependence on supplies from the Kyogle M.A. (Standard Sawmilling Co. Pty. Ltd. draws much of its supplies from Murwillumbah subdistrict, while Munro and Lever Pty. Ltd. have quota allocations from native forest areas, as well as from the plantations, in Urbenville subdistrict).
- 10.7.2 Even if they were available, timber supplies from beyond these adjoining subdistricts would appear to be outside the economic range of the mills concerned for any sustained major production. Thus timbers from the Ewingar/Washpool area, to the west of the Clarence River, would not seem a suitable source of supply for mills in the Kyogle M.A., even if such a source existed without any commitment.

- 10.7.3 Private property sources are also virtually nonexistent within economic range of the mills concerned. Only very small quantities are available from this source.
- 10.7.4 It is known that Standard Sawmilling Co. Pty. Ltd. has been investigating the possibility of obtaining supplies of rainforest logs from the South Pacific area to augment its local sources of supply, and has in fact imported flitches of timber from Western Samoa to use in its Murwillumbah mill. It is understood that the cost of such timber is substantially greater than that of local supplies, and that without adequate compensation it would be virtually impossible for the mill to maintain viable operations if imported timber had to be substituted for the possible loss of its Kyogle allocation.

11. Effects of Park Establishment on Forest Management

- 11.1 The establishment of a national park in the study area would withdraw a certain area of State Forest from future forestry control and management. If the three State Forests located along the border in the study area were to become national park (Mt. Lindesay, Roseberry and Wiangaree S.F's), the area of State Forest reduction would be about 33 000 ha, or about two thirds of the total area of the Kyogle Management Area (para. 7.2.2).
- 11.2 These State Forests currently contain about two thirds of the available timber remaining within the Kyogle M.A. for the present cutting cycle (para. 7.6.7).
- 11.3 In the short term as regards forest management, this withdrawal would reduce the life of timber operations in the Kyogle M.A. from the present 10 years to about 3 years if the present rate of cut is maintained.
- 11.4 The problems of introducing sustained yield management into the Kyogle M.A., and the virtual impossibility of doing this painlessly, have been discussed in Chapter 10. A substantial reduction in the area of forest available for future management would exacerbate these problems.
- 11.5 In particular they would largely eliminate the possibility, that exists at present in the medium and long term, to have an area of rainforest in N.S.W. managed to sustain a smallish, but potentially well viable, industry producing valuable specialty purpose timbers. Although there are many other rainforest areas within N.S.W. (Chapter 5), none of these has the extent, range of species and capacity of the study area to maintain such an industry.
- 11.6 Such an area reduction to the Management Area would almost certainly remove the justification for maintaining a forestry office in Kyogle. Already the uncertainty generated by the recent controversy has led the Forestry Commission to defer plans to build a new, separate forestry office in the town.
- 11.7 At the present time two major mills obtain a significant proportion of their timber supplies from the management area: Munro and Lever Pty. Ltd., (180 employees), with some 75 per cent of its timber supplies coming from the Kyogle M.A., and Standard Sawmilling Co. Pty. Ltd. (120 employees), 40 per cent (para. 6.6). On a straight proportion basis, about 180 employees in all currently depend upon the diminishing available timber resources of the Kyogle M.A. for their livelihood.
- 11.8 Depending upon the attitude of the National Parks & Wildlife Service, the military forces could lose the use of the rainforest stands in the study area for jungle warfare training exercises.
- 11.9 Employment opportunities resulting from the creation of a national park would appear to be significantly less than those provided by a sustained yield, multiple use forest management policy. Unknown here would be the extent to which a specific tourist industry would develop, based on the availability of the national park. In view of the proximity of the Queensland national parks and the strong drawcard of the region's ocean beaches it might be doubted whether any major development could be expected, over and above that which is already occurring in the State Forests. This appears to be the view of Standen (1).

(1) Peter Standen, Chief Planner, N.S.W. Planning & Environment Commission.
"A Planning Perspective - the N.S.W. Positions." Paper to Border
Ranges Symposium, Lamington Nat. Park, June, 1976.

- 11.10 Employment opportunities in the reforestation of farmlands in the district (see para. 10.6) would depend upon the extent to which Governments were prepared to provide specific funds for such activity, in competition with the call for funds for other projects which would seem to have a better economic basis.
- 11.11 It must however be emphasised that any appreciation of the effects of establishing a national park in the area is complicated by the fact that the forests within the area are not currently under sustained yield and, at the present rate of cut, will virtually be withdrawn from timber production by about 1986 for a period of 25 years or more (para. 10.3).

12 The National Park Proposals

12.1 The history of proposals to establish a national park in the Border Ranges area of N.S.W. has been outlined in paras. 2.7 - 2.15.

12.2 The nature of the proposals vary to some extent, particularly with respect to the actual area involved. The earliest proposals, e.g. by Groom ⁽¹⁾, p.183, refer to Wiangaree S.F., and it was this State Forest that provided the spark for the recent controversy. Subsequently Lever's Plateau was added. The Urban Systems study ⁽²⁾, commissioned with Commonwealth funding by the Border Ranges Preservation Society, covered Mt. Lindesay, Roseberry and Wiangaree State Forests; Mebbin S.F. in the Tweed catchment and then north round the Tweed escarpment to Limpinwood Nature Reserve; and private lands in the upper Richmond Valley south to the Richmond River. However only part of this area, essentially the higher plateaux, some connecting ridges and apparently all of Mt. Lindesay S.F. were suggested in the report as national park (see map 3 in Urban Systems report). The Colong Committee has recommended to the Australian Heritage Commission that the "proposed Border Ranges National Park be listed in the interim register of the national estate" ⁽³⁾: by description in the annexures to this letter the park would consist of Mt. Lindesay, Roseberry and Wiangaree State Forests. Other local suggestions have sought to extend the park proposals to include the Nightcap Range area, including Whian Whian, Goonimbar and probably Nullum State Forests. As indicated previously (para. 3.1) this background paper is considering essentially the three State Forests in the upper Richmond Valley - much of Mebbin S.F. (except for the steep escarpment, which seems incapable of being affected regardless of the controlling body) is a low altitude forest that has been under fairly intensive forest management for many years and would not seem particularly appropriate for inclusion in a National Park; the Nightcap Range area is geographically distant and distinct from these other areas.

12.3 A case for a national park in the study area has been prepared by the National Parks and Wildlife Service, and this is being produced as a separate document to accompany this background paper.

12.4 Existing National Parks and Reserves

12.4.1 The Forestry Commission has established a number of Flora Reserves and preserved areas intended for ultimate Flora Reserve gazettal in or close to the study area, including the Grady's Creek F.R. of 1500 ha on Wiangaree S.F. (see paras. 3.9.8 and 3.9.9).

12.4.2 Also within N.S.W., and within fairly close proximity, are the Limpinwood Nature Reserve (2400 ha) and Mt. Warning National Park (2100 ha).

12.4.3 On the Queensland side of the border is the Lamington N.P. (19 500 ha), which adjoins Wiangaree S.F. and consists in part of very similar basalt plateau country, and further west Mt. Barney N.P. (5000 ha).

12.4.4 Other smaller areas in the vicinity, under the control of the Queensland National Parks and Wildlife Service, include ⁽⁴⁾:

Natural Bridge N.P.	about 200 ha
Burleigh Heads N.P.	24 ha
Springbrook (3 parks)	1300 ha
Tamborine (9 parks)	570 ha

(1) Arther Groom: "One Mountain after Another". Angus & Robertson, Sydney, 1949.

(2) "Border Ranges Proposed National Park Study": Urban Systems Corp. Pty. Ltd., North Sydney, 1975.

(3) Letter of 26th November, 1976, from the Colong Committee (A.G. Colley, Hon. Secretary) to the Premier: referred to Interdepartmental Committee.

(4) Letter from Director, Qld. Nat. Parks and Wildlife Service, to the Secretary, Forestry Commission of N.S.W.: 11th January, 1977.

12.5 Employment and Visitor Usage in Queensland Parks

- 12.5.1 The Queensland Service ⁽⁴⁾ has listed the employment on its local National Parks as follows:

Lamington N.P. - 11 men. These work mostly in the northern half of the park; the southern half is managed as a wilderness area and has no visitor facilities.

Natural Bridge N.P. - 1 man
Burleigh Heads N.P. - 1 man
Springbrook Parks - 3 men
Tamborine Parks - 4 men

- 12.5.2 While stressing that the figures on visitor usage are estimates made by local staff only, with an unknown degree of accuracy, the Queensland Service has provided the following estimates of current annual visitation to these parks:

Lamington N.P.	70 000 visitor days
Burleigh Heads N.P.	70 000
Springbrook	200 000
Natural Bridge N.P.	50 000
Tamborine	100 000

(The Service notes that it is unlikely that the Springbrook visitation is in fact twice that of Tamborine, but the Service is unable to suggest which figure is more nearly correct).

- 12.5.3 The Service then observes: "Visitation (and hence employment) depends on local circumstances rather than on park area, proximity to major centres of population (Brisbane and Gold Coast) being the main cause of the high visitation for Tamborine and Springbrook. It is also to be appreciated that visitors to Lamington are going solely to visit the national park - there are no other attractions that the roads lead to - whereas for places like Tamborine and Springbrook, the visit to the park may be incidental to other activities."

- 12.5.4 The Service goes on to note: "The direct value of Lamington in terms of tourist dollars is modest compared to other more intensively visited areas. Yet Lamington is the park that is renowned world-wide as the national park of southern Queensland. It is one of the Crown Jewels of Australia's national park system, and its indirect value to the tourist industry is substantial. It is because its visitation is modest and well controlled and because a major section remains as wilderness area that it is so well preserved and hence so highly regarded."

- 12.5.5 As an indication of further employment created by the National Parks, it is noted that in 1976 the Birma-Burra Lodge, which provided lodge-type accommodation immediately adjacent to the Lamington N.P., had 23 permanent and 1 casual employees. It provided 90 beds and had 19,540 bed nights for the year to 30th June, 1976, with a high turnaway figure during peak periods (school holidays and long weekends).

- 12.6 As previously noted (para. 12.2), the area under consideration has been submitted to the Australian Heritage Commission for inclusion in the register of the national estate. Background information relating to this register and to the Commission is given in Appendix 19.

13 The Aboriginal Land Claim

- 13.1 Separate from the issues discussed to date, but relating also to the study area, is a request by Mr. E.W. McBride, of Mt. Lion, to be allowed to purchase or be given an area of about 1000 ha, forming much of the Cedar Getters Creek catchment on the eastern side of, and within, Roseberry State Forest.
- 13.2 Mr. McBride is of aboriginal descent, and claims that to his knowledge his family are the only survivors of the Gullibul (Galibel) Tribe from the Upper Richmond Valley.
- 13.3 In May, 1970, Mr. McBride wrote to the then Minister for Lands, seeking to obtain the land in question. He claimed that this was traditional hunting and secret grounds. He intended with his brothers to harvest the timber, reforest suitable parts and also create a sanctuary for bird and animal life in the more rugged area. Though not spelt out, by inference it was intended to use part of the land for farming. The then Minister for Conservation rejected this request in July, 1970.
- 13.4 In January, 1973, a further approach was made by Mr. D. Day, M.L.A., to the Minister for Youth and Community Services on behalf of Mr. McBride. Mr. Day vouched for the reputation of the McBride family and noted that the land in question had once been leased by Mr. McBride's father, but as a result of stock losses caused by drought the lease was relinquished. Mr. Day also noted that he understood many former members of the Tribe were buried in the area. The Minister for Youth and Community Services referred the matter on to a Ministerial colleague for consideration but pointed out that he would consider granting a loan to Mr. McBride for building a cottage were Mr. McBride to obtain appropriate tenure to the land. Subsequently in May, 1973, the Minister for Conservation replied, again rejecting the request and regretting that, because of existing Occupation Permits over the land, it was not possible to offer the grazing rights on the area to Mr. McBride.
- 13.5 Mr. Day, now Minister for Decentralisation and Development and Primary Industry, made further representations on behalf of his constituent in June, 1976. The Minister for Conservation and Water Resources, in his reply in October, referred the matter for further examination by the Interdepartmental Committee. At the same time he pointed out that the area formed part of the Kyogle Management Area and was scheduled for routine logging within two years; that there were Occupation Permits, held since 1957, still current over part of the area; and that the Forestry Commission would take appropriate steps to protect any sites of known aboriginal significance from damage as a result of forestry operations. He suggested that Mr. McBride should discuss this last matter with the Forester at Kyogle.
- 13.6 Mr. McBride then wrote to the Forester, outlining again his plans for the area.
- 13.7 At the request of the local office of the Forestry Commission, the Department of Aboriginal Affairs has been asked, through its local office, to advise on the validity of Mr. McBride's claims.

Extract from Report No. 3 of
Parks & Reserves Scientific Committee, February, 1971

Interstate Parks - McPherson Range

The three existing National Parks are well spaced to serve the growing population centres of the north coast. However, the absence of any National Park in the extreme north of the region and the presence of Lamington National Park (Queensland) on the border point toward the desirability of a N.S.W. addition to Lamington, making it an interstate park. The area is scenically attractive and supports a rich subtropical flora and fauna which cannot be adequately sampled elsewhere in the State. There is a considerable expanse of country adjacent to Lamington and to the Limpinwood Nature Reserve (N.S.W.) which is suitable for National Park status. However, the Limpinwood Nature Reserve should be retained as a Nature Reserve and not amalgamated into a larger National Park.

The Lamington National Park occupies some 49,000 acres on the northern side of the McPherson Range in south eastern Queensland, extending along the N.S.W. border for a distance of approximately 20 miles. In N.S.W., the eastern section of this National Park boundary lies along the watershed of the Tweed River, and the western section lies along the watershed of the Richmond River, with the Tweed Range, which separates the Richmond and Tweed catchments, running off from the McPherson Range in a southeasterly direction about halfway along the National Park boundary.

The drop from both the McPherson and Tweed Ranges into the Tweed Valley is very sharp. (Hence the more spectacular views from the Lamington National Park are mostly southwards, into N.S.W.) Most of the land running up to the Park from the Tweed Valley appears to be in private ownership, and there would seem to be little, if any, land which would be either suitable or readily available for addition to the Park in this section.

By contrast, the southwestern angle between the McPherson and Tweed Ranges is occupied by a basaltic plateau which reaches up to about 3,000 ft. along the border. This plateau has been dissected, in places very deeply with resultant high waterfalls, by a series of streams which flow generally to the southwest and which ultimately join the Richmond River.

This plateau forms Wiangarie State Forest No. 358, while south along the Tweed Range Mebbin State Forest No. 626 has a common boundary with Wiangarie State Forest and extends on to the low country on the eastern (Tweed River) side of the range. Mebbin State Forest has an area of about 10,000 acres. It has mostly been under intensive forest management for many years and, apart from a small belt along the Tweed Range, it could hardly be considered seriously for addition to any National Park system. Nonetheless it has many features of unusual botanical interest, and contains several forest preserves.

Wiangarie State Forest has an area of about 35,000 acres. The foothills of the plateau mostly carry eucalypt forest, but the plateau itself supports rainforest, which probably covers some 30,000 acres within the State Forest and which undoubtedly represents the largest single stand of rainforest still extant in N.S.W.

Most of this rainforest is of the subtropical subformation (Tarrietia alliance), but in places along the main range this gives way to cool temperate rainforest (Nothofagus alliance). This is the same vegetation pattern as is found on the Queensland side. The subtropical rainforest is of particularly fine development, in places reaching a stand height of about 180 ft. (unusually high for any rainforest community) and having the subformation's typical floristic wealth (e.g. 66 species of trees over 4 inches diameter at breast height recorded on one 9.6 acre study area).

Appendix 1 (cont.)

This would be the most suitable area adjoining the Lamington National Park for addition to the Park system in order to create an Interstate Park. Although it probably contains no features which are not already present in the Queensland Park, it would add substantially to the area of that Park and provide some excellent examples of subtropical rainforest at its optimum development (one section has already been set aside as a Flora Reserve, in part for use as a research area by the A.N.U.).

Access to the plateau and State Forest is by the Lynch's Creek Forestry Access Road, which is reached from the village of Wiangarie (railway village north of Kyogle). A very rough track, which has been used for logging, also extends on to the plateau from Lodestone, to the west. Branch roads have been constructed through the western section of the State Forest for logging and management purposes, and these feed into the Lynch's Creek Road.

The eastern and northern section of the Forest is in almost constant use by the Army for jungle training but disturbance of the vegetation has been relatively slight. Logging occurred for a number of years around the top of the Lodestone track, and more recently selective "silviculture logging" has commenced in the southern and western sections served by the Lynch's Creek Road, which was built about 1963. The "silviculture logging" aims to maintain a forest canopy without excessive openings and to preserve the original species mixture, while removing the mature stems - in other words, to use the timber without ruining the stand (as has happened in many rainforest areas), and to date it seems fairly successful.

As indicated, a 400 acre Flora Reserve has been established across the Sheepstation Creek valley. In addition the Forestry Commission has carried out ecological studies elsewhere in the Forest and has commenced a major series of studies into the silvicultural treatment of these stands. At least two local sawmills rely on this area for their supplies of mill logs.

The area as a whole is covered by the 1 inch to 1 mile Murwillumbah military map.

Other areas of State Forest extend along the McPherson Range west of Wiangarie State Forest in an unbroken chain for more than 60 miles, to Acacia Plateau (near N.S.W. village of Legume and Queensland town of Killarney). Much of this land has high scenic values and carries vegetation of great attraction and interest. (There are also features of unusual geological and zoological interest). In part this belt of forest adjoins the Mt. Barney National Park in Queensland.

Extract from "Report of the Government
Parties Committee on Forests on the
Proposal for a Border Ranges National
Park", March, 1976.

Recommendations

We recommend:

- (1) That all State Forests in the Border Ranges region continue under the multiple use management of the Forestry Commission.
- (2) Grady's Creek Flora Reserve be extended to the vicinity of Mt. Gipps to provide a complete buffer to Lamington National Park and to provide undisturbed access to Lamington from the N.S.W. side of the border.
- (3) The Forestry Commission give consideration to preserving those areas on the eastern escarpment of Lever's Plateau where Hoop Pine is regenerating naturally in fairly pure stands, as these seem to represent the only unique forest types of the area.
(It should be noted that Forestry Commission policy will ensure considerable other areas (as shown on the map) will not be logged).
- (4) The Forestry Commission be enabled, if necessary by provision of additional funds, to recommence a plantation programme in the Kyogle area so that all forest management can be placed upon a sustained yield basis within 15-20 years.
- (5) Private companies engaged in sawmilling should be encouraged to consider providing plantations for their own use, as urged by the Conservation Society of N.S.W., and to consult with the Government on this subject.
- (6) The Forestry Commission continues its research with a view to comparing managed rainforest with rainforest in the natural state.
- (7) Steps be taken to improve the capacity of the National Parks and Wildlife Service in relation to its evaluation and management of those rainforest areas under its control.

Issued: August 4, 1976.

News Release

The State Government will not proceed with the construction of a logging road on the Lever's Plateau.

The Premier, Mr. Neville Wran, said this today following Cabinet discussions on the construction of the logging road in the Border Ranges.

Mr. Wran also said that Cabinet had decided to appoint an inter-departmental committee to investigate a future management policy for the Border Ranges.

The Committee will consist of nominees of the Minister for Lands and Environment, the Minister for Local Government and Planning, the Minister for Conservation and Water Resources and the Minister for Decentralisation and Development.

"The purpose of the investigation of a management policy will be to prepare a report to Cabinet on the employment environmental and economic aspects of the Border Ranges", Mr. Wran said.

"The Committee will also examine the eventual establishment of a national park in the area".

Mr. Wran said the Cabinet decision meant that no existing jobs in the timber industry in the Border Ranges area would be threatened or that any further inroads would be made into wilderness areas until such time as a final decision was made on a management policy for the region.

"Within the management decision a determination will be made in respect of the establishment of a national park in the Border Ranges" Mr. Wran said.

Species Lists - Subtropical Rainforest

Source: Forestry Commission lists for the Grady's Creek, Lever's Plateau and Mt. Lindesay Flora Reserves. For Grady's Creek and Mt. Lindesay, X indicates presence of species in the subtropical rainforest. For Lever's Plateau, VC = very common; C = common; O = occasional; R = rare.

Note: Omission of a species indicates that it has not been recorded, not necessarily that it is not present in area.

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
<u>Pteridophyta</u>			
Adiantum formosum (Giant Maidenhair)			X
Asplenium falcatum		C	
A. nidus (Bird's Nest Fern)	X	C	X
Athyrium assimile			X
Doodia aspera (Rasp Fern)		VC	
Cyathea leichhardtii (Prickly Tree Fern)	X		
Davallia pyxidata (Mare's Foot Fern)	X	C	
Arthropteris beckleri			X
A. tenella			X
Nephrolepis cordifolia			X
Dictymia brownii	X		
Microsorium diversifolium			X
M. scandens	X		
Platycerium bifurcatum (Elkhorn Fern)		C	X
P. grande (Staghorn Fern)	X	R	X
Dicksonia antarctica (Soft Tree Fern)	X		
D. youngiae	X		
<u>Gymnospermae</u>			
Araucaria cunninghamii (Hoop Pine)	X	VC	X
Podocarpus elatus (Brown Pine)		O	
<u>Monocotyledonae</u>			
Archontophoenix cunninghamii (Bangalow Palm)	X	O	X

	<u>Grady's Creek</u>	<u>Livers Plateau</u>	<u>Mt. Lindesay</u>
<u>Monocotyledonae</u> (Cont'd)			
<i>Linospadix monostachyus</i> (Walkingstick Palm)	X	C	X
<i>Alocasia macrorrhizos</i> (Cunjevoi)	X		X
<i>Pothos longipes</i>	X		
<i>Flagellaria indica</i>	X		
<i>Cordyline terminalis</i>	X		X
<i>Lomandra montana</i>			X
<i>Rhipogonum discolor</i>	X		X
<i>Smilax australis</i>	X		X
<i>Alpinia coerulea</i> (Native Ginger)			X
<i>Dendrobium beckleri</i> (Pencil Orchid)		C	
<i>D. speciosum</i> (Rock Orchid)		O	
<i>Calanthe triplicata</i>	X		
<u>Dicotyledonae</u>			
<i>Peperomia reflexa</i>		O	
<i>Piper novaehollandiae</i> (Native Pepper)	X		X
<i>Trema aspera</i> (Poison Peach)	X		
<i>Ficus stephanocarpa</i> (Sandpaper Fig)			X
<i>F. watkinsiana</i> (Green-leaved M. Bay Fig)	X	R	
<i>Pseudomorus brunoniana</i> (Whalebone Tree)	X		X
<i>Elatostemma reticulatum</i>	X		
<i>Dendrocnide excelsa</i> (Giant Stinger)	X	O	X
<i>Banksia integrifolia</i> (White Banksia)			X
<i>Helicia glabriflora</i>	X		
<i>H. youngiana</i>	X		
<i>Lomatia arborescens</i>			X
<i>Orites excelsa</i> (Prickly Ash)	X	C	X
<i>Stenocarpus salignus</i> (Scrub Beefwood)		O	X
<i>S. sinuatus</i> (Wheel-of-Fire Tree)	X	O	
<i>Drimys insipida</i>		O	X

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
<u>Dicotyledonae</u> (Cont'd)			
Legnephora moorei			X
Rauwenhoffia leichhardtii (Zig Zag Vine)	X		X
Eupomatia bennettii	X		
E. laurina (Bolwara)	X		X
Daphnandra micrantha (Socketwood)	X	O	X
Doryphora sassafras (Sassafras)	X		X
Palmeria scandens	X		
Wilkiea austroqueenslandica	X		
W. huegeliana	X		X
W. macrophylla	X	C	
Beilschmiedia elliptica (Brown Walnut)	X		
B. obtusifolia (Hard Bolly Gum)	X		
Cinnamomum oliveri (Black Sassafras)	X	O	
C. virens (Redbark Sassafras)	X		X
Cryptocarya erythroxylon (Pigeonberry Ash)	X	C	X
C. foveolata			X
C. obovata (Pepperberry)	X	O	
Endiandra discolor (Rose Walnut)		O	
E. muelleri	X		
E. pubens (Red Apple)	X	R	
Litsea reticulata (Bollywood)	X	O	
Neolitsea dealbata	X		
N. zeylanica	X	O	X
Capparis canescens (Wild Lemon)	X	O	X
Anopterus macleayanus (Tasmanian Laurel)		O	
Cuttsia viburnea	X		
Polyosma cunninghamii (Featherwood)	X	C	X
Quintinia sieberi (Possumwood)			X
Q. verdonii (Grey Possumwood)	X		
Citriobatus lanceolatus		O	
C. multiflorus	X	C	X

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
<u>Dicotyledonae</u> (Cont'd)			
Hymenosporum flavum (Native Frangipani)	X		
Ackama paniculata (Corkwood)	X	O	
Geissois benthami (Red Carabeen)	X	O	
Schizomeria ovata (Crabapple)		VC	
Abarema grandiflora (Laceflower)	X		
Derris scandens (Derris Vine)	X		
Acronychia baueri	X	R	
A. pubescens		O	X
A. suberosa	X		
Euodia micrococca	X		
Fagara brachyacanthum (Thorny Yellowwood)	X		X
Flindersia australis (Native Teak)	X	C	
Halfordia kendack (Saffronheart)		O	
Melicope australasica (Doughwood)	X		
Guilfoylia monostylis	X	O	X
Didymochaeton rufum (False Rosewood)	X		X
Dysoxylum fraserianum (Rosewood)	X		X
Melia dubia (White Cedar)	X		
Pseudocarapa nitidula (Bog Onion)	X	O	
Synoum glandulosum (Scentless Rosewood)	X	C	
Toona australis (Red Cedar)	X	R	X
Actephila moorei	X		
Baloghia lucida (Brush Bloodwood)	X	O	X
Claoxylon australe	X		X
Croton acronychioides		O	
Omalanthus populifolius (Bleeding Heart)	X		
Euroschinus falcatus (Chinaman Cedar)	X		
Denhamia pittosporoides	X		
Maytenus bilocularis			X

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
<u>Dicotyledonae</u> (Cont'd)			
Siphonondon australe (Ivorywood)	X		
Citronella moorei (Soapy Box)		O	
Pennantia cunninghamii (Brown Beech)	X	O	X
Arytera divaricata	X	C	X
Cupaniopsis serrata	X	R	
Diploglottis australis (Native Tamarind)	X	O	X
Ellatostachys nervosa	X		
Guoia semiglauc	X		
Harpullia pendula (Tulipwood)	X		
H. alata		R	
Jagera pseudorhus (Foambark)		O	
Mischocarpus anodontus	X		
Rhysotoechia bifoliolata	X		
Sarcopteryx stipitata	X	C	
Akania lucens (Turnipwood)	X		X
Alphitonia excelsa (Red Ash)	X		
Emmenosperma alphitonioides (Yellow Ash)	X	O	
Cayratia clematidea (Slender Grape)	X		
Cissus hypoglauc	X		X
Elaeocarpus kirtonii	X	C	
Sloanea australis (Maiden's Blush)	X	VC	
S. woollsii (Yellow Carabeen)	X	O	
Brachychiton acerifolius (Flametree)	X		X
Heritiera actinophylla (Black Booyong)	X	O	X
H. trifoliolata (White Booyong)	X	O	X
Scolopia brownii	X	O	
Phaleria neumannii	X		
Austromyrtus fragrantissima (?)	X		
A. bidwillii		O	
A. lasioclada	X		
Acmena australis (Red Apple)	X	C	X
A. hemilampra	X		

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
<u>Dicotyledonae</u> (Cont'd)			
Acmena smithii (Lilly Pilly)	X		
Decaspermum paniculatum	X	R	
Rhodamnia argentea	X	O	X
R. trinervia (Brush Turpentine)			X
R. sp. nov.			X
Syzygium corynanthum (Sour Cherry)	X		
S. crebrinerve (Purple Cherry)	X	C	
S. coolminianum (Blue Lilly Pilly)	X	O	
S. francisii (Giant Water Gum)	X		
Tristania conferta (Brush Box)	X		
T. laurina (Water Gum)	X		
Polyscias elegans (Celerywood)	X		X
P. murrayi (Pencil Cedar)	X		
Alangium villosum	X		X
Embelia australisica	X		X
Rapanea howittiana	X		
R. subsessilis	X	O	
R. variabilis		C	
Planchonella australis (Black Apple)	X	O	
Diospyros pentamera (Black Myrtle)	X	O	X
Symplocos stawellii	X		
Notelaea ligustrina (Mock Olive)	X		
Melodinus australis	X		
Parsonsia straminea	X		X
Marsdenia flavescens			X
Ehretia acuminata (Koda)	X		X
Clerodendron floribundum	X		
C. tomentosum	X		
Gmelina leichhardtii (White Beech)	X	O	
Duboisia myoporoides		O	

	<u>Grady's Creek</u>	<u>Lever's Plateau</u>	<u>Mt. Lindesay</u>
Solanum callium	X		
S. sporadstrichum			X
Psychotria daphnoides	X	C	X
P. simmondsiana	X		X
Randia chartacea		R	
R. benthamiana	X		
Sambucus xanthocarpa	X		

Appendix 5

Species List - Cool Temperate Rainforest and
Adjacent Stands, Grady's Creek Flora Reserve.

(From species list attached to the working plan for this Flora Reserve.
The list should not be regarded as exhaustive).

<i>Dendrobium kingianum</i>	(King Orchid)
<i>Nothofagus moorei</i>	(Negrohead Beech)
<i>Orites excelsa</i>	(Prickly Ash)
<i>Daphnandra apetela</i>	(Socketwood)
<i>Doryphora sassafras</i>	(Sassafras)
<i>Cinnamomum oliveri</i>	(Oliver's Sassafras)
<i>Cryptocarya foveolata</i>	
<i>Anopterus macleayanus</i>	(Tasmania Laurel)
<i>Polyosma cunninghamii</i>	(Featherwood)
<i>Quintia sieberi</i>	(Possumwood)
<i>Q. verdonii</i>	(Grey Possumwood)
<i>Pittosporum undulatum</i>	(Pittosporum)
<i>Ackama paniculata</i>	(Corkwood)
<i>Geissois benthamii</i>	(Red Carabeen)
<i>Vesselowskyia rubifolia</i>	
<i>Acacia melanoxylon</i>	(Blackwood)
<i>A. orites</i>	(Mountain Wattle)
<i>Euodia parvifolia</i>	
<i>Fagara brachyacantha</i>	(Thorny Yellowwood)
<i>Guilfoylia monostylus</i>	
<i>Dysoxylum fraserianum</i>	(Rosewood)
<i>Synoum glandulosum</i>	(Scentless Rosewood)
<i>Pennantia cunninghamii</i>	(Brown Beech)
<i>Cupaniopsis serrata</i>	
<i>Elaeocarpus kirtonii</i>	
<i>Sloanea australis</i>	(Maiden's Blush)
<i>Heritiera actinophylla</i>	(Black Booyong)
<i>Acmena australis</i>	(Red Apple)
<i>A. smithii</i>	(Lilly Pilly)
<i>Tristania laurina</i>	(Water Gum)
<i>Polyscias elegans</i>	(Celerywood)
<i>Diospyros pentamera</i>	(Black Myrtle)
<i>Clerodendron floribundum</i>	
<i>Duboisia myoporoides</i>	(Duboisia/Corkwood)

Mammals recorded from Study Area, July, 1977

<u>Species</u>	<u>Lever's Plateau</u>	<u>Wiangaree Plateau</u>
Macropus robustus (Wallaroo)	+	-
M. rufogriseus (Red-necked Wallaby)	+	-
M. parryi (Pretty-face Wallaby)	+	-
M. dorsalis (Black-striped Wallaby)	+	+
M. parma (Parma Wallaby)	+	-
Wallabia bicolor (Swamp Wallaby)	+	+
Aepyprymnus rufescens (Rufous Rat-Kangaroo)	+	-
Potorous tridactylus (Potoroo)	+	+
Thylogale thetis (Red-necked Pademelon)	+	+
Thylogale stigmatica (Red-legged Pademelon)	+	-
Phascolarctos cinereus (Koala)	+	+
Trichosurus caninus (Short-eared Possum)	+	+
T. vulpecula (Brush-tailed Possum)	+	+
Pseudocheirus lanuginosus (Ringrail Possum)	+	+
Schoinobates volans (Greater Glider)	+	+
Petaurus norfolcensis (Squirrel Glider)	-	+
Dasyurops maculatus (Tiger Cat)	+	+
Antechinus stuartii (Brown Marsupial-Mouse)	+	-
Isoodon macrourus (Brindled Bandicoot)	+	-
Parameles nasuta (Long-nosed Bandicoot)	+	-
Hydromys chrysogaster (Water Rat)	+	-
Pseudomys gracilicaudatus (Eastern Chestnut Native-Mouse)	+	-
Melomys cervinipes (Fawn-footed Melomys)	+	+
Rattus fuscipes (Southern Bush-Rat)	+	+
Rattus lutreolus (Eastern Swamp-Rat)	+	-
Canis familiaris (Dingo)	+	+
Felis cattus (Cat)	-	+

+ = Recorded

- = Not recorded

Forestry Commission of N.S.W. - Attitude to Rainforest Management

(from "Indigenous Forest Policy", 1976).

3. Potential of the Indigenous Forest Estate

3.2 Rainforest

With few exceptions, areas of rainforest in N.S.W. are scattered and fragmented. Whilst the area of rainforest in the State as a whole is substantial, it is widely distributed through the coast and adjacent tablelands, and the area within most individual supply zones is limited.

Rainforest communities provide some of the State's most beautiful and valuable timbers, many with specialty uses. The rainforests are also areas of considerable biological and scenic significance. Growth rates tend to be low. Heavy logging in the stands may lead to deterioration of the remaining stems, depending on rainforest type and location. Selective logging retaining fifty percent canopy in the subtropical rainforest type, consistently shows acceptable results in retaining a viable rainforest structure. Logging to similar specifications in other rainforest types has sometimes resulted in die-back in the remaining stems and a much lighter selection seems to be necessary to retain healthy stands. The yields of such lighter logging would generally be too low to support an economic harvesting operation except to obtain raw material for high priced specialty uses.

These factors combine to limit the capacity of rainforest as long term major timber providers, and to require that particular care be exercised in the logging of these stands. Special attention should be paid to their value in providing non-material community benefits, but at the same time the value and uses of many of their timbers indicates the desirability of periodic, low intensity logging operations to maintain a supply of these timbers.

Past heavy logging has in some localities resulted in rainforest sites developing a dense crop of shrubs and vines, rather than more desirable tree species, and at the same time producing an aesthetically unattractive environment. The planting of more hardy tree species, such as Hoop Pine or certain eucalypts, offers scope for rehabilitating these sites to a more acceptable forest environment.

5.4 Policies for Major Forest Groups

5.4.1. Rainforest

The broad objective for all rainforest areas is to reduce harvesting to selective fellings for speciality logs, at a level low enough to maintain canopy and rainforest structure. This would require the phasing out of general purpose timber harvesting in most rainforest areas. The rate of selective logging of speciality timbers would generally be too low to support mills now primarily dependent on rainforests.

Where selection logging is successfully carried out without destroying the ecological viability of the rainforest, this may be continued to meet current market commitments. However, these commitments should be reduced where necessary in time to avoid the need for logging above the sustained yield level after the first cutting cycle.

Where market commitments or the nature of the forest type force a continuation of intensive logging in rainforests, rehabilitation should be carried out by planting openings at a stocking sufficient to provide an acceptable tree cover. In types which originally carried Hoop Pine, this species may be used, otherwise eucalypts suitable to the site should be planted.

Sample Stumpage Appraisal - Rainforest Sawlogs

(Based on a mill site in Wiangaree Village and logging in Wiangaree State Forest).

All charges are expressed per cubic metre

Base Rate - Sawn Value, free in yard, Brisbane		\$146.40
Less Sawn haul to market (179 km)	\$7.07	
Load and unload	<u>1.40</u>	
Total	\$8.47	\$137.93
Less Seasoning allowance	\$25.20	
Sawn value mill yard		\$112.73
Less Manufacturing margin (cost of converting log to sawn timber)	\$61.20	
Value of log equivalent, mill yard		\$51.53
Mill door log value (MDLV) per cubic metre true volume, at recovery of 44%		\$22.67
(This allows for fact that, of every 100 m ³ of logs brought to mill, on average only 44 m ³ of sawn timber will be produced. Remainder is waste).		

This MDLV applies to all milling at this site.

For specific logging area:

MDLV		\$22.67
Less felling	\$1.90	
snigging (average 250 m)	\$3.40	
log haul (38 km, various grades of road)	\$4.57	
allowance for erosion control	<u>\$0.05</u>	
Total	\$9.92	
Base stumpage rate		\$12.75

Logs are sold at this base stumpage rate, adjusted as to species group and size class (see Appendices 9 and 10), and an allowance is made for any defect in the log (e.g. punky heart) at a differential rate per cubic metre of defect, calculated to cover the additional handling involved. In the case of this mill, the defect allowance is \$30.19 per cubic metre.

Brushwoods (Rainforest Species) Groups - 1st Dec., 1973

Group A

Ash, Silver (Cudgerie)	Flindersia schottiana
Coachwood	Ceratopetalum apetalum
Yellowwood	Flindersia xanthoxyla
Red Cedar (if down graded)	Toona australis

Group B

Ash, Crow's (Teak)	Flindersia australis
Ash, Pigeonberry (Rose Maple)	Cryptocarya erythroxylon
Ash, Blueberry (Blue Fig, Silver Quandong)	Elaeocarpus grandis
Bollywood	Litsea reticulata
Corkwood (Brown Alder)	Ackama paniculata
Crabapple (White Birch)	Schizomeria ovata
Cypress, Brush	Callitris macleayana
Flame Tree	Brachychiton acerifolium
Jackwood (Silver Sycamore)	Cryptocarya glancescens
Pepperberry	C. obovata
Pine, Brown	Podocarpus elatus
Pine, Hoop	Araucaria cunninghamii
Pinkwood	Eucryphia moorei
Possumwood	Quintinia sieberi
Saffron Heart	Halfordia Kendack
Walnut, Mountain	Cryptocarya foveolata

Group C

Ash, Prickly	Orites excelsa
Ash, Red (Red Almond)	Alphitonia excelsa
Bean, Black	Castanospermum australe
Bean, Red	Dysoxylum muelleri
Beefwood	Stenocarpus salignus
Camphorwood (Black Sassafras)	Cinnamomum oliveri
Carabeen, Red	Geissois benthami
Carabeen, Yellow	Sloanea woolsii
Doughwood	Melicope australasica
Rosewood	Dysoxylum fraserianum
Sassafras	Doryphora sassafras
Satin Oak	Oreocallis pinnata
Silky Oak, Southern	Grevillea robusta (also Orites excelsa)

Group D

Ash, Grey (Bonewood)	Emmenospermum alphitonioides
Beech, Negrohead	Nothofagus moorei
Bollygum, Hard	Beilschmiedia obtusifolia
Booyong, Black (Blush Tulip Oak, Blackjack)	Heritiera actinophylla
Booyong, White (Brown Tulip Oak, Stavewood)	H. trifoliolata
Onionwood	Owenia cepiodora
Plumwood	Endiandra spp.
Silky Beech (Soapy Box)	Citronella moorei
Other rainforest species not specifically listed.	

Note: The following species are treated separately and attract a margin of \$33 per cubic metre over Group B rates ("Red Cedar Group"):

Apple, Black	Planchonella australis
Beech, White	Gmelina leichhardtii
Boxwood, Yellow	Planchonella pohlmanniana
Cedar, Red	Toona australis
Ivorywood	Siphonodon australe

Price Margins for Size and Species Group - Rainforest Species
1st September, 1975

<u>Species Group</u>	<u>Centre diameter of Log, underbark</u>				
	<u>Large</u>	<u>Medium</u>	<u>Intermediate</u>	<u>Small</u>	<u>Super Small</u>
	(80cm+)	(60-79cm)	(40-59cm)	(30-39cm)	(20-29cm)
A	+\$4.45	+3.80	+1.90	-0.75	-4.60
B	+0.75	Base rate	-1.45	-3.40	-5.70
C	-1.80	-2.65	-3.80	-5.40	-6.15
D	-5.30	-5.70	-6.15	-6.20	-6.20

All logs under 20cm centre diameter underbark have a set rate of 50¢ per cubic metre gross.

A minimum rate of 50¢ per cubic metre applies on all logs.

Sawmill Histories relevant to Kyogle Management Area

S'mill Licence No. 64

1918 issued to Munro and Lever. Located at The Gorge, Grevillia.
1939 registered as Munro and Lever Pty. Ltd.
Quota 3.0 million s.ft. from Kyogle M.A. (additional also from Urbenville)
Acquired additional quotas on transfer from Licence No's. 67, 1289, 1971 and 1834 (area allocation).
Mill now has quota allocation of 17 850 m³ of all species, plus limited area allocations of 2200 m³ and 2910 m³, from Kyogle M.A., as well as further quota from outside the Management Area.

S'mill Licence No. 67

1918 issued to Fraser Bros. and Co. Ltd. Findon Creek.
Quota 1.0 m.s.ft.
1965 Licence acquired by Munro and Lever Pty. Ltd.; Licence relinquished, quota amalgamated with Licence No. 64.

S'mill Licence No. 1289

1923 issued to Veneer Co. Pty. Ltd. Kyogle.
Quota 1.5 m.s.ft.
1971 Licence transferred to Munro and Lever Pty. Ltd.; quota amalgamated with Licence No. 64.

S'mill Licence No. 1971

1929 issued to Munro and Lever. Long Creek.
1939 registered as Munro and Lever Pty. Ltd.
Quota 1.1 m.s.ft.
1971 Quota amalgamated with Licence No. 1289, thence to No. 64.
1972 Licence expired.

S'mill Licence No. 1834

1927 issued to W. Secombe and E. J. Hardy. Upper Grady's Creek.
1953 transferred to McPherson Range Timber Co. Pty. Ltd.
Quota 1.5 m.s.ft.
Acquired additional quotas relating to restricted areas on transfer from Licence No's. 2524 and 2787.
1972 Licence surrendered. Quota allocation of 1.5 m.s.ft. transferred to Licence No. 1302; restricted area allocations transferred to Licence No. 64.

S'mill Licence No. 2524

1935 issued to Bernard Muldoon. Grady's Creek.
1953 transferred to Loadstone Timber Co.
Granted annual allocation of 0.9 m.s.ft. from 4 compartments on Wiangaree S.F.
1968 Licence transferred to McPherson Range Timber Co. Pty. Ltd. and relinquished; area allocation transferred to Licence No. 1834.

S'mill Licence No. 2787

1936 issued to Thos. Hayes and Sons. Horseshoe Creek.
1951 transferred to Border Timber Co.
Granted annual allocation of 0.7 m.s.ft. from 2 compts. on Wiangaree S.F. and 5 compts. on Toonumbar S.F.
1962 Licence acquired by McPherson Range Timber Co. Pty. Ltd.; area allocation transferred to Licence No. 1834.

Appendix 11 Cont.

S'mill Licence No. 1302

1923 issued to Standard Sawmilling Co. of Murwillumbah. Upper Bilambil.
1951 transferred to Standard Sawmilling Co. Pty. Ltd. of Murwillumbah.
Quota related to Murwillumbah Forestry Subdistrict.
Acquired additional quota allocations in Murwillumbah subdistrict on acquisition of other Licences, and obtained quota allocation in Kyogle M.A. on transfer from Licence No's. 66 and 1834.
Mill now has quota allocation of 9610 m³ of all species from Kyogle M.A., as well as other quotas from outside this Management Area.

S'mill Licence No. 66

1917 issued to Brown and Jolly Ltd. Roseberry.
1934 transferred to Roseberry Sawmilling Co. Pty. Ltd.
Quota 1.5 m.s.ft.
1965 transferred to Standard Sawmilling Co. Pty. Ltd.
1967 Licence cancelled; quota transferred to Licence No. 1302.

S'mill Licence No. 71

1918 issued to A.R. Knowles. Lismore.
Various changes of Licensee. Obtained quotas relating to Murwillumbah and Tabbimoble Forest Management Areas.
1968 transferred to James Hurford and Co. Pty. Ltd.
Acquired additional limited area allocation in Kyogle M.A. on transfer from Licence No. 3904.
Mill now has limited area allocation of 800 m³ from Kyogle M.A., as well as other quotas from outside this Management Area.

S'mill Licence No. 3904

1941 issued to J. E. Moore. Green Pigeon.
Private property mill, but granted Crown cutting rights to 1.0 m.s.ft. per annum from Fawcett's and Collin's Creeks basin of Wiangaree S.F.
Various changes in Licensee till
1965 transferred to S.F.D. and L. Jones.
1975 transferred to James Hurford and Co. Pty. Ltd., cancelled, and limited area allocation transferred to Licence No. 71.

S'mill Licence No. 8152

1953 issued to M. Hogan. Kyogle.
Private property mill, but granted Crown cutting rights to 0.5 m.s.ft. per annum from 4 compts. in Wiangaree S.F.
Mill now has this limited area allocation of 1620 m³ within Kyogle M.A.

Proportion of Species from Logging of Rainforest,Kyogle M.A.

(Figures from Forestry Commission sources, relating to period
January 1972 - June 1976).

<u>Species</u>	<u>Group (See App. 9)</u>	<u>% of Total Rainforest Cut</u>
White Booyong	D	22.3%
Red Carabeen	C	17.3
Sassafras	C	9.8
Pigeonberry Ash	B	9.6
Corkwood	B	7.5
Bollywood	B	7.1
Doughwood	C	4.5
Native Teak	B	2.8
Prickly Ash	C	2.7
Rosewood	C	2.4
Hard Bollygum	D	2.3
Hoop Pine	A	2.1
Black Booyong	D	1.7
Yellow Carabeen	C	1.5
Black Sassafras	C	1.2

Other species individually contributing less than 1% of the total yield
include Flametree, Silver Quandong, Jackwood and Saffronheart (all B)
and Grey Ash (D).

Special Uses of Selected Rainforest Timbers

(Uses taken from K. R. Bootle: "Commercial Timbers of N.S.W.", and referring to the first four species in Appendix 12).

White Booyong (Tulip Oak): Bent work (very good bending timber), billiard cues, boatbuilding (steam-bent timbers), butchers' skewers, cant hooks, caravan roof bows, cooperage staves, crutches, drop-hammer boards, furniture (brown), handles (axes), panelling (variegated brown), pulley grooves, turnery (moderately hard to turn), veneers and plywood (brown), walking sticks.

Red Carabeen (Brush Mahogany): broom heads, brush backs, caravan framing, draughtman's T-squares, drawer sides, furniture (light pink - pink brown), handles (chisel and saw), instrument boxes, joinery, musical instruments (stringed), panelling (pinkish brown), shoemaking (heels), turnery (easy to turn), veneers and plywood (light to dark red), wire drums.

Sassafras: air dispersers (large bubbles), brooms (handles), brush backs, cable drums, clothes pegs, drawer sides, dye sticks, furniture (yellow), handles (household cleaning), joinery, mouldings, turnery (easy to turn), veneers and plywood (yellow), wire drums.

Pigeonberry Ash (Rose Maple): aircraft wing ribs, air dispersers (large bubbles), furniture (light pink to pink brown), joinery, mouldings, musical instruments (stringed), panelling (pinkish brown), turnery (easy to turn), veneers and plywood (light to dark red).

2. Brindle Creek Picnic Area

At this point, the drive crosses Brindle Creek. In a beautiful, shady rainforest glade beside the Creek, the Commission has established small secluded picnic areas with fireplaces and picnic tables. This is an ideal spot for a quiet lunch followed perhaps by a leisurely stroll along the adjacent walking trail.

3. Grady's Creek Flora Reserve (1500 ha)

The forest drive skirts the southern rim of this Reserve which consists almost exclusively of sub-tropical rainforest, but with pockets of Negrohead Beech (*Nothofagus moorei*) at the higher altitudes, particularly along the Tweed Range in the east. The Reserve also takes in the headwater catchment of Grady's Creek — the first major catchment in this plateau area south of the Queensland border.

4. Negrohead Beech and Forest Walks

A small stand of cool, temperate rainforest, including several large Negrohead Beech trees, occupies this high point on the range (1050m). Until 1973, this spot was the headquarters for army jungle training exercises in what is now Grady's Creek Flora Reserve. A picnic table and fireplace have been installed here recently but there is no water supply.

5. Tweed Valley Lookout

This lookout is a vantage point for excellent views over the upper reaches of the Tweed Valley. The aspect is dominated by Mount Warning to the east, while to the south are Mount Nardi and the forests of the Nightcap and Gibbergunyah Ranges. To the north east, the village of Tyalgum nestles under the Tweed Range and beyond it, looking down the valley, it is possible to see the town of Murwillumbah and the sea near Kingscliff.

6. The Pinnacle

About 5 kilometres south of the Tweed Valley Lookout, a short walk (5 mins from the main drive) leads to an outlook over The Pinnacle — one of the most unusual local landmarks. The Pinnacle consists of a narrow finger of tertiary volcanic rock jutting out some 700 metres from the escarpment edge and with a sheer drop on either side. A walking track leads out along the ridge and, though the views are spectacular, the narrowness of the track may deter all but the most intrepid visitors.

7. The Blackbutts

At this point, a narrow strip of gnarled New England Blackbutt fringes the escarpment. The views here are similar to those obtained from both the Tweed Valley Lookout and The Pinnacle. Two picnic tables and fireplaces are set among the Blackbutts and tank water is available. From this picnic spot, walking trails lead along the escarpment and to the head of Collins Creek.

8. Horseshoe Creek Basin

The road now begins to descend steeply and, at intervals along the way, visitors will catch frequent glimpses of Horseshoe Creek. The descent is even more picturesque after heavy rain, when two waterfalls tumble off the plateau into the creek basin; or in the flowering season (normally November / December) when the fiery, red crowns of flame trees dot the valley and adjacent slopes.

PLEASE REMEMBER

- Others depend on the forest for their livelihood. Don't do anything to obstruct these people in their work.
- Use fire with the utmost care.
- Drive carefully on forest roads at all times.
- Keep the forests clean and tidy.
- Avoid using the forests during very wet, windy or fire dangerous periods.
- Don't damage or disturb the plants and animals.
- Watch out for plants and creatures that might make your visit uncomfortable — ticks, leeches, nettles, etc.
- If going to a remote area make sure someone knows where and when you are going.
- Enjoy yourselves, and come again.

FURTHER INFORMATION may be obtained from the Forestry Office, Kyogle. (Phone Kyogle 321099)

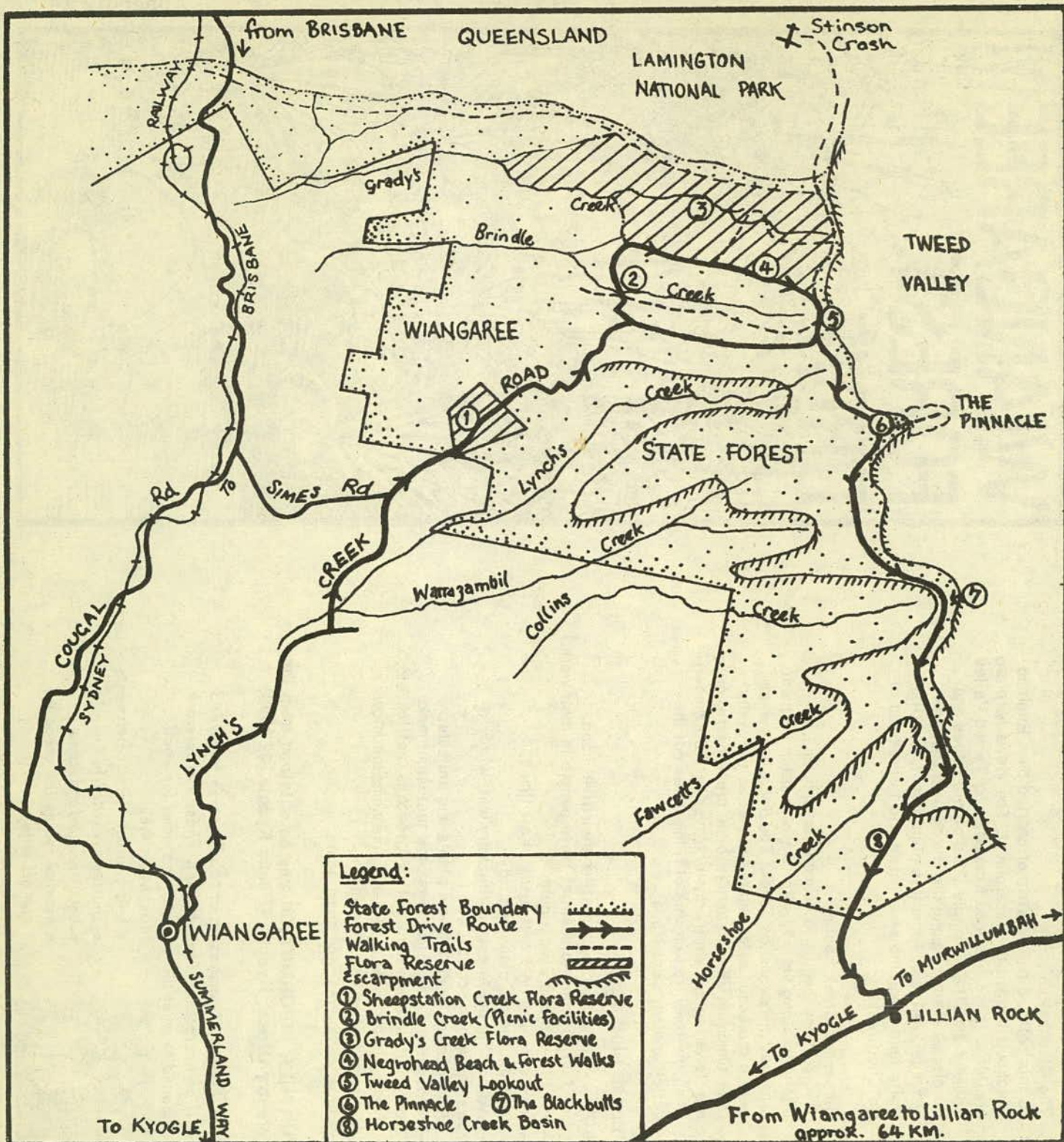
The Forestry Commission of N.S.W. cares for over 3 million hectares of State Forest. These Forests are managed to meet the community's need for wood.



In addition they:

- help protect water catchments
- shelter our wildlife
- beautify our landscape
- provide recreation areas we can all enjoy.





INTRODUCTION

Wiangaree State Forest (14,000 ha) situated on a high basaltic plateau north east of Kyogle, consists mainly of sub-tropical rainforest extending from the Queensland border to the foot of the Tweed Range.

The plateau itself is the skeletal remains of the much eroded and dissected Tweed shield volcano, and Mount Warning to the east is the plug-like remnant of its central lava vent chamber. When the volcano became inactive millions of years ago, plants colonised the plateau.

Today, the vegetation is mainly sub-tropical rainforest interspersed with patches of cool, temperate rainforest dominated by Negrohead (Antarctic) Beech. The latter are probably remnants of extensive stands of Beech which once grew here, at a time when the climate was much colder.

Like most State Forests, Wiangaree was set aside primarily for timber production, but because of the

scarcity of rainforest in New South Wales (as a result of land clearing in the past) forestry practices here are rather different from those employed in the more abundant hardwood forests of the State. Logging, for example, is on a carefully controlled selection system, aimed at retaining 50 per cent of the overhead rainforest canopy, and preserving the full diversity of the species. Unlogged strips are retained beside roads and creeks and along escarpments. In addition, two areas within this forest have been set aside as Flora Reserve. This means they are protected by statute from all logging operations and are reserved for scientific study and reference purposes.

POINTS OF INTEREST

1. Sheepstation Creek Flora Reserve

A fine sample of sub-tropical rainforest is preserved in an undisturbed condition in this Reserve which was established in 1966, partly as a possible field study area for the Australian National University. Apart from rainforest, the area contains small patches of Brush Box, Tallowwood / Sydney Blue Gum and Flooded Gum types.

Interpretative Forest Signs - Wiangaree State Forest

1. Installed alongside Wiangaree Forest Drive, and adjacent to stands logged in 1963:

Rainforest Logging

- . Since the first days of European settlement, our rainforests have provided timbers, canes and other products to meet man's many needs.
- . To-day rainforests are carefully managed for the continued production of these materials while retaining the essential character of the rainforest.
- . The rainforest near here was logged in 1963. Areas logged recently will look like this in the years to come.

2. Alongside road near picnic facilities at Brindle Creek:

Wiangaree State Forest

- . The 14 500 ha of Wiangaree State Forest carry mostly rainforest, much differing only in degree from the equatorial forests of southeast Asia.
- . The rainforest occurs because of the high rainfall and the rich basalt soils, resulting from volcanic outflows some 25 million years ago.
- . Since 1926 this forest has provided a continuing yield of fine timbers - Carabeen, Booyong, Sassafras and many others - for use in furniture, construction and veneer.
- . The forest is managed to maintain the supply of timber, while preserving its rainforest identity and meeting the needs for wildlife habitat, catchment protection and recreation.

3. Alongside road where this forms boundary of Flora Reserve:

Grady's Creek Flora Reserve

- . The valley immediately before you forms part of the Grady's Creek Flora Reserve.
- . This 1500 hectare Reserve has been set aside to preserve a virgin rainforest area for research purposes and for limited public use.
- . The Reserve varies from 650 m to over 1000 m in altitude. Types of rainforest related to those of the tropics and to those of New Zealand occur in the Reserve.
- . The next ridge to the north is the McPherson Range, marking the Queensland border. Beyond is the Lamington National Park.

4. Further along Flora Reserve boundary, near stand of Negrohead Beech:

Negrohead Beech

- . Negrohead Beech (*Nothofagus moorei*) is one of the Southern or Antarctic Beeches, found also in Victoria, Tasmania, New Zealand, southern South America and the New Guinea Highlands.

- . Related to the European Beech trees, Negrohead Beech occurs in very moist, cool sites from the Barrington Tops to the McPherson Range, usually at altitudes of over 1000 m.
 - . Here, near its northernmost limits, Negrohead Beech appears as a relic from an earlier, colder epoch. The larger trees would be many centuries old.
5. On first encountering the Tweed scarp, with view to Mt. Warning and over the Tweed Valley:

Tweed Valley Lookout (Height - 940 m)

- . "We now saw the breakers again ... their situation may always be found by the peaked mountain which bears S. W. by W. from them, and on their account I have named it Mount Warning." Lt. J. Cook, R.N., 16th May, 1770.
- . Mt. Warning is the plug of a great volcano that erupted some 20 million years ago, pouring forth lavas to form a great high plain.
- . Part of this plain remains here on the Tweed and McPherson Ranges. Its erosion has produced the Tweed Valley.
- . Mt. Warning - height 1156 m; distance 15.5 km. Distance to Murwillumbah 28.5 km.

11th July 1976

NEWS RELEASE

Minister for
Environment, Housing
and
Community Development
Canberra A.C.T.

APPOINTMENTS TO AUSTRALIAN HERITAGE COMMISSION

The appointment of six part-time Commissioners to the Australian Heritage Commission was today announced by the Minister for Environment, Housing and Community Development, the Hon. Kevin Newman.

Mr. Newman said that the Chairman of the Commission, Melbourne businessman Mr. David Yencken, had been appointed last June. Further appointments had been delayed while the Government reviewed the structure and functions of the Commission.

Now that the review has been completed, and the Bill to amend the Act for the Commission was before the Parliament, the Government was proceeding with the appointments.

The name of the Commissioners are:-

Mr. R. Walker of New South Wales, the General Secretary of the Australian Council of National Trusts.

Mr. E. K. Sinclair, of Victoria, a company director, part-time Commissioner of the Industries Assistance Commission, and Deputy President of the Library Council of Victoria.

Professor John Mulvaney, Professor of Pre-History, Australian National University, Canberra.

Miss Margaret Feilman, of Western Australia, an architect and town planner.

Professor G. N. Blainey, Professor of Economic History, University of Melbourne.

Mr. Vincent N. Serventy, editor of Wildlife in Australia, author and prominent conservationist.

Mr. Newman said that the Heritage Commission was regarded as the Government's principal adviser on all aspects of the national estate.

"The Commission will work with governments and the community and, in particular, with the voluntary organisations that are making such a valuable contribution in the conservation field, such as the National Trusts," Mr. Newman said.

"The most important task ahead of the Commission in the next 12 months will be the establishment of the Register of the National Estate."

"The Commission will be seeking submissions from Commonwealth, State and Local Government authorities, as well as from voluntary organisations, on which sites should be included in the Register. These sites will include both the natural and cultural components of the national estate."

Mr. Newman said that he had asked his Department to provide the necessary resources to establish the Commission as an efficient and effective unit of Government. In addition to the staff made available to service the Commission, the Department would play a significant role in supporting the work of the Commission by providing management services, information and library services and professional and technical advice.

He expected the Commission would also look to the Australian National Parks and Wildlife Service for advice on nature conservation matters.

"The Government is determined to achieve a responsible balance between conservation and economic growth and looks to the Commission for objective and enlightened advice on the national estate," Mr. Newman said.

REGISTER OF THE NATIONAL ESTATE - BACKGROUND INFORMATION

Under the Australian Heritage Commission Act 1975 the Australian Heritage Commission is required to establish and keep a register of places included in the National Estate.

The Act defines the National Estate as consisting of those places being components of the natural environment of Australia, or the cultural environment of Australia, that have aesthetic, historic, scientific, or social significance or other special value for future generations as well as for the present community. For the purposes of the Act Australia includes all external Territories, the territorial sea of Australia, and the continental shelf of Australia.

To assist the Commission in establishing the Register nominations are being sought from relevant bodies and interested individuals throughout Australia. The Commonwealth Government has requested the Commission to have the Register well advanced by June 1977 to provide a basis for development of a program for the protection, preservation, and presentation of the National Estate. If a substantial register is to be achieved by this date it is important that nominations for as many places as possible be received by the Commission by 31st December, 1976. Submissions will of course be accepted after this date, as the compilation of the Register will be an ongoing process; however, it is doubtful that nominations received after 31st December could be placed on the Register in time for consideration in drawing up the 1976/77 budget.

We would like to receive nominations for the most significant places first to be sure that the first listings include the places considered by the nominators to be unequivocally part of the National Estate. We would however like to make clear that there will be no gradings on the Register and those places submitted and accepted later will have the same status as places which have been considered first.

The following points might be noted:

- Registration of places is an ongoing process and nominations will be accepted at any time.
- National Parks and other government reserves, and buildings classified by the National Trusts will in general be nominated by the government bodies and Trusts concerned. If there is any doubt that this will occur in particular cases, a check should first be made with these bodies before nominating the site. This will avoid duplication of effort.

Appendix 16

(iii)

- Similarly, checks should be made in the case of places that have governing boards, trustees, etc., to avoid or reduce duplication of nominations.
- If for any reason the nominator considers that by registration a place might become threatened, the matter should be discussed with a suitable State Government body or voluntary society and/or with Commission staff. The nature of the threat should be clearly defined on the nomination form so that the Commission may consider suitable means to avert this threat.
- For the purposes of this initial listing the Commission will be relying heavily on assessments of the value of a nominated place previously made by recognised experts or expert bodies.

Standard Erosion Mitigation Conditions for
Logging and Clearing in New South Wales

1. General

(a) These conditions for mitigation of erosion shall apply to all land clearing, logging and forest operations controlled by the Catchment Areas Protection Board and the Forestry Commission of N.S.W. The Catchment Areas Protection Board authorises these operations under provisions of Section 21 of the Soil Conservation Act 1938, as amended. The Forestry Commission of N.S.W. exercises control of these operations on Crown timber lands under provisions of the Forestry Act 1916 as amended.

(b) The person authorised by the Catchment Areas Protection Board shall ensure that all activities connected with the clearing and/or logging operations on the authorised area shall be conducted in such a manner that erosion is not aggravated and shall carry out any instructions given by the Catchment Areas Protection Board or its nominee with a view to minimising or preventing erosion.

(c) Notwithstanding the following conditions, in catchments of major water storages and in areas where the erosion hazard so warrants, restrictions on the method and intensity of all forest operations may be imposed by the Catchment Areas Protection Board or the Forestry Commission of N.S.W.

2. Conditions for Logging

(a) Roading

Roads shall be located where practicable on ridges. They shall not intrude into filter strips beside streams except where the road crosses the stream.

Roads are defined as those maintained on some regular basis so that they are generally available for use.

A minor road is defined as one that is constructed for a short term specific purpose, e.g. for timber haulage from log dump or for access during clearing and is used at most intermittently.

(i) Roads

Roads shall be properly formed, and they shall be gravelled if the density of traffic so warrants, and this is specified.

All batters shall be constructed to a stable slope. Positive consolidation may be necessary on fills to minimise subsequent slumping and erosion of fill batters. Revegetation of batters may be required on some roads, and this shall be carried out when specified.

Adequate pipe drainage shall be provided in roads consistent with sound engineering practice so that erosion of the road surface and table drains is minimised. Pipes should discharge water onto undisturbed vegetation.

The use of borrow pits for the provision of extra material during road construction should be kept to an absolute minimum. Where use of a borrow pit is unavoidable topsoil shall be stockpiled and subsequently replaced to aid revegetation. The bottoms of pits should be graded and levelled, sides should be battered and shaped to conform to the surrounds and the replaced topsoil fertilized and seeded where necessary to establish a vegetative cover.

Maximum grades on roads shall be kept below 10°.

Bridges and culverts on roads shall be designed to transmit peak discharges consistent with the standard of road. Bridge approaches shall be stabilized and revegetated where necessary following construction. Culvert outlets should be located or designed to minimise scour and erosion.

Maintenance grading shall be carried out only where necessary and disturbance to vegetation should be minimised.

(ii) Minor Roads and Logging Tracks

Wherever the type of operations permit and as far as practicable, minor roads and tracks should be constructed with crossfall drainage.

Immediately after the logging operation has ceased (even if it is planned to use the road at any time in the future) the road or logging track shall be drained by cross banks where necessary. The channels of these banks must be constructed with a minimum gradient to ensure that there is positive lateral drainage onto the surrounding vegetation. Cross banks must not direct water directly onto other tracks or roads. The exits of these banks must allow water to escape readily from the track or road. The spacing of these banks will depend on the grade of the road or track and on the erodibility of the soil. Unless otherwise specified bank spacings to be employed are those in clause (ii) and the table under '(d) Snigging'.

For any operation the height of the cross banks shall be specified.

Immediately after operations have ceased on minor roads and logging tracks, the surface material shall be replaced as far as practicable and they shall be drained by banks unless otherwise specified. Seeding and/or fertilizing shall be specified where necessary.

The use of borrow pits should be kept to an absolute minimum, and if employed, should be dealt with as under '(i) Roads'.

Minor roads and logging tracks shall not cross running streams unless a causeway, bridge or pipe culvert designed to transmit peak flows has been provided. They may cross dry stream beds via causeways, temporary culverts or log crossings provided there is minimum disturbance to the surrounds.

"Blading-off" on minor roads and logging tracks shall be permitted only where track damage is minimal and where subsequent drainage and repair is possible.

Each "blading-off" operation must be specifically approved.

The use of minor roads should be minimised during wet weather. They should carry no traffic at times when there is runoff from the road surface.

(b) Filter Strips

(i) A filter strip is defined as a strip of existing vegetation retained along both sides of a stream.

(ii) A filter strip of existing vegetation shall be retained to extend at least 20 m on each side of a stream, and shall be provided downstream from the point on that stream where its catchment area exceeds (at most) 100 ha. Both the width of filter strip and the catchment

area may be varied if, in the opinion of the Forestry Commission or Catchment Areas Protection Board, slope, soil erodibility or stream conditions so warrant, in which case width and area shall be specified.

(c) Felling

(i) No tree shall be felled into a watercourse within a filter strip.

(ii) Trees may be felled into or within a filter strip. Tractors shall not enter the filter strip to remove logs.

(iii) No logging operations shall take place within 100 metres of the top water level of any major water storage.

(iv) No tree shall be felled within 20 metres of a prescribed stream as defined under the Water Act 1912, without specific authority.

(v) Logging operations should be carried out so that there is minimum disturbance within any watercourse.

(d) Snigging

(i) As far as it is practicable snigging should be uphill. Downhill snigging should not be practiced in areas of more erodible soils or where specified.

(ii) The drainage of snig tracks shall be carried out in the same way as for minor roads. The height, width and spacing of the cross banks shall be specified. Unless otherwise specified the following table shows the maximum bank spacing required for each grade and erosion class:-

Grade of Snig Track or Road	<u>Maximum Spacing of Banks Along Track or Road</u>	
	<u>Average Erosion Class</u>	<u>Extreme Erosion Class</u>
Less than 15°	60 m	50 m
15° - 20°	40 m	30 m
20° - 25°	20 m	15 m
25° - 30°	15 m	

Snig grades on extreme erosion class soils shall not exceed 25°, and on other soils should exceed 25° only where specified.

The extreme erosion class contains soils formed on granites (particularly deeply weathered granites) and on coarse sedimentary rocks such as easily weathered conglomerates and sandstones.

In the case of "outrow" extraction tracks in plantations, drainage shall be carried out when necessary as specified.

(iii) Snig tracks shall not cross the beds of defined streams without application of the same conditions which apply to minor roads and logging tracks.

(iv) Snig tracks shall not intrude into filter strips, except in (iii) above.

(v) A tractor blade should not be used to remove soil from a snig track except during initial track construction and during track drainage. "Blading-off" or snig tracks shall be permitted only where

subsequent track drainage is possible. Each "blading-off" operation must be specifically approved.

(vi) The use of snig tracks in wet conditions shall be minimised.

(vii) As far as practicable surface material should be returned to the track immediately after logging ceases on that track to aid in revegetation, and at the same time to reestablish crossfall drainage. In circumstances where it is considered necessary the method of revegetation shall be specified.

(e) Log Dumps

(i) Log dumps should be located as far as practicable in accordance with an uphill extraction pattern. In any case they shall not be located closer than 10 metres from a filter strip or drainage line.

(ii) When ungravelled dumps are constructed and unless otherwise specified, topsoil is to be stockpiled in a recoverable position. Upon completion of logging (even if further logging is contemplated in the near future) dumps are to be levelled where necessary, drained so that runoff is directed onto surrounding vegetation, and the topsoil spread evenly out over the dump. The dump shall be revegetated and/or ripped where specified.

(iii) Gravelled dumps shall be drained upon completion of logging so that run-off is directed onto surrounding vegetation.

(f) Burning

Any burning associated with logging operations shall be carried out only in accordance with the provisions of the Bush Fires Act, 1949.

3. Conditions for Clearing

Clearing for pasture or agriculture is defined as permanent clearing, while clearing for plantations of pine or eucalypt is defined as temporary clearing.

No clearing operation shall take place within 100 metres of the top water level of any major water storage.

No clearing shall take place within 20 metres of a prescribed stream, as defined under Water Act 1912, without specific authority.

(a) Permanent Clearing

(i) Clearing Method

Destruction of timber by ringbarking, felling, or poisoning shall be limited to areas with slopes not exceeding 27° unless otherwise specified.

Destruction of timber by the use of a bulldozer or other tractor shall be limited to areas with slopes not exceeding 18° unless otherwise specified.

Where retention of trees may be required, this shall be specified.

Clearing shall not be carried out between the banks and within strips at least 20 metres wide along each side of any creek, entrenched

watercourse or defined depression, or as specified.

In areas with risk of mass movement or in areas with soils of extreme erosion class, conditions for clearing shall be specified.

(ii) Roads and Tracks

Conditions are to be applied in the same way as for logging.

(iii) Windrowing, Stacking and Burning

Windrows shall be directed on the contour unless otherwise specified. Timber shall not be stacked or burned within 20 metres of a drainage line, stream or standing green timber unless otherwise specified.

Destruction of felled timber by burning shall only be carried out in accordance with the provisions of the Bush Fires Act, 1949.

(iv) Cultivation

Cultivation shall not be carried out on slopes in excess of 18° unless otherwise specified.

(v) Revegetation

Immediately on completion of operations disturbed ground and other bare areas shall be sown with seed and fertilized or otherwise vegetated. Where necessary, the method of revegetation shall be specified.

(b) Temporary Clearing

(i) Roads, Tracks and Filter Strips

Conditions are to be applied in the same way as for logging.

(ii) Clearing Operation

Clearing shall generally be restricted to slopes of 18° or less, and only in exceptional circumstances should exceed 25°. The method of clearing slopes over 18° shall be specified.

In areas with soils of extreme erosion class clearing shall not be carried out on slopes in excess of 18°.

(iii) Windrows

Windrows shall not be located within or across the bottom of drainage lines. They shall be located on the contour where slopes and soil erodibility dictate, and where this is specified.

Windrows should be separated from filter strips and other retained forest stands sufficiently to minimise damage during burning of the windrows.

(iv) Burning

Destruction of felled timber by burning shall be carried out only in accordance with the provisions of the Bush Fires Act, 1949.

(v) Ploughing

Ploughing shall not be carried out in the bottom of drainage lines. Ploughing shall be confined to slopes of less than 18°, except where specified.

In areas with soils of extreme erosion class the conditions for ploughing and planting shall be specified.

Forestry Commission of N.S.W.,
93-95 Clarence Street,
SYDNEY. 2000.

Circular No. 1083

H.O. 7892.

18th March, 1974.

Aesthetic and Environmental Aspects
of Forest Road Construction.

INTRODUCTION

It is becoming increasingly obvious that the Commission must improve its current practices in road planning, location and construction in order to keep pace with developing community demands in the aesthetic and environmental facets of forest roading. There is also a very real need to ensure that road construction practices do not cause accelerated soil erosion or water pollution.

The Commission is also actively encouraging the public to use the State's forests for recreation purposes. The expected upsurge in public use of forest road networks has focussed attention on certain deficiencies in current attitudes to road planning and construction. These deficiencies have manifested themselves mainly in an unnecessary reduction in aesthetic values from a tourist and visual angle, and in soil erosion and water pollution from a material point of view.

The need for change in the approach to various aspects of roading is usually highlighted by specific examples of bad practice, and subsequent changes in these cases represent a forced reaction to a negative situation.

While there have been a few of these specific cases highlighted in recent times there is also a considerable body of literature both from local and foreign sources which indicates that the need to make conscious efforts in the aesthetic and environmental aspects of road construction is one by no means confined to the local scene.

The Commission is anxious to inculcate a positive approach to aesthetic and environmental problems encountered in the forest. The present circular is confined to these problems when associated with road construction. For this aim to be achieved, it will be necessary for all officers concerned with forest roading to keep aesthetic criteria well in mind from the time of initial planning through to the completion of construction. Compromises will obviously be necessary at times, but a positive realisation of aesthetic aims can often produce a much superior road at little additional cost.

OVERALL PLANNING

Aesthetic and environmental aspects must receive due consideration along with the more traditional forestry criteria at the initial planning stage of any road or roading network.

Preference should be given to proposals which minimise disturbance of aesthetic values, which minimise soil erosion and consequential streamflow pollution and which highlight or enhance positive factors such as the viewing of outstanding landscapes or fine timber stands.

While these factors should be considered at all times, particular attention is necessary in forests which either are close to large population centres or possess outstanding tourist potential.

LOCATING FOREST ROADS

Opportunities to vary road locations exist according to the purpose of the road and the type of topography traversed.

In the case of logging roads in steep topography, the operational constraints of obligatory points, dump sites, steep sideslopes and rock occurrence often reduce the choice of road line possible to a fairly narrow corridor.

However, in many cases there are choices available. Other things being equal, preference should be given to ridge top roading over sideslopes or gully locations. The likely disadvantage of logging against gravity is more than countered by the following advantages of a ridgetop roading system:-

1. The greater distance from creeks and perennial streams results in a much more effective water filtration effect and reduces the amount of soil finding its way into streams. This filtering effect is further aided by the fanning out of snig tracks downwards as distinct from the concentration of tracks and surface water which results from logging down to a gully road.
2. There is less interference with subsidiary drainage lines.
3. The reduced number of creek crossings minimises soil disturbance on creek banks and (bridge) approaches.
4. The generally superior maintenance potential of ridge top roads - better drying, more natural gravel in the pavement, reduced necessity for pipe culverts both in number and size - makes them a better engineering proposition in any case.

CONSTRUCTION

The following specific aspects of road construction require careful attention:-

Clearing

Legitimate criticism can be levelled at the quality of the road-line clearing on some Commission jobs. This refers both to the width of clearing and the problem of disposal of the debris - these two factors are obviously closely related.

The most general criticism is that clearing is often wider than necessary. Excessive clearing may result in an unsightly scar and a high potential for costly maintenance due to scrub and weed regrowth.

Complete clearing should be restricted to the actual width required to accommodate the road formation including cut and fill batters. This width of course is not constant and will necessitate proper pegging, setting out and detailed supervision of the clearing work. Beyond this strip clear falling should be selective and intermittent and should be restricted to:-

1. Trees which are too close to the road or to the batters for safety - depending on size, type and condition, etc.
2. Clearing for sight distance - should not necessarily be clear falling and in fact more often should only be thinning.
3. Clearing to allow sun and wind on to the road to encourage surface drying - this is often over-done and should be looked at carefully.
4. Clearing of snags or over mature trees.

Appendix 18 (Cont'd)

5. Thinning of over-dense thicket regrowth or similar clearing to improve the aesthetic appearance of the roadside.

Apart from improving the appearance, this policy will have three main benefits:-

- a. the actual clearing work is reduced in quantity even though it requires more thought, sensitivity and supervision;
- b. the amount of clearing debris to be disposed of is minimised;
- c. the potential maintenance requirement in control of roadside scrub growth is minimised.

The other major improvement needed in clearing work is in disposal of debris and this problem is obviously proportional to the clearing width adopted.

Some forest roads with wide clearing present a most unattractive appearance with cleared trees stacked along the timberline. They also present lateral access problems and can inhibit future maintenance work.

Positive attempts are required to improve this facet of construction work and this will involve some additional cost. It may be necessary to cross cut trees for heaping and burning if this is possible, and to push what cannot be destroyed in this way back into the forest cover, or to carefully selected locations.

Particular attention is required in areas or on roads with high recreation potential and in forest types which are susceptible to damage by indiscriminate burning. In such cases it may be necessary to snig the debris away to a place where it can be burnt safely or otherwise disposed of.

Care should be taken to keep clearing debris out of creeks, gully retention strips and all other preservation areas. This will often require the disposal of timber and slash on the uphill side of the road at some additional cost.

The need for tractors to cross creeks should be closely watched and such crossings confined where possible to the actual road formation. It is essential that disturbance of creek beds should be minimised both in extent and severity.

Earthworks

The initial visual impact of a road springs mainly from the quality and finish of its earthworks. These should convey an immediate impression of a planned approach to the job which has been carried through to the finished product.

Where a designed road is being built, earthworks should conform closely to the design. Where the road is not designed, its finished state should reflect the fact that care has been taken to build and trim the formation in accord with good roading practice. There should be no evidence of false starts to cuttings or excessive or inconsistent formation widths.

Cut batters should be trimmed to the correct slope. Positive consolidation may be necessary on fills to minimise subsequent slumping and erosion of fill batters. Revegetation of batters may be required on important roads, particularly on susceptible soil types or in important catchments.

Appendix 18 (Cont'd)

Given good constructional practices in accordance with the foregoing, restoration, trimming and general tidying up of the roadside on completion of the earthworks is probably the most important visual factor of all in presenting an aesthetically satisfactory road. In some cases this finishing off work should include some amenity replanting.

Borrow Pits

One of the more unsightly aspects of Commission road construction is the widespread use of borrow pits to correct imbalances in the distribution of earth quantities. The aim should be to reduce the use of borrow pits to those cases where an economic alternative does not exist.

When borrow pits are unavoidable, they should be planned with their eventual restoration in mind. Where practicable, top soil should be stockpiled for subsequent replacement to aid revegetation. The bottoms of pits should be graded and levelled, edges should be battered and shaped to conform with the surrounds and all disturbed surfaces should be fertilised and seeded to establish a grass cover. Such action is particularly important in unstable soil types such as erodible granites.

Creek and Stream Crossings

Crossings of major streams should receive special attention at the planning stage. Surveys will aim to reduce creek crossings to the minimum and to keep roads as far away from streams as possible.

Disturbance of the creek bed must be avoided wherever possible and machine crossings restricted to the actual formation area.

Special attention should be given to the stabilisation and revegetation of bridge approaches when construction is complete.

Culverts

The discharge of culverts requires special and individual consideration particularly where the outlet is located other than in the natural stream channel. This is the case with relief culverts and where the slope of the water course requires the culvert to be laid across the flank of the gully or to emerge in a fill batter. In these circumstances the discharge should be either conducted back to the stream or encouraged to spread gradually over the ground, the main principles in both cases being to dissipate the energy without causing scour or erosion. Where considerable height has to be lost, this may entail grassed or paved waterways, corrugated metal or pre-cast concrete fluming, jute mesh and bitumen emulsion treatment, stone pitching or various other methods.

Soil Stabilisation and Revegetation

The stabilising of bare earth surfaces after road construction is most important. Good road construction practices may be sufficient to revegetate stable soils on gentle topography.

However specific attention must be paid to problem areas, particularly where soils are unstable or in steep topography.

The batters of major fills and earthworks in bridge approaches will usually require seeding and fertilising to promote fast revegetation and surface stabilisation. This treatment should also be extended to borrow pits and cut batters where necessary.

Gravel Pits

It is difficult to make a gravel pit into an aesthetic attraction unless it becomes a lake.

However, a little consideration in the preparation and method of working can improve the appearance of a pit which can be seen from the road.

Where the choice is available, pits should be set back from the road and the workings screened by the retention of natural tree cover.

Guide Posts

Apart from the primary purpose of safety, guide posts add a finishing touch to a road and are relatively inexpensive. They should be used more than they have been in the past. Similarly the fence or side structure at motor ramps, bridge curves, etc., are visually very important and should receive particular care.

General

Some of the above points represent significant changes from the basic road construction practices hitherto employed by the Commission. They will cost money to implement and will result in increased road construction costs.

Nevertheless they are important and can no longer be ignored. It is confidently expected that attention to these factors will produce a marked improvement in the aesthetic and environmental effectiveness of forest road construction at an acceptable increase in cost.

Each District Forester should ensure that foresters, foremen and plant operators fully appreciate the changed emphases outlined in this Circular, so that the Commission's requirements in the aesthetic and environmental facets of forest roading can be successfully translated into practical achievement in the field.

A. R. COCKS,
Secretary.

per: