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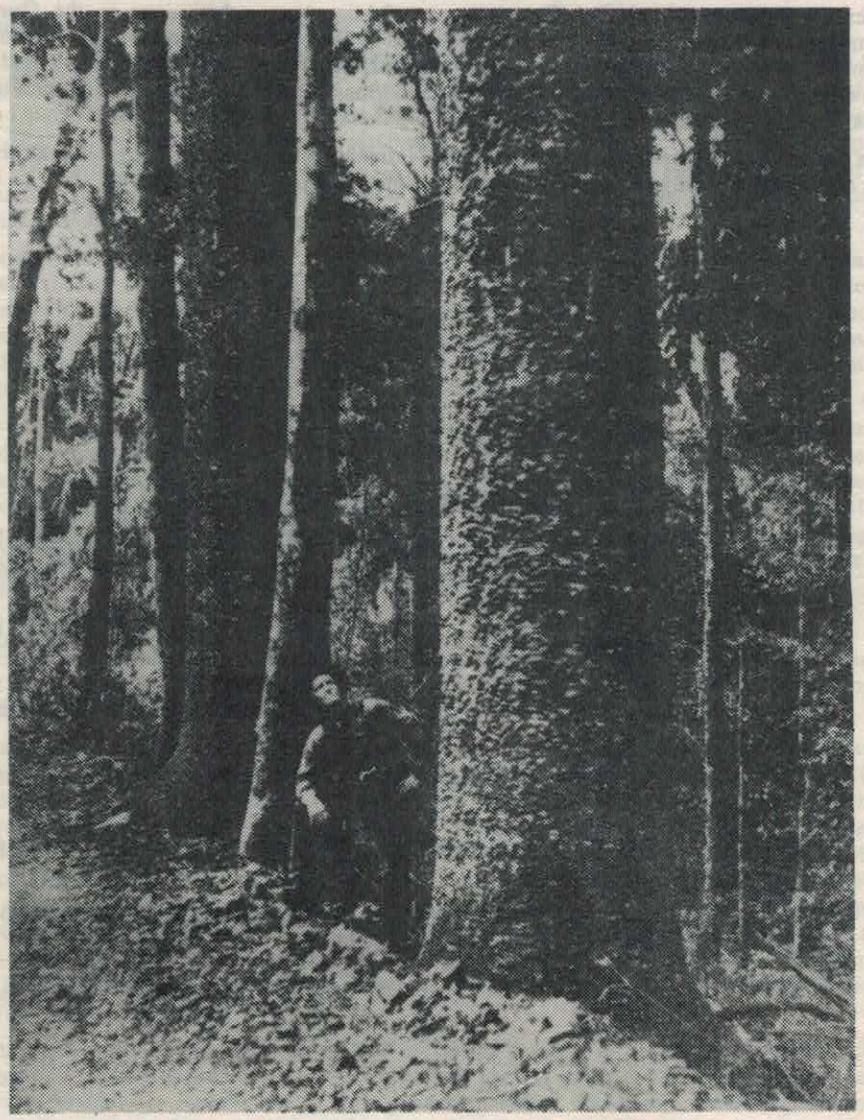
# Eighth Romeo W. Lahey Memorial Lecture
## 15 March 1984



*Mr. Lahey examining a hoop pine tree*

Eight Romeo Watkins Lahey Memorial lectures sponsored by the National Parks Association of Queensland have been delivered to honour the memory of one of the founders of the National Parks Association of Queensland and its President from 1930 to 1961. On his retirement as president, Mr. Lahey, M.B.E. was elected Life Councillor. He died on 26 October, 1968 at the age of 82. After a tremendous effort from 1911 to 1915 his plan for reservation of Lamington National Park was approved in 1915. A civil engineer by profession, he served in the first A.I.F. and in the Australian Army in World War II.

Under his guidance, the N.P.A.Q. was successful in many submissions to the Queensland Government for National Parks in widely spread parts of Queensland. In his 70's, he completed field work on the Association's proposal for a large National Park based on Windsor Tableland and the eastern escarpment including Daintree catchment and Mossman Gorge. Most of his plan for this large National Park in North Queensland was accepted by the Government.

In his lifetime he had the satisfaction of seeing the National Parks of Queensland grow to an area of 2.3 million acres, much of which was due to proposals submitted by N.P.A.Q.

## AIMS AND OBJECTS

(1) To preserve intact in their natural condition the existing National Parks of Queensland; and to secure the reservation of all suitable areas.

(2) To educate public opinion to a fuller appreciation of the necessity and value of National Parks.

(3) To form a link between the public and the administration dealing with the National Parks.

(4) To co-operate with other organisations having the same or similar objects.

(5) To assist in the enforcement of protective regulations concerning National Parks.

**Membership is available to any person who is in accord with the above aims and objects.**

Eighth Romeo Lahey Memorial Lecture
15th March, 1984

# THE RESERVATION OF RAINFOREST IN QUEENSLAND

By G.H. Cossins

## Introduction

Mr. President, Distinguished Guests and Fellow Members, I should like to commence this Romeo Lahey Memorial Lecture by thanking the Council of the National Parks Association of Queensland for their kind invitation to speak. Firstly because the subject is one to which I have given some attention in recent years, and have found it to be very interesting, secondly because it is a subject of deep public interest, but more particularly because it was our Founder's interest in rainforest which led to the proclamation of Lamington National Park, and to the establishment of this Association. From such beginnings N.P.A.Q. is still persisting in its aim for more National Parks in Queensland.

It is notable that not only Lamington N.P. and Witches Falls N.P., the first Park in Queensland, but also most of the early Parks, were rainforest parks or at least had a rainforest component. It is interesting to consider why this should be so. Australia lies astride the Tropic of Capricorn, and in common with other countries similarly situated, expereinces a somewhat arid climate. Its vegetation is predominently eucalypt and acacia, and it is possible that the cool moist forest, with its waterfalls and perennial streams, was a welcome contrast. Here was a new and different world.

Early in colonial history, rainforests had been exploited for their cedar and other trees such as black bean and maple, so valued by the cabinet maker. By the time that Lamington N.P. was finally reserved in 1915, large tracts of rainforest had already been cleared, principally for dairying and sugar growing. At that time the principal motives for reservation were the preservation of landscape and a spiritual regard for the forest. It was only in later years that a disquiet was felt that a valuable resource was disappearing too rapidly. Before proceeding to consider in detail the reservation of rainforest some attention should first be given to the nature and occurrence of this ecosystem.

## What is rainforest?

This is a question which has been examined for many years by the recognised authorities in this field. The fact that no definition of rainforest has received general acceptance to date allows us to approach the problem from a different angle.

Let us look at a subtropical rainforest in South Queensland such as we are most familiar with. By contrast with the surrounding forests and woodlands, rainforest is much more complicated. It is dark, cool and moist. There is a bewildering variety of trees, bedecked with vines and epiphytes such as the King Orchid *Dendrobium speciosum* and the Crows Nest Fern *Asplenium nidus.* Towering tree trunks disappear into a mass of foliage which obscures the sun. Some of the trunks are reinforced with buttresses reminiscent of an old world cathedral. The floor of the undisturbed forest can be surprisingly open, and littered with decaying tree trunks, on which masses of moss and fungi can be seen. The herbage of the open country is missing and may be replaced by ferns. Considering the mass of foliage above, the leaf litter is surprisingly light. The fallen leaves comprise a wide variety of simple and compound forms, and are soft to touch. Their common feature is a curved pointed apex, the drip tip. In swampy places, palm forests replace other species.

Closer examination shows that the roof of the forest consists of a number of layers. Scattered emergents of a number of species dominate the closely packed canopy, while young suppressed trees await an opportunity to replace one of their giant neighbours, when storm or old age presents the possibility. Then the race is on, one tree gains a place, the others decline. The fallen giant joins the rapidly decomposing litter on the forest floor. Many species of trees are scattered randomly throughout the forest, but no one species dominates.

Light is essential to all plants, and in the closed environment of the rainforest, a number of strategies are adopted. Trees grow upwards to reach the light, as do vines which use the trees for support. The trees become host to ferns and orchids, which germinate high in the canopy. This latter strategy is improved on by the strangler fig. It germinates in a convenient niche, sends down roots, and in developing encompasses the death of its host, which it finally replaces.

Under the stimulus of moisture and heat, the small fauna of the forest, fungi and ultimately bacteria rapidly reduce dead material to a form suitable to be taken up by the trees as nutrient. Recycling of leaf litter in warm moist conditions can be particularly rapid, resulting in a much higher proportion of the nutrients being held in the trees as opposed to the soil, when compared with other types of forest. It is easy to make the false assumption that any land which carries heavy rainforest must be very fertile. Some rainforests occur on deep, fertile soils, but this is not always the case. A few years after clearing rainforest from certain soil types, the soil organic matter has almost disappeared and such nutrients as have not been leached by rainwater are rapidly consumed. Successive yields of grass or crop are increasingly disappointing. It is not realised by most people that rainforest forms a closed cycle system. Its closed canopy buffers the effects of dry periods, establishing a warm moist microclimate which promotes growth. Further, the canopy baffles the force of the rain and reduces the size of the raindrops, and so contributes to the balance between soil formed and soil lost.

## Occurrence of Rainforest

Before examining rainforest in other parts of the State, it would be pertinent to consider its distribution. In Queensland, rainforests extend in a broken chain along the east coast from Torres Strait to the Queensland-New South Wales border. Broadly they fall into four main groups, i.e. the Monsoon Forests of Cape York Peninsula, the Tropical Rainforests between Cooktown and Ingham, the Subtropical Rainforests of Central and Southeast Queensland, and the Bottle Tree Scrubs of sub coastal South Queensland. The coastal groupings are separated by dry corridors of eucalypt forest and woodland, which lie between Coen and Cooktown, Ingham and Bowen, and St. Lawrence and Gladstone respectively. The Bottle Tree Scrubs are scattered over an area of sub coastal South Queensland. Webb and Tracey (1981) have identified their core area as lying between Boonah and Biloela.

Webb and Tracey (1981) showed that these rainforests consist of a number of structural types growing on a wide range of soils of varying nutrients status. Climate, topography and other edaphic factors are involved in determining the structure of a particular type of rainforest. In accordance with these factors, rainforest may be found on plateaux with basalt derived soils, the summits of granite ranges, tropical lowlands, the enriched sands of coastal dunes, and as gallery forests on river alluvium in otherwise dry areas.

The extent of surviving rainforest in Queensland is a matter of controversy at present. Webb and Tracey (1981) estimate that only one third of the original forest remains. Recently a Forestry Department spokesman claimed that 50% was the correct figure, but he may have been quoting from the Forestry Department's Information Sheet No. 19, which states 50% in relation to the Ingham Cooktown forest, and not for Queensland as a whole. Whichever estimate is closest, rainforest in Queensland has always been a scarce resource, and now is extremely so.

## Northern Tropical Rainforest

The description of rainforest given previously applies to South and Central Queensland, and must be amplified to cover the Ingham-Cooktown region, where such areas of lowland tropical rainforest as remain are more complex. Here three canopy layers occur, there is a profusion of orchids and aroids, cauliflory is common, and the size of leaves is generally larger. Tree species are more numerous, and in mature forest there is a patchiness in their distribution. It is in these forests that primitive angiosperms or flowering plants are found. The term complex is well illustrated by the Calamus species, the climbing palms. In South Queensland there is only one species *Calamus muelleri*, the infamous wait-a-while. There are at least five species in the northern forests.

Altitude and temperature are factors in the distribution of rainforest. The lofty ranges of the Ingham-Cooktown region lie close to the coast, and here the changes effected by altitude and temperature are well illustrated. With an increase in elevation, the forest becomes less complex, the trees are shorter, the leaves smaller, aroids decline and are replaced by ferns, until at windswept heights the canopy is reduced to a single layer of low thicket with tiny leaves. A decrease in rainfall has a similar effect.

**Monsoon Rainforest**

Beyond the Bloomfield River the altitude decreases as does the rainfall, which is increasingly restricted to a short summer season. The remainder of the year is hot and dry. Rainforest still persists on the higher ground or in gallery forests along rivers. Nature compensates by increasing the number of deciduous trees, which respond to the dry season by discarding their leaves. This is the Monsoon Rainforest of North Queensland. In such places as the McIlwraith Range, the extra elevation intercepts the south east wind and forests reminiscent of those further south are found. However, on the western aspect in the rainshadow, the rainforest is monsoonal. The Iron Range area benefits from the effects of a persistent southeast wind, which impinges on elevated ground and supports a low-land rainforest.

**Response to damage**

The recent serious wind damage to the rainforest in Lamington N.P. raises the question of the extent of recovery which can be expected. The McPherson Range is the northern limit of the Cool Temperate Rainforest, characterised by the Antarctic Beech *Notofagus moorei* This could well be a relict vegetation which will have difficulty in recovering.

Since disturbances occur in rainforests, and their consequences have a bearing on the later threads of this address, it is proposed to briefly outline the four stages recognised in the regeneration of rainforest in South Queensland. For convenience let us assume that a few hectares, adjacent to primary rainforest were cleared for grazing and later abandoned. Firstly pioneer species such as *Omolanthus populifolius* (Bleeding Heart), and *Solanum mauritianum* (Wild Tobacco) appear. These plants are short lived, but produce large quantities of viable seed. They are intolerant of shade, and although readily available to commence repair, are shaded out by the second stage of fast growing tres which can rise to 25 metres and live from 15 to 50 years. One of these is *Dendrocnide photinophylla* the all too familiar Gympie Stinging Tree. The seedlings of these second stage trees are also intolerant of shade, and are gradually eliminated by third stage trees such as White Cedar, Hoop Pine and the Flame Tree. In turn a fourth and final stage is reached by trees which are slow growing but longest lived. They fruit irregularly and their seeds are larger, not so easily dispersed, and viable only for a few weeks. *Argyrodendron, Eugenia* and *Elaeocarpus* are a few examples.

Hopkins et al (1977) state that by 40 to 50 years of growth, almost all the species of the nearby primary rainforest are represented in the understorey. Another 40 to 50 years may be required before the fruiting stage is reached. They consider that this secondary forest would not be fully reproductively independent of the adjacent primary forest until it is 100 years old. The regenerating forest increasingly resembles the primary forest as the trees become intermixed. It is considered that two or three mature species generations are required to produce a mature forest, and in South Queensland this may total 800 years.

Where a single tree is lost, the gap is rapidly filled by suppressed trees waiting their opportunity. In larger gaps where the suppressed trees are also brought down, trees of the second stage quickly fill the breach. The process of repair is then followed as previously described.

Since cyclones, droughts, and other natural causes disturb the forest periodically, it is never uniform. Recovery depends on several factors, for example on the nature and extent of the disturbance, and the availability of seed. There is no problem in the first two stages since seed production is high and viability lengthy. In the later stages this is not so, since seeds are larger, more difficult to disperse, and do not remain viable for so long. In nature the success of the final stages depends on the proximity of mature

forest as a source of seed. Extensively cleared areas could not be expected to regenerate unaided, except on a very lengthy time scale.

The pattern of succession cannot always be anticipated with certainty. It depends on the nature and extent of the disturbance, the fertility of the soil, and the proximity to other rainforest. On areas of low fertility, such as those on granite-derived soils or coastal sand dunes, rain forest can be affected by loss of soil nutrient and may not return to the original composition. The new vegetation may favour fire which further deflects the possibility of return. The presence of a species like lantana can produce conditions which are unsuitable for later phase species. Because of the time lag due to the longevity of rainforest trees, a forest may be out of phase with a changing climate. In these circumstances, the regenerating forest may have a different composition from that of its predecessor. (Hopkins, 1981). This is the basis for concern in the Antarctic Beech areas of Lamington National Park. The predictability of succession must be borne in mind when considering interference with rainforest.

**Ebb and Flow of rainforest**

The shortness of our lives promotes the impression that we live in an unchanging world, that the hills and forests have ever been so. Geological science has now demonstrated that the hills are not everlasting, but it may come as a surprise that at least some parts of the North Queensland rainforest are very young. It is now believed that much of this forest is not more than 8,000 years old. Kershaw (1978) studied fossil pollen sequences at four sites near the eastern edge of the Atherton Tableland. Lynch's Crater, one of these sites, today lies in the Complex Mesophyll Vine Forest zone, an area of high rainfall and complex rainforest. Kershaw concluded that the area and nature of the forest had varied considerably in relation to the climatic changes induced by the advance and retreat of glaciation on a world-wide scale. It seems that between 83,000 and 79,000 years ago, a cool wet climate supported a simple microphyll vine and fern forest. Gradually rainforest elements became reduced and conifers appeared, producing a Low Microphyll Vine forest similar to a Hoop Pine Scrub during the period 76,300 to 63,000 years ago. The climate became warmer and wetter between 63,000 and 50,000 years ago, and the area was covered with Complex Notophyll Vine Forest with *Araucaria*. Between 50,000 and 38,000 years ago it bacame drier and Low Microphyll Forest returned. From 39,000 to 8,000 years ago it became drier still and eucalyptus and casuarina woodland covered the area. Then after 8,000 years ago the climate became warm and moist, and the complex mesophyll and notophyll vine forests found by the early settlers appeared. This leads us to consider where this complex rainforest had been in the intervening years.

**Refugia**

It was to be expected that, despite the dry conditions during the glacial periods of the Quaternary Ice Age, some areas would continue to enjoy conditions required to support rainforest. In this direction Webb and Tracey (1981) have made an important contribution to rainforest studies, by identifying these refuge areas or 'refugia' as follows.

(1) Large relatively wet areas.
(2) Small relatively dry topographic isolates.
(3) Small, often narrow edaphic isolates.
(4) Topographic-edaphic-climatic isolates.

In confirmation of these views, it is found that an unusually high concentration of primitive angiosperms or flowering plants and localised endemics are found in the larger and more diversified of these refugia.

Large relatively wet areas occur on the summits of mountain ranges, in gullies on the upper slopes of cloudy wet mountains, on very wet lowlands, and in deep moist gorges of coastal and subcoastal lowlands. It is interesting that granite and schist formations offer a greater diversity of landscapes, which provide survival niches, than do basalt ones.

Small relatively dry topographical isolates are found on bouldery outcrops, and in rock crevices in dry subcoastal country, where they are protected from fire.

Small often narrow edaphic isolates are small areas where moisture, soil fertility and drainage are favourable. These are found in gallery forests, coastal dune systems, some well drained mangrove fringes, tropical coastal freshwater seasonal swamps and coastal hillside gullies.

Topographic-edaphic-climatic isolates are found on relatively moist mountain tops and in drier areas where the soils are derived from residual basalt caps or from granite.

**Distribution of Refugia**

In terms of this paper, the distribution of refugia is very important, since by their very nature they should be reserved.

Webb and Tracey (1981) identified the principal large wet refugia in the humid forests of North Queensland as —

(1) Mt Finnegan (Cedar Bay N.P.) (2) Thornton Peak (Cape Tribulation N.P.) (3) Mt Windsor Tableland (partly in Daintree River National Park) (4) Mt Carbine Tableland (5) Lamb Range (6) Malbon Thompson Range (7 & 8) Bellenden Ker and Bartle Frere (Bellenden Ker N.P.) (9) Herberton Range (10) Walter Hill Range (11) Seaview Range (12) Cardwell Range.

A number of permanent rivers from the Bloomfield south to the Herbert flow through very wet lowlands, but much of this has been cleared or at least converted to private tenure. Wet coastal gorges occur on these rivers, and gallery forests would have persisted along the rivers from the Normanby to the Tully.

Further south, moist upland refugia are located in Mt Elliott N.P., Eungella N.P., the McPherson Range (several N.P.'s), and in the Conondale Range, where an extension to the present small National Parks is being sought.

Small relatively dry topographic isolates are found in Cape York Peninsula and the sub-coastal areas of Central and South Queensland. These refugia survive in small areas protected from fire, and are usually deciduous vine thickets, such as one near Coen.

Small, often narrow edaphic isolates-Gallery forests are found on the Archer, Claudie, Lockhart and Mitchell Rivers, and the streams draining from the McIlwraith Range. Dune systems with enriched sands support vine forest on Fraser Island, and in the Cooloola area.

Topographic-edaphic-climatic isolates occur on deep soils derived from basalt or granite, and are found on moist elevations in generally lower rainfall areas. These include McIlwraith Range (proposed N.P.), Mt Webb N.P., Iron Range N.P., Mt Dryander, Many Peaks Range and the Bunya Mts N.P. Related to this type are patches of closed forest on basaltic soils in low rainfall areas. This type of forest is only protected by the fact that the surrounding open grassy woodlands do not build up intense wildfires. A good example is in the Forty Mile Scrub N.P.

**Distribution of Rainforest Fauna**

Since animals and birds are an integral part of the rainforest ecosystem, and play a vital role in pollination, seed dispersal and litter breakdown (Hopkins et al, 1976), consideration of their distribution is important in the context of rainforest reservation.

The situation is summed up by Winter (1978) who recognised three major groups of mammal habitats, each with a focus from which the species radiate in ever decreasing numbers.

(1) There is a concentration of Southeast Queensland-Northeast New South Wales species in Southeast Queensland, which includes several endemic species such as the rednecked pademelon. The focus or core area is seen in the Lamington N.P. and the Wiangaree State Forest. Species disappear northwards terminating in the rainforests of the Mackay area, in which the species recorded are those with a range further north. However the Mackay area had not been intensively surveyed at the time of writing.

(2) The Ingham-Cooktown region presents a more complex situation. It is virtually two areas, joined by a strip of rainforest in the vicinity of Kuranda. The highest mountains in the state lie close to the coast, and by virtue of their altitude offer a wide range of habitats from shoreline to mountaintop. In this region are eight known endemic species of mammals, six of which are found in the southern half of the forest, and two, Bennett's Tree Kangaroo (*Dendrolagus bennettianus)* and the Thornton Peak melomys in the northern section. A third endemic could be included in the north if a sub-species of the Herbert River ringtail (*Pseudocheirus herbertensis cinereus)* is accepted as such. Only two of these endemic species are found over the whole altitudinal range. The other six are confined to the forests above the 300 metres level, which is the upper limit of mesophyll vine forest. Winter in a private communication referred to in the Forestry Department's Position Paper in 1983 has described two core areas, one centred on Thornton Peak and the other on the Bellenden Ker area. Between them they contain all the mammals of the Ingham-Cooktown region including the endemic species. Fewer species are found with increasing distance from centres of the core areas. It is interesting that these core areas roughly correspond with two of Webb's refugia.

(3) In Cape York Peninsula a chain of rainforests extends from Torres Strait to the vicinity of Coen. These forests contain 15 species of mammals, ten of which are shared with New Guinea. Three mammals, the Grey Cuscus (*Phalanger orientalis)*, the Spotted Cuscus (*Phalanger maculatus)*, and the Spiny-haired or New Guinea Bandicoot (*Echynipera rufescens)* have their southern limit in the McIlwraith Range. There are no endemic species in Cape York Peninsula. Hynes and Tracey (1980) state that 13 species of birds find their southern limit in the Iron Range Area.

Winter (1978) states that avifauna may be grouped in the same manner as mammals. In Southeast Queensland, the endemics include the Albert Lyrebird and the Rufous Scrub Bird. Again a number of species occupy variable ranges as far north as Mackay.

Altitude is also a factor in the distribution of bird habitats in the Ingham-Cooktown rainforest. Of the ten endemic species, seven are confined to the uplands.

The avifauna is constrained to some degree by the dry woodlands between Coen and Cooktown, but in the other direction it is largely shared with New Guinea. The Torres Strait pigeon, which breeds on islands off the coast below Cooktown, is one of two fruit eating birds which rely on the chain of rainforests on their annual migration to New Guinea.

There is little space to consider reptiles and amphibians, but mention should be made of the Platypus frog, which is confined to the Conondale and Blackall Ranges, and of its recently discovered relative at Eungella.

It is interesting to note that the ant fauna of the Iron Range area is Papuan in character. About half of these species are found further south, in the Ingham-Cooktown rainforest. Here they are restricted to the lowlands below 350 metres: above this level the population is old Australian (Taylor, 1972).

Unfortunately time does not permit further consideration of this interesting fauna, but it is its distribution which is pertinent to this paper.

## Faunal Response to Habitat Change

All fauna require food and shelter, and the impairment of these must have a deleterious effect on the population.

Normally fire only has a minimal effect on the margins of rainforest, however it can be serious in two sets of circumstances. Repeated burning can slowly destroy quite large areas of rainforest in the course of time, while severe cyclone damage in proximity to sclerophyll forest can provide combustible material for hot fires in a dry period: Die-back due to *Phytophthora cinnamomi*, a root rot fungus to which the laurel family is prone, is potentially dangerous in rainforest. The wallowing of feral pigs and the cutting of logging roads have been claimed as vectors in the transmission of this disease.

Cyclonic damage and canopy reduction by logging are the major causes of habitat change. It would seem that the effects depend on the diet and nesting or denning practices of each particular species. An animal depending upon a restricted diet, or specialised nesting conditions, would be more at risk than one which can readily adapt to the new conditions. A decline of possums could be expected owing to a loss of den sites, whereas insectiverous birds of the lower strata could actually experience a short term increase.

A number of studies have been done on this subject. Pattemore and Kikkawa (1975) report that selective logging temporarily reduces the frequency of birds, but with a reversion to mature forest, the successive changes in vegetation are accompanied by changes in bird distribution, until the composition and population sizes return to something close to those of intact forest.

Preen (1981) studied vertabrate fauna in detail and reported that some amphibians and reptiles are adversely affected by changes in microclimate, due to canopy opening. Endemic marsupials are reduced, as also are some of the possums. As in the case of floral succession, recovery of faunal numbers would be greatly accelerated by the presence of nearby intact forest.

Winter (1978) states that 'to our knowledge no species of rainforest mammal has become extinct since large scale clearing commenced with the advent of European man in Australia'. However in an ecosystem in which a high percentage of the flora is yet to be described, and in which new mammals may still be found (vide the Thornton Peak melomys), it is always possible that some faunal extinction has occured unnoticed, and may do so again.

### Rainforest as a source of Chemicals

The Aboriginals were familiar with many rainforest plants as a source of food, medicine and narcotics. Systematic research for medicaments began during the Second World War, and has continued. The 28 alkaloids derived from the bark of *Himantandra*, a tree which belongs to a primitive family of plants in North Queensland, serves to illustrate the potential of rainforest in this regard, (Webb 1969). It is interesting that Francis (1951) writes that *Himantandra baccata* was milled at Boonjie, Atherton Tableland, and that the wood was used in cabinet making.

### Wet Sclerophyll Ecotones

In South Queensland it is common for rainforest to be separated from open dry sclerophyll forest by a belt of open forest of eucalypts with an understorey of rainforest plants. *Eucalyptus grandis* (Flooded Gum), *E. microcorys* (Tallowwood), and *Tristania conferta* (Brush Box) are common in this situation. These ecotones are probably the result of fire causing attrition of the forest margin. The seedlings of open forest trees appear and grow quickly followed by the rainforest understorey which shades out further open forest tree seedlings. In the absence of fire, the open forest trees die out in time and the rainforest prevails. In the meantime, the ecotone protects the rainforest from drying winds. Although this wet sclerophyll forest is not closed forest, it is a precursor of rainforest in that when the eucalypt seedlings fail to germinate the forest behaves as repairing rainforest, and should be classed as such. However the standing eucalypts and tristanias are valuable from the aspect of timber production, and those so interested conveniently refuse to recognise this ecotone as developing rainforest.

In North Queensland, this ecotone forms a mosaic with rainforest, and is probably the result of cyclones as well as fire. Some of these northern vine forest ecotones are dominated by acacias as emergents instead of eucalypts.

### Classification of Rainforests

As the area of rainforest diminished, so interest in the fate of the remainder grew. Any policy of management requires a detailed knowledge of the subject, and a convenient framework for relating its different aspects. Rainforest varies greatly between Cape York and Tasmania. The problem was to find an all embracing framework which adequately described the various vegetation types and established a relationship between them. A commonly used method is to type the system in terms of a predominant plant or alliance of plants, but the very diversity of rainforest prevents the adoption of this approach.

Building on earlier attempts, Webb (1959) developed a structural classification utilising such features as the most common leaf size, the number of canopy layers, emergens, the abundance of vines, mosses, other epiphytes, palms, tree ferns and plank buttresses. The result was a set of rainforest types bearing such familiar names as Complex Mesophyll Vine Forest or Semi-Evergreen Vine Forest. Elaboration of this classification required very detailed pro-formas for gathering data in the field. This approach is useful for large scale systematic survey and has the advantage that a deep knowledge of botany is not necessary.

Webb et al (1981) published a floristic classification which permits the identification of floristic provinces, and may form the basis of a detailed examination of rainforest.

Tracey and Webb (1975) published a series of 15 maps containing 25 types of vegetation, covering the forests between Ingham and Cooktown. Including sub-types 17 types of vine forest were identified, together with a further 10 vine forest types in which eucalyptus and acacia emergents occur. These maps in conjunction with a booklet by Tracey (1982) provide a useful ecological framework for land use planning in the northern tropical rainforest.

The introduction of mapping by aerial photography provided a method which is particularly useful when large remote areas are to be examined. Stanton (1975) made good use of this process, when studying Cape York Peninsula with a view to identifying areas worthy of being included in the National Parks Estate. After recognising various vegetation types from photographs, he tested his conclusions by following transects on the ground, and so refining his methods.

The Downey Creek rainforests were first classified by Tracey and Webb (1975), who identified three types of rainforest. Hopkins and Graham (1981) using more detailed aerial photos and ground surveys of structural features and soil types, identified 13 rainforest types in the same area. Lest this appears to be an extreme academic exercise, Kikkawa (1968) pointed out that more detailed mapping of some eucalypt woodlands revealed scattered islands of rainforest with tenuous connections, which are of great significance for the migration of birds.

### Early Park Reservation

Witches Falls N.P. 441 in 1908 was the first National Park to be declared under the Queensand State Forests and National Park Act 1906. About 20% of this Park is complex notophyll vine forest, and much of the remainder is wet sclerophyll forest. Bunya Mountains N.P. 603 came later in 1908, and Cunninghams Gap N.P. (now Main Range N.P. 933) in the following year. Both of these contain extensive areas of rainforest. Despite the persistent efforts of Robert Collins and later Romeo Lahey, Lamington N.P. 496 was not declared until 1915. By the end of the Second World War, a large number of National Parks had been declared in Queensland. A high proportion of these was islands along the Queensland coast, or caves in the Chillagoe district. Quite a few of these islands and caves were associated with small patches of rainforest. The majority of the other parks contained much rainforest, notably Conway Range, Whitsunday Island, Bellenden Ker, Hinchinbrook Island and Eungella National Parks.

### Later Reservations

In recent years, many more rainforest Parks were gazetted — some large, some small. Prominent amongst these in North Queensland were Daintree River N.P. 133, Iron Range N.P. 8, Cedar Bay N.P. 212, Cape Tribulation N.P. 164, and Jardine River N.P. 26. The National Parks Association of Queensland has been active in this direction since its inception in 1930. Keith Jarrott's Romeo Lahey Lecture of August 1980 gave an impressive list of National Parks recommended by this organisation, and which were subsequently gazetted. Many of these Parks contain rainforest.

These years saw the introduction of park selection by scientific methods, and for scientific reasons. The ideas that adequate representation of all ecosystems should be conserved in National Parks, and that it is vital for gene pools to be maintained, were gradually accepted and diseminated. It was realised by many that nature has a right to its own existence, and that everything should not be converted to man's

immediate use. The fruits of the systematic approach may be seen in the case of rainforests in the work of Dr. Len Webb. He realised that except for fringe areas on the lower slopes of highland National Parks, there was no National Park in the mainland coastal tropical belt below 330 metres. In 1966, he published recommendations for the reservation of 20 areas covering ecosystems not then represented in the National Park Estate (Webb, 1966). Sixteen of these areas have been reserved to date, in part or in whole. Reference has already been made to the work of Peter Stanton in Cape York Peninsula (Stanton, 1976). As a result Jardine River and Iron Range National Parks are now part of the system.

Daintree River N.P. 133, gazetted in 1961, was the culmination of Romeo Lahey's career. He examined the Mt Windsor Tableland and the Daintree and Mossman River catchments. A large scale model of the area, later donated to the Forestry Department, was constructed, strikingly demonstrating the contours. N.P.A.Q. based it's submission for a major rainforest park in this region on Romeo's field work.

So far fourteen rainforest National Parks have been mentioned in this paper. There are other large parks with rainforest components including Archer Bend N.P. 3 and Lakefield N.P. 10. Besides these there are many smaller Parks. Some near Brisbane such as the Tamborine and Springbrook groups of Parks, and those on the D'Aguilar, Condondale and Blackall Ranges, have a high visitor attendance. The Ingham-Cooktown rainforests have many small Parks, not only of interest to the tourist, but of importance in preserving examples of scarce vegetation types. Just to mention a few, there are Black Mt N.P. 166, Lake Eacham N.P. 202, Lake Barrine N.P. 398, Magnetic Island N.P. 398, Edmund Kennedy N.P. 771, Barron Falls N.P. 904, McNamee Creek N.P. 1311, and Russell River N.P. 1353. This by no means exhausts the list.

Queensland has been very fortunate in the activity displayed by the Forestry Department in the past, and in more recent times by the National Parks and Wildlife Service of Queensland, in assembling an array of rainforest National Parks of which the State can be proud. However, valuable as the present Parks are, they do not encompass a number of areas which are important for the preservation of adequate wildlife habitats for certain types of fauna and avifauna, of certain rainforest types, and of rare and important plants. This will be the subject of the remainder of this paper, but only after we consider the pros and cons of logging the remaining intact rainforests.

## To Log or Not to Log?

The Northern Tropical Rainforest between Ingham and Cooktown is divided for administrative purposes into six sawlog supply areas. The State Forests of the first five supply areas, which lie between Ingham and the Daintree River, have already been logged in the most suitable areas with the exception of S.F. 144 on the Mt Windsor Tableland, which is in the process of being logged. The only largely intact rainforests are those in Timber Reserve 165 in Supply Area 6, and those in the Timber Reserves in Cape York Peninsula.

In 1981 the Forestry Department published a Position Paper in which it reviewed its management strategy at that date. It stated that the Department would continue to log forests on a sustainable basis from 1986, but despite this it anticipates a shortfall in production which it proposes to bridge by planting 20,900 ha of pine trees. It also stated that it would log T.R. 165, which lies beyond the Daintree, if it is decided to bridge that river.

A further Forestry Position Paper 'Rainforest Research in North Queensland' was published in 1983. This paper presents the theme that rainforest is periodically subject to natural disturbance of such a frequency that no part of the forest reaches a climax, that this subclimax condition contains a wider diversity of species than a climax forest would, and so it is more ecologically resilient. An assumption is drawn from this that a forest adapted to natural disturbance would react similarly to man-made disturbance in the form of selective logging, and that there is no reason to believe at the theoretical level that selective logging will alter the species composition of the stand.

This relies on a number of authors who agree that few areas of rainforest in Queensland have ever reached or will ever reach a true steady state. This is not surprising in view of the opinion that a period of

800 years might be required for a regenerating forest in South Queensland to be indistinguishable from an adjacent primary forest. It is an assumption that a forest adapted to natural disturbance will react similarly to a man-made disturbance, which is controversial. This assumption is a generalisation, and does not necessarily apply to all situations. Reference to Webb (1958) shows that certain areas, particularly ridges are very susceptible to cyclone damage, but other areas in sheltered positions enjoy considerable protection. Since it is in the protected areas that the more desirable timber grows, it is hard to believe that cyclones cause a canopy disturbance on a scale greater than selective logging as attributed on page 5 to Webb. Reference to Webb's article fails to reveal such a statement. The 1983 Position Paper (page 16) shows figures for the destruction of commercial stems before and after logging, but no attempt has been made to quantify cyclone damage in areas decreed for logging. There is more to logging than some canopy defoliation, the uprooting of scattered trees, and possibly an occasional landslip. The first massive cut removes all trees down to a predetermined size. Some of these could have been standing for 1000 years. With a further cut every 40 years on a sustained yield basis, no tree can attain such an age or proportion. The forest is permanently changed. The removal of logs removes nutrients, which is a significant loss in the case of a forest growing on low fertility soils, e.g. soils derived from granite or sand dune systems. In a mature forest, the distribution of the trees does not follow a regular pattern but is patchy. This suggests that trees of particular scientific interest, the narrow endemics and primitive angiosperms, could be eliminated unknowingly. It is noteworthy that the statistical section of the 1983 Position Paper mainly refers to timbers of commercial value at the present time. There are no statistics showing the number of plants of scientific interest before and after logging any specific area.

It seems that the authorities upon whom the Forestry Department relied are not as confident as the Department on the effects particularly long term, of selective logging.

These same authorities are impressed by the biogeographical significance of the humid tropical region of North Queensland, which is attracting scientific interest internationally. There is a complex history of climatic sifting, migration, and community evolution in the North Queensland rainforests. Some of the taxa of the wet highlands of North Queensland are also found in temperate and montane habitats elsewhere (Tracey, 1982). Webb and Tracey (1981) estimate that 73 rainforest genera of primitive angiosperms and gymnosperms are found in this area.

Tracey (1982) states that the now relatively restricted area of North Queensland rainforests evidently retain habitats resembling the seasonally mild climate of the uplands of the Gondwanic continent, postulated as the birthplace of the angiosperms. The region therefore provides a unique model for testing postulates that are of such fundamental importance in world botany. This is an overwhelming argument in favour of conserving all remaining rainforests in North Queensland, whether they are fragmented or entire, but particularly when they occupy refugia as classified by Webb and Tracey (1981).

The situation may best be summarised by a statement by Dr. Webb before the Royal Society of Queensland on 31 October 1983 that *'There should be no further clearing of rainforest, and no unlogged rainforest should be logged'.*

**An alternative source of timber**

At this stage, it is necessary to consider the domestic and industrial needs of the people of North Queensland. Since there is currently a surplus of plantation pine in South Queensland, which the pulp millers seem loathe to utilise, this timber could be sent north to satisfy construction needs. There should still be a supply of cabinet timbers available to industry from forests now being logged. If this is not available it might be remembered that the Scandanavians have built attractive furniture from pine.

In any case, the Forestry Department has conceded that North Queensland will require 20,900 ha of plantation pine by 2010, assuming a maintainance of sustained yield from rainforest. Whatever views are held on logging rainforest, large scale plantations are necessary in North Queensland. These should be commenced immediately. Such action will improve the employment situation, which will deteriorate when the present heavy logging program exhausts the limited timber stocks remaining.

It is predictable that harvesting plantation timber will be more economic than harvesting rainforest,

particularly rainforest which has already had the prime production of centuries removed. I believe that this economic aspect is the key to the survival of the remaining rainforest.

### Future Rainforest Reservation

It is now time to review the rainforests of Queensland and identify areas urgently calling for immediate reservation. For convenience I shall divide them into five groups —

(1) North Queensland Tropical Rainforest south of the Daintree River.
(2) North Queensland Tropical Rainforest north of the Daintree River.
(3) Monsoon Rainforest of Cape York Peninsula.
(4) Subtropical Rainforest of Central and South Queensland.
(5) The Bottle Tree Scrubs of Subcoastal South Queensland.

The two sections of the North Queensland Tropical Rainforest correspond to the areas in which the forest on most available sites have already undergone a heavy primary logging or have been cleared for agriculture, and to areas of virtually intact forest respectively.

### (1) North Queensland Tropical Rainforest south of the Daintree River

The Queensland Forestry Position Paper of 1981 tabulates the Tropical Forest south of the Daintree as follows —

| | |
|---|---|
| Crown Land available for logging | 143,000 ha |
| Crown Land proposed for National Parks | 17,000 ha |
| Existing National Parks | 88,000 ha |
| Crown Land not available for logging | 297,000 ha |

Most of the Crown Land available for logging has already been logged, with the exception of the Windsor Tableland which is being cut over at present. This operation is expected to continue until at least 1986.

The Crown Land not available for logging is withheld for Preservation, Scientific, Recreational and Local Inaccessibility reasons, reasons which would justify National Park status. It should be appreciated that these areas do not necessarily lie in one convenient block, but form a mosaic with patches of the logged forest. Just the same, it would be reasonable for any of this land in the proximity of a National Park to be added to that Park, and so enjoy greater protection, particularly from mining. Any isolated portion of significant size should be converted to National Park status.

Of the refugia nominated by Webb and Tracey (1981), Bellenden Ker and Bartle Frere are in the Bellenden Ker National Park. There is still time to include Mt Carbine Tableland, (a long standing National Park proposal of N.P.A.Q.) before it is logged. The remaining refugia south of the Daintree are in forests which have been subject in part to logging. Owing to their nature it is important that these refugia are preserved from further damage, particularly the unlogged sections.

Two of Webb's lowland rainforest proposals can be implemented. The first is an area south of the mouth of the Daintree River, which has evergreen vine forest on low fertility coastal soils. This is a proposal which N.P.A.Q. recently stressed again. The other is the so-called Cooroo lands on the left bank of the North Johnstone River, where there is a complex mesophyll vine forest on lowland basalt. It is a cyclone scrub, situated so as to receive the full blast of the wind. The reason for reserving this area is for study, and to provide a base for comparison.

An area which is attracting considerable attention is Downey Creek, mentioned earlier. Here are 7000 ha of lowland rainforest divided by Hopkins and Graham (1981) into 13 rainforest types. One type in particular, Complex Mesophyll Vine Forest on lowland basalt, is rare, since it has been extensively cleared elsewhere for agriculture. There are known to be at least two primitive plant species in this catchment. The 15% of the valley which has recently been declared a Scientific Area contains a large proportion of this special type of forest. Unfortunately a section of 100 ha within this formation has been logged already. A good case for adding this valley to Palmerston National Park can be made.

**(2) North Queensland Tropical Rainforest north of the Daintree River.**

North of this river lie the Cape Tribulation, Cedar Bay and Black Mountain National Parks, and a large timber reserve T.R. 165. N.P.A.Q. has already submitted interim proposals for the early extension of the first two of these parks. Briefly the reasons for these extensions were as follows:-

**Cape Tribulation N.P. 164**

(A) To preserve important Rainforest Refugia.
(B) To preserve narrow endemics and primitive floral species.
(C) To preserve the habitat of at least three mammalian species or subspecies.
(D) To preserve the habitat of two birds endemic to the northern section of the Ingham-Cooktown rainforest.
(E) To preserve an old reptile fauna.
(F) To preserve an old ant fauna.
(G) To preserve areas which are likely to contain undiscovered flora and/or fauna.
(H) To preserve intact at least the upper section of the Roaring Meg catchment.
(I) To preserve the environment of Mt Pieter Botte, and the surrounding high country.

**Cedar Bay N.P. 212**

(A) To preserve important Rainforest Refugia.
(B) To preserve narrow endemics and primitive angiosperms.
(C) To preserve the most southerly examples of Monsoon Forest.
(D) To preserve the habitat of Bennett's Tree Kangaroo.
(E) To preserve a magnificent unspoiled coastline.
(F) To complement the recently proclaimed Marine National Park along the coast.

Except in the northern section of the proposed extension of Cedar Bay N.P., where the altitude is lessening, these proposals referred mainly to land above 450 metres. They were considered to be a minimum area, proposed as a matter of urgency in view of the various threats to the integrity of these areas.

**Further National Parks or extensions in Timber Reserve 165.**

Acceptance of N.P.A.Q.'s proposals for the extension of the present Cape Tribulation and Cedar Bay National Parks would leave 38,000 ha of Mesophyll Vine Forest in T.R. 165. This region contains some valleys with very steep hillsides, notably in Roaring Meg Creek. It would not be an exaggeration to anticipate that no more than 9,000 ha would be available for logging north of the Daintree, providing that the Department observes the same criteria of availability as to the south of this river. The area mentioned above is proportionally the same as for Supply Areas 1-5 inclusive, but excluding National Parks both present and proposed. This area is a very small proportion of the total area available for logging, and can only briefly postpone the day when an acute shortage of millable timber must be faced.

In view of the importance of the conservation values of this rainforest it should be converted to National Park Status.

**(3) Monsoon Forest of Cape York Peninsula**

Along the east coast of Cape York Peninsula lies a chain of discontinuous patches of rainforest, stretching from Torres Strait to the vicinity of Coen. These forests differ from one another with regard to altitude, site conditions, soil and rainfall. Consequently there are differences in their floristics.

In the south lie the McIlwraith, Macrossan, Embley, and Howard Ranges. These are plateaux with soils derived from granite and metamorphics, and have sufficient altitude to intercept the moist southeast winds. Consequently, they support semi-deciduous mesophyll vine forest on their eastern aspect at lower altitudes, and notophyll vine forest with Hoop Pine emergents at elevation. On the dry western slopes is deciduous vine thicket. Along the major streams flowing from these plateaux are gallery forests on alluvial soil (Pedley, 1971).

These forested ranges persist northwards ending in the Janet Range near the mouth of the Pascoe River. In the so-called Iron Range area is the largest remaining area of lowland rainforest to be found in Australia, and yet it is almost completely free from the disruptive influences of cyclonic winds and human activities (Stanton, 1976). The Claudie River alluvium supports a semi-deciduous mesophyll vine forest, grading into deciduous vine thicket and forest on low hills, while evergreen notophyll vine forest dominated by Blepharocarya involucrigera is widespread (Hynes and Tracey 1980).

These are scattered pockets of vine forest throughout the coastal area, between the Pascoe River and the Jardine Valley (Laverack and Stanton, 1977). The Vine Forests of the Jardine Valley are the most northerly of the moderately wet vine forests and show affinities with those of the Iron Range area, but grow on soils derived from sandstone. To the south of Captain Billy Creek are areas of low closed vine forest with Hoop Pine emergents (Laverack and Stanton 1977).

In the vicinity of Bamaga is the Lockerbie Scrub, where semi-deciduous mesophyll vine forest grows on deep red soil derived from a ferruginous sandstone. A number of species occur here, but not further south in the Peninsula (Stanton, 1976a).

The 15 species of mammals of these forests, ten being shared with New Guinea, have already been mentioned, three of them have their southern limit in the McIlwraith Range. As with the mammals, the avifauna mainly has affinities with that of New Guinea. The chain of rainforests form a corridor leading to New Guinea, important not only as a migration route for birds, but historically as a major faunal and floral interchange zone. It acts as a strong ecological filter that varies in intensity according to the adaptation or habitat speciations of the groups concerned (Kikkawa, 1980).

Thus it will be seen that there are strong biological reasons why the integrity of all these Peninsula rainforests should be maintained by reservation as National Parks. This can partly be achieved by

(a) Creating a National Park by amalgamating Timber Reserve 14 with the balance of Parishes Sidmouth and Lingen and that portion of Parish Trollope lying north of an easterly extension of the southern boundary of T.R. 14. It would be desirable to include Parish Cremorne, which contains a substantial portion of the Macrossan Range and the headwaters of the Nesbitt River. However this parish is part of an Aboriginal reserve and I hesitate to complicate the issue, but some protected status is warranted.

(b) Extending Iron Range National Park by including the vacant land surrounded by the Park in Parish Weymouth, and by carrying a line from the present southern boundary of the Park to the most easterly point of the present detached section of the Park, and continued southerly to the boundary of Parish Lloyd. That portion of Parish Lloyd to the west of this line should be added to the Park.

(c) Fortunately most of the closed forest described by Laverack and Stanton (1977) is in Jardine River National Park. However the southern boundary of the Park should be altered to include the watershed of Captain Billy Creek in order to preserve areas of low closed vine forest with Hoop Pine emergents.

(d) Seeking some protected status for Lockerbie Scrub - in an Aboriginal Reserve. It is considered to be wiser to enlist the interest of the people of this reserve and of the Department of Aboriginal and Islander Affairs, rather than transfer this land to the National Park Estate.

### (4) Subtropical Rainforest of Central and South Queensland

In this portion of the State there are three major areas where further immediate reservation of rainforest is warranted. These are the Conondale Range, Fraser Island and Cooloola.

### Conondale Range

From the Conondale Range a series of creeks drain into Booloumba Creek in a general north east direction. The high country is an elevated plateau carrying Complex Notophyll Vine Forest on volcanic derived soils. Part of this plateau lies in Conondale N.P. 1100. The ridges separating the creeks have shallow stony soils, which support Dry Sclerophyll Forest. In the deep gullies of the creeks is a

Notophyll Vine Forest with pure stands of Piccabeen Palms in some places. On the slopes above the gullies, but below the upland rainforest occurs a Wet Sclerophyll Forest of rose gum, tallowwood, brush box, blackbutt and Sydney blue gum with an understorey of rainforest species. This formation called hardwood is the prime objective of the Forestry Department.

The fauna of this area has been closely studied, and justifies the description of being one of the richest in Southeast Queensland. It was selected to represent its type in a major fauna survey of Queensland (Lavery, 1978). The wealth of its fauna is due to some extent to the mosaic of land and vegetation forms, which provide a wide diversity of habitats. This region is the home of a most primitive Australian frog, the Platypus Frog *Rheobatrachus silas*, which is confined to the rainforest streams of the Conondale and Blackall Ranges as far as is known.

The Conondale Range Management Plan published in 1983 states that it is the Departments intention to selectively log the Wet and Dry Sclerophyll Forests. However it goes on to say that in over-mature wet sclerophyll forest, selective logging of mature trees, with the removal also of declining trees and those interfering with the growth of more useful trees, will result in the removal of most of the trees. It is claimed that such heavy disturbance is necessary to achieve regeneration. Regeneration will probably occur, but the result will be a juvenile forest short of faunal habitats, whilst there is a strong possibility of pollution of the creeks of this high rainfall area. The platypus frog and other creatures of the streams would be placed at risk. Further disturbance can be expected from enrichment planting to ensure full stocking of the hardwood areas. It is difficult to see how the Department can reconcile these practises with another of it's stated objectives, conservation of forest environment and wildlife. Since timber production is necessary the solution to this dilemma is to reserve an adequate sample of this area in a National Park, where conservation of forest environment and wildlife can not be compromised.

There have been a number of proposals for the establishment of a National Park in this area or at least the extension of Conondale Range N.P. 1100. Some have been very extensive in range others less ambitious. However to retain a wide range of habitats in two forms of rainforest, and wet and dry sclerophyll forest, the bare minimum which should be considered is the extension of N.P. 1100 to include the watersheds of Bundaroo and South Booloumba Creeks and any intervening streams, to the junction of Bundaroo and South Booloumba Creeks. This would have the effect of removing approximately 1700 ha from a forest of 26,000 ha. Such a concession would make a negligible difference to the economics of forestry in the Conondale Range area, but it would make a valuable contribution to the conservation status of this ecosystem.

### Fraser Island

The high sandy islands of Fraser, Moreton and Stradbroke, together with the former island Cooloola, are unusual geomorphological features, which ordinarily would be sufficient to establish their importance, but on Fraser Island and in Cooloola, rainforest is found growing in that improbable medium sand. Blake (1968) lists 12 rainforest trees and ten vine species on Fraser Island, and reports that the forests are well developed structurally, though they are less complex than those of the mainland. Francis (1951) mentions eight trees including Carrol *Backhousia myrtifolia* which have their most northerly limit on Fraser Island. The rainforests grow in valley bottoms, protected from strong winds. Mingled with these rainforest pockets are forests of Satinay *Syncarpia hillii*, Brush Box *Tristania conferta*, Blackbutt *Eucalyptus pillularis*, and sometimes Tallowwood *E. microcorys* with a rainforest understorey.

The forests on Fraser Island have been subject to logging for over 100 years. First one species was taken and then another. As they were exhausted, other species attracted attention. The Forestry Department in its Information Sheet No 13 'Fraser Island-Forestry' states that it now aims to improve the productivity of the forest by (1) Regeneration (2) Enrichment Planting (3) Thinning. These procedures involve the removal of commercially useless and unwanted stems, disturbance of the top soil and planting of blackbutt seedlings. This may produce a monoculture of blackbutt, but in places it will certainly destroy a rainforest with a far greater diversity of species and habitats.

Before this can be perpertrated at least a viable sample should be reserved. The present Great Sandy National Park 16 may have 500 ha of rainforest - carrol scrub and blackbutt forest mingled in the vicinity of Lake Bowarrady on the southern boundary of the Park. This is only a tiny fragment of the 22,000 ha of these vegetation types on the Island (Sinclair). A much more representative sample could be reserved by altering the southern boundary of the Park to a line from the mouth of Bowarrady Creek to the Pinnacles. This would provide an extra 1,400 hectares, which would still be only 8.6% of the rainforest on the Island. There are of course other reasons why National Parks on Fraser Island should be extended.

### Cooloola

The integrity of the present Cooloola National Park N.P. 1238 is disturbed by the presence of the Central Forestry Area. This is a long tapering piece of land occupying the major portion of the high dunes, virtually dividing the sand dune component of the Park into two sections. It also deprives the Park of one of the major ecosystems of the Cooloola area.

These dunes support a vegetation ranging from tall closed forest to low open woodland. Associated with the rainforest is a belt of sclerophyll forest containing either pure Blackbutt stands or Blackbutt in association with red bloodwood and scribbly gum (Stanton 1976b).

There were those who were not happy about the exclusion of this central Forestry Area when Cooloola N.P. was established. They were sensitive to the century old practice of logging in the wet season, and although access to the forest was through a National Park they were inclined to acquiesce.

A Forestry Department proposal to enrich the blackbutt forests of Fraser Island, vide Information Sheet No 13, is just as applicable to Cooloola. Since the rainforest and the blackbutt stands interlock it is predictable that forestry procedures (felling, soil disturbance, road building) would damage the rainforest. Rainforest would be sacrificed to gain access to blackbutt stands. Mining has been disallowed at present, but it is quite conceivable that at some time in the future, some State Government could find a pretext to revoke that decision.

It seems that a compromise on land use in the Central Forestry Area is no longer possible, and that this area should be incorporated in Cooloola National Park.

### The Bottle Tree Scrubs Sub-coastal of South Queensland

Bottle tree scrubs have long been recognised, particularly in the Brigalow areas. They have been studied by a number of authorities including the late Dr. S.T. Blake. With the publication of a numerical analysis of floristic data for 1147 species of trees from 265 sites by Webb and Tracey (1977), a basis for a general floristic classification became possible. The classification contains three rainforest regions, which are segregated as widely different ecological entities and not transitions from one to another. They approximate core areas near where ancient floras from Gondwanaland crystallised under different conditions, and independent lines of evolation were followed.

This throws a new light on bottle tree scrubs. They are no longer considered depauperate versions of the coastal rainforests, although they are floristically related. Their structural types are Semi-evergreen Vine Thicket and Low Microphyll Vine Forest. In the former *Brachychiton australe* and *B. rupestre* are found. The core areas of the Cool/moist and the Cool/dry regions are thought to lie between Boonah and Biloela.

Since much of the core area has been cleared for agriculture, or has been alienated, it is to the State Forests that we must turn to identify examples of ths form of rainforest with urgent reservation in view.

### Do we need more rainforest in National Parks?

In the face of all these recommendations for more reservation of rainforest this is a question which will be asked. It could be asserted that the present area of approximately 270,000 ha is more than adequate, and that the area involved in further proposals appears to be extravagant.

I believe that we need these new National Parks together with extensions to present Parks, in order to comply with the view of the scientific world that adequate reservation of all major ecosystems should be made. From this it follows that all 27 major rainforest types identified by Tracey and Webb (1975) should be well represented. At present this is not so, particularly in regard to the highly developed Complex Mesophyll Vine Forest. By virtue of their fundamental importance every effort should be made to preserve such as is left of the Rainforest Refugia. The habitats of endemic mammals and birds in the Tropical Rainforest have been discussed and these also should be preserved intact. The chain of rainforests in Cape York Peninsula should be retained as a biological corridor. The proposals for South Queensland are smaller in area, but are of equal scientific importance.

## Summary and Conclusion

This paper has shown that rainforest is a very complex ecosystem, occurring on a wide range of soils, and conditioned by the extent and seasonality of rainfall, temperature, the nutrient status of the soil, drainage, altitude and protection from fire. Along the east coast of Queensland lie the Monsoonal Rainforests of Cape York Peninsula, the Tropical Rainforest between Ingham and Cooktown, and the Subtropical Rainforests of Central and Southeast Queensland. These rainforests are separated by areas of dry sclerophyll forest and woodland. In the subcoastal areas of South Queensland are patches of Bottle Tree or Dry Scrub.

Rainforest is subject to disturbance by wind, fire and the activities of man. It has a capacity to regenerate, qualified by the extent and frequency of the disturbance, and the proximity of mature forest as a source of seed for the later seral stages.

The Tropical Rainforest of North Queensland has been subject to a series of structural changes in the last 80,000 years. During periods of extreme drought rainforest survived in a number of refugia, identified by their great diversity of species and the presence of narrow endemics and primitive angiosperms. Some refugia lie in National Parks, many do not.

Fauna and avifauna play an active role in rainforest ecology, in pollination, seed dispersal and litter breakdown. The major habitat groupings are (1) Southeast and Central Queensland with a core area in Lamington N.P., (2) Ingham-Cooktown area with core areas based on the Bellenden Ker area and Thornton Peak, (3) Cape York Peninsula, where a chain of rainforests form a corridor to New Guinea. In the Tropical Rainforest, altitude defines the habitats of some fauna and avifauna.

Rainforests have a potential as a source of chemicals.

The merits of logging rainforests were considered. It was concluded that *'no further rainforest should be cleared, and that no unlogged rainforest should be logged.'* A shortfall in timber available in North Queensland by 2010 is predicted by the Forestry Department and 20,900 ha of plantation timber will be required. It is recommended that planting be commenced at once and that surplus pine from South Queensland be used to bridge the gap.

The reservation of rainforest to date was reviewed, and considered incomplete. Recommendations were made for urgent reservation of rainforest in each of the major rainforest groups.

### North Queensland Tropical Rainforest South of the Daintree River.

(1) All refugia not yet protected in National Parks.
(2) Webb's two outstanding recommendations, the Evergreen Vine forest south of the Daintree River, and the Cooroo Lands.
(3) Downey Creek area.

### North Queensland Tropical Rainforest North of the Daintree River.

(1) N.P.A.Q.'s recommended extension to Cape Tribulation National Park.
(2) N.P.A.Q.'s recommended extension to Cedar Bay National Park.
(3) All remaining rainforest in Timber Reserve 165.

**Monsoon Rainforest of Cape York Peninsula.**

(1) Creation of a McIlwraith Range National Park.
(2) Extension to Iron Range National Park.
(3) Extension to Jardine River National Park.
(4) Some protected status for Lockerbie Scrub, and the rainforest in Parish Cremorne, both of which lie in Aboriginal Reserves.

**Subtropical Rainforest of Central and Southeast Queensland**

(1) Extension to Conondale Range National Park.
(2) Extension to Great Sandy National Park.
(3) Inclusion of the Central Forestry Area in Cooloola National Park.

**The Bottle Tree Scrubs of Subcoastal South Queensland**

Reservation of Bottle Tree Scrubs in State Forests of Subcoastal South Queensland.

This review has described an ecosystem of a very limited extent, with a fascinating array of flora and fauna, with a history going back to the isolation of the continent, and which is by no means fully explored and understood. Queensland rainforests are attracting the attention of the scientific world, and are the only ones in the world which can be visited without the risk of serious illness. Their northern sections are in close proximity to the Great Barrier Reef, another of the world's outstanding formations. This is a priceless combination, which should be preserved intact. Our attitude to our rainforests is an indicator of our cultural maturity.

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