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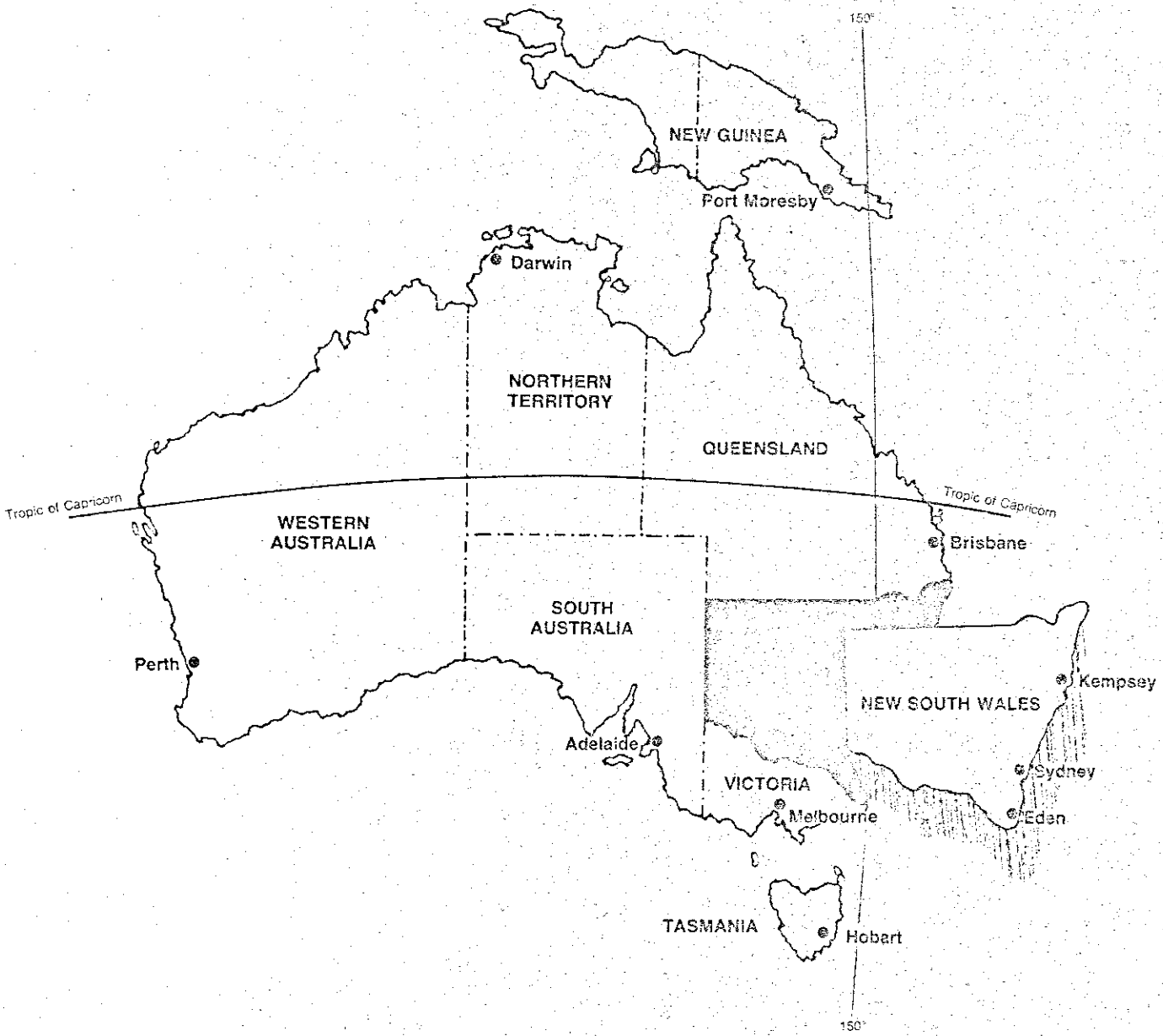
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Australian Rainforests in New South Wales

Australian Rainforests in New South Wales

Volume II

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By

Alexander G. Floyd

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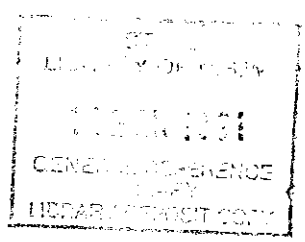

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Introduction

The basic components of a rainforest are the various species of plants which, with the fauna, constitute the ongoing ecosystem. In New South Wales rainforests there are 57 recognized plant groupings or suballiances, which can be referred to 13 alliances. The alliances in turn can be identified as belonging to one of the four subformations.

For each of these suballiances, structure, physiognomy, location and interrelationships with other suballiances will be discussed.

Species lists for representative locations of each suballiance are provided on microfiche as an appendix. Appropriate notation is included in the text.

CHAPTER 1

Subtropical Rainforest

Subtropical is the most complex rainforest subformation in New South Wales, occupying warm fertile sites with high rainfall. This tall forest consists of two or three strata of trees forming a billowing rather than even canopy. Most species exhibit compound leaves, with entire leaves or leaflets more than 7.5 cm long. Stranglers, palms, plank buttressing, large epiphytes and woody vines are characteristic features. The ground layer consists of large-leaved herbs and ferns. Littoral rainforest is derived from this subformation but also contains some representatives from the dry rainforest subformation, all with the ability to withstand high levels of airborne salt.

In New South Wales, there are five alliances consisting of 20 suballiances (Fig. 9). The *Argyrodendron trifoliolatum* Alliance or warm subtropical rainforest occupies the fertile lowlands but is replaced at somewhat cooler sites by the *Argyrodendron actinophyllum* Alliance and in the south by the *Dendrocnide-Ficus* Alliance. The *Caldcluvia* Alliance — cool subtropical rainforest — is found on the higher and increasingly cooler basaltic plateaux. The fifth alliance, *Cupaniopsis-Acmena*, occurs near the sea and is also known as littoral rainforest.

***Argyrodendron trifoliolatum* Alliance**

This warm subtropical alliance is generally found at low altitudes on fertile soil near sea level, in sheltered mid-valleys (0–250 m altitude) or on basaltic terraces up to 580 m below Springbrook. It requires protection from cold or hot drying winds as well as those laden with salt from the sea. It is the most structurally complex rainforest alliance in New South Wales, occurring on the potentially best agricultural land. In consequence, it has often been virtually destroyed with the exception of small remnant patches where terrain is flood-prone, inadequately drained or rather stony. With increasing altitude and cooler conditions, it is replaced by the *Argyrodendron actinophyllum* Alliance. South of the Manning River, its niche is occupied by the *Dendrocnide-Ficus* Alliance. Where soil moisture becomes a limiting factor in the dry spring period, it is replaced by examples of dry rainforest such as the *Castanospermum-Waterhousea floribunda* Alliance along stream banks, or by the *Drypetes-Araucaria* Alliance on dry rocky slopes. Near the sea where exposed to atmospheric salt, it is replaced by littoral rainforest of the *Cupaniopsis-Acmena* Alliance (Fig. 9).

The *Argyrodendron trifoliolatum* Alliance is restricted geographically to the warm, protected, fertile soils of the coastal river systems north from Wallis Lake. However, *Argyrodendron trifoliolatum* itself only extends as far south as the Hastings River.

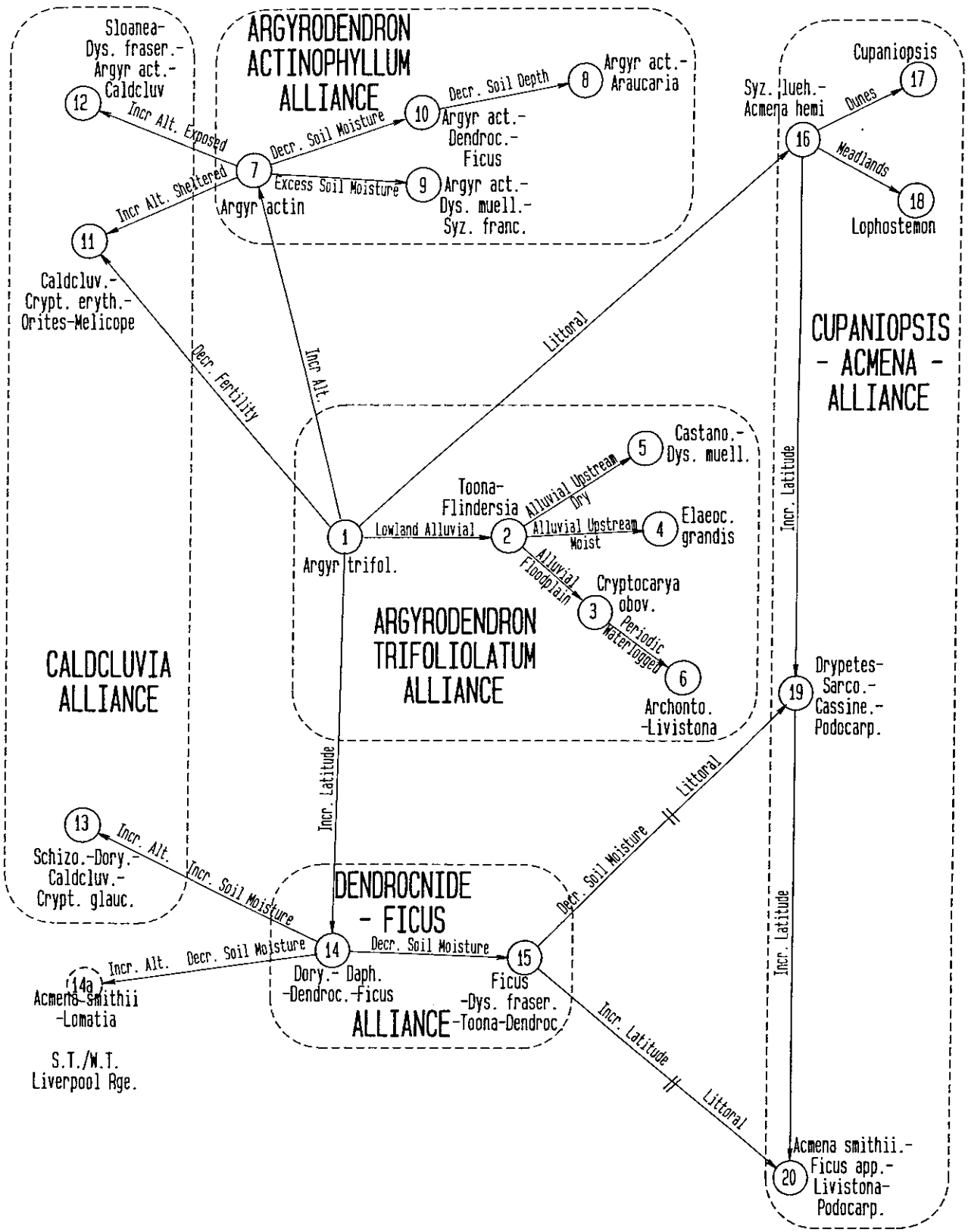


Figure 9. Floristic classification of subtropical rainforest.

The alliance can be recognized floristically by the high diversity of species in all strata and by the abundance of at least some of the following species: trees include *Archontophoenix cunninghamiana, Ficus watkinsiana, Dendrocnide excelsa, Daphnandra micrantha, Cryptocarya obovata, Endiandra pubens, Neolitsea dealbata, Castanospermum australe, Flindersia schottiana, Dysoxylum fraserianum, D. muelleri, Melia azedarach, Toona australis, Castanospora alphandii, Diploglottis australis, Elattostachys nervosa, Akania lucens, Alphitonia excelsa, Elaeocarpus grandis, E. obovatus, Sloanea australis, S. woollsii, Argyrodendron trifoliolatum, Brachychiton acerifolius, Lophostemon confertus, Polyscias elegans* and *Planchonella australis*. Typical species of the shrub stratum are *Cyathea leichhardtiana, Linospadix monostachys, Cordyline petiolaris* and *Harpullia alata*. The herb layer is of *Adiantum formosum, Lastreopsis* spp. and *Alocasia macrorrhizos*. Characteristic vines are *Arthropteris tenella, Calamus muelleri, Pothos longipes, Piper novae-hollandiae, Austrosteenisia* spp. and *Millettia* spp. Large epiphytes are typical of this alliance, particularly *Asplenium australasicum, Platycerium bifurcatum* and *P. superbum*.

There are six suballiances:

1. *Argyrodendron trifoliolatum*
2. *Toona-Flindersia*
3. *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria*
4. *Elaeocarpus grandis*
5. *Castanospermum-Dysoxylum muelleri*
6. *Archontophoenix-Livistona*

Suballiance No. 1: *Argyrodendron trifoliolatum*

This is the most luxuriant rainforest suballiance in New South Wales, with its massive, buttressed trees and profusion of large epiphytes and woody vines (Photo 54). Towering above the main canopy and with wide-spreading crowns are scattered *Ficus macrophylla, F. watkinsiana, Dendrocnide excelsa* and *Sloanea woollsii*. The main canopy consists of tall, long-barrelled, buttressed *Argyrodendron trifoliolatum, Geissois benthamii* and *Pseudoweinmannia lachnocarpa*. There are also unbuttressed trees such as *Cryptocarya erythroxylon, Diospyros pentamera* and *Anthocarapa nitidula*. Along the creeks are crooked, leaning *Sloanea australis* and *Pennantia cunninghamii*. The shrub layer contains several diagnostic species such as *Cyathea cooperi* and *Randia chartacea*. Other common species include *Linospadix monostachyus, Wilkiea austro-queenslandica, Citriobatus pauciflorus, Actephila lindleyi* and *Cordyline petiolaris*. The herbaceous ground cover is generally sparse due to the low light conditions, being mainly *Adiantum formosum, Pteris umbrosa, Lastreopsis* spp. and *Calanthe triplicata*. However, *Elatostemma reticulatum, Pollia crispata* and *Helmholtzia glaberrima* are common in very wet situations and on seeping rock faces. Climbers are very well developed. Large, woody lianes such as *Millettia megasperma, Piper novae-hollandiae, Austrosteenisia blackii* and *Cissus* spp. festoon and form curtains from the tallest trees. Wiry vines, including *Arthropteris* spp., *Microsorum scandens* and *Pothos longipes*, cling tightly to tree trunks and rocks. Magnificent, massive epiphytes of *Asplenium australasicum, Platycerium bifurcatum, P. superbum* and *Dendrobium speciosum* are a feature of this suballiance in particular. Such aerial gardens may support other epiphytes including *Asplenium polyodon, Davallia pyxidata* and *Dictymia brownii*.

Argyrodendron trifoliolatum is found as far south as the Bellinger River; and there is a reported isolated occurrence on the eastern boundary of Bellangry State Forest. There are five major areas in New South Wales for this suballiance — Tweed Valley, Nightcap Range, Big Scrub, Richmond Range and Orara-Bellingen valleys.

TWEED VALLEY

Within the Tweed Valley and particularly at the base of the rhyolite cliffs in the north and north-west sectors and again on the south–to–east lower slopes of Mt Warning

are some of the most luxuriant rainforests in New South Wales. The finest of all is in Numinbah Nature Reserve on a basalt shelf at the foot of the Springbrook Plateau in the heads of Pat Smiths, Couchy and Crystal Creeks (Species Lists, Microfiche). The ground is strewn with massive rhyolite blocks up to 3 m high which have fallen from the 250 m high sheer cliffs. The major canopy trees are particularly tall and of great diameter, including the following estimates which are records for New South Wales.

	Total Height	Diameter at 1.4 m
Argyrodendron trifoliolatum	45 m	200 cm
Syzygium crebrinerve	40	
Acmena ingens	40	
Pseudoweinmannia lachnocarpa	35	250
Castanospermum australe	35	120

Just west of Mt Cougal is found one of only four occurrences of *Neisosperma poweri* in New South Wales, although in Queensland it extends from upper Tallebudgera Creek to North Queensland.

Where the rainforest on Numinbah Nature Reserve is undisturbed, access is relatively easy, but following disturbance, it is very difficult due to the dense growth of *Calamus muelleri.* A feature of this rainforest is the abundance of birds.

There are similar shelfs at the head of the Tweed Valley, such as Hidden Valley in Limpinwood Nature Reserve and Cockscomb Point further south. These carry rainforests where *Argyrodendron trifoliolatum* is the major canopy species with associates such as *Dendrocnide excelsa, Daphnandra micrantha* and *Lophostemon confertus.* The smaller tree layer is mainly *Bosistoa pentacocca* and *Baloghia inophylla.* At Hidden Creek are the largest recorded trees in New South Wales of *Floydia praealta,* estimated at 35 m tall and 60 cm diameter.

There are small, narrow rainforest areas along the streams flowing westwards from the Tweed Range below the cliffs. At Lynches Creek — 340–400 m altitude — the forest is dominated by *Argyrodendron trifoliolatum, Sloanea woollsii, S. australis* and also *Geissois benthamii.* With increasing altitude at Sheepstation Creek — 500–550 m — *Argyrodendron actinophyllum* is equally as common as *A. trifoliolatum.* At locations of higher elevation such as Levers Plateau and Mt Lindesay, *A. actinophyllum* predominates. These areas will be discussed under the *Agyrodendron actinophyllum* sub-alliance.

On the lower slopes of Mt Warning and on the sheltered floor of the inner caldera formed between the mountain and the resistant ring dykes to the east, north and west, there are some fine rainforests upon the fertile soils derived from gabbro, the plutonic equivalent of basalt. The major canopy species are *Argyrodendron trifoliolatum, Dendrocnide excelsa, Brachychiton acerifolius* and *Ficus* spp. The more tropical rainforest species are found on the northern side in the broad valley of Wollumbin Creek and include *Floydia praealta, Cryptocarya erythroxylon, Bosistoa pentacocca, Bouchardatia neurococca, Melicope octandra, Pentaceras australis, Hedraianthera porphyropetala, Syzygium hodgkinsoniae* and four other species of this genus. To the west of the mountain in the rather steep narrow gully of Cedar Creek below Brummies Lookout are tall *Toona australis,* moss-shrouded *Daphnandra tenuipes* and many species of ground ferns such as *Pneumatopteris sogorensis* up to 2.5 m tall in this consistently moist environment. The latter is common in North Queensland, but there are only two records for southern Queensland and three to the south and west of Mt Warning.

On the south-east rim of the Tweed Valley near Mt Chowan is the Black Scrub on Nullum State Forest. The scrub has been logged for *Araucaria cunninghamii, Dysoxylum fraserianum, D. muelleri, Toona australis, Argyrodendron actinophyllum* and *A. trifoliolatum.* The more common large trees remaining include *Pseudoweinmannia lachnocarpa, Sloanea woollsii, Syzygium francisii, Dendrocnide excelsa* and *Ficus* spp. The soil is a red loam derived from volcanic rocks. Of special interest here is the largest *Acacia bakeri* in New South Wales, estimated at 40 m tall and 90 cm diameter. This is the only species of *Acacia* in Australia which occurs in the climax rainforest. There is also a record-size tree of *Symplocos stawellii,* estimated at 20 m tall and 80 cm diameter.

The well drained Tweed River flats have been cleared for cane or cattle, but three fragments remain (two on private property) as reminders of what these vast forests must have contained. Towards the head of the Oxley River (main arm of the Tweed River) in Limpinwood Nature Reserve are four rare and endangered tree species.

Bosistoa selwynii. Recorded from Whian Whian State Forest in the 1950s, but otherwise only from Middle Pocket, North Pumpenbil Creek and from this area in New South Wales to Maryborough in Queensland.

Endiandra hayesii. From the Richmond River to Gold Coast hinterland but not common.

Diospyros mabacea. This species is now confined to the Oxley River (13 plants) and to Stotts Island Nature Reserve downstream in the Tweed River where several immature plants are conserved. The remaining five wild plants are not protected.

Fontainea australis. Described in 1985 from just a small number of plants confined to the Oxley site only.

Downstream at Eungella, the suballiance contains in addition to *Diospyros mabacea* two of the remaining 20 wild trees of *Diplogottis campbellii.* All the wild trees of this latter species are outside reserves and are mostly in the Tweed Valley except for one tree at Tintenbar and one on upper Tallebudgera Creek. A small patch of privately owned regrowth rainforest near the bank of the Tweed River downstream at Banora Point contains a further two trees of *D. campbellii.*

The suballiance in the Tweed Valley contains many rare and endangered species, in many cases confined to it or to the Gold Coast hinterland as well. In addition to those already discussed, *Lepiderema pulchella* is found in the northern half of the valley and north to Tallebudgera Creek, with most specimens on partially cleared or regrowth private land. *Cassia marksiana* is represented by about 60 plants widely scattered over 18 sites in the Tweed Valley, but with only one tree in a reserve on Stotts Island Nature Reserve, and north to Beenleigh, Queensland. There is a disjunct population in North Queensland. *Bosistoa transversa* extends north from the Tweed at Urliup and Terranora to Maryborough, Queensland. *Acacia bakeri* occurs from the Brunswick River north to Gympie but is nowhere common. One other species, *Desmodium acanthocladum,* is confined to the Richmond-Tweed and does not occur in Queensland. It is a streamside shrub (Photo 82). The small tree, *Ochrosia moorei,* is recorded as a single individual at each of 21 locations in New South Wales from the Richmond River to the edge of the Springbrook Plateau.

NIGHTCAP RANGE

This range is the southern rim of the Mt Warning caldera, where the basalt from Mt Warning is overlaid by younger rhyolitic lavas which form resistant clifflines. There have been good examples of the suballiance on the basalt shelfs at the base of the rhyolite cliffs on both the north and the south sides of the range. All have been logged to some extent.

At Perch Creek, below the falls on the northern or Tweed side of the range, the predominantly *Argyrodendron trifoliolatum* forest has been selectively logged, and the openings thus created are choked with *Lantana*. Restricted species present are *Bosistoa pentacocca, Bouchardatia neurococca* and the tall ground fern, *Pneumatopteris sogorensis*. All are found along the creekline.

Further east on the same side of the range is Griers Scrub near Mt Nardi. Following selective logging, the site is still subject to wind damage and blowdowns. The resultant openings are fillled with tangles of *Calamus muelleri*. Judging by the size of the remnant trees, this must have been a magnificent forest of very large, tall *Argyrodendron trifoliolatum, Pseudoweinmannia lachnocarpa, Dendrocnide excelsa* and *Syzygium crebrinerve*. One specimen of *Sarcopteryx stipata*, normally only a small tree, was estimated at a record height of 40 m and a diameter of 75 cm.

On the southern or Richmond Valley side of the range, the large basin in the head of Goolmangar Creek was originally an excellent example of the suballiance until it was very heavily logged in 1942–53 for ammunition box timber during the war and later for case timber of *Argyrodendron trifoliolatum, Sloanea woollsii*, and *Dysoxylum fraserianum*. Hardly a tree was left standing, and there is now a regrowth forest of *Dendrocnide excelsa, Daphnandra micrantha* and *Polyscias murrayi*.

At the head of Terania Creek, which is also part of the Richmond Valley, there was originally a fine forest of *Argyrodendron trifoliolatum, Dendrocnide excelsa, Sloanea woollsii, Geissois benthamii* and *Toona australis* on basaltic soil. Contrary to current local popular opinion, this was not originally regarded as part of the Big Scrub which only extended north to Dunoon. Although Terania Creek has 44 tree species in common with the Big Scrub, a further 28 species typical of the Big Scrub are absent. This valley has a long history of logging, commencing with the cedar-cutters in the 1840s, intensive rainforest logging during the Second World War and after in 1943–52, further logging of some rainforest as well as eucalypts in the 1950s and a final logging in 1968 of all commercial species. Its present state suggests that some patches escaped the more recent loggings. There is a grove of three *Toona australis* about 120 cm diameter and 50 m tall with a *Gmelina leichhardtii* nearby actually measured at 59 m tall and 267 cm diameter which is by far the tallest tree of this species known. There are also some very large trees of *Ficus watkinsiana* and *Dendrocnide excelsa*, both of which were unacceptable milling species.

BIG SCRUB

The lava which flowed down the southern slopes of the mighty Mt Warning volcano about 20 million years ago extended to the present-day Richmond River. It is buried now beneath the younger rhyolite lavas of the Nightcap Range. The fertile, undulating topography to the south of this range was, until about 100 years ago, an almost unbroken expanse of lush, subtropical rainforest known as the "Big Scrub" or "Red Scrub" (because of the colour of the soil). Extending over 75 000 ha (Fig. 10), it was the largest area of lowland subtropical rainforest in Australia. By the year 1900, this rainforest was almost completely destroyed by felling and burning. Only about 10 major remnants survive, five of these are less than 15 ha in extent. Of the original 75 000 ha, only 300 ha or 0.4% remain. Unfortunately, this includes nearly 200 ha in the Big Scrub Flora Reserve which is on the northern margin and subject to rhyolitic influence.

The Big Scrub was not a homogeneous rainforest area but consisted of at least four suballiances each now represented in several major remnants (Table 7, Vol. 1). Whether other suballiances were present, which have been completely destroyed, we will never know.

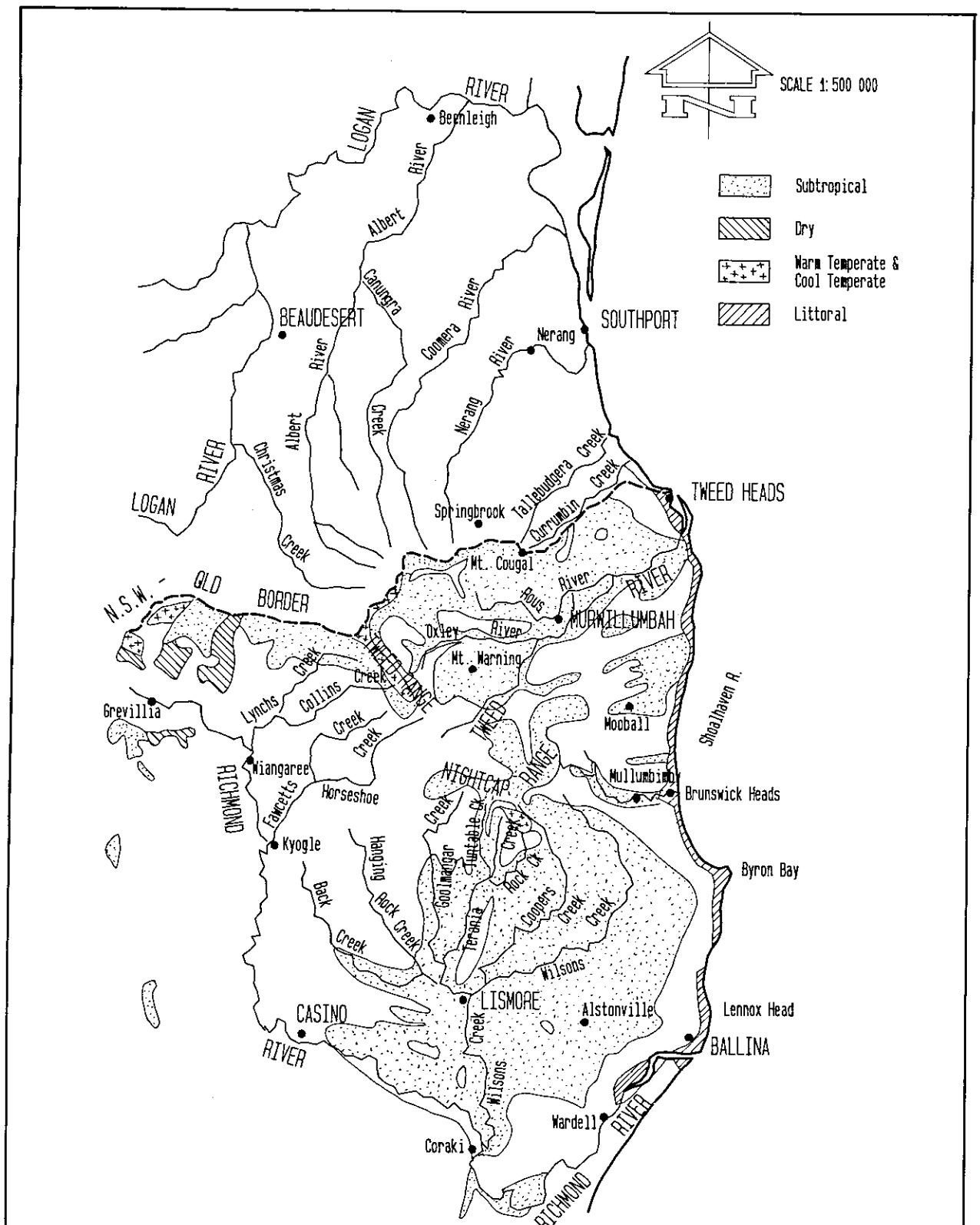


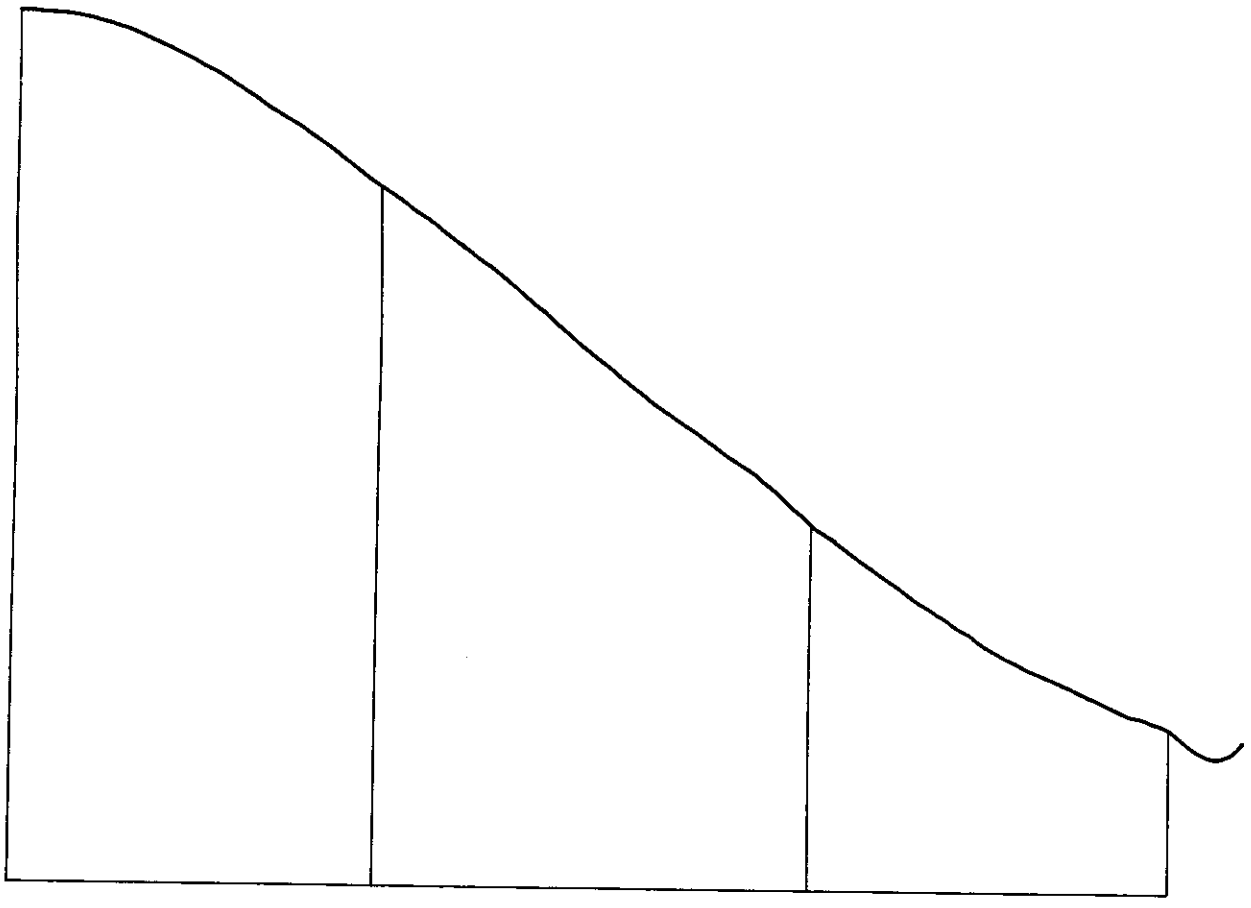
Fig. 10. Original distribution of rainforests in the Richmond-Tweed.

Victoria Park Nature Reserve south of Alstonville on the plateau consists of only 8 ha of rainforest with a further 8 ha being converted from grassland back into rainforest. Of 82 tree species present, *Argyrodendron trifoliolatum* is most common in association with *Flindersia xanthoxyla, F. schottiana, Ficus macrophylla* and *F. watkinsiana* (Species List, Microfiche). In the past, the great attraction of this reserve was the "big fig", a gigantic *Ficus macrophylla* towering above the surrounding trees and allegedly sighted by Captain Cook as he sailed up the coast in 1770. Its crown was smashed in a storm 200 years later, but its huge, rotting butt is still the focal point of the reserve. A shrub of special interest here is *Baloghia marmorata,* known only from this general area and Mt Tamborine, Queensland. Other species of restricted distribution are *Floydia praealta, Macadamia tetraphylla, Ailanthus triphysa, Ochrosia moorei* and *Quassia* sp. aff. *bidwillii.* The last two are represented at Victoria Park by a single individual only.

The more elevated sections of Johnstons Scrub near Eureka are also of the *Argyrodendron trifoliolatum* Suballiance. This locale also had a huge *Ficus macrophylla* of great age, which rivalled or perhaps surpassed the tree at Victoria Park. In 1962, its top was blown out, and it died in 1972. The dead tree collapsed in 1973 and had almost completely rotted away by 1981. Apart from *Argyrodendron,* the major canopy species are *Flindersia schottiana* and *Dysoxylum fraserianum* (Photo 54). This reserve under local council control is the largest area surviving of the true "Big Scrub", consisting of 20 ha representing three different suballiances as determined by the topography (Fig. 11).

The Lands Department reserve at Booyong is on an alluvial plain between two tributaries of Wilsons Creek. Its area of 13 ha is dissected by a sealed road. The recording of 90 tree species highlights its diversity. Although at this site *Argyrodendron* is still the most common tall tree, with huge *Ficus obliqua* and *F. watkinsiana* towering above, the reserve differs from Victoria Park in many respects. Some tree species which are common at Victoria Park are absent at Booyong — *Dendrocnide excelsa, Archontophoenix, Flindersia schottiana, F. xanthoxyla, Pentaceras, Dysoxylum muelleri* and *Syzygium crebrinerve.* Rainforests on the heavier alluvial soils at Booyong and Boatharbour are characterized by species which are at best rare at Victoria Park, including *Beilschmiedia elliptica, B. obtusifolia, Cinnamomum oliveri, Cryptocarya obovata, Castanospermum australe, Elaeocarpus obovatus, Castanospora alphandii, Austromyrtus fragrantissima, Acmena ingens, Syzygium francisii, S. australe* and *Ehretia acuminata.* It may be significant that three of the tree species restricted to Victoria Park — *Flindersia schottiana, F. xanthoxyla* and *Pentaceras australis* — have dry fruits while all of the trees listed as restricted to the alluvial rainforests have juicy fruits. Five of these latter have been found in Queensland to be the preferred food plants of pigeons. They are *Beilschmiedia elliptica, B. obtusifolia, Cinnamomum oliveri, Cryptocarya obovata* and *Elaeocarpus obovatus.* If these remnants were of adequate size, it would be reasonable to expect to find more fruit-eating birds in the alluvial rainforests than in the plateau rainforests. The occurrence of flying fox camps certainly supports this argument, since they can be found at Wingham Brush but not at nearby Boorgana Nature Reserve, at Bellingen Island but not in Dorrigo National Park, at Susan Island, Booyong and Boatharbour but not at Victoria Park, Hayters Hill, Johnstons Scrub or Big Scrub Flora reserve. However, there is a colony in Davis Scrub Nature Reserve on the Alstonville Plateau. It is therefore necessary to preserve more than one example of the *Argyrodendron trifoliolatum* Suballiance if there are such important differences in the associated species, which could in turn produce different wildlife habitats.

There are two trees of record size at Booyong — *Syzygium francisii* at 45 m tall (previous record 30 m) and 150 cm diameter above the huge buttresses (previously 90 cm), and *Clerodendrum floribundum* at 30 m tall (previously 20 m) and 30 cm diameter.



SUBALLIANCE 1	SUBALLIANCE 5	SUBALLIANCE 1
Argyrodendron trifoliolatum	*Castanospermum australe-Dysoxylum muelleri*	*Argyrodendron trifoliolatum*
Major associates	Major associates	Major associates
Dysoxylum fraserianum *Flindersia schottiana* *Flindersia xanthoxyla* *Ficus macrophylla*	*Argyrodendron trifoliolatum* *Ficus macrophylla*	*Castanospermum australe* *Melia azedarach* var. *australasica* *Ehretia acuminata*
Upper slopes	Moist mid-slopes	Lower slopes and alluvial floodplain
Comparable to Victoria Park Nature Reserve	Comparable to Davis Scrub Nature Reserve	Comparable to Booyong Recreation Reserve

Fig. 11. Floristic relationships between Johnstons Scrub and some other Big Scrub remnants.

Being on the high banks of Wilsons River downstream from Boatharbour, Currie Park, beside the Lismore racecourse, is floristically related to Booyong. *Argyrodendron trifoliolatum* and *Castanospermum australe* followed by *Cryptocarya obovata* are the most common large trees in the park. Their numbers indicate an affinity with Boatharbour of the *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance, except that *Dendrocnide excelsa* and *Ficus* spp. are rare. The undergrowth is similar, including *Ochrosia moorei, Floydia praealta, Austromyrtus fragrantissima, Notelaea johnsonii* and *Desmodium acanthocladum.* This remnant has long narrow margins which in many places are heavily infested with *Ligustrum sinense, L. lucidum* and *Cinnamomum camphora.*

The Big Scrub Flora Reserve of 196 ha consists in part of this suballiance, particularly on the more elevated sections away from Rocky Creek. Logging in the mid-1950s, particularly for *Castanospermum australe* and *Toona australis,* has tended to increase the relative importance of *Argyrodendron.* Floristically the reserve is a very diverse area with 123 tree species out of 208 species of flowering plants and ferns. However, this high figure reflects the presence of rhyolitic alluvium along the creek which supports many warm temperate rainforest elements including *Ceratopetalum apetalum, Schizomeria ovata, Cinnamomum oliveri* and *Cryptocarya glaucescens.* It is possible that prior to logging, most of this reserve would have belonged to the *Castanospermum-Dysoxylum muelleri* Suballiance which still occurs in Davis Scrub and in part of Johnstons Scrub.

At Broken Head Nature Reserve near the eastern margin of the Big Scrub, on metasediments probably enriched by basalt, there is a rather atypical example of this suballiance in the steep gully heads near the sea. The more common canopy trees are *Argyrodendron trifoliolatum, Ficus obliqua, F. watkinsiana* and *Dysoxylum fraserianum.* Less common are *Floydia praealta, Elaeocarpus grandis* and *Flindersia australis.* The lower tree layer consists mainly of *Archontophoenix cunninghamiana* and *Sloanea australis.*

Despite the extensive nature of the Big Scrub, there are no plants known to be endemic to it, although *Fontainea oraria* only occurs in littoral rainforest on its margin. *Quassia* sp. aff. *bidwillii* is found at Dorrigo National Park, Victoria Park Nature Reserve, Pierces Creek, Big Scrub Flora Reserve and in Nightcap National Park. The most extraordinary disjunction is that of *Baloghia marmorata,* which is only found in the restricted Meerschaum Vale-Davis Scrub area and then again on Mt Tamborine in Queensland. Many other species extend from the Big Scrub to the Tweed and north to the Gold Coast hinterland, which is the extent of the original Mt Warning volcano. These include *Macadamia tetraphylla, Archidendron muellerianum, Rhodamnia maideniana, Syzygium moorei, Helmholtzia glaberrima* and *Tinospora tinosporoides.* There is also a number of species which extends from the Big Scrub up the Queensland Coast to Gympie *(Floydia praealta, Bouchardatia neurococca, Atalaya multiflora, Syzygium hodgkinsoniae),* to Gladstone *(Notelaea johnsonii)* or to North Queensland *(Microtrichomanes vitiense).*

RICHMOND RANGE

The Richmond Range of sandstone with remnant basalt capping from the Focal Peak source in Queensland separates the Richmond Valley from the Clarence Valley to the west. This suballiance occurs on or below such basalt caps on the moister southerly or easterly aspects.

The largest and best area is the Cambridge Plateau Flora Reserve in the head of Trynney Creek, where it occupies 867 ha. Because the mean altitude is 530 m, *Argyrodendron actinophyllum* is very common with *A. trifoliolatum.* The latter predominates at lower altitudes such as the original Cambridge Plateau Flora Reserve at

380 m altitude. The main plateau is intermediate between the *Argyrodendron trifoliolatum* and *A. actinophylla* Suballiances but has been included in discussion of *A. trifoliolatum* because there are many typical lowland associates also present. This is a very well developed forest with the canopy height at about 40 m. There is one tree of *Gmelina leichhardtii* (the "Cec Jones Tree") which is about 35 m tall and 200 cm diameter. Cec Jones was the forester in charge when this whole area was selectively logged in 1966. As a result of his efforts and those of his foreman, the logging was kept to a minimum with a consequent rapid filling in of the canopy once more. Apart from the two *Argyrodendron* spp., other common trees are *Syzygium crebinerve, Sloanea woollsii, Flindersia xanthoxyla, Daphnandra micrantha* and *Dendrocnide excelsa.* In the small tree layer, *Alangium villosum* is common.

Further north along the Richmond Range in the head of Sandy Creek at 560–600 m altitude is the largest area of unlogged subtropical rainforest on the range, totalling 280 ha and now known as Bungdoozle Flora Reserve. The reserve is on a southern aspect with basaltic soil. The major canopy species are *Argyrodendron trifoliolatum, Cryptocarya erythroxylon, Litsea reticulata, Syzygium crebrinerve* and *Diospyros pentamera.* There is a dense ground cover of *Linospadix monostachyus, Alocasia macrorrhizos, Pollia crispata, Lomandra spicata, Adiantum formosum* and *Lastreopsis* spp. Further downstream below the basaltic influence, the yellow earth derived from the underlying sandstone supports many warm temperate rainforest elements.

Even further north, another area of this suballiance extends east into the heads of Iron Pot and Eden Creeks. Upper Duck Creek is south-west of Dome Mountain with a southerly aspect and a position near the lower boundary of the basalt at 600–700 m altitude. The total area at Duck Creek is 430 ha, but other than this very steep area, most was heavily logged in the late 1950s. Because its altitude is greater than Cambridge Plateau and Sandy Creek, *Argyrodendron actinophyllum* is almost as common as *A. trifoliolatum.* Other common canopy species are *Cryptocarya erythroxylon* and *Syzygium francisii,* the latter being up to 40 m tall and 120 cm diameter. One specimen of *Hodgkinsonia ovatiflora* was estimated to be a record 25 m tall and 60 cm diameter.

On the sandstones below 500 m altitude where the soil is less fertile, there is open forest of *Eucalyptus grandis, E. saligna* and *E. microcorys* with a rainforest understorey. There has been much cyclone damage and many landslips on these very steep slopes.

To the east, Iron Pot Creek has created a broad, flat valley with a basalt cliffline at Murray Scrub Flora Reserve. The creek has now eroded right through the basalt into the fine-grained sediments below, so that it is entrenched within the valley. This site is part of 3 500 ha of subtropical rainforest in Iron Pot and Eden Creeks. Most of this area is given over to the *Argyrodendron trifoliolatum* Suballiance. The area was all heavily logged in the late 1950s and early 1960s with the exception of Murray Scrub, which was inaccessible from the road system above the cliffs. The scrub, however, was selectively logged for *Toona australis* last century by timber-getters who followed the creek up from the south. This is a very protected site with the rainforest confined to the eastern side of the creek on a series of terraces stepping up to the base of the basalt cliffs where access is difficult due to the large fallen blocks. The canopy trees are particularly tall, with many species reaching record size here.

Although many of the heights listed below are in the vicinity of 35 m, these species are generally found in the lower storey. The major tree species are *Argyrodendron trifoliolatum* and *Dendrocnide excelsa,* but there are also massive specimens of *Ficus watkinsiana, F. macrophylla, Cryptocarya erythroxylon, Argyrodendron actinophyllum, Dysoxylum fraserianum,* and *D. muelleri* (Species List, Microfiche). Huge vines of *Piper novae-hollandiae* are conspicuous hanging in curtains from the tallest trees. Epiphytes, too, are conspicuous, but consist of only 10 species. Topographically, Murray Scrub

Record sizes of trees, Murray Scrub

	Height *m*		Diameter *B.H. cm*	
Ficus fraseri	24	without top (18)	61	(60)
Streblus brunonianus	*30	(15)	*45	(40)
Aphananthe philippinensis	32	(30)	104	(60)
Neolitsea australiensis	*40	(15)	*50	(25)
Ailanthus triphysa	35	(30)	86	(60)
Flindersia australis	?	(40)	186	(180)
Dysoxylum rufum	32	(25)	74	(60)
Arytera divaricata	36	(24)	73	(?)
Elattostachys nervosa	29	(21)	47	(50)

*Denotes estimate only.

Numbers in brackets are the previous record.

and Booyong Reserve are comparable. Murray Scrub, however, contains some warm temperate rainforest elements on the poorer soils derived from sedimentary rocks. The following floristic comparison can be drawn for the respective subtropical rainforests:

	Booyong	Murray Scrub
Area in hectares	13	340
No. of Tree Species	81	72
No. of Shrub Species	18	15
No. of Herb Species	8	15
No. of Vine Species	29	25
No. of Epiphyte Species	6	9
No. of Species, Total	142	136

Despite Murray Scrub's greater area, the scrub is slightly less diverse floristically than Booyong. The explanation may be that the scrub is further inland and in a drier location.

The Richmond Range does not appear to contain any subtropical rainforest species at their geographic limits.

ORARA AND BELLINGER VALLEYS

In these valleys, the *Argyrodendron trifoliolatum* Suballiance is restricted to the well-developed alluvial plains which receive only short-duration flooding of several hours rather than the days of inundation as may occur further downstream.

The Coramba Nature Reserve is the only remnant of the suballiance in the Clarence Valley. Further downstream at Susan Island in the Clarence River, flooding is more prevalent; the *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance occupies this flood plain. Similarly at Maclean Reserve, the *Castanospermum-Dysoxylum muelleri* Suballiance is in evidence. At Coramba Nature Reserve, *Cryptocarya obovata* is very common, but not regarded as typical of the *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance because *Dendrocnide excelsa* and *Ficus watkinsiana* are absent. The most common canopy species are *Argyrodendron trifoliolatum, Cinnamomum oliveri, Cryptocarya glaucescens, C. obovata, Toona australis, Melia azedarach* and *Sloanea woollsii.* The rainforest is generally in good condition but with dense *Ligustrum sinense* and *L. lucidum* dominating the margins and invading any gaps. There is a riverine fringing strip of flood-tolerant species such as *Tristaniopsis laurina, Syzygium francisii, Sloanea woollsii* and *Cryptocarya obovata.*

Along lower Rosewood Creek in Dorrigo National Park, in the broad basaltic alluvial valley at 80–130 m altitude, there is a well-developed subtropical rainforest of

the suballiance. The major canopy species are *Argyrodendron trifoliolatum, Sloanea woollsii* and *Cinnamomum oliveri,* with *Archontophoenix* filling the gaps (Species List, Microfiche). A number of species which are common in this suballiance in the Big Scrub do not occur further south until encountered along lower Rosewood Creek. These include *Hicksbeachia pinnatifolia* which extends a little further south to Missabotti in the Nambucca valley, *Boehmeria platyphylla* which has a disjunct population at Mt Boss State Forest in the Hastings Valley, *Millettia australis* which occurs again at Port Macquarie, and three species which are at their southern limit — *Endiandra compressa, Castanospora alphandii* and *Carronia multisepala.* Fringing the river is a riparian community dominated by *Backhousia myrtifolia* with *Syzygium australe* and *Tristaniopsis laurina* also common. On the slightly poorer soils further away from the river and its alluvium, *Argyrodendron* is absent but huge trees of *Backhousia anisata* up to 46 m high and 177 cm diameter dominate the forest. These areas belong in the *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea* Suballiance which is intermediate between subtropical and warm temperate rainforest.

On the Never Never River, a northern tributary of the Bellinger River at 100–250 m altitude below the base of the Gleniffer Falls, a similar alluvial rainforest habitat is derived from the less fertile metasediments. *Argyrodendron trifoliolatum* and *Dendrocnide excelsa* are absent, *Sloanea woollsii* is uncommon and *Lophostemon confertus* is very common. Although *Hickbeachia* and *Castanospora* are once again present, this community also is best classified as the *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea* Suballiance.

Suballiance No. 2: Toona-Flindersia

This suballiance is not common in New South Wales, but may be more prevalent in South-east Queensland. Because it once occupied well drained sites on the fertile alluvial flats, it has been logged for its highly desirable timbers and then farmed. Only two significant areas are known — Stotts Island Nature Reserve and Hortons Creek, Nymboida (converted lease). The suballiance has close affinities with that of *Argyrodendron trifoliolatum* but appears to prefer warmer and better-drained sites which may even suffer from seasonal soil moisture stress.

Although it has never been cleared, Stotts Island would appear at first observation to be an unlikely site for the suballiance. The reason for the island's undisturbed status is that it is flood-prone. However, although most of this 142 ha island is periodically flooded by the Tweed River, an area of about 16 ha only receives brief inundation because it occupies the west, south and east edges of the island where the banks are commonly 2 m above normal river height and are accordingly the more elevated and better drained sections of the island. There are huge emergent *Ficus macrophylla* and some *F. obliqua.* The main canopy consists of *Cryptocarya obovata, Flindersia schottiana, F. xanthoxyla, Toona australis, Harpullia pendula, Elaeocarpus grandis, E. obovatus* and *Diospyros pentamera* (Species List, Microfiche). There is a small tree layer in which *Aphananthe philippinensis* and *Streblus brunonianus* are very common. A number of rare and endangered species are preserved on the island, including *Archidendron hendersonii, Lepiderema pulchella* and *Randia moorei.* Of special importance is a single tree of *Cassia brewsteri* var. *marksiana* which is possibly the largest known and is certainly the only specimen preserved in New South Wales. In 1957, a seedling of *Diospyros mabacea* was recorded from the island, the first live specimen known since 1917. Several small trees there are the only known specimens within conserved areas on the lower Tweed. This rare and endangered species is represented by only about 20 wild trees along the Oxley-Tweed Rivers.

At Hortons Creek, a tributary of Clouds Creek and hence the Nymboida River, there are about 20 ha of basaltic alluvium with a protected southern aspect. The area has been logged several times, the latest being a selective logging in 1974–75 for *Toona australis* and *Grevillea robusta*. The disturbances resulted in a range of age classes of *Toona* from 2 to 25 m tall and up to 40 cm diameter. Such prolific regrowth of the species over such a large area is not known elsewhere. There are three gigantic, emergent *Ficus watkinsiana*, and the main canopy is of *Dendrocnide excelsa, Grevillea robusta, Flindersia schottiana, Melia azedarach* var. *australasica, Toona australis* and *Argyrodendron actinophyllum* (Species List, Microfiche). Less abundant trees are *Ehretia acuminata* of exceptional size, *Dysoxylum fraserianum* and one specimen of *Argyrodendron trifoliolatum*. There are no unusual or endangered species or geographical limits recorded for the site, but the extent of the area of *Toona* regrowth is exceptional. The future forest will be quite magnificent.

Suballiance No. 3: *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.*-Araucaria*

This is the major suballiance on the well-drained, fertile, basaltically-enriched alluvial lowland flood plains north from the Manning River. Much of the rich alluvial river flats now under agriculture would originally have supported this suballiance within the main flood channel, and Suballiance No. 1: *Argyrodendron trifoliolatum* where less flood prone.

These were truly magnificent forests as can be gauged by the report of Government Surveyor Clement Hodgkinson in 1844 as he explored the lower Tweed River by boat and on foot: ". . . The brush grows on the richest alluvial land and consists of trees of almost endless variety, and very large dimensions, totally differing in appearance from the ordinary Eucalyptus and Casuarina which grow on the common open forests of Australia, for the brush trees in general possess a rich umbrageous foliage of bright shining green. But the peculiar appearance of the brush is principally caused by the countless species of creepers, wild vines and parasitical plants of singular conformation, which, interlaced and entwined in inextricable confusion, bind and weave together the trees almost to their summits, and hang in rich and elegant flowering festoons from the highest branches."

Today's remnants of these majestic forests are pitiful oases in an agricultural desert. In the north on the Richmond, Brunswick and Tweed Rivers, the rainforest appears to be coping adequately with the exotic weeds, but further south on the Clarence, Bellinger, Macleay and Manning Rivers, the small remnants are being progressively replaced by exotics at all levels except where teams of regenerators are attempting to restore the balance as discussed in Chapter 8 of Volume 1.

TWEED RIVER

The only area which Surveyor Hodgkinson could still identify would be Stotts Island. Otherwise, the forest has long since disappeared along the many kilometres of riverbank. Only 35 ha continues to support Suballiance No. 3, and much of the remainder is swamp or swamp forest. It occupies a slightly lower zone than the previous suballiance which it adjoins towards the centre of the island. Fewer tree species are present — 34 rather than 70 — and their height is less. Floodplain species such as *Archontophoenix cunninghamiana* and *Syzygium francisii* are more common. Additional tree species in evidence are *Araucaria cunninghamii* and *Cryptocarya triplinervis* (Species List, Microfiche). Large trees of *Ficus macrophylla, F. obliqua* and *F. virens* and smaller trees of *Aphananthe philippinensis, Streblus brunonianus* and *Elaeocarpus obovatus* are also present.

Rare and endangered species in this rainforest include *Archidendron hendersonii* and *Sterculia quadrifida*.

BRUNSWICK RIVER

Immediately upstream from the highway bridge across the Brunswick River is an interesting rainforest patch on heavy clay alluvium. The rainforest is probably best included in the third suballiance, although *Cryptocarya obovata* is absent. Although 11 ha in area, the site includes much swamp forest. The more common canopy trees are *Dendrocnide photinophylla, Ficus watkinsiana, Araucaria cunninghamii, Grevillea hilliana, Acacia bakeri, Flindersia bennettiana, F. schottiana, Euroschinus falcata, Syzygium hodgkinsoniae, S. moorei* and *Diospyros pentamera.* There are particularly tall trees of *Flindersia bennettiana, Acacia bakeri, Syzygium hodgkinsoniae, S. moorei* and *Grevillea hilliana,* the latter being at its southern limit here. Amongst the small trees is *Davidsonia pruriens,* also at its southern limit. Since *Endiandra globosa* occurs only along the Brunswick River and the coastal streams north to Tallebudgera Creek, it, too, is close to its southern limit.

In 1957, the first collection in New South Wales of *Randia moorei* since 1903 was made at this site. The rare and endangered species is now known from Broken Head Nature Reserve to Beenleigh, but often as only a few trees on unreserved land.

RICHMOND RIVER

The best developed remnant of this floodplain suballiance in New South Wales is at Boatharbour Nature Reserve in the original "Big Scrub" at the junction of Coopers and Wilsons Creeks. Only 6 km upstream from Lismore, this area of nearly 14 ha was the head of navigation in the early days and is frequently inundated by the meeting of the swirling floodwaters of these two creeks. Botanically, it is a very rich forest with 103 species of trees and a further 24 species of shrubs (Species List, Microfiche). It exhibits the typical three layers of trees with the top layer of huge emergents comprising tapered sentinel *Araucaria cunninghamii* and wide-spreading *Ficus obliqua, F. macrophylla* and *Cryptocarya obovata* (Photo 55). The main canopy is of *Cinnamomum oliveri, Alphitonia excelsa* and *Syzygium francisii.* The lower storey is mainly *Mallotus philippensis, Aphananthe philippinensis* and *Planchonella australis.*

The trees are particularly tall, as can be seen from the following estimated records:

Record heights of trees, Boatharbour

	Height m	Diameter m
Euroschinus falcata	45 (40)	75 (90)
Elaeocarpus obovatus	45 (35)	150 (+90)
Stenocarpus sinuatus	40 (30)	75 (30)
Bridelia exaltata	35 (25)	40 (90)
Emmenosperma alphitonioides	35 (35)	75 (60)
Mischocarpus australus (sundaicus)	35 (8)	50 (?)
Geijera salicifolia var. *latifolia*	30 (24–27)	?

(Figures in brackets are previous record sizes.)

There are a number of rare and endangered species such as *Austromyrtus fragrantissima* (Photo 56). This species was not seen between 1890 and 1976, when it was rediscovered at Boatharbour. Six small trees are now known at that site, and the range as a riparian or stream-side species has been extended from Woodburn on the lower Richmond to Currumbin Creek, Queensland. The shrub, *Desmodium acanthocladum,* is also a stream-side species in this suballiance and in the *Argyrodendron trifoliolatum* Suballiance, occurring from the Richmond to the Tweed River, where it is often found bedecked in flood debris. *Ochrosia moorei* occurs at Boatharbour as a single tree, just

as in many of the Big Scrub remnants in both *Argyrodendron trifoliolatum* and this suballiance, from Victoria Park to Springbrook. *Notelaea johnsonii* is represented by several small trees in the Boatharbour Nature Reserve as well as being scattered through many of the other Big Scrub remnants and north to Central Queensland (Dawes Range).

Despite its excellent development and wealth of rare and endangered species, Boatharbour is threatened by a proposal to re-align the trunk road from Lismore to Bangalow through the eastern section.

CLARENCE RIVER

Only two subtropical rainforest remnants remain on the Clarence River in addition to the Coramba Nature Reserve on the Orara River (*Argyrodendron trifoliolatum* Suballiance). At Maclean, there is an example of the *Castanospermum-Dysoxylum muelleri* Suballiance (No. 5), and in the middle of the river at Grafton is Susan Island Nature Reserve — a rather dry version of the subject suballiance (No. 3). The mean annual rainfall at Grafton is only 910 mm, which is marginal for this suballiance. At other New South Wales sites supporting the suballiance, rainfall ranges from 1 100 to 1 900 mm.

The lower rainfall is reflected in four of the most common canopy species at Susan Island being associated with the dry rainforest subform. These are *Dendrocnide photinophylla, Harpullia pendula, Brachychiton discolor* and *Eucalyptus tereticornis.* Other major canopy trees are *Ficus macrophylla, Dendrocnide excelsa* and *Dysoxylum muelleri* (Species List, Microfiche). *Toona australis* on the island was logged in 1838–42 and there is no regeneration. At the present time, the rainforest which is a nature reserve occupies only 23 ha or 25% of the island, but in the 1920s, rainforest was twice that area. Grazing of cattle was practised over the whole island until the western rainforested section was declared a nature reserve in 1982, and the cattle excluded by fencing. Before gazettal, the rainforest was steadily deteriorating due to crown breakage by the flying fox colony and the lack of regeneration to fill these light gaps because of cattle trampling and browsing. It is hoped that there will be a recovery by native flora rather than a proliferation of the exotics which are gaining a hold. Eight exotic tree species are present, of which *Cinnamomum camphora* and *Ligustrum lucidum* are common. The two most common shrubs present are the exotic *Solanum mauritianum* and *Solanum pseudocapsicum,* and the two most common herbs are the exotic *Tradescantia albiflora* and *Rivina humilis.* Of eight exotic species of vines and scramblers in evidence, *Ipomoea cairica* and *Lantana camara* are among the three most common vines present, the other being the native *Legnephora moorei.* Clearly, the rehabilitation programme has been commenced just in time.

BELLINGER RIVER

A situation similar to the Clarence River is found on the Bellinger River. The only remnant of the original, extensive rainforest of the floodplain is found on an island in the river within the town limits of Bellingen. This has been known as Paradise Island or Jarrett Park, and more recently, as Bat Island or Bellingen Island. Originally, the island contained approximately 4.5 ha of rainforest, but this has been reduced to 2.6 ha by the death and non-replacement of the very large *Ficus* spp. in the centre of the island. The main canopy and emergent trees consist of *Dendrocnide excelsa, Ficus macrophylla, F. obliqua, F. watkinsiana, Argyrodendron trifoliolatum* and *Cryptocarya obovata* (Species List, Microfiche). Common smaller trees include *Melia azedarach, Toona australis, Sloanea australis, Ficus coronata, Endiandra pubens* and *Waterhousea floribunda.*

As at Susan Island, there is a large resident colony of flying foxes causing much breaking of the crowns and often eventual death. There is also a heavy infestation of

weeds which includes six out of the 42 tree species, seven of the eight shrub species, *Tradescantia* as the most common herb and *Anredera cordifolia* as one of the two most common vines. The last two mentioned species are smothering the regeneration on the forest floor and the edge trees around the gaps respectively. The forest is degrading rapidly as the smothered trees die and there is no native regeneration to fill the gap. Although there is a rehabilitation programme in operation on the island, it has been mainly attempting to control *Tradescantia* on the forest floor although *Anredera* continued to smother many of the trees. This procedure was in marked contrast to the cutting and poisoning of the larger vines at Wingham Brush which appears so promising. Recently there has been greater emphasis upon planting of some gap edges and the cutting of *Anredera* vines in some sections.

LOWER MACLEAY RIVER

The vast alluvial floodplains of the lower Macleay River downstream from Kempsey yielded large volumes of timber of *Toona australis* in the late 1830s. Surveyor C. Hodgkinson described how, upon entering the mouth of the Macleay River at Grassy Head, the first few miles were of mangroves with thickets of myrtle, palm and swamp oak. This scene was then superseded by dense alluvial brushes, rising like gigantic green walls on both sides of the river. Twenty miles (32 km) upstream from the mouth to the head of navigation, the brush land was interspersed with small alluvial plains devoid of trees and varying from 50 to 100 acres (20–40 ha) in area. Hence, the floodplains from Jerseyville to Kempsey were originally tall, subtropical rainforest of the third suballiance. All that is left today are three small patches, each of less than one hectare, between Jerseyville and Smithtown. These remnants have been heavily disturbed in the past and even now have very little understoryey because of grazing.

The large, emergent trees are mainly *Ficus obliqua* and *F. superba* var. *henneana*, and the main canopy consists of *Syzygium francisii, Aphananthe philippinensis, Streblus brunonianus* and *Diospyros pentamera.* Although *Cryptocarya obovata* is present, it is uncommon. One puzzling aspect of the inventory is the total absence of *Dendrocnide excelsa* on all contemporary lists for the lower Macleay, despite its common occurrence further upstream. It is inconceivable that the species was not present in the original forest. Perhaps it was preferentially destroyed, because of its stinging habit. Vines — particularly the thorny *Maclura cochinchinensis* — are quite common in the three remnants. Other common vines are *Ripogonum album, Smilax australis, Ipomoea cairica* and *Parsonsia straminea.* The heavy grazing pressure has kept *Cinnamomum camphora* and *Ligustrum sinense* seedlings under control; but it has also prevented recruits of all the native species from filling any gaps caused by the death of older trees. Inexorably, these rainforest remnants will be converted to pasture under this form of management.

MANNING RIVER

The southern limit of remnants of the third suballiance is on the alluvial flats of the Manning River, which have been enriched by the basalts of the Comboyne and Bulga plateaux and the Barrington-Gloucester Tops. There are two remnants, of which the larger is the Wingham Brush of 8 ha within the town boundary. There are many immense, emergent *Ficus macrophylla,* and the main canopy is of *Dendrocnide excelsa, Melia azedarach, Argyrodendron actinophyllum, Planchonella australis, Cryptocarya obovata, Dendrocnide photinophylla* and *Dysoxylum rufum* (Species List, Microfiche). *Alangium villosum* is very common in the small tree stratum. Unfortunately, many exotic species are present. Until recently, they were effectively smothering any regeneration of native species as well as the canopy trees. Of the six exotic tree species on the site, the two species of *Ligustrum* are the most serious weeds. There are four exotic shrub species and six exotic herb species including *Tradescantia albiflora,* which blankets the

ground and any seedlings. In addition, there are eight species of exotic vines. Among these, *Macfadyena unguis-cati* and *Anredera cordifolia* are capable of smothering canopy trees. Despite this attack on the rainforest at all levels including breakage of the canopy by resident flying foxes, a council-funded team of local citizens has, since 1981, transformed a large section of the rainforest by painting the herbicide glyphosate on to the cut stems of the vines and spraying its regeneration.

Eighteen kilometres downstream from Wingham Brush is the Coocumbac Island Nature Reserve of 6 ha. The island is immediately upstream from the traffic bridge at Taree. As might be anticipated, there are giant figs on the island, particularly *Ficus macrophylla, F. obliqua* and *F. superba* var. *henneana*. The main canopy is composed of *Aphananthe philippinensis, Celtis paniculata, Olea paniculata* and *Dysoxylum fraserianum*. Many of these species are more common here than at Wingham Brush because of the more maritime characteristics of climate on the tidal river. Other tree species such as *Cryptocarya obovata* and *Argyrodendron actinophyllum* are uncommon on the island. *Dysoxylum rufum* and *Alangium villosum* have not been recorded at all, despite their common occurrence at Wingham Brush which is only 9 km distant by the flight of a bird. Although these two remnants are quite distinct floristically, they are best included within the same suballiance. The island is progressing through various seral stages following logging for timber such as *Dysoxylum fraserianum* and clearing of the upstream section for market gardens. The downstream tip of the island, and indeed the entire area, is accreting with silt deposited by each flood. Although many of the exotic shrubs, herbs and vines recorded at Wingham Brush are also present here, they are not as serious at this stage and are being controlled more easily by the regeneration team of the National Parks and Wildlife Service.

***Suballiance No. 4:** Elaeocarpus grandis*

This community has rather exacting requirements due in no small part to the large fruits, up to 30 mm diameter, which are dispersed by water rather than by birds. In North Queensland, however, the fruits are eaten by cassowaries which effectively transport the very hard seeds. In New South Wales the suballiance is confined to narrow strips near rivers on alluvial floodplains, provided that the drainage is good. It exists, therefore, as a lowland, riverine fringing community within a more extensive community such as Suballiance No. 5: *Castanospermum-Dysoxylum muelleri*; No. 6: *Archontophoenix-Livistona*; or No. 33: *Ceratopetalum-Argyrodendron*.

In the Richmond Valley, Suballiance No. 4 can be recognized at Wanganui in upper Coopers Creek, on basaltic alluvium below the rhyolite cliffs on either side of the valley. Typical, associated species are *Archontophoenix cunninghamiana, Dysoxylum muelleri, Toona australis* and *Sloanea australis* (Species List, Microfiche). The shrub layer may be dominated by *Cyathea cooperi* with *Helmholtzia glaberrima* as a common herb along the riverbank. *Calamus muelleri* and *Pothos longipes* are the common vines. Away from the stream, Suballiance No. 4 gives way to the *Castanospermum-Dysoxylum muelleri* suballiance. Similar communities occur at Minyon Falls and Rocky Creek, downstream from the Big Scrub Flora Reserve. At Terania Creek (Species List, Microfiche), further upstream from the Park boundary, on the poorly drained rhyolitic soils, the fourth suballiance is replaced by that of Suballiance No. 6, *Archontophoenix-Livistona*.

There are two examples of Suballiance No. 4 in the Clarence Valley, the best development being at a major creek junction on Middle Creek in Gibraltar Range National Park. The overstorey consists of very tall *Elaeocarpus grandis, Toona australis* and *Lophostemon confertus* above a lower storey of *Archontophoenix* and *Cyathea cooperi* (Species List, Microfiche).

At Maclean on the lower Clarence, the lowland alluvial rainforest is of the *Castanospermum-Dysoxylum muelleri* Suballiance No. 5. *Elaeocarpus grandis* is common, although not as a distinct floristic unit.

Along Woolgoolga Creek, on the alluvial flats just within and downstream from the Flora Reserve, there is a fringe of this suballiance bordering rainforest of Suballiance No. 33: *Ceratopetalum-Argyrodendron.*

Scattered trees, or clumps of trees, of *Elaeocarpus grandis* appear further south along Rosewood Creek in the Bellinger Valley and in the Nambucca Valley, but they have not developed a distinctive community.

Suballiance No. 5: *Castanospermum-Dysoxylum muelleri*

This suballiance is found on fertile, deep, basaltic red loams built up by weathering of the lowland plateaux at locations such as Wollongbar and Davis Scrub Nature Reserve, by colluvium on benches or terraces on the top of lava flows at Numinbah Nature Reserve and Lynches Creek access road to the Border Ranges National Park, or by alluvial accumulation in the river valleys such as those at Wanganui, Minyon Falls, Boomerang Falls, Big Scrub Flora Reserve, Johnstons Scrub, Kellin Falls and Maclean Reserve. A reliable soil moisture level appears to be a major requirement. A related suballiance, No. 24, is characterized by *Castanospermum* and *Grevillea robusta.* It occupies the drier upper reaches of the Richmond and Clarence Rivers as a narrow ribbon along the banks only. The seed of *Castanospermum australe,* like the fruit of *Elaeocarpus grandis,* is very large and not well adapted for dispersal except by water or gravity downhill. However, *Castanospermum* seeds were eaten by the Aborigines, who could have carried them to new sites for preparation as food. They may have dropped or left some of them around the camp site where they germinated. There is a kurrajong *(Brachychiton populneus)* growing on an Aboriginal midden at Evans Head which is many kilometres from the nearest living known trees. *Dysoxylum muelleri* seeds are spread by birds.

ALSTONVILLE PLATEAU

Suballiance No. 5 is well represented at Davis Scrub Nature Reserve — a remnant of 13 ha at 165–175 m altitude surrounded by cleared land. Although only 4 km from Victoria Park Nature Reserve on the same plateau, Davis Scrub has a different floristic composition. Victoria Park is on the southern edge of the plateau with more rapid subsurface drainage and accordingly supports the *Argyrodendron trifoliolatum* Suballiance. At Davis Scrub, the two major canopy species of Victoria Park — *Argyrodendron trifoliolatum* and *Flindersia xanthoxyla* — are only of minor importance, and *Castanospermum* and *Dysoxylum muelleri* are the two most common species, followed by *Syzygium crebrinerve* (Species List, Microfiche). Both areas have emergent *Ficus macrophylla* with huge spreading crowns. There are several tree species reaching or approaching record size here, including *Dysoxylum muelleri* at 35 m tall and 120 cm diameter and *Euodia micrococca* at 30 m and 60 cm diameter. Two species which are close to their southern limit are *Syzygium hodgkinsoniae* which extends north to Gympie in Queensland and *Rhodamnia maideniana* which is confined to the old Mt Warning volcano and occurs as far north as Mudgeeraba Creek. Plants with a restricted distribution include *Ochrosia moorei* and *Quassia* sp. aff. *bidwillii.*

A similar but smaller remnant of about 2 ha is found at the Wollongbar Agricultural Experiment Station 5 km to the north. In addition to *Castanospermum* and *Dysoxylum muelleri* being very common, *Flindersia xanthoxyla, F. schottiana, Argyrodendron trifoliolatum* and *Toona australis* are also well represented. This small remnant is badly infested with many aggressive exotics such as *Ligustrum lucidum, L. sinense, Olea africana, Coffea arabica, Protasparagus plumosus* and *Passiflora subpeltata.* One of the

largest recorded specimens of *Mallotus discolor*, estimated at 28 m tall and 60 cm diameter, occurs on the site. This is the type locality of *Notelaea johnsonii*, which is virtually restricted to the Mt Warning complex. The undescribed *Quassia* is also present.

BORDER RANGES TERRACES

Several examples of this suballiance can be seen on well-watered benches or terraces, part way up mountain sides on geological boundaries where differential weathering has taken place. In the head of Couchy Creek extending east towards the head of Crystal Creek is a magnificent example of the *Argyrodendoron trifoliolatum* Suballiance. Within it on the top of the basalt with the rhyolite cliffs of Springbrook rising immediately to the north and providing continuous seepage, the *Castanospermum-Dysoxylum muelleri* Suballiance occurs. However, although *Castanospermum* is the most common species, *Dysoxylum muelleri* is absent. A possible explanation is the altitude of 540–570 m, well above the usual 0–300 m altitudinal range of this species in New South Wales. Other common canopy species are *Ficus watkinsiana, Dendrocnide photinophylla, Pseudoweinmannia lachnocarpa, Brachychiton acerifolius, Syzygium hodgkinsoniae* and *Lophostemon confertus* (Species List, Microfiche). Among the vines, *Calamus muelleri* is most common, and *Piper novae-hollandiae, Cissus hypoglauca, C. sterculiifolia, Arthropteris beckleri* and *Ripogonum album* are also common. Epiphytes are conspicuous, particularly *Asplenium australasicum.*

Midway up the mountainside at 300 m altitude on the Lynchs Creek access road to the Border Ranges National Park, there is a smaller but similar bench on the boundary between basalt flows. Both *Castanospermum* and *Dysoxylum muelleri* are common there, with *Toona australis.*

ALLUVIAL FLOODPLAINS

The main occurrences of this fifth suballiance, however, are on the alluvial deposits in the valleys.

On the Tweed River, it occurs mainly as dense forests of *Castanospermum* on the river banks from Uki downstream to Dum Dum.

At Wanganui on upper Coopers Creek in the Richmond Valley at 160–200 m altitude, there is a basalt pavement with rhyolite cliffs on either side of the valley. Although minor areas of the *Elaeocarpus grandis* Suballiance are in evidence, the major rainforest is of the *Castanospermum-Dysoxylum muelleri* suballiance. The most common canopy species are *Dysoxylum muelleri, Toona australis, Syzygium crebrinerve* and *Sloanea australis. Castanospermum* is less common. *Helmholtzia glaberrima* is very common in moist, shady sites, and *Calamus muelleri* is the most frequently encountered vine. Nearby at similar elevations, there are narrow gullies below Minyon and Boomerang Falls. On the basalt below the rhyolite in these gullies are small, localized areas where *Castanospermum* may predominate although *Dysoxylum muelleri* is absent. This is certainly the case at Boomerang Falls; on a small area of 9 ha, major canopy species are *Castanospermum, Geissois benthamii, Sloanea australis* and *S. woollsii* (Species List, Microfiche). Below Minyon Falls, the alluvium is mainly derived from rhyolite, thereby favouring the *Ceratopetalum apetalum-Sloanea woollsii* Suballiance No. 33. *Castanospermum* and *Sloanea australis* occur only as minor pockets on the better basaltic soil.

A very fine example of the *Castanospermum-Dysoxylum muelleri* Suballiance was previously present in the Big Scrub Flora Reserve along Rocky Creek, but the site was selectively logged for *Toona australis* and *Castanospermum* 30 to 40 years ago. It may be that this spot was originally similar to Davis and Johnstons Scrubs. The most common trees in this 196 ha flora reserve are *Castanospermum, Syzygium crebrinerve* and *Sloanea australis* with *Argyrodendron trifoliolatum, Ficus watkinsiana* and *Dendrocnide excelsa*

common. There is a dense shrub layer of *Linospadix monostachyus, Triunia youngiana* and *Wilkiea austroqueenslandica.* Rare and endangered plants include *Ochrosia moorei* and *Quassia* sp. aff. *bidwillii.*

It must be noted that the Big Scrub Flora Reserve is in fact on the margin of the basalt of the original Big Scrub. Even before it was logged, it may not have been typical of much of the surrounding area. Johnstons Scrub at Eureka is the largest area of unlogged, genuine Big Scrub. Approximately half of its 20.4 ha on the upper slopes has already been described under the *Argyrodendron trifoliolatum* Suballiance, but I regard the remaining half on the lower slopes bordering Coopers Creek as the most impressive example of the *Castanospermum-Dysoxylum muelleri* Suballiance in New South Wales. The *Castanospermum* trees are very common and of large size. There are only occcasional specimens of *Dysoxylum muelleri.* The scattered emergent *Ficus macrophylla* are of gigantic size. Other common canopy species are *Ficus watkinsiana, Dendrocnide excelsa, Anthocarapa nitidula* and *Argyrodendron trifoliolatum.* The largest *Duboisia myoporoides* is recorded here, being 20 m tall and 45 cm diameter. Rare and endangered plants include *Syzygium hodgkinsoniae, Desmodium acanthocladum* and *Ochrosia moorei.* On a stony basaltic ridge at Eltham, a small remnant is dominated by *Castanospermum* and *Dysoxylum muelleri* with *D. fraserianum* and *Argyrodendron trifoliolatum* also common.

Kellin Falls on Emigrant Creek at Knockrow is towards the south-east edge of the Big Scrub. The canopy consists mainly of *Dysoxylum muelleri* and the introduced *Cinnamomum camphora. Castanospermum* is less common, as are *Sloanea australis, Syzygium moorei* and *Argyrodendron trifoliolatum.* Rare and endangered species include *Syzygium hodgkinsoniae* and *Elaeocarpus eumundi.*

On the lower Clarence River at Maclean, on deep alluvium only 5 m above sea level, is the sole remaining patch of the original rainforest which probably extended discontinuously from Iluka to Grafton. The mean annual rainfall at Maclean is 1 225 mm, and only 910 mm at Grafton. Accordingly, the upriver location contains many dry rainforest species such as those on Susan Island. The 3 ha remnant at Maclean is dominated by *Castanospermum* and *Dysoxylum muelleri.* Other typical floodplain canopy species such as *Cryptocarya obovata, Elaeocarpus grandis, Aphananthe philippinensis* and *Streblus brunonianus* are also common (Species List, Microfiche). Exotics such as *Cinnamomum camphora* and *Lantana camara* are common but effective control is still possible. Severe breakage resulting from a large colony of little red flying foxes in 1985–86 is cause for great concern, particularly if further damage is sustained in the next few years.

Suballiance No. 6: Archontophoenix-Livistona

Often known as palm forest, this suballiance is most often found in those lowland subtropical rainforest sites where drainage is impeded and there is free surface water during the wet season. *Archontophoenix cunninghamiana* dominates the inland palm forests where the water is fresh (Photo 57), but *Livistona australis* prefers more saline areas such as estuarine conditions or old strand lines. The soil type appears not to be critical for this suballiance which occurs on material ranging from sand to basaltic alluvium.

BRUNSWICK-TWEED

This area presents the full spectrum of salinity levels from adjoining mangrove forests on Stotts Island to the headwaters of streams at the base of Mt Warning. Stotts Island Nature Reserve is situated in the tidal zone of the Tweed River and contains the largest single area of this suballiance in New South Wales — 77 ha or 54% of the island. *Livistona* is far more common than *Archontophoenix* because the most elevated sections of this suballiance are only about 1 m above mean high tide while the lower

sections are infiltrated by mangroves. The highest areas consist of mounds with tall *Araucaria cunninghamii* towering above a well developed palm stratum and large *Syzygium francisii* (Species List, Microfiche). At a slightly lower level, there is a swamp forest of *Livistona, Archontophoenix, Casuarina glauca, Elaeocarpus obovatus, Cupaniopsis anacardioides* and *Syzygium moorei* as well as very tall swamp sclerophyll forest species such as *Melaleuca quinquenervia* and *Casuarina glauca.* The ground cover is sparse, being mainly *Crinum pedunculatum.* The lowest areas, where surface water is present most of the time, consist entirely of the two palm species.

Nearer the sea at the base of Round Mountain on the sheltered south-east side there are 3 ha of this suballiance on yellow-brown earth derived from metasediments. The site borders a swamp sclerophyll forest of *Melaleuca quinquenervia, Casuarina glauca* and *Eucalyptus robusta.* Suballiance 6 consists mainly of *Archontophoenix* up to 25 m tall with only occasional *Livistona* (Species List, Microfiche). *Planchonella laurifolia* is also very common and exhibits its best development in New South Wales. Other common species are *Elaeocarpus grandis, Ficus coronata* and *Glochidion sumatranum.* The latter extends as far south as Iluka but here achieves a record of 30 m height and 30 cm diameter. Less common tree species are *Syzygium luehmannii* and *Euodia elleryana,* typical components of littoral rainforest. Of special interest was the discovery in 1979 of one plant of *Dendrocnide moroides* which was last seen in New South Wales at Nimbin in 1925. Several plants have since been located nearby at Reserve Creek and Cudgen Lake. Other plants of interest are the vine, *Cayratia acris,* which extends south to Lismore but is rare in New South Wales and *Endiandra globosa,* which is restricted to the lowlands between Mullumbimby and the Gold Coast hinterland.

A very tall-growing but small area of this suballiance occurs further south in the Brunswick Valley at Belongil Creek, Yelgun. It adjoins a large wetland area. *Archontophoenix* grows to 15 m beneath and between very tall *Melaleuca quinquenervia* more than 30 m tall. Other common tree species are *Commersonia bartramia,* 30 cm diameter; *Glochidion sumatranum,* 20 cm diameter; *Ficus coronata* and *Symplocos stawellii.* Occasional specimens include *Ficus obliqua, F. watkinsiana, Euodia elleryana, Jagera pseudorhus, Acmena smithii* and *Rhodomyrtus psidioides.* Hence, many late secondary tree species are present. Only 25 tree species are recorded overall, and 10 are uncommon. This development could indicate that a wildfire burnt through the site some time in the past 100 to 50 years. The ground cover is virtually restricted to *Calanthe triplicata* and *Alocasia macrorrhizos.*

Inland at the base of Mt Warning on the north and northeastern sides, the broad flat headwaters areas of Korrumbyn and Wollumbin Creeks have some of the finest examples of this suballiance in New South Wales. These are quite large areas, 38 and 36 ha respectively. The only palm present is *Archontophoenix,* and there are scattered, taller trees of *Ficus macrophylla, F. watkinsiana, Elaeocarpus grandis, Beilschmiedia elliptica* and *Lophostemon confertus.* It is indeed strange that although *Helmholtzia glaberrima* is a common ground cover along creeks in the McPherson, Tweed and Nightcap Ranges, it has not been recorded from the hub of these features at Mt Warning.

NIGHTCAP RANGE

There are several areas on the Nightcap Range at 190 to 200 m altitude on soil derived from a mixture of basalt and rhyolite. *Archontophoenix* dominates the forest in height and frequency; *Livistona* is completely absent. The greatest area of this suballiance in New South Wales, 150 ha, occurs at Terania Creek on the broad flat valley and lower slopes (Species List, Microfiche). Much of it is on a quaking mixture of boulders and clay of considerable depth which may represent an old landslip subsequently colonized by palms. A cyclone which struck the valley from the south in the early 1940s did enormous damage. Perhaps the younger palm forests originated at

that time. It certainly appears that they are capable of preventing effective regeneration of the other rainforest species so that a virtual monoculture is produced. Although the lengthy and expensive Terania Creek enquiry in 1980 produced much useful data, the mystery of the origin or origins of these palm forests was not fully addressed and was not elucidated. The major associated tree species of the lower layer is *Sloanea australis. Ficus coronata, Endiandra pubens* and *Elaeocarpus grandis* appear less frequently. The sparse shrub layer is mainly *Cyathea cooperi,* and the herbaceous layer is of *Helmholtzia glaberrima* and *Elatostema reticulatum.* Major common vines are *Calamus muelleri* and *Pothos longipes.*

Also on the Nightcap Range, but 10 km to the south-east, small, discrete patches of this suballiance are found on the broader flat areas below Minyon and Quandong Falls. The major tree species are similar to those at Terania Creek, but several rare and endangered species are also present (Table 8).

Table 8. Rare and endangered species, Minyon and Quandong Falls.

Dicksonia youngiae	Restricted to a few permanently moist sites from the Richmond River to Fraser Island and at two sites in the Bellinger Valley.
Pneumatopteris sogorensis	Only known in New South Wales from five localities in the Richmond-Tweed at its southern limit and two in South Queensland. Found mainly in North Queensland.
Endiandra compressa	One of only two disjunct occurrences in New South Wales of this essentially-Queensland species. Also in the Bellinger Valley.
Endiandra hayesii	Restricted to the Richmond River, New South Wales, to Burleigh Heads, Queensland. The original material was collected here.
Syzygium hodgkinsoniae	Scattered through the Big Scrub remnants and in South Queensland.

LOWER CLARENCE

The suballiance occurs at only two sites on the Clarence River, both near the sea.

Johnsons Lane, Iluka, adjoins mangroves, so *Archontophoenix* and *Livistona* are equally represented. Other common trees — *Syzygium luehmannii, Glochidion ferdinandi* and *Commersonia bartramia* — have affinities with littoral rainforest. .

There is a narrow gully on deep, white sand below Clarence Peak near Brooms Head at only 50–60 m altitude and possibly only 1 km inland from the old Pleistocene shoreline. *Archontophoenix* and *Livistona* are equally common. Other canopy trees are typically littoral in affinity and include *Endiandra discolor, Schizomeria ovata* and *Synoum glandulosum* (Species List, Microfiche). The most common small trees are *Trochocarpa laurina* and *Eupomatia laurina.* There is ample evidence of a long and frequent fire history which has doubtless selected in favour of the fire resistant species listed.

BELLINGER VALLEY

A very simple palm forest occurs 8 km north-east of Bellingen and is included in Tuckers Nob State Forest in a broad valley of deep quartz gravel derived from adamellite. Only three tree species are present of which *Archontophoenix* comprises the canopy and *Sloanea australis* forms the small tree stratum. There are also occasional tall shrubs of *Ficus coronata.* The herbaceous layer consists of scattered ferns, *Pollia crispata* and *Elatostema reticulatum.* Vines are mainly *Microsorum scandens, Calamus muelleri* and *Piper novae-hollandiae.* Epiphytes are uncommon.

Also in the Bellinger Valley, on the lower Rosewood Creek at Dorrigo National Park, there are broad alluvial flats dominated by the usual *Archontophoenix* and *Sloanea australis.*

WALLIS LAKE

Further south on Yahou Island Nature Reserve in tidal Wallis Lake near Forster, there are 7.5 ha of this suballiance. *Livistona* is very common and reaches 25–30 m

high (Species List, Microfiche). *Archontophoenix* is absent. *Livistona* is noted for its extreme fire resistance and tends to dominate repeatedly burnt areas. Beneath these palms on lacustrine sands is a dense shrubby layer of rainforest species which reflect the long history of fires of both European and Aboriginal man. There are a number of commonly occurring secondary species including *Acacia maidenii, A. longifolia, Acronychia oblongifolia, Glochidion ferdinandi* and *Notelaea longifolia.* Fire resistant tree species are also present, but are less common. These include *Endiandra sieberi, Alphitonia excelsa, Acmena smithii, Olea paniculata* and *Rhodomyrtus psidioides.* Associated with these rainforest trees, *Callistemon salignus* and *Melaleuca quinquenervia* are common. The only common rainforest vine is *Maclura cochinchinensis.*

Argyrodendron actinophyllum Alliance

This alliance occupies similar edaphic and topographic sites to that of the *Argyrodendron trifoliolatum* Alliance, but it occurs at cooler, higher elevations and/or latitudes. In the north, it is generally above 600 m altitude and up to about 1 000 m; to the south at Coxs Brush, Karuah River, it is at only 300 m. It can withstand greater exposure than *A. trifoliolatum* and occurs with dry rainforest elements in the New England gorges. It is replaced by littoral rainforest of the *Cupaniopsis-Acmena* alliance on the Mid North Coast where exposed to atmospheric salt. In higher and cooler situations, it is replaced by the *Caldcluvia* Alliance (Fig. 9).

The species *Argyrodendron actinophyllum* consists of two subspecies of which ssp. *diversifolium* is restricted to North Queensland, while ssp. *actinophyllum* is found south from Gympie, Queensland, to the Karuah River, New South Wales.

There are four suballiances:

7. *Argyrodendron actinophyllum*
8. *Argyrodendron actinophyllum-Araucaria*
9. *Argyrodendron actinophyllum-Dysoxylum muelleri-Syzygium francisii*
10. *Argyrodendoron actinophyllum-Dendrocnide-Ficus*

Suballiance No. 7: Argyrodendron actinophyllum

This suballiance is the cooler-conditions equivalent of Suballiance No. 1: *Argyrodendron trifoliolatum.* It generally occupies moist, basaltically derived or enriched soils from the Karuah River northwards into South Queensland. Typical canopy species are *Argyrodendron actinophyllum* and *Dendrocnide excelsa,* often with *Sloanea woollsii* and *Dysoxylum fraserianum.*

RICHMOND VALLEY

Suballiance No. 7 is uncommon in the Tweed Valley, possibly because its typical mid-altitude niche is unavailable due to the high escarpment cliffs. It does occur in the upper Richmond below the cliffs of Mt Lindesay and on Levers Plateau particularly in the head of Long Creek at 600–800 m altitude on basalt. (These sites are at a lower altitude than the Wiangarie Tops and the flat top of Mt Lindesay, which are occupied by *Caldcluvia-Cryptocarya erythroxylon-Orites-Melicope octandra-Acmena ingens* Suballiance.) Less common tree species are *Streblus brunonianus, Argyrodendron trifoliolatum* and *Ficus watkinsiana.* The shrub layer consists of *Linospadix monostachyus, Cordyline petiolaris* and *Solanum inaequilaterum.* The ground cover includes such ferns as *Adiantum formosum, Pteris umbrosa* and *Pellaea falcata, Alocasia, Pollia crispata* and *Elatostemma* spp. Epiphytes consist mainly of *Asplenium australasicum* with *Liparis reflexa* on rock faces.

In the middle Richmond River area, in the catchment of Rocky Creek at Whian Whian State Forest, the suballiance occupies the remains of the Blue Knob basalt (or younger basalt) at 650–700 m altitude. The *Argyrodendron trifoliolatum* Suballiance occurs at 200–300 m on the lower (or Lismore) basalt. Floristically, the site is similar to occurrences on Mt Lindesay and Lever's Plateau, but there are additional species including *Dysoxylum fraserianum, Acmena ingens, Syzygium crebrinerve* and *Diospyros pentamera.*

UPPER CLARENCE

In the upper Clarence Valley, the major areas for the suballiance are Tooloom Scrub Flora Reserve, Wilsons Peak (Photo 58) and Mt Clunie Flora Reserves and the south Yabbra area. The relevant communities in Tooloom Scrub Flora Reserve are at 600–840 m altitude in the heads of major streams such as Kangaroo, Wallaby and Rockhill Creeks or on the moister protected easterly and southerly upper slopes. The climate is marginal for subtropical rainforest. Mean annual rainfall is only 1 260 mm, and annual rainfall fluctuated between 670 and 1 900 mm in the period from 1947 to 1968. There is a pronounced August-to-October dry period when mean monthly rainfall is only 29–48 mm. The combination of winter frosts in the valleys followed by a dry spring has resulted in some disastrous wildfires. There was almost no rain at Wallaby Creek in 1915, and a wildfire burnt 800 m into the rainforest, causing such a heavy leaf fall that a second fire burnt through only two weeks later. The rainforest was burnt again in 1926, following strong westerly winds, and it was not until 10 weeks later that any rain was received. The common occurrence of *Araucaria* in these forests probably represents in part a seral stage or stages resulting from the disturbance by these fires. Although *Argyrodendron actinophyllum* and *Dendrocnide excelsa* are the two major canopy species, *Cryptocarya erythroxylon, Syzygium francisii* and *Anthocarapa nitidula* are also common (Species List, Microfiche). Other species include *Dysoxylum fraserianum* and *Citronella moorei.* The small tree layer consists of *Neolitsea australasica, Capparis arborea* and *Baloghia inophylla.* The shrub layer is mainly *Linospadix monostachyus, Cordyline petiolaris* and *Citriobatus pauciflorus.* Ground cover is of *Lastreopsis decomposita, Alocasia* and *Pollia. Arthropteris tenella* is the most common shade climber, and *Piper novae-hollandiae, Rauwenhoffia leichhardtii, Cissus antarctica* and *Millettia megasperma* are the major sun climbers. Epiphytes are common, being mostly *Asplenium australasicum, Dendrobium gracilicaule* and *D. speciosum.*

The rainforest in the head of Kangaroo Creek near the Urbenville–Legume road is very well developed with a very large tree of *Citronella moorei* and *Gmelina leichhardtii.* The largest *Dendrocnide excelsa* recorded in New South Wales, being 43 m tall and 4.34 m diameter, occurs here, and an *Araucaria cunninghamii* at 50 m tall has a record diameter of 1.87 m.

A similar but smaller area exists to the north-west, south of Trough Creek on Koreelah State Forest. It occupies the valley floor and a series of terraces up to the cliff base at 900–940 m altitude.

On the steeper slopes and above the cliffs is Suballiance No. 8: *Argyrodendron actinophyllum-Araucaria.* At the head of Koreelah Creek on the southern slopes of the McPherson range, there are good examples of this suballiance at a greater altitude of 800–1 100 m. Because of the cooler conditions *Dysoxylum fraserianum* is also a common canopy species with *Brachychiton acerifolius.* As in the area south of Trough Creek, the drier and stonier sites contain *Araucaria* and represent the *Argyrodendron actinophyllum-Araucaria* Suballiance. In the headwaters of Yabbra and Little Haystack Creeks at 500–650 m altitude, there was originally a magnificent rainforest referable to this *Argyrodendron actinophyllum* Suballiance. The area was also known as the Tooloom Scrub. There was massive disturbance due to heavy logging in the 1950s, a severe

cyclone in 1954 and further logging in 1977. As a result, there is a broken canopy formed by the remnants of *Argyrodendron actinophyllum, Flindersia xanthoxyla, Diospyros pentamera* and scattered huge, spreading figs such as *Ficus macrophylla, F. obliqua* and *F. watkinsiana.* The intervening canopy also contains *Sloanea woollsii, Dendrocnide excelsa, Brachychiton acerifolius, Syzygium corynanthum* and *S. crebrinerve.* Where the disturbance of 30 years ago was extensive, forming large gaps, a canopy of secondary species such as *Euodia micrococca, Acacia melanoxylon, A. irrorata* and *Alphitonia excelsa* developed; this is now collapsing due to senility. The shrub and herb layers are similar to those at the Tooloom Scrub Flora Reserve. The vines contain an additional grape vine, *Cissus sterculiifolia,* and *Platycerium superbum* is an additional common epiphyte. The diminutive epiphytic filmy fern, *Microtrichomanes vitiense,* occurs at Yabbra Falls. Now it is otherwise known in New South Wales only from Terania Creek and Big Scrub Flora Reserve. As its specific name implies, this fern also occurs in Fiji and New Caledonia.

ORARA-NYMBOIDA VALLEYS

Suballiance No. 7 is found in the Orara and Nymboida Rivers areas north-west of Coffs Harbour. There are examples on a colluvial shelf on the conglomerate basal beds at Waihou Flora Reserve, and Chapmans Plain Flora Reserve, it fringes a natural, basaltic, grassy plain. Because of the absence of basalt at Waihou, there are scattered emergents of *Eucalyptus grandis* rather than *Ficus* spp. *Dendrocnide* is absent in the main canopy, which consists of *Argyrodendron actinophyllum, Dysoxylum fraserianum, Caldcluvia paniculosa, Chrysophyllum whitei, Diospyros pentamera, Syzygium oleosum* and *Hodgkinsonia ovatiflora.* The other layers are a truncated version of what is found at Tooloom Scrub Flora Reserve, except that the epiphytic *Platycerium superbum* is very common and conspicuous. Chapmans Plain Flora Reserve is typical of a number of natural grassy plains in the Dorrigo area on remnant basaltic flats at 700–800 m altitude. Their origin is uncertain but could be a legacy of the widespread cold, dry conditions which persisted intermittently until about 10 000 years ago. The flora of these grasslands is not that which would be expected from a recent clearing of the forest since it consists of tussock grass (*Poa labillardieri* and/or *P. sieberana*) and various *Fabaceae* and *Asteraceae* of krasnozem soils. The perpetuation of these grassy plains is certainly due to a combination of fire by both Aboriginal and European man and to frost. The grassy plain of 3 ha has been planted with exotic pines and is surrounded by 16 ha of this subtropical rainforest suballiance. Bordering the plain and attempting to invade it is a fringe of *Eucalyptus saligna* which is relatively frost-resistant. The rainforest contains scattered emergent *Araucaria,* and the main canopy consists of *Argyrodendron actinophyllum, Daphnandra micrantha, Diploglottis australis, Rhodamnia argentea* and *Toona australis.* Logging has undoubtedly reduced the importance of the latter species. There is much in common between these Dorrigo plains and the grassy "balds" of the Bunya Mountains in South Queensland (Webb 1964). The same species of grasses occur on the treeless areas, and the rainforest contains Auraucarian emergents over a rainforest of *Argyrodendron, Diploglottis* and *Toona.*

BELLINGER VALLEY

A number of well-devloped examples of the suballiance are found within the valley on basaltically enriched soils. Possibly the best area is below The Glade on Dorrigo National Park at an elevation of 650–750 m on the eastern edge of the basalt plateau — or more correctly, upon ledges below the edge. The canopy mainly consists of *Argyrodendron actinophyllum, Dendrocnide excelsa, Ficus watkinsiana, Sloanea woollsii* and *Planchonella australis* (Species List, Microfiche).

There are a number of interesting smaller trees such as *Akania lucens, Acradenia euodiiformis* and *Bosistoa floydii.* The latter species is locally common, but it is restricted to the Dorrigo escarpment, Mistake and Oakes State Forests and the upper Orara Valley. The shrub and herb layers are as listed for the Tooloom Scrub Flora Reserve,

and vines include additional common species such as *Microsorum scandens* and *Pothos longipes*. The epiphytes are well represented by 34 species of which *Platycerium bifurcatum, Pyrrosia confluens* and *P. rupestris* are additional common species.

There are also magnificent forests further south — below the escarpment in the heads of Bishops and Dardanelles Creeks and in a saddle of the separating ridge at the Black Scrub. These sites are now all within New England National Park. *Argyrodendron* grow up to 50 m tall, and there are several *Toona* up to 40 m tall and 150 cm diameter on Bishops Creek. The tallest *Alangium villosum* recorded is at Dardanelles Creek — 25 m for this normally small tree.

The more common canopy species, apart from *Argyrodendron* and *Dendrocnide*, are *Syzygium crebrinerve, Geissois benthamii, Schizomeria ovata. Dysoxylum fraserianum, Caldcluvia paniculosa, Doryphora sassafras* and *Daphnandra micrantha*. The small trees, shrubs and herbs layers are as previously noted. Vines are mostly thin and wiry rather than woody; the most common are *Arthropteris tenella* on the butts of trees and *Ripogonum discolor*. The diversity of epiphytic species is low. Only *Asplenium australasicum* is consistently common. Although there are only 26–42 species of trees at these higher-altitude sites of 600–1 050 m, there are 52–54 species in the lower reaches of the same creeks and at Crescent Creek (only 100–400 m altitude). The additional species consist of *Ficus* spp., *Archontophoenix, Alphitonia, Sloanea australis, Elaeocarpus grandis* and various members of the families *Lauraceae* and *Sapindaceae*.

Although the shrub layer is dominated by the same species regardless of altitude, there are 18 native species in the lowlands in comparison with only 11 immediately below the escarpment. Similarly, herbaceous ground cover comprises 29 species in the low altitude sites (including 16 species of ferns) in comparison with only 15 species (nine species of ferns) at higher altitudes. Typical species at low altitudes are *Adiantum* (three species), *Alocasia, Commelinaceae* (three species) and *Alpinia caerulea*. Vines and epiphytes are also better represented in the lowland sites with typical species such as *Legnephora moorei, Rauwenhoffia leichhardtii, Austrosteenisia glabristyla, Melodinus australis, Platycerium superbum, Bulbophyllum exiguum, Oberonia palmicola* and *Peperomia tetraphylla*. These are generally species with more tropical affinities which are excluded from the higher altitude subtropical rainforests because of the cooler conditions. There is also a difference in species diversity and structure between the low-altitude sites. Crescent Creek originates in the igneous rocks of the Crescent Complex rather than in the nutritionally poorer metamorphics traversed by Bishops and Dardanelles Creeks; it contains additional species including *Beilschmiedia elliptica, Polyscias elegans, Cyathea cooperi, Triunia youngiana, Adiantum formosum* and *Cissus sterculiifolia*.

Of special interest on Crescent Creek is a clump of the rare bristly tree fern, *Dicksonia youngiae*, which is found only in the cool, moist gullies of the McPherson Range, at the bases of Minyon and Boomerang Falls, at Crescent Creek and again on Cooks Creek in the Kalang Valley to the east of Crescent Creek. The alluvial flats on the lower sections of Bishops Creek are broader than those on Dardanelles Creek and contain additional species as a consequence of their superior development. There are several very large *Toona*, occasional *Archontophoenix*, and among the vines are *Calamus muelleri, Ripogonum elseyanum* and *Rauwenhoffia leichhardtii*. The abundance of epiphytic ferns and orchids upon the trunks and branches of *Ficus coronata* overhanging Bishops Creek is exceptional.

NAMBUCCA VALLEY

A similar situation of well developed rainforest on benches of enriched soil exists at Killiekrankie Flora Reserve (900–1 000 m altitude) and League Scrub Forest Preserve (700–800 m) in Oakes State Forest. Both Nambucca Valley sites are on volcanic soil and support Suballiance No. 7. The most common canopy trees are

Argyrodendron actinophyllum and *Dendrocnide excelsa* (Species List, Microfiche). League Scrub is situated on a basalt bench with a red loam soil, whereas the geology of Killiecrankie is more complex, including basalt, trachyte and dolerite. The soil is a brown loam.

The lower-altitude League Scrub has 73 rainforest tree species but Killiekrankie has only 56. Notably absent from Killiekrankie are *Ficus macrophylla, F. obliqua, Cryptocarya erythroxylon, C. obovata, Acradenia euodiiformis, Syzygium crebrinerve, S. corynanthum* and *Planchonella australis. Sloanea woollsii,* which is very common as a large tree at League Scrub, is only occasionally seen at Killiekrankie. In the ground layer, *Alocasia* and *Alpinia* are only at the lower altitude as are vines such as *Passiflora herbertiana* and *Zehneria cunninghamii.* Of the four native grape species at League Scrub, only *Cissus antarctica* is common at the higher altitude.

Only in the case of the ferns does Killiekrankie show greater species diversity than League Scrub (23 *vs* 16 species). This diversity is probably due to the greater frequency of fog. Two typically high altitude species there are *Dicksonia antarctica* and *Asplenium bulbiferum.*

The two forest conserved areas are one of the major localities for *Daphnandra tenuipes,* which replaces the more widespread *D. micrantha.* Most of the rainforest on Killiekrankie was burnt in the 1968 fires and consists of regrowth *Dendrocnide* and climber tangles. Another fire in the near future would be disastrous. League Scrub has not been logged, unlike the surrounding open forest. However, in 1964–65, a strip along both sides of the road through the preserve was logged to allow better drying of the road surface. The result is a very unattractive avenue of vine thicket and *Dendrocnide* regrowth. There is also evidence of older disturbance throughout the rainforest, possibly due to cyclone damage or fire.

UPPER MACLEAY VALLEY

In the Kunderang Brook catchment of the Macleay Valley, the suballiance is restricted to deep soils in moist sheltered gullies with a south or east aspect such as in Threadneedle, Kennys and Bull Creeks. The canopy consists of *Argyrodendron actinophyllum* with associated common species such as *Daphnandra micrantha, Doryphora sassafras* and *Caldcluvia paniculosa.* The small tree stratum is of *Baloghia inophylla, Cryptocarya meissneriana* and *Pennantia cunninghamii.* Herbs are mainly ferns such as *Pteris umbrosa* and *Lastreopsis acuminata,* and vines are wiry shade-lovers such as *Ripogonum discolor, Arthropteris tenella* and *Microsorum scandens.*

Epiphytes are limited, mainly *Dictymia brownii* and occasional *Asplenium australasicum. Platycerium superbum* has not been recorded, and *P. bifurcatum* is rare. This scarcity contrasts with the dry rainforest on the drier nearby slopes where the trunks and branches of trees are almost hidden by epiphytes.

Towards the upper end of the altitudinal range of this suballiance in Threadneedle and Kennys Creeks, a number of warm temperate rainforest elements appear, including *Ceratopetalum apetalum, Doryphora sassafras, Schizomeria ovata* and *Orites excelsa.*

UPPER MANNING VALLEY

At Daisy Patch Flora Reserve on Enfield State Forest in the upper Manning on a deep basaltic red loam, there is a small area of subtropical rainforest in a sheltered niche. It occupies a shelf about 200 m wide at the base of the basalt just below the escarpment edge, at an elevation of 1 000–1 100 m. On the steep exposed slopes above, there is warm temperate rainforest of the *Doryphora-Quintinia sieberi* Suballiance No. 40. Accordingly, the subtropical rainforest niche receives adequate soil moisture and protection from the cold, dry tableland winds. Although only several hectares in extent, the site has been logged for *Toona australis* and *Dysoxylum fraserianum.* The

canopy now consists mainly of *Argyrodendron actinophyllum* with *Dysoxylum fraserianum, Caldcluvia paniculosa* and *Ehretia acuminata* common. *Toona,* following its earlier logging, is less common (Species List, Microfiche). The most common smaller trees are *Daphnandra micrantha, Pennantia cunninghamii, Cryptocarya meissneriana, Baloghia inophylla* and *Quintinia verdonii.* The ground cover is mainly *Lastreopsis decomposita.* The more common vines are large woody species such as *Parsonsia straminea* and *Pandorea pandorana.* The epiphytes are not well represented and are the same species as at Kunderang Brook. The excellent development at Daisy Patch is illustrated by three tree species of record or near record size — *Euodia* sp. at 20 m tall and 35 cm diameter, *Guilfoylia monostylis* at a new record of 20 m and 65 cm diameter, and *Ehretia acuminata* at 30 m and 85 cm diameter.

KARUAH VALLEY

The most southern occurrence of Suballiance No. 7 is at Coxs Brush on the Karuah River near its junction with the Telegherry River. Unfortunately, the site was logged in 1976. The elevation is 320–450 m. Soil is derived from sandstone with interbedded lava. It probably represents a fragment of an ancient corridor for subtropical rainforest extending south via Karuah to the eastern slopes of the Barrington and Gloucerster Tops. The possible alternate inland route up the Manning Valley to the west of the Tops would appear to be less likely because of the dry sections along the valley.

Associated with the key canopy species, *Argyrodendron actinophyllum* (here at its southern limit) and *Dendrocnide excelsa,* are *Dysoxylum fraserianum, Planchonella australis, Diploglottis australis* and one very large *Ficus obliqua* (Species List, Microfiche). The more common species of the small tree stratum include *Daphnandra micrantha. Baloghia inophylla* and *Syzygium australe. Dysoxylum rufum, Claoxylon australe* and *Alangium villosum* are also common. There is a rich herbaceous ground cover floristically similar to that in the far north of the state at Levers Plateau. The vines are mainly the thick, woody *Cissus antarctica* and the stem climbers such as *Arthropteris tenella* and *Microsorum scandens.* Epiphytes are uncommon, the lack possibly accentuated by the logging disturbance. They consist of *Asplenium australasicum* and *Pyrrosia confluens.*

Suballiance No. 8: *Argyrodendron actinophyllum-Araucaria*

Particularly in the upper Clarence and Richmond Valleys considerable areas of rainforest designated by the multiple typing on Forestry Commission maps as 1/21 signify the coexistence of *Argyrodendron* and *Araucaria.* Such sites are on basaltic red loams but are subject to periodic drying which excludes a number of species of the *Argyrodendron actinophyllum* Suballiance No. 7. Conditions are not so dry as to support dry rainforest of the *Araucaria* Suballiance No. 21; however. Suballiance No. 8 often occurs as patches within Suballiance No. 7 on steep, rocky slopes or small basalt cappings. In the upper Clarence-Richmond it occurs at 700–1 100 m altitude in association with *Dendrocnide excelsa* and often with *Dysoxylum fraserianum,* because of the high altitude. Further south in the Orara and Nymboida Valleys at Twelve Sixty and Red Cedar Flora Reserves, the eighth suballiance occurs at lower elevations of only 360–670 m, where *Dendrocnide* is only occasionally sighted and *Toona australis* takes over from *Dysoxylum fraserianum.*

UPPER CLARENCE AND RICHMOND RIVERS

On Wilsons Peak and Mt Clunie Flora Reserves (Species List, Microfiche), south of Trough Creek and on Mt Lindesay, the subtropical rainforest consists mainly of the *Argyrodendron actinophyllum* Suballiance. Patches of *Argyrodendron actinophyllum-Araucaria* Suballiance are found on the somewhat drier sections as discussed earlier.

The *Araucaria* Suballiance is found on the dry, steep northern and western aspects. Other common canopy species in this *Argyrodendron actinophyllum-Araucaria* suballiance are *Brachychiton acerifolius* and *Diospyros pentamera. Baloghia inophylla* and *Daphnandra micrantha* are in the small tree layer. Shrubs include mainly *Linospadix monostachyus* and *Citriobatus pauciflorus* The ground layer is of *Adiantum formosum, Lastreopsis* spp. and *Pellacea falcata.* The most common vine is *Cissus antarctica.* Major epiphytes are *Pyrrosia confluens, Asplenium australasicum, Platycerium superbum, Dendrobium gracilicaule* and *D. speciosum.* On the steep, unstable screen slope at the base of the south-east side of Wilsons Peak, there is a simple forest of *Dendrocnide excelsa* and *Pennantia cunninghamii* with a ground cover of huge clumps of *Asplenium australasicum* on the boulders. South of Trough Creek on Koreelah State Forest at the base of the rhyolite cliffs, there is a large specimen of the rare *Rhodamnia whiteana.* It is estimated at 18 m tall. Also of interest in this suballiance is a patch of *Dicksonia youngiae* along Little Haystack Creek, Yabbra State Forest. Much of this catchment was logged in the 1950s.

ORARA RIVER

Further south at Twelve Sixty Flora Reserve in the Orara Valley on a sandstone bench enriched by a previous basalt capping, there are remnants of a fine example of this suballiance beneath scattered tall trees of *Lophostemon confertus, Eucalyptus grandis, E. microcorys* and *E. pilularis.* This stand was heavily logged some years ago for *Toona australis, Araucaria* and *Grevillea robusta.* Currently, it consists of a canopy predominantly of *Argyrodendron actinophyllum* and other common species such as *Araucaria, Toona, Melia azedarach* var. *australasica, Flindersia schottiana, Diploglottis australis, Syzygium australe* and *Polyscias elegans* (Species List, Microfiche). The shrub layer is mainly of *Cordyline petiolaris,* and the ground cover is of *Adiantum formosum* and *Alpinia caerulea.* Vines are mostly thick, woody grapes such as *Cissus antarctica, C. hypoglauca* and *Tetrastigma nitens.* Epiphytes are restricted to *Platycerium superbum* and *Asplenium australasicum.*

NYMBOIDA RIVER

The Red Cedar Flora Reserve on Wild Cattle Creek State Forest is located on a small, basaltic-capped plateau dropping steeply into the Nymboida River. This very well drained rainforest is only 8.5 ha in area and was probably logged for *Toona* and *Araucaria* many years ago. There is a stand of *Eucalyptus saligna* of exceptional size and straightness on the edge of the rainforest which towers above it. The most common canopy trees are *Argyrodendron actinophyllum, Araucaria, Caldcluvia paniculosa* and *Toona australis.* The latter species is most common in both the canopy where it reaches 40 m in height and 60 cm diameter and the lower layers where it is commonly 15–20 m tall. The site is regarded as one of the finest groves of this important timber species. Among the many associated species is a fine specimen of *Alphitonia excelsa.* The shrub layer is composed mainly of the introduced *Solanum pseudocapsicum* and the native *S. brownii.* The ground cover is of ferns such as *Adiantum formosum* and *Pteris umbrosa* and the aroid *Alocasia macrorrhizos.* Climbers include shady stem climbers *(Microsorum scandens),* prickly scramblers *(Rubus rosifolius)* and wiry cucurbits (*Zehneria cunninghamii* and *Sicyos australis*). Epiphytes are common and comprise *Dendrobium speciosum, D. beckleri, Pyrrosia confluens* and an occasional *Asplenium australasicum.*

Suballiance No. 9: *Argyrodendron actinophyllum-Dysoxylum muelleri-Syzygium francisii*

The more widespread *Argyrodendron actinophyllum* Suballiance No. 7 is replaced by Suballiance No. 9 in localized areas of seasonally impeded drainage on rich basaltic soils at elevations of 400–500 m. *Dysoxylum muelleri* and *Syzygium francisii* are common components. Where the impeded drainage is more permanent, palm forests (Suballiance No. 6) are best adapted to the conditions.

Mebbin Lagoons Flora Reserve on Mebbin State Forest west of Mt Warning consists of only 8 ha at 400–440 m altitude. There are about four lagoons on a basalt shelf 60–200 m wide which probably represents the top of one flow when lava sheets flowed to the west from Mt Warning at about three degrees. The shelf slopes down towards the base of the cliffs of the Tweed Range to form temporary lagoons after heavy or prolonged rain. These are surrounded by very tall *Eucalyptus grandis* with a tall understorey of *Dysoxylum muelleri, Syzygium francisii* and *Argyrodendron actinophyllum* (Species List, Microfiche). The *Dysoxylum* are of exceptional size and abundance, and the *Syzygium* are also tall and impressive. Also near the lagoons are dense thickets of *Archontophoenix cunninghamiana.* Other common canopy trees are *Lophostemon confertus, Ficus macrophylla, Dendrocnide photinophylla* and *D. excelsa.* As a habitat for native pigeons, this preserve should be without equal. Apart from such common food trees as *Archontophoenix* and *Ficus macrophylla,* there are 10 species of laurels (*Cryptocarya erythroxylon* being the most common), four species of the *Meliaceae* and also of the *Sapindaceae, Elaeocarpus obovatus, Sloanea australis, S. woollsii* and *Syzygium francisii.* In the past, pigeon shooters were well aware of this locality. The shrub layer consists of *Linospadix monostachyus, Cordyline* spp. and *Harpullia alata.* The ground cover is *Adiantum formosum* and *Lastreopsis marginans. Ripogonum album* is the most common vine.

In Murray Scrub Flora Reserve on Toonumbar State Forest, there are similar lagoons in the broader, southern section on the horizontal strata of sedimentary rocks beneath the basalt. The lagoons are fringed by large, buttressed *Syzygium francisii.* There are also large *Dysoxylum muelleri* and patches of *Archontophoenix* in the moister situations. Both species of *Argyrodendron* are common here. In Griers Scrub at Nightcap National Park, similar, poorly drained sections supporting this suballiance have a preponderance of *A. trifoliolatum* rather than *A. actinophyllum.*

At Pretty Gully Reserve for the protection of Native Flora in the upper Clarence Valley, there is an area of only 3.9 ha of subtropical rainforest. The lower, poorly-drained section near Pretty Gully consists of *Argyrodendron actinophyllum, Dysoxylum muelleri* and occasional *Syzygium francisii* (Photo 59). Beneath and between these canopy trees is a dense palm understorey (Species List, Microfiche).

Suballiance No. 10: *Argyrodendron actinophyllum-Dendrocnide-Ficus*

The *Argyrodendron actinophyllum* Suballiance No. 7 is raplaced at mid altitudes of about 300–800 m on somewhat drier situations by the *A. actinophyllum-Dendrocnide-Ficus* Suballiance.

At Mt Nothofagus Flora Reserve and Georges Creek Nature Reserve, the suballiance includes either *Ficus macrophylla* or *F. watkinsiana* as emergents, *Baloghia inophylla* in the small tree layer, *Linospadix monostachyus* as a common shrub, *Lastreopsis acuminata* and *Pteris umbrosa* as ground cover. The major vines are *Arthropteris tenella* on the butts of trees and *Piper* up in the crowns where *Asplenium australasicum* is the most conspicuous epiphyte (Species List, Microfiche).

RICHMOND-CLARENCE VALLEYS

North of the Macleay River, Suballiance No. 10 is replaced by the *Araucaria* Suballiance No. 21 on increasingly drier sites upslope such as occur at Mt Nothofagus Flora Reserve on the upper Clarence, Chandlers Creek Flora Reserve in the Mann watershed and at Burns Scrub in the Nymboida Valley. The latter two sites have much in common in that with increasing dryness, the fire-resistant *Backhousia sciadophora* Suballiance No. 28 may also be represented. At Chandlers Creek and Burns Scrub, the *Agyrodendron-Dendrocnide-Ficus* Suballiance is confined to the moister gullies. In addition to these major canopy species, both sites support many Euphorbiaceae species such as *Mallotus philippensis* in a small tree layer, a sparse shrub layer and a ground

cover of scattered *Pellaea falcata* var. *nana*. The major vines are the grapes *Cissus antarctica* and *Tetrastigma nitens*, and also *Legnephora moorei* and the wiry *Ripogonum album*. There are many conspicuous epiphytes such as *Asplenium australasicum*, *Platycerium superbum* and *Dendrobium gracilicaule*.

EASTERN DORRIGO-HASTINGS RIVER

At Tulipwood Flora Reserve west of Coffs Harbour, south of the Macleay River at Carrai and Toorumbee and in the Hastings Valley at Mt Seaview, Suballiance No. 10 occupies the moister sheltered valleys which have deeper, richer soil than the slopes which support the *Backhousia sciadophora* Suballiance. Soil here is generally of less fertile sedimentary or metasedimentary origin, although at Hogsback Mountain, Carrai, it is derived from limestone. The suballiance is only found on southern and eastern aspects, where protected from hot or cold desiccating winds. The major canopy species may include *Dendrocnide excelsa* and/or *D. photinophylla*, huge spreading *Ficus watkinsiana* and *F. macrophylla*, and also *Dysoxylum fraserianum*. The small tree layer is characterized by *Guilfoylia monostylis*, *Baloghia inophylla* and *Mallotus philippensis* (Species List, Microfiche for Mt Seaview Nature Reserve). The shrub layer is rather sparse and consists mainly of *Cordyline petiolaris* and *Citriobatus pauciflorus*. Herbaceous ground cover is scattered ferns such as *Adiantum formosum*, *Lastreopsis acuminata*, *Pteris umbrosa* and *Pellaea falcata* var. *nana*. The most common climbers are *Arthropteris tenella* on the butts of trees, and the grapes *Cissus antarctica* and *Tetrastigma nitens* in the canopy. Epiphytes are quite common, including mainly *Asplenium australasicum*, *Platycerium superbum*, *Pyrrosia confluens* and *Dendrobium speciosum*.

GLOUCESTER

In the Woko-Camels Hump-Gangat area near Gloucester, there are significant areas of "curricabark scrub" — more precisely described as *Backhousia sciadophora* Suballiance with narrow, sheltered gullies of this *Argyrodendron-Dendrocnide-Ficus* Suballiance. Although examples are preserved in Woko National Park and Camels Hump Nature Reserve, the best is on private property at Gangat (Species List, Microfiche). The following floristic details emphasize this fact. The subtropical rainforest components are of equal area.

	No. of Species	
Structural Class	Gangat	Camels Hump Nature Reserve
Trees	42	34
Shrubs	6	5
Herbs	18	12
Vines	16	13
Epiphytes	7	9
Total	89	73

The reason for the lower number of epiphytic species at Gangat is probably the early logging of some species such as *Dysoxylum fraserianum* and the unauthorized felling in about 1978 of many *Dendrocnide* by collectors of epiphytes. The remaining trees certainly are well endowed with them. There are some fine individual trees such as the truly majestic *Eucalyptus saligna* near the lower edge of the rainforest, a large *Elaeocarpus obovatus* and a *Podocarpus elatus* estimated at 35 m tall and 55 cm diameter. Important rainforest remnants such as these have been considered for zoning as environmental protection-scientific or 7(j) by the Gloucester Shire Council.

Caldcluvia Alliance

With increasing altitude or latitude under cooler conditions with high reliable rainfall and moderate to fertile soils, *Argyrodendron* is replaced by *Caldcluvia paniculosa* in association with *Cryptocarya erythroxylon, Dysoxylum fraserianum* or *Schizomeria ovata* (Fig. 9). This alliance consisting of three suballiances is often referred to as the cool subtropical rainforest. It comprises the high-altitude plateau rainforest of the eastern McPherson Range and the discrete, rich, alluvial, high-mountain gullies along the escarpment south to the eastern slopes of Barrington Tops. The Caldcluvia Alliance is a cooler extension of the *Argyrodendron actinophyllum* alliance.

The three suballiances are:

11. *Caldcluvia-Cryptocarya erythroxylon-Orites-Melicope octandra-Acmena ingens.*
12. *Sloanea woollsii-Dysoxylum fraserianum-Argyrodendron actinophyllum-Caldcluvia.*
13. *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens.*

Suballiance No. 11: *Caldcluvia-Cryptocarya erythroxylon-Orites-Melicope octandra-Acmena ingens*

EASTERN McPHERSON AND TWEED RANGES

Major areas of this suballiance are found on the gently sloping plateau of the eastern McPherson and Tweed Ranges, just west of the escarpment edge. Mean annual rainfall in that situation has been estimated at about 3 500 mm while the adjoining plateau to the west receives about 2 000 mm. Both areas receive supplementary precipitation through fog. Rainfall is fairly evenly distributed and reliable throughout the year. Elevations range from 700 to nearly 1 200 m. The soil is a deep, rich, red or brown loam derived from basalt. The site is well protected from strong winds by the slightly higher escarpment edge or rim of the Mt Warning caldera. Although some buttressed trees such as *Sloanea woollsii* and *Geissois benthamii* are present, there are few *Ficus* spp. or *Argyrodendron.* Many trees such as *Caldcluvia, Cryptocarya erythroxylon* and *Orites* are weakly buttressed. Tree palms are generally not common, and *Cyathea cooperi, Pollia* and *Adiantum formosum* are absent.

Along the McPherson Range north of its junction with the Tweed Range, the plateau lies within the Lamington National Park in Queensland. Occurrences of the eleventh suballiance in New South Wales are restricted to the gently sloping crest at the head of the Tyalgum Track (800–1 020 m) or to protected valleys projecting into the Tweed Valley as in Hidden Creek on Limpinwood Nature Reserve (700–1 000 m). Both sites are characterized by *Caldcluvia paniculosa, Geissois benthamii* and *Melicope octandra.* The former two species produce bright red, new leaves in November which are very conspicuous from the Tweed Valley below. At Hidden Creek, there are many fine trees of *Floydia praealta* including the largest known — 35 m tall and 60 cm diameter. This species is restricted to the area from Ballina north to Imbil. Smaller trees include *Actephila lindleyi, Acmena smithii* and warm temperate species such as *Argophyllum nullumense, Oreocallis pinnata* and *Anopterus macleayanus.* Major shrubs are *Triunia youngiana, Tasmannia insipida* and *Psychotria daphnoides.* The herb layer is very sparse. *Calamus muelleri* is a particularly common vine.

On the plateau west of the crest of the Tweed Range in the broad upper valleys above the falls of Gradys, Brindle, Lynchs, Warrazambil and Collins Creeks at elevations of 800–1 000 m, there are well-developed, large areas of this suballiance. The most abundant canopy trees are *Caldcluvia paniculosa* and *Geissois benthamii,* but *Cryptocarya erythroxylon, Orites excelsa* and *Melicope octandra* are also common (Species List, Microfiche). *Acmena ingens* is present as well. The small tree layer consists mainly of *Polyosma cunninghamii, Cupaniopsis flagelliformis* and *Sloanea australis,* and the shrub

layer of *Triunia youngiana, Wilkiea austroqueenslandica* and *W. huegeliana.* Herbs are sparse, but along the creeks there is often a dense groundcover of *Elatostema reticulatum.* The most common woody vine is *Palmeria scandens.* Major stem climbers are *Microsorum scandens* and *Pothos longipes.* The most conspicuous epiphyte is *Asplenium australasicum.*

On the exposed top of the Tweed Range near Mebbin Rock at 940–980 m altitude, the canopy is low and there are many blow-downs with consequent impenetrable vine thickets in the gaps. Below the crest on the eastern side at 920–940 m, there is a marked increase in canopy height and a reduction in wind damage. Floristically, the site is similar to the western plateau except that *Acradenia euodiiformis* is a very common small tree. It is often associated with *Nothofagus moorei* elsewhere along this section of the range and northward along the McPherson Range (Photo 60).

WESTERN McPHERSON RANGE

The sloping basaltic top of Mt Lindesay contains an isolated example of this suballiance within a sheltered valley on the southern side at 1 000–1 190 m altitude. The canopy trees are only 15 m tall because of the exposure, but they are 50 cm diameter. Leaves are smaller than on the same species to the east. Floristically, the valley is similar in many respects to the plateau west of the Tweed Range; *Caldcluvia* and *Orites* are common as well as *Cryptocarya foveolata* and *Doryphora sassafras* (Species List, Microfiche). The small tree layer consists of *Cuttsia viburnea, Quintinia sieberi, Polyosma cunninghamii, Acronychia pubescens* and *Syzygium australe.* There is a dense shrub layer; about midway down the gully on rather soggy soil, it consists of a complete cover of the tree fern *Dicksonia antarctica.* Other common shrub species are *Tasmannia insipida* and *Citriobatus pauciflorus.* The herb layer is also well developed with many ferns including *Lastreopsis smithiana* and *Blechnum wattsii,* which are commonly found in cool temperate rainforest. The most common flowering herbs are *Elatostema reticulatum* and *Plectranthus parviflorus.* The only common climber is *Microsorum scandens,* although the climbing epiphyte *Fieldia australis* is plentiful. Other common epiphytes are *Dendrobium pugioniforme* and *Grammitis billardieri.* It is interesting that there are cool temperate rainforest elements present in all strata, including *Cryptocarya foveolata, Quintinia sieberi, Dicksonia antarctica, Lastreopsis smithiana, Blechnum wattsii, Fieldia australis* and *Grammitis billardieri.* The summit of Mt Lindesay has the altitude (1 000–1 190 m), soil, aspect and rainfall to support cool temperate rainforest. Presumably because of its isolation, however, the site does not now contain *Nothofagus* which is present on Mt Nothofagus to the west and in Brindle and Gradys Creeks to the east.

WASHPOOL

There is only one known occurrence of this suballiance south of the Border Ranges — in Weat Gully, Washpool National Park at only 650–900 m altitude. Because of this lower altitude, some warm subtropical rainforest elements are present, including *Archontophoenix, Ficus watkinsiana* and *Syzygium crebrinerve* (Species List, Microfiche). If *Argyrodendron* was present, the stand would be positioned within the *Argyrodendron actinophyllum* Suballiance. Most areas of subtropical rainforest in Washpool National Park are of Suballiance No. 12: *Sloanea woollsii-Dysoxylum fraserianum-Caldcluvia,* but in Weat Gully, *Sloanea woollsii* is entirely absent and the other two species are of only minor importance. Accordingly, this anomalous area is included in the *Caldcluvia-Cryptocarya erythroxylon-Orites-Melicope octandra-Acmena ingens* Suballiance, although two of its key species do not occur in the general area — *Orites* and *Caldcluvia* are uncommon, and only *Cryptocarya erythroxylon* is very common. The site occupies a comparatively large area of alluvium at the junction of two creeks in a

particularly sheltered situation. There are magnificent specimens of *C. erythroxylon* and *Lophostemon confertus* and three large *Toona australis*. Other species present are typical of warm subtropical rainforest and include *Pennantia cunninghamii, Piper novae-hollandiae* and *Cissus sterculiifolia.*

Suballiance No. 12: *Sloanea woollsii-Dysoxylum fraserianum-Argyrodendron actinophyllum-Caldcluvia*

The previous suballiance requires very high, reliable rainfall and deep, fertile soil, but Suballiance No. 12 can survive with a somewhat lower rainfall and less fertile soil. It is found on the western McPherson Range, from Washpool National Park to Mt Hyland Nature Reserve on coastal mountain slopes, from Yarrahapinni to Middlebrother Mountain, at Boorganna Nature Reserve and on the lower eastern slopes of the Barrington area. Altitude ranges from 1 100 m on the western McPherson Range to between 280 m and 600 m at Barrington. The soil is derived from fine-grained metasediments sometimes enriched by basalt, from intermediate igneous rocks such as dacite, adamellite and granodiorite or in some cases from basalt. On poorer soils, the suballiance is replaced by No. 33: *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea woollsii.* At cooler, higher altitudes in the Barrington Tops, the replacement is the floristically simpler Suballiance No. 13: *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens.*

The characteristic feature of Suballiance No. 12 when viewed from the air is the large, light green crowns of *Sloanea woollsii* (Photo 61). Major canopy species are *Sloanea woollsii* and *Dysoxylum fraserianum* with *Argyrodendron actinophyllum, Cryptocarya erythroxylon* and *Caldcluvia* also important. Several warm temperate species such as *Orites excelsa* and *Doryphora sassafras* are present, supported by *Schizomeria ovata, Dendrocnide excelsa, Daphnandra micrantha, Syzygium crebrinerve* and *Diospyros pentamera.* The more common smaller trees are *Baloghia inophylla* and *Pennantia cunninghamii.* The shrub layer is typified by *Cyathea leichhardtiana, Linospadix monostachyus* and *Tasmannia insipida.* The major herb is *Lastreopsis microsora.* The climbing ferns, *Arthropteris tenella* and *Microsorum scandens,* are found on the butts of the trees. The major woody vines extending into the tree tops are *Piper novae-hollandiae, Palmeria scandens* and *Cissus antarctica.* Epiphytes are conspicuous, including mainly *Asplenium australasicum, Dictymia brownii, Pyrrosia confluens* and *Dendrobium speciosum.*

WESTERN McPHERSON RANGE-ACACIA PLATEAU-TOOLOOM

There are good examples of this suballiance on the upper Clarence and Richmond Rivers. Along the western McPherson Range, there is a small area in a sheltered gully head with a south-east aspect on the Mt Glennie plateau at 900–960 m on an enriched, rhyolitic soil. Apart from this favourable niche, the vegetation is warm temperate rainforest of Suballiance No. 35: *Schizomeria-Caldcluvia.*

Further west along the McPherson Range at Mt Nothofagus, No. 12 is the most common suballiance in the sheltered, moist gullies at 700–1 000 m altitude. The largest trees are *Sloanea woollsii, Brachychiton acerifolius, Geissois benthamii, Doryphora sassafras* and *Cryptocarya erythroxylon.* An additional canopy species with temperate rainforest affinities is *Cryptocarya foveolata.*

South along the Great Dividing Range from its junction with the McPherson Range an extensive area of Suballiance No. 12 on Acacia Plateau was progressively cleared from 1900 onwards, with the major clearing in the 1930s for dairying. There was also pressure at this time to revoke the adjoining sections of Koreelah State Forest in favour of agriculture. In a bid to circumvent this, the Forestry Commission logged, cleared and planted the southern section of the forest with the indigenous *Araucaria cunninghamii* between 1939 and 1954. The project was halted in 1954 due to failures from frosts, drought, weeds and rat attacks on the bases of young plants.

Although the basaltic soil was very fertile, the high altitude of 850–1 080 m resulted in severe frosts in large cleared areas although frosts were not a problem in natural, smaller openings in the rainforest. The annual rainfall of only 1 300 mm is marginal for subtropical rainforest, particularly when it is unreliable — ranging at this site from 700 to 1 700 mm over a nine-year period. Although very little of the northern section of the State Forest was actually planted, it was virtually all logged in preparation and cleared or partly cleared. More than 30 years later, such areas can be classified only as viny scrub. From early accounts, the original plateau rainforest was magnificent, consisting of large *Sloanea woollsii, Dysoxylum fraserianum* and *Syzygium crebrinerve* with occasional *Araucaria* emergents. None of it has been preserved in its original condition either in New South Wales or Queensland. The Acacia Plateau Flora Reserve of 585 ha has recently been created to cover all of this northern plateau section as well as the undisturbed slopes of the old Trough Creek Forest Preserve of only 30 ha (Species List, Microfiche). The tall shrub, *Myoporum betcheanum*, is restricted to this disturbed suballiance at Acacia Plateau, Tooloom Range, Yabbra State Forest, Cangi State Forest and Bellingen.

The Tooloom Scrub consists mainly of Suballiance No. 7: *Argyrodendron actinophyllum*, or No. 8: *A. actinophyllum-Araucaria.* However, in a cooler, small basin at 920 m altitude in the Beaury Plantation section, there is a good example of Suballiance No. 12, dominated by *Sloanea woollsii.* It is in a moist gully head with a southern aspect where it is protected from fires by ridges on the west, north and east.

A similar situation exists at Haystack Mountain, Yabbra State Forest. At an altitude of only 500–600 m, Suballiances 7 and 8, which are characterized by *A. actinophyllum*, are most common. In the protected, moist gullies, however, the major canopy species are *Sloanea woollsii* and *Argyrodendron actinophyllum.*

CURRAWINYA MOUNTAIN-GIRARD STATE FOREST

Further south on the Clarence River at Currawinya Mountain, the suballiance occurs in a small but well-developed forest. Soils are derived from the Drake Volcanics and granodiorite. The forest has a southerly aspect at 650–820 m altitude.

The most common large trees in the western section are *Sloanea woollsii* and *Cryptocarya erythroxylon.* Also tall but less common are *Dysoxylum fraserianum, Syzygium crebrinerve* and *Diospyros pentamera.* The other strata are well-developed, particularly the epiphytes among which *Platycerium bifurcatum* is most common. The eastern section has been subjected to fires, and it would appear that the vegetation has adapted to this fire regime over a lengthy period. Canopy trees are all thick-barked species such as *Schizomeria ovata, Doryphora sassafras* and *Litsea reticulata.*

There are small areas of this suballiance towards Tenterfield on Girard State Forest in the heads of Cedar Log and Goughs Creeks at 700–900 m altitude. The moderately fertile soils are derived from dacite and quartz andesite.

Sloanea woollsii is the most common canopy species, but *Dysoxylum fraserianum, Caldcluvia, Orites, Syzygium crebrinerve* and *Schizomeria* are also common. There are several large *Toona australis* on the steeper sections of Cedar Log Creek and a very large *Gmelina leichhardtii* just south of the fire tower on Mt Richmond in White Beech Flora Reserve.

WASHPOOL

In Washpool and Gibraltar Range National Parks, most of the rainforest is of the warm temperate subform except in gully heads with a moist aspect, protected from fire and located on deep, moderately fertile soil. The best examples of Suballiance No. 12 occur being at 650–1 030 m altitude in the basins on Eaglehawk Creek, Middle

Creek and Cedar Valley. The latter locality is exceptional — more sheltered than the others and on a fertile red loam possibly derived from a metabasalt.

The most common canopy species are *Sloanea woollsii, Cryptocarya erythroxylon* and *Dysoxylum fraserianum.* Other common large trees are *Ficus watkinsiana,* and there are several spectacularly large *Toona australis* (Species List, Microfiche). Forty-six species of trees are recorded, a great number for this latitude and altitude. Other indicators of the rainforest's superior development are the prevalence of drapes of *Piper novae-hollandiae* from the trunks and branches of the tallest trees and the great diversity of epiphytes — 14 species among which *Platycerium superbum* has only been recorded at this site in Washpool National Park.

On middle Creek, the rainforest extends from 650 m to 1 030 m altitude and is slightly poorer in development. It lacks *Toona australis, Piper* is less common and there are only nine species of epiphytes. The soil is derived from metasediments only; and there is a more exposed easterly aspect.

The third area on Eaglehawk Creek is within a basin formed by ridges on three sides, leaving only a narrow creek exit. The altitude is 700–800 m, and soil is a moderately fertile colluvium derived from rhyodacite and quartz andesite ("blue granite") which contains a high proportion of calcium felspars. Because the altitude is generally lower than at Cedar and Middle Creeks, the site contains a number of tall species which are more warmth-dependent — including *Syzygium corynanthum* and *Gmelina leichhardtii* — as well as the more typical species of the suballiance. The sheltered nature of the basin and the scattered overstorey of huge *Lophostemon confertus* are responsible for some very tall trees of all major species as well as *Doryphora sassafras.* However, perhaps because of the site's small area, there are only 33 recorded tree species and nine species of epiphytes.

In the head of Malara Creek several kilometres to the north, there is a simplified example of this suballiance on somewhat poorer soils derived from adamellite, at 1 040 m altitude. Only 14 tree species are recorded, with *Dysoxylum fraserianum* and *Brachychiton acerifolius. Sloanea woollsii* was not recorded at this high altitude, but it tends to dominate the lower altitudes at lower Oorooroo and Coombadjha Creeks.

A protected, moist location with a southerly aspect and soil derived from metasediments occurs at only 450 m altitude in a gully head off Oorooroo Creek. The major canopy species are *Sloanea woollsii, Dendrocnide excelsa* and *Daphnandra micrantha.* Only nine other tree species are recorded, and *Dysoxylum fraserianum* is noticeably absent. No epiphytes are recorded.

However, in a protected gorge at lower Coombadjha Creek on the alluvial flood plain at 350–400 m altitude, there is a well-developed rainforest which supports 54 tree species. Apart from *Lophostemon confertus* and *Sloanea woollsii* in the tall canopy, there are also several low-altitude species including *Ficus watkinsiana* and *Elaeocarpus grandis. Cryptocarya erythroxylon* is common, but *Dysoxylum fraserianum* is uncommon. *Caldcluvia paniculosa* is seen only occasionally. Other lowland tree species commonly present are *Dendrocnide excelsa, Syzygium corynanthum* and *S. francisii.* There is a dense lower tree layer of *Archontophoenix cunninghamiana,* and a common tree fern is the lowland species, *Cyathea cooperi.* The vine *Piper* is very conspicuous as is the lowland *Cissus sterculiifolia.*

CANGI-MUNNINGYUNDO MOUNTAIN

Although *Argyrodendron* is absent in Washpool and Gibraltar National Parks, it is common on metasediments south of the infertile Dandahra Granite belt in Cangi State Forest and on Munningyundo Mountain, Nymboida National Park, only 20 km

south-west of Gibraltar Range National Park. The latter locality is at 880–970 m altitude in the sheltered broad gully heads with easterly to southerly aspects. It is characterized by *Sloanea woollsii, Caldcluvia* and *Argyrodendron actinophyllum. Dysoxylum* is less common. On the fire-prone edge, there is an ecotone of *Schizomeria ovata, Endiandra sieberi, Neolitsea dealbata, Synoum glandulosum* and *Acmena smithii.*

MT HYLAND-MOBONG CREEK

Sloanea woollsii is also very common on Mt Hyland Nature Reserve. *Argyrodendron* is less so, and *Dysoxylum* and *Caldcluvia* are occasional only. These sites are at 950–1 050 m altitude on argyllite and leuco-adamellite and are limited to mid slopes because of exposure to desiccating winds and wildfires upslope and to cold air pockets in the major valley bottoms.

At both Foamy and Obeloe Creeks, *Piper* is absent, and the most common climbers are *Arthropteris tenella* and *Microsorum scandens.* The main epiphytes are *Asplenium australasicum* and *Pyrrosia confluens.* Up to 1 040 m altitude, there are 38 tree species present (Species List, Microfiche), but at higher altitudes of 1 040 m to 1 140 m in Obeloe Creek, there are only nine tree species. Temperate rainforest elements appear in the understorey at the higher altitude. These include *Dicksonia antarctica, Todea barbara* and *Fieldia australis.*

Mobong Creek Flora Reserve at 580–630 m altitude on metasediments in the Eastern Dorrigo area is a typical example of the suballiance. *Sloanea woollsii* is predominant, but *Argyrodendron* and *Caldcluvia* are also present. The large *Toona australis* which was a feature of this reserve died suddenly about 15 years ago.

YARRAHAPINNI-BROTHERS MOUNTAINS

On the mid-north coast, several high peaks of granitic origin within 10 km of the sea have unusually well-developed rainforest on their coastal flanks, particularly to the south-east. The forest is probably a result of the warm, moisture-laden winds being chilled as they are forced up and over the mountains, giving increased precipitation and creating mists which would favour subtropical rainforest development on these mid maritime sites.

Yarrahapinni Mountain, south-east of Macksville, has two rainforest areas on the slopes.

The lower forest, in the head of Way Way Creek at 100–140 m altitude, contains 28 tree species with a canopy of *Sloanea woollsii, Doryphora sassafras* and *Diospyros pentamera.* The understorey is mainly of *Archontophoenix cunninghamiana.* Epiphytes are conspicuous, particularly *Platycerium bifurcatum* and *P. superbum.*

Higher up the mountain, where mist and rain increases, there is a better-developed rainforest along Freshwater Creek at 350–400 m altitude near the summit. This forest contains 32 recorded tree species, with a canopy of *Syzygium crebrinerve, Geissois benthamii, Doryphora sassafras, Sloanea woollsii, Caldcluvia, Ficus watkinsiana* and *Citronella moorei. Archontophoenix* is very common in the understorey. The *Syzygium crebrinerve* are particularly large trees.

Three species of trees — *Dendrocnide excelsa, D. photinophylla* and *Guilfoylia monostylis* — and also three species of vines — *Cayratia clematidea, C. eurynema* and *Parsonsia velutina* — have not been recorded elsewhere on the mountain. Neither of these two areas are on the adamellite (granite) but are on the metasediments.

Further south, the *Caldcluvia* Alliance occurs just below the summits of North Brother and Middle Brother Mountains at 450–550 m altitude, on microgranite close to the sea. It is probable that magnesium and calcium could be carried inland by southerly storms. North Brother Mountain, at a slightly lower elevation, is a smaller area, supporting only 24 species. Middle Brother Mountain has 49 tree species.

The canopy species are largely comparable, consisting of *Sloanea woollsii* with *Argyrodendron actinophyllum, Caldcluvia* and *Doryphora/Daphnandra.* Additional species on Middle Brother Mountain are *Dysoxylum fraserianum* and *Lophostemon confertus.*

No epiphytes or lithotypes were recorded on North Brother Mountain, but *Asplenium australasicum* is common on the trees at Middle Brother Mountain, and the rock faces are covered by *Dendrobium kingianum* and *Liparis reflexa.*

Andersons Sugarloaf on Andersons and Nulla-Five Day State Forests in the Middle Macleay Valley is of special interest because this isolated mountain has a basalt capping at 850–890 m altitude and steep southern slopes with soil derived from slates with basaltic enrichment down to 400 m altitude. The southern end of the elongated summit consists of rough-barked, large, straight trees of *Dysoxylum fraserianum, Argyrodendron actinophyllum, Litsea reticulata* and *Doryphora sassafras.* Smooth-barked canopy species such as *Sloanea woollsii* are represented by just a few, badly fire-scarred individuals. In 1968 the mountain and particularly the southern end was described as burning like a torch. It has now been reduced to an impenetrable vine thicket. Cloud often conceals the summit, encouraging the luxuriant growth of epiphytes such as huge *Asplenium australasicum* with hanging *Asplenium polyodon.* Branches are festooned with *Dictymia brownii* and *Pyrrosia confluens.* On the steep southern slopes, the trees are taller than on the summit — one *Daphnandra micrantha* is estimated at a record 40 m tall and 75 cm diameter. Two other species which equal records established elsewhere are *Stenocarpus salignus* (30 m tall and 60 cm diameter) and *Cupaniopsis foveolata* (13 m tall). Major canopy species are *Dysoxylum fraserianum, Argyrodendron actinophyllum, Doryphora sassafras* and *Daphnandra micrantha.* Also present are *Litsea reticulata, Sloanea woollsii* and *Caldcluvia paniculosa.* Epiphytes are once again very conspicuous, and *Dendrobium teretifolium* is an additional common species.

The succulent herb, *Boehmeria platyphylla,* is found at this site in moist gully bottoms. It was previously known only as far south as Dorrigo National Park and a disjunct community west of Port Macquarie on Mt Boss State Forest.

Forty kilometres south-west of Port Macquarie is the fertile, basaltic Comboyne Plateau of about 18 000 ha at 650–700 m altitude. The deep, red loam on the plateau was almost completely cleared for farming between 1900 and 1925. A mere 4 ha remains in the centre of the plateau, but this rainforest is too small to be viable in the long term.

There is also a small area of 40 ha within Boorganna Nature Reserve on the extreme southern edge extending down to Mumfords Creek. Despite its peripheral location, this site contains 53 tree species (Species List, Microfiche) and several very large trees. A *Dysoxylum fraserianum* was estimated at 50 m tall and 170 cm diameter, and an *Elaeocarpus kirtonii* was 45 m tall and 120 cm diameter. The most common canopy species are *Sloanea woollsii* and *Geissois benthamii* as well as *Dysoxylum fraserianum, Argyrodendron actinophyllum, Cryptocarya erythroxylon, Caldcluvia paniculosa, Dendrocnide excelsa* and *Daphnandra micrantha.* Epiphytes are well represented by 14 species. Four species of trees reach their southern limit here at the nature reserve — *Geissois benthamii, Akania lucens, Syzygium corynanthum* and *S. crebrinerve.*

Smaller examples of the suballiance occur in a gully head at Dingo Tops Forest Park and on the south-west slopes in Rowleys Rock Flora Reserve on Dingo State Forest, off the south-west edge of the Bulga Plateau. Floristically, these areas are simplified to only 27 and 15 tree species respectively although they contain all the key species. At Rowleys Rock, the rainforest extends up to 1 000 m altitude, where there are frequent frosts and occasional snowfalls.

GLOUCESTER-WANGAT RIVERS

The southern limit of Suballiance No. 12 is the more sheltered valleys of the Gloucester Tops, below 800 m altitude and with an easterly aspect, as seen on the Gloucester, Karuah and Wangat Rivers. (The streams further west such as the Paterson to Williams Rivers which drain off the Barrington Tops are drier and more exposed to the westerly winds. Conditions there favour the *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens* Suballiance No. 13 and the *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona* Suballiance No. 14.) The valley soils are alluvial, derived from mudstone and siltstone but possibly enriched by grandiorite from Gloucester Tops.

The best development of Suballiance No. 12 in this area is at Bangalow Creek, one to two kilometres upstream from the creek's junction with the Wangat River in Barrington Tops National Park.

There is a discontinuous overstorey of *Lophostemon confertus* and *Eucalyptus saligna* with a very well developed rainforest up to 35 m tall. The most common tall trees are *Sloanea woollsii* with *Caldcluvia paniculosa, Cryptocarya erythroxylon, C. glaucescens, Schizomeria ovata, Elaeocarpus kirtonii* and *Doryphora sassafras.* Other less common tall trees are *Cryptocarya obovata, Litsea reticulata,* and *Citronella moorei.* The only known occurrence in the Barrington-Gloucester Tops area of *Podocarpus elatus* is at Bangalow Creek, where specimens are common in a range of sizes up to 30 m tall. The distinctive feature of Bangalow Creek, and also of the Wangat River downstream, is the prevalent palm understorey of both *Archontophoenix cunninghamiana* and *Livistona australis* which are not seen along other streams to the west. The rainforest at Bangalow Creek is also unusual because of its large area, being about 2 km in width and not confined to the major alluvial flats as are other local examples.

Many of the tree species have juicy fruits which are eaten by pigeons, and until recently, the site was much frequented by pigeon shooters.

Sloanea woollsii and the vine, *Melodinus australis,* are at their southern limit on Bangalow Creek, and *Cryptocarya meissneriana* extends slightly further downstream.

Nearby, in the head of the Karuah River at Whispering Gully on Chichester State Forest, there is a slightly less well-developed example of this suballiance. It supports 48 rather than 53 tree species, but includes both *Dysoxylum* and *Argyrodendron* as additions to the canopy layer.

There are small areas of this suballiance on the lower Gloucester River and its tributaries at 500–800 m altitude. The best is on the main river at 520–620 m altitude. Although this area is part of Gloucester Tops Flora Reserve, most of it has been heavily logged. One small, unlogged area is outstanding for its many tall trees of *Sloanea woollsii, Dysoxylum fraserianum, Caldcluvia paniculosa* and *Schizomeria ovata* (Species List, Microfiche).

A number of rainforest species may have reached the Barrington Tops from the north via the Karuah and Wangat Rivers rather than via the Manning and Gloucester Rivers further inland. Examples which are not seen along the latter two rivers are *Argyrodendron actinophyllum, Lophostemon confertus, Gmelina leichhardtii, Archontophoenix cunninghamiana, Livistona australis* and *Calanthe triplicata.* The most likely reason for the absence of these species on the inland rivers appears to be that the dry mid-section of the Manning River prevents streamside migration following arid cycles.

Suballiance No. 13: *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens*

This is the common subtropical rainforest suballiance above 500 m altitude below Barrington Tops — in cooler conditions than the preceding suballiance.

Suballiance No. 13 is generally floristically simpler than Suballiance No. 12. *Argyrodendron* is absent, and *Sloanea woollsii* is restricted to the Chichester catchment.

On sites which are drier or further south, the suballiance is replaced by the *Dendrocnide-Ficus* Alliance which includes suballiances No. 14 and No. 15 (Fig. 9).

The thirteenth suballiance is classified as forest type 3 (Forestry Commission of New South Wales, 1965) and extends from the Gloucester River tributaries to the Paterson River on alluvial sediments sometimes enriched by basalt. It is characterized by major canopy trees comprising *Schizomeria ovata, Doryphora sassafras, Caldcluvia paniculosa* and *Cryptocarya glaucescens,* but with other common trees such as *Orites excelsa* and *Daphnandra micrantha.* Most of these species are common components of warm temperate rainforest to which this suballiance shows some affinities. (Less common species which are important in Suballiances 11 and 12 are *Dysoxylum fraserianum* and *Cryptocarya erythroxylon.)* The most common small tree is *Polyosma cunninghamii,* and *Citriobatus pauciflorus* is the major shrub. Among the ground cover, *Adiantum formosum* and *Lastreopsis decomposita* are most common. *Arthropteris tenella* is the main shade climber on the butts of trees, with *Palmeria scandens* and *Cissus antarctica* in the canopy. The most common epiphytes are *Dictymia brownii. Pyrrosia rupestris, Asplenium australasicum* and *Dendrobium pugioniforme.*

CONEAC-BERRICO TRIGS

To the east and separated from the Barrington Tops, several high peaks support rainforest on the protected south and east aspects. Coneac Trig at 850 m on Coneac State Forest and Sharpes Creek at 1 000 m altitude on Barrington Tops National Park extension are typical examples of the suballiance (Species List, Microfiche). Berrico Trig at 970–980 m on Chichester State Forest is another example. Soil at all these sites is derived from fine-grained sediments.

GLOUCESTER-BARRINGTON TOPS

On the mid-slopes of the Barrington Tops, stands of this suballiance occur on the steep, rocky slopes of the Dilgry and Moppy Rivers which are tributaries of the Gloucester River. They are floristically poorer than those to the south within the Hunter catchment. There is a good example of the suballiance in the valley of the Chichester River west of Gloucester Falls at 550–650 m altitude. The site occupies the base of a long slope where there is ample soil depth and moisture. There are 46 recorded species of which *Sloanea woollsii* and *Citronella moorei* are the most common and tallest. Other large canopy species include *Caldcluvia paniculosa* and *Litsea reticulata* (Species List, Microfiche).

Proceeding westward along the southern fall of the Barrington Tops, one encounters a similar example at Wirrala Creek on the Williams River, at 540–680 m altitude and extending downstream to Rocky Crossing. *Sloanea woollsii,* however, is not recorded at this site and there is an overstorey of huge *Eucalyptus saligna* (Species List, Microfiche). A narrow band of predominantly subtropical rainforest situated on alluvium consists of *Cryptocarya erythroxylon, Diploglottis australis, Toona australis* and *Brachychiton acerifolius.* Large epiphytes such as *Asplenium australasicum* and *Platycerium bifurcatum* are common among the 17 species recorded. The river appears to have been rejuvenated and is actively cutting down into its bed to form minor gorges.

On the old raised valley floor 20–50 m above, species are mostly warm temperate rainforest elements such as *Doryphora, Caldcluvia, Schizomeria, Cryptocarya glaucescens, Orites excelsa* and *Diospyros pentamera.*

The topography is very steep with much evidence of recent landslips. There is a magnificent example on the Allyn River at 620–780 m altitude, just below the fork with Tweedie Creek. The subtropical rainforest elements of the canopy are the same as those at the Williams River site, but the trees are all about 35 m tall. One *Doryphora* was estimated at a record 135 cm diameter, and an *Elaeocarpus kirtonii* and a *Citronella moorei* were 200 cm in diameter.

Another example occurs high up on a basalt shelf on the eastern face of Mt Gunama, in the same catchment at 890–1 000 m altitude. There are very large trees, up to 35 m tall of *Elaeocarpus kirtonii, Dysoxylum fraserianum, Doryphora, Daphnandra* and *Dendrocnide excelsa.* Due to its exposed location on the upper slopes, this rainforest exhibits many gaps caused by windthrow.

Further west along the southern fall of the Tops in the Paterson and Fal Brook catchments, there are other examples on terraces at 750–950 m altitude where there is a deep accumulation of soil enriched by basalt from the Tops. At Jolliffes Gap on the eastern slopes of Mt Paterson, the suballiance is dominated by *Doryphora* and *Cryptocarya glaucescens.* There are emergents of *Eucalyptus saligna* and *E. quadrangulata* (Species List, Microfiche). Other key species are also well represented. *Orites excelsa, Cryptocarya erythroxylon* and *Dysoxylum fraserianum* are also common. The largest trees are *Elaeocarpus kirtonii, Toona australis* and *Citronella moorei.* There is *Nothofagus* on the steeper slopes above the shelf. The rainforest is protected from the dry westerly winds by its easterly aspect, but because it is high on the slopes of Mt Paterson, there has been some damage in cyclonic blowdowns. The emergent eucalypts show evidence of a fire 200–300 years ago.

A similar forest once occurred on the shelf below Mt Cabrebald, but this area is now choked with thickets of shrubs and vines following logging 10–15 years ago.

The terrace at Jolliffes Gap can be followed on to the exposed western slopes of Mt Paterson, known as Carters Brush. At this site, the suballiance has been greatly disturbed. There are many large gaps in the rainforest canopy due to wind damage, and a series of terraces has been created by landslips on this unstable mountainside. The vegetation reflects this instability, consisting of a mixture of subtropical, warm and cool temperate rainforest species with *Nothofagus* and *Cryptocarya foveolata* present.

Mt Royal in the Carrow Brook catchment has a basalt terrace supporting a fine example of Suballiance No. 13 on the south-east side, with large trees of *Toona australis, Dysoxylum fraserianum* and *Citronella moorei. Cryptocarya foveolata* reaches its southern limit at Mt Royal. Other common species are *Doryphora sassafras* and *Caldcluvia paniculosa.* On the steeper slopes above the terrace is warm temperate rainforest of the *Schizomeria-Doryphora-Caldcluvia-Orites* Suballiance No. 39. These species give way in turn to grassy balds on top of the mountain. There is a considerable area of this subtropical rainforest Suballiance No. 13 in the head of Fal Brook to the west. Some of the forest has been damaged in the 10 years prior to 1984, by logging of the *Eucalyptus saligna* overstorey. Other than this damage, the site is similar to Mt Royal. It is the known southern limit of *Vesselowskya rubifolia.* All of these rainforest sites in the Paterson-Fal Brook area were added to Barrington Tops National Park in 1984.

***Dendrocnide-Ficus* Alliance**

This fourth alliance is found under drier and warmer conditions than the *Caldcluvia,* and it usually occurs at higher latitudes or altitudes than the *Argyrodendron trifoliolatum* Alliance (Fig. 9). A further reduction in soil moisture would produce dry rainforest of the *Choricarpia-Backhousia* Alliance or the *Drypetes-Araucaria* Alliance. Except for one

site near Drake, the *Dendrocnide-Ficus* Alliance is confined to the region between the Hastings and the Clyde Rivers.

There are two suballiances:

14. *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona*

15. *Ficus-Dysoxylum fraserianum/Toona-Dendrocnide*

Suballiance No. 14: *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona*

Requiring drier conditions than the preceding *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens* Suballiance, No. 14 extends from the western base of the Barrington Tops south via Wollemi and Gosford to the Blue Mountains and thence to the Illawarra and Clyde Valley west of Batemans Bay. It prefers the more sheltered gullies with fairly fertile soils derived from basaltically enriched sediments or intermediate igneous rocks such as monzonite or trachyte. The most common tree species are *Dendrocnide excelsa, Doryphora sassafras, Ficus coronata, F. obliqua, Toona australis* and *Acmena smithii.* The major shrubs are *Eupomatia laurina* and *Citriobatus pauciflorus.* The ground cover is of ferns, particularly *Adiantum formosum* and *Pellaea falcata.* Shade climbers are common, particularly *Arthropteris tenella* and *Microsorum scandens* on the butts of trees. The more robust sun-lovers include *Cissus antarctica, Parsonsia straminea, Marsdenia flavescens, Pandorea pandorana* and *Morinda jasminoides.* Epiphytes are conspicuous on larger rough-barked trees such as *Dendrocnide, Toona, Citronella* and *Dysoxylum fraserianum.* The main species are *Asplenium australasicum, Pyrrosia rupestris* and *Dendrobium speciosum.*

BARRINGTON

There is a most interesting gradation of rainforest in the lower gullies of the Williams, Allyn and Paterson-Boonabilla streams at an altitudinal range of 380–470 m.

Gullies on the Williams River to the east support the previous suballiance, *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens,* with emergents of *Eucalyptus saligna* and *Syncarpia glomulifera.*

These species of the moister microclimate are replaced to the west on the Allyn River and especially at Boonabilla Creek, where there may be greater desiccation from dry westerly winds sweeping across the dry Hunter Valley. There is a riverbank fringe of huge *Casuarina cunninghamiana* up to 60 m tall and carrying many clumps of *Platycerium bifurcatum, Dendrobium speciosum* and *D. teretifolium.* Back from the stream, there are massive *Ficus macrophylla* and *F. obliqua.* The main rainforest canopy is about 30 m tall and consists of *Daphnandra, Dendrocnide, Toona, Cryptocarya obovata, Planchonella australis* and *Streblus brunonianus* (Species List, Microfiche). At Boonabilla Creek, the valley floor is very wide, and the stream falls only 100 m over the 6 km section downstream from the Binalong Creek junction in comparison with 220 m by the Williams River over the same distance upstream from Barrington Guest House. One specimen of *Syzygium australe* in this valley is the largest ever recorded — 35 m tall and 60 cm diameter. Both the Allyn and Boonabilla Creeks were logged for *Toona* about 150 years ago and for eucalypts about 20 years ago. Indeed the Boonabilla rainforest appears to be a late seral, even-aged forest with few large trees, many secondary species and an open sub-canopy zone which makes walking quite easy. At Blue Gum Flat, there is a grassy woodland of *Eucalyptus saligna* surrounded by rainforest. Its origin is uncertain, but there is no doubt about its perpetuation by fire as indicated by the fire scars and the distinct rainforest boundary.

HUNTER VALLEY

The Liverpool Range is a relatively low, dry saddle on the Great Dividing Range, north-west of Barrington Tops near Murrurundi. This saddle supports a number of small rainforest areas on rich, basaltic soil at 650–1 000 m altitude. At one site, Cedar Brush Gap, the average annual rainfall is only about 1 100 mm, an amount usually regarded as inadequate for rainforest. However, Fisher and Timms (1978) estimated that the common low cloud encountered here at the head of the Hunter Valley would increase effective precipitation by as much as 50%, thus allowing rainforest to survive 160 km inland. Protected by emergent *Eucalyptus viminalis,* there is well-developed Suballiance No. 14 rainforest at Cedar Brush Nature Reserve and Kelahers Brush. Its dry nature is exemplified by the fact that the most common small trees are *Euodia micrococca* and *Cassine australis,* and the epiphytes are *Pyrrosia confluens* and *P. rupestris* with small, thick leaves. The other nine species of epiphytes and parasites are less common and conspicuous. At higher altitudes and on drier soils, there is a mixed subtropical-warm temperate rainforest typified by *Acmena smithii* and *Lomatia arborescens.*

There are few favourable sites for subtropical rainforest on the southern side of the Hunter Valley, due to the poor sandstone soils and frequent fierce fires. However, in the gorge of Cedar Creek, at Wollemi National Park, there is a niche where fires cannot penetrate and the soil on the floor of the gorge is enriched by the basalt from Nullo Mountain upstream. This gorge contains a floristically simple forest of only 12 tree species including the emergent *Eucalyptus bicostata,* which has a disjunct distribution north of Sydney around Nullo Mountain, Nundle, Walcha and Carrai Plateau west of Kempsey. The height of the rainforest canopy is about 30 m consisting of *Doryphora, Dendrocnide, Toona* and *Emmenosperma alphitonioides* (Species List, Microfiche). The *Toona* are mostly 60–75 cm diameter with no large trees, and all appear to be about 100 years old. Since there is no sign of fire, the most likely explanation for the absence of older, larger trees could be a landslip temporarily damming the gorge and so drowning the vegetation. Other common trees present are *Ficus coronata* and *Claoxylon australe.* In contrast to the tree layers, the ground strata contain a rich diversity — 18 species of ferns with large clumps of *Asplenium australasicum* on the boulders and trees. Other common epiphytes or lithophytes are *Pyrrosia rupestris* and *Dendrobium striolatum.*

WATAGAN MOUNTAINS

On the Central Coast at Gap Creek and at Hessies Point on the Wyong River in Olney State Forest, the typical assemblage of species occurs on the fine-grained, alluvial sediments. There are emergent *Eucalyptus saligna, E. deanei* and *Syncarpia glomulifera.*

At Little Jilliby Flora Reserve, however, it appears that the creek is not permanent; moisture-loving species such as *Doryphora, Daphnandra* and *Dendrocnide excelsa* are replaced by *Dendrocnide photinophylla.* Following logging of the eucalypt overstorey about 30 years ago, the gaps have regenerated with *Toona,* which is now up to 30 m tall. This reserve is the known southern limit of *Dysoxylum fraserianum* and *Pyrrosia confluens.* With increasing dryness at these localities, Suballiance No. 30: *Backhousia myrtifolia-Acmena smithii,* and/or Suballiance No. 27: *Choricarpia leptopetala,* replace No. 14.

BLUE MOUNTAINS

There are two rather poor examples of Suballiance No. 14 in the Blue Mountains.

At Green Scrub, Mountain Lagoon in Wollemi National Park, there was once a well-developed rainforest on small basaltic remnants at 460–600 m altitude. Following

logging and repeated fires, the rainforest is now in a greatly disturbed and unstable state. There are scattered trees of *Doryphora, Ficus coronata, F. rubiginosa* and *Toona* in the gullies, shrouded in vines of *Palmeria scandens, Cissus hypoglauca, Smilax australis, Pandorea pandorana* and *Morinda jasminoides* in an otherwise low, viney scrub. The slopes support a dense, closed forest of round-crowned trees of *Acacia parramattensis* and *A. elata* up to 20 m tall, thereby suggesting an origin from a severe fire about 50 years ago. Sections were burnt again in the mid 1970s and in about 1982–83. An impressive list of 24 species of ferns and 15 epiphytes attests to the forest's former glory.

The second example of the suballiance is found on Mt Colboyd, Christys Creek, in Kanangra-Boyd National Park. It occurs on the broader alluvial deposits in a quartzite, sandstone gully at 600–700 m altitude. The canopy is often very broken with the gaps consisting of an almost impenetrable growth of *Urtica incisa, Sigesbeckia orientalis, Senecio linearifolius, Hymenanthera dentata, Bursaria spinosa* and *Rubus rosifolius* with various wild grapes such as *Cayratia clematidea, Cissus antarctica* and *C. hypoglauca.* The tree canopy consists of only 13 species, of which *Doryphora* and *Acacia falciformis* are most common, with *Eucalyptus smithii* as emergents. The subtropical rainforest component consists of *Toona, Ehretia acuminata* and *Acronychia oblongifolia.* The creek-line is overhung by *Ficus coronata,* and in its dense shade grow stingless nettles such as *Australina muelleri, Elatostema reticulatum* and *Parietaria debilis* as well as *Pteris umbrosa.* As at Green Scrub, this site shows clear signs of fire incursions. Because the rainforest is probably shrinking, it may not be viable in the long term.

ILLAWARRA

Midway up the Illawarra escarpment at about 300 m altitude but below the sandstone cliffs, there is often a shelf of accumulated, moderately fertile soil derived from fine-grained sediments, trachyte, tuff or basalt. Soil moisture is good due to seepage from the sandstone strata above. The easterly to southerly aspects give protection from desiccating westerlies. The proximity to the sea and the presence of the escarpment ensures a higher rainfall than on the coastal plain. Typical sites are the Mt Keira Scout Camp, south side of Barren Grounds Nature Reserve, Cambewarra Mountain and Browns Mountain. In addition to the key tree species, *Citronella moorei, Pennantia cunninghamii* and *Elaeocarpus kirtonii* are common also (Species List, Microfiche for Cambewarra Mountain). All areas were probably logged for *Toona* about 150 years ago, so that only open-grown trees with short boles remain. Because of the great demand and high price of the timber, these specimens are a saleable commodity.

Mt Keira and Browns Mountain have been subjected to little or no logging and no fires and have a full canopy; Cambewarra Mountain and Barren Grounds Nature Reserve have gaps in the canopy due to logging, fires and wind damage. As a result, the latter sites contain patches of viney scrub and much *Lantana.* The Barren Grounds forest was, in fact, largely cleared and now consists of only 12 tree species. The other three sites have in excess of 30 species. The only other site in public ownership in this area is Cambewarra Mountain.

MILTON

There is only one well-developed example of Suballiance No. 14 south of the Illawarra. It occurs on the fertile, red-brown loam derived from monzonite (a plutonic rock intermediate between a syenite and a diorite) at Yatteyattah Recreation Reserve north of Milton. Only 6 km from the sea and at 10–45 m altitude, this area has an equable climate. The 19 ha set in the gorge of Currowar Creek are all that remain of the once extensive subtropical rainforest around Milton, the rest having

been cleared for agriculture. The scientific importance of the site can be appreciated by realising that it is the most southern occurrence known of *Ficus superba* var. *henneana, Streblus brunonianus, Litsea reticulata, Toona australis, Elaeocarpus kirtonii, Pollia crispata, Maclura cochinchinensis* and *Legnephora moorei.* There are 34 tree species, the most significant being massive *Ficus obliqua* and *Citronella moorei* supporting large clumps of *Asplenium australasicum* and *Platycerium bifurcatum.* Other typical species are *Dendrocnide, Toona* up to 50 cm diameter, *Diploglottis australis, Emmenosperma alphitonioides, Elaeocarpus kirtonii* and *Diospyros pentamera* (Species List, Microfiche). Overhanging Currowar Creek are *Ficus coronata* and large *Syzygium australe* up to 50 cm diameter and 20 m tall, the latter hosting orchids such as *Plectorrhiza tridentata* and *Sarcochilus olivaceus.* Unfortunately, some of these trees have been felled in the past for their epiphytes. Apart from the early logging for *Toona,* the site was undisturbed until 1964 when despite the protestations of the then Fauna Protection Panel, the Electricity Commission cleared a north–south swathe through this, the only small remnant of the original vegetation, in order to erect a power line. At least six large *Ficus* and associated vegetation were felled. The most provocative action was to spray and brush the resulting regeneration. Until a few years ago, pigeons and grey-headed fruit bats were shot at this site where many trees such as *Ficus* produce an abundance of fruit for the rich avifauna of pigeons, doves and cat birds.

CLYDE VALLEY

South to Currowan Creek in sheltered gullies at 200–400 m altitude, there are other smaller and less developed areas of no more than 26 tree species. The moderately fertile soils are derived from fine-grained sediments, often with basaltic enrichment. The poorer soils of the lower slopes support Suballiance No. 37: *Ceratopetalum/Schizomeria-Acmena-Doryphora.* However, the narrow alluvial creek banks are predominantly of subtropical rainforest in the suballiance under discussion. Typical examples are Mares Hill Forest Preserve on Yadboro State Forest, Wallaby Forest Preserve on Currowan State Forest and Musgrave Creek in Budawang National Park. Typical canopy species on all these sites are *Doryphora, Dendrocnide, Ficus obliqua, F. coronata* and *Citronella moorei* (Species List, Microfiche for Musgrave Creek). Wallaby Forest Preserve contains some huge trees of *Citronella* festooned with *Piper* vine and is the known southern limit of *Palmeria scandens.* Musgrave Creek is the best developed of these four sites, having 25 species of trees including *Pennantia cunninghamii, Emmenosperma alphitonioides* and *Polysoma cunninghamii* all at their southern limit. It also shows great species diversity among the epiphytes, with 14 species in comparison to seven at Wallaby Forest Preserve.

It is possible to recognize subtropical rainforest elements further south, at such sites as the base of Mt Dromedary, but these forests have *Acmena smithii* and *Doryphora* as the most common canopy species and have been included under Suballiance No. 42 of the *Acmena smithii* Alliance.

***Suballiance No. 15:** Ficus-Dysoxylum fraserianum/Toona-Dendrocnide*

This suballiance occupies somewhat drier sites than its predecessor, and may even adjoin it as it does at Mt Colboyd. It prefers mid-altitude dry gullies or lower slopes on moderately fertile soil such as material derived from dacite, limestone or basaltically enriched sediments. It links the subtropical to the dry rainforest subform, containing elements of both. With increasing dryness, it gives way to the *Ficus-Streblus-Dendrocnide-Cassine* and the *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis* suballiances (Nos. 23 and 29) of the dry rainforest.

Floristically, Suballiance No. 15 is characterized by various figs including *Ficus coronata, F. macrophylla, F. obliqua* and *F. rubiginosa, Dysoxylum fraserianum* and/or *Toona,*

Dendrocnide and *Ehretia acuminata.* The shrub layer is quite diverse with *Citriobatus pauciflorus* and *Clerodendrum tomentosum* being most common. The ground cover may be sparse. *Adiantum formosum* and *Doodia aspera* are typical of the 23 listed fern species. Vines and scramblers are most conspicuous, with the introduced *Lantana* occupying any canopy gaps if north of the Hunter River. Native grapes are a common group, particularly *Cissus antarctica, C. hypoglauca* and *Tetrastigma nitens.* Epiphytes are less common than in most subtropical rainforest suballiances and are mainly *Asplenium australasicum, Platycerium bifurcatum, P. superbum, Pyrrosia confluens, P. rupestris* and *Dendrobium speciosum.*

DRAKE

At Long Gully in Girard State Forest, 6–8 km south of Drake on the lower slopes and narrow gully floor in the headwaters of Long Creek, there are scattered trees or clumps of trees of this suballiance with low viney scrub in the openings (Species List, Microfiche). The broken canopy is the result of logging for *Toona* and mining for gold. An old road still runs up the centre of the gully to an abandoned mine site. There are several huge *Ficus obliqua.* Epiphytes are common high up on the larger trees, but smaller trees have been felled by poachers. This site differs from those to the south, having palms in the canopy *(Archontophoenix)* and also in the understorey of the intact clumps of trees *(Linospadix).* There is another example of the suballiance on the Timbarra River, 8 km to the east.

HASTINGS

Bago Bluff Flora Reserve is located in the Wauchope area on the dry northern lower slopes of the Broken Bago Range. Soil at the site is derived from conglomerate overlaid by sandstone. The altitude is 70–220 m. This is a floristically rich area, containing 64 tree species of which six are figs and 15 epiphytes (Species List, Microfiche). *Dendrocnide, Daphnandra micrantha* and *Toona* are common trees, as is *Flindersia schottiana* which is very close to its southern limit.

Several tree species show major disjunctions here. *Syzygium francisii* occurs on a seepage line at Mt Seaview to the north-west and reappears at Cape Hawke south of Forster. *Harpullia hillii* occurs at Willi Willi in the Macleay Valley and at Knorrit Flat on the Manning River.

DUNGOG

South of Dungog, there are scattered areas of dry rainforest on soils derived from sedimentary rocks enriched by basalt. Niches where the soil depth and moisture are more favourable support Suballiance No. 15. Two such areas are a small, intact bench on the southern side of Mt Ararat and the protected gorge on Pilchers Mountain. (Photo 62).

On Mt Ararat, the rainforest consists of *Ficus* spp., *Dendrocnide, Dysoxylum fraserianum* with many young trees, occasional *Toona* and *Diospyros pentamera* and one very large *Citronella* hosting many large *Asplenium australasicum, Platycerium bifurcatum* and *P. superbum.*

The larger rainforest area on Pilchers Mountain is in a Reserve for Public Recreation rather than on freehold land and is mainly dry rainforest of Suballiance No. 23: *Ficus* spp.-*Streblus-Dendrocnide-Cassine* as at Mt Ararat. However, along the gullies and particularly in the narrow gorge, there are good examples of subtropical rainforest Suballiance No. 15. *Ficus* spp., *Dendrocnide* and *Melia* are common canopy species, and *Dysoxylum fraserianum* is the most common species. There are occasional *Toona* and *Elaeocarpus obovatus* (Species List, Microfiche). Moisture-demanding species

within the gorge include *Sloanea australis, Pennantia cunninghamii, Alocasia macrorrhizos, Diplazium australe, Pollia crispata, Adiantum formosum, Microsorum scandens, Piper novae-hollandiae, Cayratia eurynema* (a new southern record), *Peperomia tetraphylla, Asplenium australasicum* and *Dendrobium speciosum.*

BLUE MOUNTAINS

In a rainforest distribution pattern similar to Dungog, there are several small areas of Suballiance No. 15 in an area of dry rainforest at Kanangra-Boyd National Park south of the Blue Mountains. On Mt Colboyd at 600–700 m altitude on soil derived from quartzite and sandstone, there are only small clumps of this suballiance on the dry, north-facing lower slopes. Major tree species are *Ficus rubiginosa, Dendrocnide excelsa, Toona, Pittosporum undulatum, Ehretia acuminata, Claoxylon australe* and *Hymenanthera dentata.* The ground cover is of *Urtica incisa, Doodia aspera, Pellaea falcata* and *Polystichum australiense.* Vines are mainly grapes such as *Cissus antarctica* and *C. hypoglauca.* The micro-climate is unsuitable for epiphytes.

At Church and Cedar Creeks, slightly to the south on soils derived from limestone at elevations of 335 m to 460 m, there are pockets of this suballiance on the deeper alluvium at creek junctions with interconnecting narrow creek banks. There are only 24 tree species recorded in comparison with 59 species at Pilchers Mountain (Species List, Microfiche). Beneath and between the scattered emergents of *Casuarina cunninghamiana* and *Eucalyptus blakelyi* is a tree cover of *Ficus rubiginosa, Dendrocnide, Toona* and *Ehretia acuminata.* Smaller trees include *Alectryon subcinereus, Claoxylon australe, Hymenanthera dentata* and *Bursaria spinosa.* On the margin and uphill is a unique vegetation type known as "Blue Bush" which consists of three species of *Acacia* — *A. clunies-rossii, A. binervia* and *A. falciformis.* All are distinguished by blue-grey foliage and forming a compact, rounded canopy up to 15 m high. *A. clunies-rossii* is restricted to the Kowmung and Coxs Rivers. Because Cedar Creek has a larger catchment with more permanent water than Church Creek, its rainforest is better developed. As a result, it supports a number of species which are not at Church Creek. These include *Omalanthus populifolius, Alphitonia excelsa, Clerodendrum tomentosum, Commelina cyanea, Parsonsia* sp. *A.* and *Pyrrosia rupestris,* the only epiphyte present.

Cupaniopsis anacardioides-Acmena spp. Alliance

Because it is always found in proximity to the sea, this alliance is also known as littoral rainforest. Species environmental factors determine its distinctive structure and physiognomy, and it has been suggested that the alliance could be considered as a distinct subformation. However, 90.4% of tree species recorded also occur in New South Wales subtropical rainforest. Only 30.2% of the species occur in dry rainforest. Accordingly, it seems more appropriate to regard the floristic mix as a maritime variant of subtropical rainforest, particularly since only 4.4% of its tree species are restricted to it (Fig. 9).

Special features which determine this alliance are:

1. An equable climate in consequence of being so close to the sea. (The mean daily temperature range at Iluka is only 7°C, while inland at Grafton, it is 14°C.)
2. High atmospheric moisture from the predominantly sea breezes. (At Iluka Nature Reserve, the monthly humidity is never below 60%.)
3. The addition of mineral nutrients such as calcium, magnesium, potassium and phosphorus through salt spray and the presence of adequate calcium and phosphorus in sand through shell fragments, etc. For example, the phosphate concentration in the leaves of *Acmena smithii* in this suballiance in Bundagen Flora

Reserve was 0.80% of oven dry weight; 2 km further inland, it was only 0.30%. Calcium content of soil in the reserve was 0.72%; further inland it was 0.37% (Baur 1957).

4. Salt scalding of non salt-tolerant species to produce horizontal wind shearing and dense rigid canopy tops.
5. Coriaceous leaves due to wind exposure which also reduces the number of epiphytic species. (On exposed situations where water availability is lowered there are fewer species of trees, and particularly of ferns.)

The littoral rainforests on sand owe their presence today to two unrelated events. The climate five to ten thousand years ago was wetter and warmer than today, thus favouring rainforest. Also, due to rising sea level the outer barrier sand dunes were formed three to six thousand years ago. These were then colonized by this rainforest, of which only relicts remained at the time of European settlement. At Cape Hawke, these have been reduced to only 18% of that area (Clough 1979). It is therefore possible that the littoral rainforest could not regain territory lost in the last century — the climate may no longer be suitable.

There is a preponderance of tree species in the families Myrtaceae, Euphorbiaceae, Lauraceae, Sapindaceae, Moraceae and Rutaceae in this alliance. There is a wide range in foliage salt-tolerance, the most tolerant being *Podocarpus elatus, Cassine australis, Cupaniopsis anacardioides, Planchonella australis, Notelea longifolia* and *Eupomatia laurina.*

There are five suballiances:

16. *Syzygium luehmannii-Acmena hemilampra*
17. *Cupaniopsis anacardioides*
18. *Lophostemon confertus*
19. *Drypetes-Sarcomelicope-Cassine-Podocarpus*
20. *Acmena smithii-Ficus-Livistona-Podocarpus*

Suballiance No. 16: *Syzygium luehmannii-Acmena hemilampra*

Structurally and physiognomically this is the most highly developed suballiance. It also has the greatest floristic diversity. It occurs as far south as the entrance to the Macleay River on recent beach sand. Further south to the Hunter Valley, where neither of the key species are present, the more sheltered littoral rainforest niches are occupied by Suballiance 19, *Drypetes-Sarcomelicope-Cassine-Podocarpus.* An even more floristically simplified form, Suballiance 20, *Acmena smithii-Ficus-Livistona-Podocarpus,* occurs on the Illawarra and South Coast. Closer to the beach where no longer fully protected from the strong, salt-laden winds, is Suballiance 17: *Cupaniopsis anacardioides,* and Suballiance 18: *Lophostemon confertus,* is on the exposed coastal headlands (Fig. 9).

The more plentiful tree species are *Syzygium luehmannii* (Photo 63), *Mischocarpus pyriformis, Acmena hemilampra* (north from Iluka), *Acronychia imperforata, Drypetes australasica* and *Cupaniopsis anacardioides* on the seaward edge. Other typical tree species include *Podocarpus elatus, Aphananthe philippinensis, Litsea australis, Euroschinus falcata, Cassine australis, Guioa semiglauca* and *Diospyros pentamera.* The sparse shrub layer is mainly *Psychotria loniceroides,* and the scattered ground cover on this often dry, sandy surface consists of *Pellaea falcata, Oplismenus imbecillis* and *Commelina cyanea.* Woody vines are very common, particularly the grapes *Cissus sterculiifolia* and *C. antarctica* as well as *Flagellaria indica.* Also common is the wiry *Smilax australis.* The exotic *Lantana camara* is the most common scrambler. Although 21 epiphytic species are listed in the appendix, most are rare on these sites, the most frequently occurring being *Platycerium bifurcatum* and *Pyrrosia confluens.*

TWEED

There are a number of very small remnants of this suballiance along the lower Tweed River. On the southern side of Ukerebagh Island Nature Reserve, there is a small patch which was heavily disturbed by earlier settlement and fire but is now protected.

Apart from the typical tree species already mentioned, several northern species commonly occur, including *Diospyros fasciculosa* and *Exocarpos latifolia.* Adjoining and upstream on Portion 224, Parish of Terranora, a narrow band of this suballiance is found on the crest of the levee bank. Additional tree species here are *Flindersia bennettiana, Sterculia quadrifida, Polyalthia nitidissima, Planchonella chartacea* and *Archidendron hendersonii.* All but the first of these species are rare south of Queensland. On Crown Land on the eastern side of Cudgen Lake, a good example of littoral rainforest extended from Bogangar to Kingscliff before the protecting high dunes were removed during mining for rutile in the late 1950s and early 1960s. By November 1960, only 2 ha remained in a Reserve for Public Recreation and Preservation of Flora, the remainder to the east of the main coast road having been mined. This remnant consisted of *Araucaria cunninghamii* emergents above a dense forest of *Flindersia bennettiana, Halfordia kendack, Diospyros fasciculosa, Syzygium luehmannii, Acmena hemilampra* and *Mischocarpus pyriformis.* Due to exposure to salt influence, the canopy has died back, and *Cupaniopsis anacardioides* is providing a new canopy on the seaward side. Rare and endangered species still present are *Acronychia littoralis* (at its northern limit) and *Cryptocarya foetida* which was originally represented by three fine trees. Minor areas occur at Hastings Point, Lower Cudgera and Mooball Beach. At Wooyung, the suballiance is dominated by *Acmena hemilampra* and *Mischocarpus pyriformis* with the usual protective edge of *Cupaniopsis anacardioides.*

BRUNSWICK-BROKEN HEAD

In the Brunswick Valley, there is a small remnant on the New Brighton Peninsula where *Acmena hemilampra* and *Diospyros fasciculosa* are the most common trees, with occasional *Syzygium luehmannii.*

At Harrys Hill on the north bank of the Brunswick River, on metasediments beneath a thin cover of sand, the rainforest is similar to that just described. In addition, the forest contains several trees of *Cryptocarya foetida,* with smaller trees and seedlings. This is the only known possibly viable population of this rare and endangered species which is now scattered from Ballina to Cooloola National Park. On sand just north of the boundary of Brunswick Heads Nature Reserve on freehold land, there is the type locality of the rare *Acronychia littoralis.* There were originally nine trees on this semi-cleared land, but only one tree remains due to further clearing in 1981. The entire known population of the species does not exceed 10 individuals.

Adjoining the north-west boundary of Broken Head Nature Reserve and within the Recreation Reserve, there is a good example of this suballiance. The most common canopy species are *Acmena hemilampra, Aphananthe philippinensis, Mischocarpus pyriformis, Flindersia bennettiana* and *Araucaria cunninghamii* (Species List, Microfiche). Vines are very common, particularly *Calamus muelleri* and *Flagellaria indica. Lantana camara* is a serious problem in any areas where the canopy is disturbed. This rainforest patch is under threat from the likely expansion of the camping and caravan park (Photo 64).

CLARENCE

The largest and best developed example of this suballiance in New South Wales is on 65 ha on the northern side of the Clarence River entrance in Iluka Nature

Reserve (Photo 63). There are two tree layers at 25–30 m and at 5–17 m heights. More than 60% of trees greater than 20 cm diameter are either *Acmena hemilampra* or *Syzygium luehmannii*. A further 14% are *Mischocarpus pyriformis* and *Euroschinus falcata*. Other common canopy trees are *Flindersia bennettiana* and *F. schottiana* (Species List, Microfiche). The lower tree layer includes *Drypetes australasica, Arytera divaricata, Diospyros pentamera, Dendrocnide photinophylla* and *Cassine australis*. Vines are very well represented by 44 species, most of them less than 2.5 cm diameter except for *Cissus antarctica, C. sterculiifolia* and *Malaisia scandens*. The most common vines are *Cissus sterculiifolia, Lantana camara* and *Morinda jasminoides*. Although 16 species of epiphytes and parasites are recorded, most are uncommon due to pilfering over many years. Most common are *Platycerium bifurcatum* and *Cymbidium madidum*.

This is a most important area biogeographically. Seven tree species at their southern limits are *Acmena hemilampra, Halfordia kendack, Flindersia bennettiana, Ailanthus triphysa, Polyalthia nitidissima, Glochidion sumatranum* and *Diospyros fasciculosa*. There are four vine species and one epiphyte also at their southern limit — *Pisonia aculeata, Parsonsia latifolia, Thozetia racemosa, Hippocratea barbata* and *Bulbophyllum minutissimum*.

The natural protective vegetation on the seaward side would originally have been *Cupaniopsis anacardioides* and *Banksia integrifolia*, but in many places this has been destroyed by fire and salt scorch, allowing a monoculture of the introduced weed *Chrysanthemoides monilifera* ssp. *rotundata* to take over right up to the exposed rainforest edge (Photo 65).

BELLINGER

The next significant area to the south is Bundagen Flora Reserve, 8 km north of the Bellinger River entrance. It is protected by the sea to the east and by Bundagen Creek to the west and north. The most common canopy species are *Syzygium luehmannii* and *Euroschinus falcata* with *Acmena smithii* replacing *A. hemilampra*. Another common tree species is *Podocarpus elatus* which grows to quite a large size with much regeneration nearby (Species List, Microfiche). There are scattered emergent *Banksia integrifolia* from an earlier seral stage before the micro-climate was modified to favour rainforest. This rainforest is in a reasonably good condition despite unauthorized fishermen's shacks which were demolished about 20 years ago and of intermittent felling of trees by epiphyte thieves. Both species of *Platycerium* are still fairly plentiful. The taking of epiphytes has been reduced by closure of the 4WD track which bisected the rainforest longitudinally.

A similar but smaller area occurs several kilometres to the north at Scrub Creek on freehold land. The site has been partly burnt and could suffer excessive exposure due to sand extraction on the lee of the hind dunes.

NAMBUCCA-MACLEAY

In the Nambucca and Macleay valleys, there are several small fragments of Suballiance No. 16.

One of these is on the west bank of Warrell Creek about 10 km south of Nambucca Heads, a small, attenuated area on an old levee bank protected from fire by the creek to the east and swamp forest to the west. Major canopy species are *Podocarpus elatus, Cupaniopsis anacardioides, Acmena smithii, Alphitonia excelsa* and *Syzygium luehmannii*. *Livistona australis* is very common on the less elevated sites, and *Casuarina glauca* in the more saline swamps. Vines consist mainly of *Smilax australis, Parsonsia straminea* and *Lantana camara*. No epiphytes have been recorded, probably because of the canopy exposure in this narrow patch.

South of Scotts Head at the Yarrahapinni Ecology Study Centre, the rainforest is in a special niche protected by high sand dunes to the east and the cliffs of the old shoreline to the west. Major canopy species are *Syzygium luehmannii* and *Mischocarpus pyriformis* with large specimens of *Ficus watkinsiana*. Other common canopy trees include *Flindersia schottiana, Podocarpus elatus, Aphananthe philippinensis* and *Drypetes australasica* (Species List, Microfiche). The most common small tree species are *Ficus coronata, Rhodomyrtus psidioides* and *Notelaea longifolia. Monococcus echinophorus* and *Capparis arborea* dominate the shrub layer. Vines are very well developed, particularly wiry vines such as *Smilax australis* or woody vines such as *Flagellaria indica, Piper novae-hollandiae, Cissus antarctica, C. hypoglauca* and *C. sterculiifolia*. Of the nine species of epiphytes, the most conspicuous are *Platycerium bifurcatum, P. superbum* and *Asplenium australasicum*.

A little further south near the entrance of the Macleay River is Shark Island. The northern end of the island is an Aboriginal Reserve in which Suballiance No. 16 is still intact. The remainder of the island has been completely or partially cleared, much of it being freehold. In the previous channel of the river, the island is quite low and actively accreting. The rainforest is on the highest areas such as the old levee banks. The river and swamp forest give protection from fire.

The major canopy species is *Syzygium luehmannii*. Also very common in the canopy is *Glochidion ferdinandi*. Other common canopy trees are *Livistona australis, Ficus fraseri, Litsea australis, Flindersia schottiana, Cupaniopsis anacardioides, Jagera pseudorhus, Alphitonia excelsa* and *Syzygium oleosum*. There are large trees of *Celtis paniculata* and *Arytera divaricata. Syzygium luehmannii* is at its known southern limit here. The small tree layer consists mainly of *Acronychia imperforata, A. oblongifolia* and *Notelaea longifolia*. The most abundant vines are *Flagellaria indica, Smilax australis* and *Ipomoea cairica*. Epiphytes are rare in the rainforest, but *Platycerium bifurcatum* and *Dendrobium teretifolium* are common on *Casuarina glauca* in the adjoining swamp forest.

Suballiance No. 17: Cupaniopsis anacardioides

No. 17 is the most widespread suballiance of littoral rainforest on the North Coast. It occurs as fragmented remnants south to the Hunter, although *Cupaniopsis* extends as far south as the Illawarra. King (1985) lists 46 major areas of this suballiance but refers to many other smaller areas. Such remnants are typically narrow, often in the lee of the hind dune or the protective coastal fringe of *Banksia integrifolia*. Because it can withstand greater exposure to wind-blown salt than the previous suballiance, No. 17 invariably forms a buffer zone on the coastal margin. With increasing exposure, it often forms a low, wind-moulded scrub. On the South Coast, *Eucalyptus botryoides, Banksia integrifolia* and *Leptospermum laevigatum* replace this rainforest suballiance.

In Suballiance No. 17, there are often scattered, emergent *Banksia integrifolia* trees above a dense canopy up to 15 m high in which *Cupaniopsis anacardioides* is the major species. Also common in this canopy is the smooth-leaved form of *Cryptocarya triplinervis* (var. *triplinervis* south to the Macleay River only) and *Endiandra sieberi*. Common to occasional species include *Drypetes australasica, Glochidion ferdinandi* and *Celtis paniculata*. There is a small tree to tall shrub layer consisting mainly of *Acronychia imperforata, Syzygium oleosum* and *Notelaea longifolia*. Other species include *Alectryon coriaceus, Arytera divaricata, Cassine australis* and *Rhodomyrtus psidioides*. A number of these species are restricted to the littoral rainforest, including *Cryptocarya triplinervis* var. *triplinervis* (smooth-leaved form), *Cupaniopsis anacardioides, Acronychia imperforata* and *Alectryon coriaceus*. The smaller shrub layer is sparse, and the herbaceous ground cover is mainly *Pellaea falcata*. Vines and scramblers are common, particularly *Lantana*

camara in disturbed sections. The main woody vine is *Cissus antarctica,* and wiry vines include *Smilax australis* and *Stephania japonica.* Epiphytes are generally not common, except in the remote Moonee Beach Nature Reserve. Exposure to salt winds could be a limiting factor, but it is more likely that easy access for thieves is responsible for their absence.

TWEED

Along the Tweed coastline where rutile mining was so extensive in the 1960s, only small pockets now remain of what must originally have been an almost continuous strip behind the dunes. On Cook Island, *Cupaniopsis* forms a low, dense wind-pruned scrub intertwined with tough vines of *Parsonsia straminea* and *Marsdenia rostrata* (Photo 66). Nearby at Fingal, a small section of intact dune shields a typical example of this suballiance. On Ukerebagh Island and the adjoining Portion 224 upstream, rainforest of this suballiance forms a protective screen around a stand of the *Syzygium luehmannii-Acmena hemilampra* Suballiance.

Although there is a small remnant at Kingscliff, further south to Bogangar there is only a regenerating strip east of Cudgen Lake which has survived the rutile mining. The original rainforest was of the *S. luehmannii-A. hemilampra* Suballiance, but exposure due to mining on the dunes to the east caused massive dieback of this less salt-tolerant vegetation. There is now a protective screen of the *Cupaniopsis anacardioides* Suballiance emerging on the seaward side. Other small remnants are found at Hastings Point, Lower Cudgera and from Potts Point to New Brighton.

BRUNSWICK-BROKEN HEAD

There is a good example of the suballiance 700 m north of the Brunswick Heads breakwater on the peninsula. The north arm of the river protects the western flank from fire, and the dunes shelter the eastern side. Much of this suballiance was eroded away at the start of the breakwater east of Harrys Hill, but a new protective zone is now forming for the *S. luehmannii-A. hemilampra* Suballiance further inland. Canopy species consist of emergent *Banksia integrifolia* with *Cupaniopsis anacardioides, Cryptocarya triplinervis* and *Diospyros pentamera* (Species List, Microfiche). This latter area has now been added to Brunswick Heads Nature Reserve.

South of Byron Bay at Broken Head, there are two interesting areas of littoral rainforest on sand. Within the Nature Reserve, west and north-west of the caravan park, there is a good sample of this suballiance containing interesting species such as *Exocarpos latifolius* and *Endiandra hayesii.* Two kilometres south of the Nature Reserve, a typical patch contains *Cupaniopsis anacardioides, Guioa semiglauca, Acmena hemilampra, Acronychia imperforata* and the rare, recently-described *Acronychia littoralis.* Four of the nine surviving specimens of the latter species occur in this unreserved area.

RICHMOND

There are a number of fragments on the Richmond River, such as the site immediately south of Lennox Head, where there is an exposed, coastal basaltic edge supporting wind-sheared *Cupaniopsis anacardioides* and ecologically related species such as *Archidendron hendersonii.*

About 3 km south of Lennox Head on an exposed basalt plateau within 1 km of the sea, there is a regrowth littoral rainforest of *C. anacardioides, Guioa semiglauca, Ailanthus triphysa* and *Alectryon coriaceus.* The site is freehold land destined for residential subdivision which has already occurred on adjoining land. This is the only known habitat of the recently described small tree, *Fontainea oraria,* represented by only 10

trees in the world. Until recently, there were thought to be only two species in the genus, one in New Caledonia, New Guinea and South-east Queensland and another restricted to North-east Queensland. However, Jessup and Guymer (1985) described the South-east Queensland populations as two new species, with a further two new species for North-east New South Wales. The habitat of one of the two new species in New South Wales *(Fontainea australis)* has been added to Limpinwood Nature Reserve. The only population of *Fontainea oraria* has been protected by an Interim Conservation Order since 1985.

Scattered individual trees representing Suballiance No.17 occur throughout the residential section of East Ballina.

Pimlico and Little Pimlico Islands are on the lower Richmond River, close to the south-east extremity of the original Big Scrub basaltic plateau but on coastal sand and alluvium. On the higher ground surrounded by mangroves are typical examples of this suballiance in positions which are probably exposed to significant wind-borne salt from the broad tidal stretches of the river. The special significance of these sites is the large number of rainforest species of the Big Scrub which reach or approach their southern limit here. They include *Archidendron hendersonii, Planchonella chartacea, Sterculia quadrifida, Carissa ovata, Arytera distylis, Ancana stenopetala* and *Randia chartacea.* For three other species — *Glochidion sumatranum, Diospyros fasciculosa* and *Canthium lamprophyllum* — these islands are the only known occurrence between Ballina and their southern limit at Iluka. In addition, this *Canthium* is of near record size on Pimlico Island, an estimated 15 m tall and 45 cm diameter.

In Broadwater National Park, there is a poorly developed occurrence of this suballiance beneath *Banksia integrifolia* where sheltered from fires to the west by Salty Lagoon. There has been heavy disturbance of what must once have been a good example of this rainforest in the caravan park at Evans Head; only some of the canopy trees now remain. At Gumma Garra in the northern section of Bundajalung National Park, frequent fires have favoured resistant tree species such as *Endiandra sieberi, Acronychia imperforata, Euroschinus falcata* and *Mischocarpus pyriformis. C. anacardioides* is only occasionally encountered. In the central section of the park at Jerusalem Creek, there is a simple rainforest of *C. anacardioides* and *Acronychia imperforata* with *Banksia integrifolia.*

CLARENCE

At Woody Head, Suballiance No.17 forms a seaward fringe to the previously described Suballiance No. 16: *Syzygium luehmanni-Acmena hemilampra.* Slightly to the south at Iluka Nature Reserve, *C. anacardioides* with or without *Banksia integrifolia* occurs in the shelter of the 12 m dunes. At a lower situation on the hind dune, it is joined by *Alectryon coriaceus, Cassine australis* and *Pittosporum revolutum.* Again, the *Syzygium luehmannii-Acmena hemilampra* Suballiance occurs further to the west. There are numerous depauperate areas south from Yamba to Woolgoolga, but none can be regarded as viable in the long term.

COFFS HARBOUR-NAMBUCCA

The occurrence of the suballiance on Moonee Beach Nature Reserve is virtually undisturbed due to Moonee Creek flowing parallel to the coast and only about 500 m inland. Both human access and fires are blocked from the west and south. In addition to the usual characteristic species, *Syzygium australe* is also common (Species List, Microfiche). The local Aboriginal name for this tree with edible fruit is "Woolgoolga". Although this species was once common in the suballiance along Woolgoolga Beach, the area is now largely cleared. A feature at Moonee Beach Nature Reserve is the

prolific growth of *Platycerium bifurcatum, Davallia pyxidata* and *Ophioglossum pendulum,* often low down on the trunks of *Endiandra sieberi.* This development of epiphytes might well have been the situation in many of these rainforests before European settlement.

In Bundagen Flora Reserve, access by 4WD has been possible until recently. There has been a long history of theft of epiphytes, particularly from the *Syzygium luehmannii-Acmena* suballiance which the *Cupaniopsis anacardioides* Suballiance protects. Additional common species to those usually encountered are *Endiandra discolor* and *Mischocarpus pyriformis.* The vine, *Mucuna gigantea,* is at its known southern limit here.

A much smaller area occurs along Warrell Creek. Where it is shielded by swamp forest to the west, it forms a protective border to the better-developed *S. luehmannii-Acmena* Suballiance on higher ground.

MACLEAY

South of the Macleay River at Gap Beach in Arakoon State Recreation Area, there is a well developed but narrow strip of this suballiance behind a protective belt of *Banksia integrifolia* on the low, frontal dunes. The short beach is sheltered by the prominent headlands to the north and south, but clearing, burning and grazing have reduced the rainforest strip in width. In the centre of the beach, the strip is now missing. Beneath the *Banksia,* the major canopy species are *Cupaniopsis anacardioides, Elattostachys nervosa, Podocarpus elatus, Rhodomyrtus psidioides, Syzygium australe* and *S. oleosum* (Species List, Microfiche). Of special interest is the occurrence of *Hibiscus tiliaceus* — otherwise known only south of Coffs Harbour at Port Macquarie. Just south of Smoky Cape in the northern section of Hat Head National Park, there is a small area of this suballiance near Smoky Rest Area. This is the known southern limit of *Cryptocarya triplinervis.*

HASTINGS

In the Hastings area, there are three rocky headlands between Crescent Head and Port Macquarie. All are partially vegetated with Suballiance No. 19: *Drypetes-Sarcomelicope-Cassine-Podocarpus,* but with a protective screen on the seaward side of the *Cupaniopsis anacardioides* Suballiance. At Racecourse Headland in the north and Big Hill south of it, the protective *Banksia* forests immediately south of the headlands have been cleared, allowing the prevailing salt-laden south-east winds to penetrate the rainforest and poison the understorey. This exposure will eventually prevent the forest from replacing itself as the canopy dies. At Point Plomer, the rainforest on the northern side of the headland is only 5 m tall and exhibits distinct wind-moulding, although on the southern side, it is about 15 m high. These three headlands have similar floristics with the seaward edge consisting of *Cupaniopsis anacardioides, Guioa semiglauca, Drypetes australasica, Cassine australis, Ficus rubiginosa* and *Notelaea longifolia.*

At Hastings Point, on the northern entrance of the Hastings River, the *Drypetes-Sarcomelicope-Cassine-Podocarpus* Suballiance occurs on the more fertile and protected sandy silt levee bank. On the seaward side, *Cupaniopsis anacardioides* Suballiance occurs on the sand. Floristically, the latter suballiance is comparable to that on the more northern headlands.

In Sea Acres Nature Reserve at Port Macquarie, the exposed seaward slope consists of *Cupaniopsis anacardioides, Arytera divaricata, Cassine australis, Elaeocarpus obovatus, Scolopia braunii* and *Notelaea longifolia.* The native shrub layer consists of *Citriobatus pauciflorus* and *Alyxia ruscifolia,* but the South African *Chrysanthemoides monilifera* ssp. *rotundata* is rapidly taking over any disturbed areas. *Doodia aspera* is the most common herb. Vines are mainly *Smilax australis, Ripogonum discolor, Cissus hypoglauca* and *Lantana camara.* Epiphytes are quite rare. *Hibiscus tiliaceus* occurs at its

known southern limit on a perched strandline midway along Miners Beach. *Sophora tomentosa* is at its known southern limit at the southern end of Shelley Beach. *Pandanus pedunculatus,* recorded also at Bonny Hills, is close to its southern limit here.

These sheltered beaches at Port Macquarie appear to be refugia of a previously warmer period. Further south on Point Perpendicular in Kattang Nature Reserve near Camden Head, there is a wind-swept low closed forest of this suballiance.

MANNING

There were once quite extensive areas of this suballiance within the Manning region, but much of the rainforest has now been destroyed by rutile mining.

In the north, in Crowdy Bay National Park, at The Gap, there is a narrow band of Suballiance No. 17 in good condition immediately behind the dunes. The canopy ranges from one to 10 metres tall. The site is protected on its western flank by a *Melaleuca* swamp forest.

Until mined for rutile in 1972 to 1973, there was a virtually continuous strip of this suballiance about 3.5 km long, south of Crowdy Bay approaching Harrington. It has now been added to Crowdy Bay National Park. It was protected from fires on its western side by Crowdy and Harrington Lagoons. Both this stretch and The Gap have emergent *Banksia integrifolia* and a dense canopy of *Cupaniopsis anacardioides, Alectryon coriaceus, Acronychia imperforata, Notelaea longifolia, Acmena smithii* and *Rhodomyrtus psidioides.* Vines are very common, particularly *Cissus antarctica* and *C. hypoglauca* with, of course, the scrambling *Lantana camara.*

At Harrington on the northern entrance of the Manning River, where the soil is perhaps more fertile, the suballiance is well developed. It is now badly infested with many species of exotic vines such as *Protasparagus plumosus, Anredera cordifolia, Convolvulus purpurea* and *Zebrina pendula* (Species List, Microfiche). This area is the known southern limit of *Beilschmiedia obtusifolia.* In addition to the typical tree species, *Ficus obliqua* and *Planchonella australis* are common. Common scramblers are *Maclura cochinchinensis* and *Lantana camara.*

At Manning Point on the south side of the entrance of the Manning River, a typical example of this suballiance occurs resembling that at Harrington although *Ficus obliqua* is less common. Unfortunately, the best section of the rainforest has been cleared of undergrowth since the site is a popular picnic area. This clearing will prevent regeneration of any gaps which may occur from time to time. The exposed seaward side of the forest is protected by scattered *Banksia integrifolia* and a dense, viney thicket of *Smilax australis, Maclura cochinchinensis* and *Lantana camara.*

For 7 km to the south, the full length of Mitchells Island, there has been almost continuous annihilation of the rainforest by rutile mining (Photo 67). There are small remnants at Old Bar and Saltwater. The latter is mostly cleared with only scattered trees or clumps and a narrow, marginal fringe.

All of these locations south from point Plomer are on unconsolidated sand, but at Red Head and Black Head, they are on rocky headlands composed of mudstone and tuff. Floristically, they are similar to those from Point Plomer to Racecourse Headland.

FORSTER-PORT STEPHENS

Around Wallis Lake south of Forster, there are several occurrences of Suballiance No. 17 as merely a protective fringe to less salt-resistant suballiances such as Nos. 19

and 23. At Cape Hawke in Booti Booti State Recreation Area, Suballiance No. 17 occurs on the lower slopes near the ocean and also on the sand dunes at the northern end of Seven Mile Beach (Species List, Microfiche). At the latter location, there is dieback due to wind exposure after rutile mining destroyed the protective *Banksia* forest to the south.

A low, windswept canopy is entwined with *Smilax australis, Dioscorea transversa* and *Stephania japonica.*

On Yahou Island Nature Reserve in Wallis Lake, the suballiance forms a fringe around the disturbed dry rainforest of *Ficus-Streblus-Dendrocnide-Cassine* Suballiance No. 23. It also occupied protected bays at Tiona, Elizabeth Bay and Shelly Beach.

In the Myall Lakes-Port Stephens area, it is once again only a protective marginal strip, such as at Seal Rocks north of the road on the more sandy margins of the *Drypetes-Sarcomelicope-Cassine-Podocarpus* Suballiance No. 19. Here, a main cover of *Banksia integrifolia* is intermixed with mainly *Cupaniopsis anacardioides* as well as associated *Alectryon coriaceus, Planchonella australis* and *Diospyros pentamera.* This is the known southern limit of *Acronychia imperforata* (which otherwise has only been recorded as far south as Sea Acres), *Mischocarpus pyriformis* and *Alectryon coriaceus* (which is also at Treachery Head nearby).

South of Seal Rocks, the suballiance is scarcely recognizable. For example, there is merely a fringe of *Cupaniopsis anacardioides* around the *Ficus-Streblus-Dendrocnide-Cassine* Suballiance No. 23 at Yacaaba Headland. At Snapper Island in Port Stephens, *C. anacardioides* is only scattered throughout Suballiance No. 23 forest.

***Suballiance No. 18:** Lophostemon confertus*

Particularly on the mid north coast of New South Wales, there are a number of coastal headland situations on soil derived from fine-grained sediments and meta-sediments where an overstorey of *Lophostemon confertus* with short stocky trunks protects a littoral rainforest of Suballiance No. 19: *Drypetes-Sarcomelicope-Cassine-Podocarpus.* The *Lophostemon* is performing a similar protective role on these exposed, non-sandy headlands to that of *Banksia integrifolia* and *Cupaniopsis anacardioides* (Sub-alliance No. 17) on the sandy dunal strips.

The lower canopy consists mainly of *Guioa semiglauca* and *Cupaniopsis anacardioides* with a diverse assemblage of other species including *Banksia integrifolia, Drypetes australasica, Acmena smithii, Planchonella australis, Ficus rubiginosa, Cryptocarya triplinervis, Acronychia imperforata, Alectryon coriaceus, Arytera divaricata, Notelaea longifolia* and *Canthium coprosmoides.* The shrub layer consists of *Cordyline stricta, Wilkiea huegeliana* and *Breynia oblongifolia.* The sparse herb layer is mainly of *Doodia aspera, Lomandra longifolia* and *Alpinia caerulea.* The most common vines are *Geitonoplesium cymosum, Ripogonum album, Smilax australis, Cissus antarctica, C. hypoglauca* and *Lantana camara.* Epiphytes are absent except for an occasional, inconspicuous *Pyrrosia confluens.* This suballiance extends from Queensland to Seal Rocks.

TWEED-BROKEN HEAD

At Broken Head Nature Reserve in the north, the suballiance occupies the spurs running down to the sea (Photo 68). Although *Lophostemon* grows only to about 10 m high, there is a floristically diverse rainforest tree layer with additional species such as *Flindersia schottiana, Pentaceras australis* and the rare and endangered *Cryptocarya foetida* (Species List, Microfiche). The shrub layer contains three species of *Cordyline, Alyxia ruscifolia, Lepidozamia peroffskyana* and the Queensland *Xylosma terraereginae* (close to its southern limit and only known elsewhere in New South Wales at Brunswick Heads

Nature Reserve, Lennox Head and Ballina). An additional and very common vine is *Calamus muelleri.*

COFFS HARBOUR-BELLINGER

On the northern side of the headland at Moonee, the main associated tree species are *Endiandra sieberi, Acronychia oblongifolia, Cryptocarya triplinervis, Glochidion ferdinandi, Bridelia exaltata, Cupaniopsis anacardioides* and *Rapanea variabilis* (Species List, Microfiche). The presence of *Endiandra sieberi* is probably due to the accumulation of sand at the base of the headland. There are many other examples on the headlands south to Coffs Harbour, including Korora and Charlesworth Bay, where the main associated tree species are *Cupaniopsis anacardioides* and *Guioa semiglauca.*

At Boambee Headland, the ridges on the southern side support a dense, low canopy of *L. confertus,* and the protected intervening gullies contain canopy trees of *Dysoxylum muelleri, Dendrocnide excelsa* and *Planchonella myrsinoides* (Species List, Microfiche). Beneath the *L. confertus* is a developing rainforest of the canopy species as well as *Archontophoenix cunninghamiana, Celtis paniculata, Planchonella australis, Cryptocarya triplinervis, Ficus coronata, Arytera divaricata, Cupaniopsis anacardioides* and *Guioa semiglauca.* Vines are very common, tending to drape the forest edge and smother any regeneration within openings. The more aggressive vines are *Ripogonum album, Smilax australis, Cissus hypoglauca* and *Ipomoea purpurea. Lantana camara* is a rampant scrambler. The effect of repeated burning upon the suballiance can be seen at Tuckers Rocks in Pine Creek State Forest, where the rainforest understorey has been replaced by *Imperata cylindrica* and *Pteridium esculentum.*

CRESCENT HEAD-CROWDY BAY

A good example of Suballiance No. 18 can be seen in a south-facing gully just west of Smoky Cape Lighthouse, although the understorey is unusually sparse due to repeated fires. The canopy consists of *L. confertus* and *Livistona australis* with a fire-resistant small tree layer of *Synoum glandulosum, Acmena smithii* and *Rhodamnia rubescens.*

On the southern side of Point Plomer in Limeburners Creek Nature Reserve, the *L. confertus* overstorey protects a lower canopy of *Guioa semiglauca, Cupaniopsis anacardioides, Ficus rubiginosa, Acmena smithii* and *Drypetes australasica* (Species List, Microfiche).

Much of the rainforest in this area lacks the *L. confertus* cover and has already been discussed under the *Cupaniopsis anacardioides* Suballiance No. 17. Further examples of a floristically simple association of *L. confertus* overstorey and *Cupaniopsis anacardioides* understorey occur further south, near Sea Acres Nature Reserve north of Shelly Beach Road, south of Lake Cathie, at Point Perpendicular on Kattang Nature Reserve and on the southern side of Diamond Head in Crowdy Bay National Park.

MANNING-PORT STEPHENS

South of the Manning at Red Head and Black Head, the *L. confertus* is in the more sheltered gullies associated with hardy species such as *Banksia integrifolia* and *Cupaniopsis anacardioides.* There is a lower storey of *Guioa semiglauca, Planchonella australis, Acmena smithii* and ecotonal species such as *Acacia maidenii, Pittosporum undulatum, Rhodamnia rubescens, Cryptocarya rigida* and *Mallotus philippensis* (Species List, Microfiche). Black Head is the known southern limit of *Bridelia exaltata.*

As *L. confertus* approaches its southern limit at the Myall Lakes, it shows a tendency to require more shelter than in sites further north. At Seal Rocks, for example, it occurs in the swales of the hind dunes rather than on the headlands. It is probably excluded from the slopes of the dunes by repeated burning.

Associated lower canopy species are *Livistona australis, Endiandra sieberi, Trochocarpa laurina, Acmena smithii, Cryptocarya glaucescens, C. rigida, Endiandra discolor* and *Glochidion ferdinandi.* Some of these species are characteristic of developing inland gully rainforests rather than littoral rainforest. Indeed, on McGraths and Johnsons Islands in the Myall Lakes at the known southern limit of *L. confertus,* there are very few littoral rainforest species present; the communities are probably part of the mainland gully systems to the west.

***Suballiance No. 19:** Drypetes-Sarcomelicope-Cassine-Podocarpus*

Suballiance No. 16: *Syzygium luehmannii-Acmena hemilampra,* does not occur south of the Macleay River. On the mid north coast its place is taken at the more sheltered littoral rainforest sites, protected from fire, by the somewhat simplified community now to be described. Its distribution extends from Gap Beach to Myall Lakes, with a less representative example at Royal National Park.

On the cooler central and south coasts, Suballiance No. 13 is replaced by the even more simplified Suballiance No. 20, in which *Acmena smithii* predominates with *Ficus* spp., *Livistona* and *Podocarpus.* It grades into Suballiance No. 23: *Ficus-Streblus-Dendrocnide-Cassine,* which is more of an inland dry rainforest community, with typically a better representation of *Ficus macrophylla, F. rubiginosa, F. superba* var. *henneana, Streblus, Dendrocnide excelsa, Maclura* and *Malaisia,* but fewer *Banksia integrifolia, Dendrocnide photinophylla, Sarcomelicope, Drypetes* and *Tetrastigma nitens.*

Major canopy species of Suballiance No. 19 are *Drypetes australasica, Sarcomelicope simplicifolia, Cassine australis* and *Podocarpus elatus.* Other common species are *Dendrocnide photinophylla, Dysoxylum fraserianum* and *Olea paniculata.* Less common but typical canopy trees are *Livistona australis, Banksia integrifolia, Ficus rubiginosa, F. obliqua* and *Planchonella australis.*

The sub-canopy stratum is mainly *Claoxylon australe, Mallotus philippensis* (north of Seal Rocks), *Arytera divaricata* and *Cupaniopsis anacardioides.* Also present in this layer is *Capparis arborea, Guioa semiglauca* and *Notelaea longifolia.*

Ground ferns are mainly *Doodia aspera* and *Pellaea falcata.* The main creeper on rocks and on the bases of trees is *Arthropteris tenella.* Wiry vines are very common, particularly *Smilax australis.* Amongst woody vines present are several native grapes, of which *Cissus antarctica* is the most common. The prevalence of epiphytes is governed to a large extent by accessibility to thieves. *Platycerium bifurcatum,* and sometimes *Asplenium australasicum,* were originally common.

MACLEAY-HASTINGS

At Gap Beach in Arakoon State Recreation Area, a patch of rainforest on the steep southern slope of the northern headland is protected from southerly winds by Green Island and Smoky Cape to the south. Inland, an amphitheatre of hills affords some protection from fires to the west (Photo 69).

This site provides an example of an intermediate suballiance. Although *Drypetes, Sarcomelicope* and *Cassine* are very common, *Podocarpus* is rare and *Ficus macrophylla* and *F. watkinsiana* are present in numbers more typical of the dry rainforest Suballiance 23, *Ficus-Streblus-Dendrocnide-Cassine* (Species List, Microfiche).

Because vehicular access to this area is difficult, there are some fine clumps of the epiphytes, *Platycerium bifurcatum* and *Davallia pyxidata.* However, an access road to this secluded beach has been proposed, and such a road would probably ensure the quick removal of these epiphytes.

Between Crescent Head and the Hastings River there are three headlands supporting Suballiance No. 19 on their southern sides. At Racecourse Headland and Big Hill (Species List, Microfiche) the vegetation is typical of this suballiance; but at Big Hill where epiphytes are still common, *Podocarpus* trees are being felled for the *Platycerium bifurcatum*. Needless to say, the road is in close proximity. There has been dieback of the understorey at both areas due to salt spray poisoning following destruction of the protective margin. (These circumstances were described under Suballiance No. 17.) The southernmost of these three headlands, Point Plomer, is floristically poorer than the others; both *Sarcomelicope* and *Podocarpus* are absent or rare. South of these headlands at Hastings Point on the north bank of the entrance of the Hastings River, there is a small rainforest remnant on well drained sand and alluvium. Because drainage is better, there are no palms or *Tristaniopsis laurina*, and the alluvial soil favours *Mischocarpus pyriformis* and *Ficus obliqua*. As at Gap Beach, this area contains many species typical of the inland dry rainforest Suballiance No. 23 — *Ficus superba* var. *henneana, Capparis arborea, Alchornea ilicifolia, Scolopia braunii* and *Diospyros australis*. Special features of Hastings Point are that it is the known southern limit of *Rhodamnia argentea* and that it is close to the southern limit of *Archidendron grandiflorum*.

Sea Acres at Port Macquarie is an excellent example which illustrates the progression from the *Cupaniopsis anacardioides* Suballiance on the dunes to Suballiance No. 19 on the western hind dune slopes and eastern cliff slopes. In the gully at the base of these cliffs of the old shore line, there is a taller better-developed rainforest of Suballiances No. 6, *Archontophoenix*, and No. 15, *Ficus-Dysoxylum-Dendrocnide* characterized by *Archontophoenix cunninghamiana, Sloanea australis, Ficus obliqua, Syzygium corynanthum* and *S. francisii*. The same floristics apply to other locally moist sites at Bago Bluff Flora Reserve and Cape Hawke.

Epiphytes are very common at Sea Acres in this Suballiance No. 19, particularly on the large *Ficus obliqua*. They include conspicuous species such as *Platycerium bifurcatum, P. superbum, Davallia pyxidata* and *Ophioglossum pendulum*. This area is the known southern limit of the vine, *Millettia australis*, which extends north to Gladstone, Queensland.

MANNING-CAPE HAWKE

South of the Manning River, there are only two areas of significance to the suballiance. The Black Head rainforest has been largely destroyed by clearing for a bowling club on the headland. Of the four key species, *Cassine australis* occurs only occasionally, and *Podocarpus elatus* is absent. Cape Hawke on Booti Booti State Recreation Area is the northern member of a chain of islands, some of which have been joined to the mainland by sand, such as Cape Hawke via Seven Mile Beach to Booti Booti, Seal Rocks, Mungo Brush and Yacaaba Headland. Others including Broughton and John Gould Islands are still isolated. At Cape Hawke, the southern and upper steep eastern slopes consist of a typical example of the suballiance, growing to 20 m tall (Species List, Microfiche). Vines are common, particularly *Arthropteris tenella* on the rocks and lower tree trunks and *Cissus antarctica* in the canopy.

Of seven species of epiphytes, only *Platycerium bifurcatum* is common. On the eastern slopes running down to the sea, there is a reduction of tree height in proportion to increased exposure. On the mid-slope section, *Drypetes* and *Streblus brunonianus* are less common, although *Baloghia inophylla, Austromyrtus bidwillii* and *Capparis arborea* are well represented (Photo 70). *Platycerium bifurcatum* is still common but may be quite low down on the trunks of trees such as *Podocarpus elatus*. In the moister lower gullies on these eastern slopes, the canopy is composed of *Dysoxylum fraserianum, Drypetes australasica* and *Euroschinus falcata* with an understorey of *Claoxylon*

australe, Pisonia umbellifera, Livistona australis and *Crinum pedunculatum.* The site shows some similarity to the western slopes of John Gould Island off Port Stephens, which will be discussed later, under the dry rainforest Suballiance No. 23. Several plants are at their known southern limit at Cape Hawke — *Ixora beckleri, Austromyrtus bidwillii* and *Planchonella myrsinoides,* which possesses unusual, red, hairy, new leaves both at this site and on nearby Yahou Island in Wallis Lake. (Elsewhere, from Bundaberg to the Clarence River, Sawtell and Lord Howe Island, new leaves of *P. myrsinoides* have rusty-yellow, black or white hairs. The southern population appears to have been isolated for a lengthy period.) *Cleistanthus cunninghamii* reaches its southern coastal limit at Cape Hawke but extends further south inland, in the dry rainforest Suballiance No. 23 to Paterson.

SEAL ROCKS-MYALL LAKES

In the Myall Lakes National Park, there is a rainforest patch to the north at Seal Rocks. Most of the rainforest north of the road is of Suballiance No. 19. The canopy is of typical species (Species List, Microfiche) and is about 15 m tall. Vines are very common, particularly wire types including *Geitonoplesium cymosum* and *Smilax australis.* Woody vines, too, are prominent — particularly grape vines such as *Cissus antarctica, C. hypoglauca* and *Tetrastigma nitens.* Other common woody vines are *Pandorea pandorana* and *Morinda jasminoides.* Epiphytes are rare, possibly due to theft. *Asplenium australasicum* and *Platycerium bifurcatum* are still present but in very low numbers. At Mungo Brush in Myall Lakes National Park, about 2 ha of this suballiance occur on what was until recently an island of volcanic rock in the lake (Photo 71). (Old charts show an island, but the land is now joined by swamp sclerophyll forest to the eastern shore.) This could expose the rainforest to a cycle of burning not previously encountered. The rainforest is floristically diverse, and like the one-time island of Cape Hawke to the north and the present John Gould Island to the east, it contains *Pisonia umbellifera* in the understorey (Species List, Microfiche). The vines are typical of this suballiance. As at Seal Rocks, epiphytes are rare, possibly as a result of thieves. This site is the southern limit of *Drypetes australasica* along the coast, although like *Cleistanthus cunninghamii* it extends further south inland to Paterson.

ROYAL NATIONAL PARK

There is one possible occurrence of this suballiance further south, at Burning Palms, Royal National Park. Of the four characteristic canopy species, only *Cassine australis* is present. However, other tree species such as *Livistona australis, Ficus rubiginosa, Diospyros australis* and *Pisonia umbellifera* relate the community to this suballiance. *Arthropteris tenella* occurs on rocks and the bases of trees, and the wiry vine, *Ripogonum album,* is present. *Cissus hypoglauca* is a very common woody vine in the canopy. Only occasional epiphytes are seen, and these are mainly *Asplenium australasicum* and *Platycerium bifurcatum.* The site is certainly littoral, being on a high shelf overlooking the ocean. It is also related to Suballiance No. 34, *Ceratopetalum-Diploglottis-Acmena,* because it contains some warm temperate rainforest species including *Cryptocarya glaucescens* and *Ceratopetalum apetalum.*

Suballiance No. 20: *Acmena smithii-Ficus* spp.*-Livistona-Podocarpus*

This suballiance is a floristically simplified form of No. 19. *Acmena smithii* is the major tree species. *Drypetes australasica, Sarcomelicope simplicifolia* and *Dendrocnide* spp. are generally absent or of lesser importance because the suballiance occurs in locations beyond or approaching their southern limits. *Livistona australis* and *Podocarpus elatus* are common, the latter only as far south as Beecroft Peninsula at Jervis Bay. The distribution of this suballiance is mainly from the Hawkesbury River to Mimosa Rocks

National Park, but there is also one location at Blueys Beach, Booti Booti State Recreation Area. All sites are within range of salt-laden winds and are on sandy soils derived from sand, sandstone or rhyolite.

Apart from *Acmena, Livistona* and *Podocarpus,* several species of *Ficus* characterize this suballiance — *F. coronata, F. fraseri* and *F. rubiginosa.* Other trees common in the canopy include *Endiandra sieberi, Euroschinus falcata, Pittosporum undulatum* and *Guioa semiglauca.* Sub-canopy trees are *Claoxylon australe, Cassine australis, Eupomatia laurina* and *Diospyros australis.* Shrubs and herbs are not well represented; only *Breynia oblongifolia* and *Doodia aspera* respectively are common.

Vines and scramblers are very conspicuous. *Cissus antarctica* is common south to Beecroft Peninsula, whereas *C. hypoglauca* occupies this niche further south. *Smilax australis* is common throughout in association with *Ripogonum album, Stephania japonica, Parsonsia straminea, Marsdenia rostrata* and *Morinda jasminoides. Lantana camara* forms dense thickets in any gaps in the canopy as far south as Comerong Island. Only five species of epiphytes have been recorded, and only *Platycerium bifurcatum* is present at most sites. Even so, some locations are devoid of epiphytes. These include Blueys Beach, Comerong Island and the Durras Mountain to Oaky Beach section just north of Batemans Bay. This condition may reflect a history of poaching rather than any ecological barrier.

FORSTER-HAWKESBURY

There are two known Suballiance No. 20 sites north of Sydney. One of these, at Blueys Beach, Booti Booti State Recreation Area, is rather confusing. Other nearby sites under apparently comparable conditions support the *Drypetes-Sarcomelicope-Cassine-Podocarpus* suballiance, but Blueys Beach site has a preponderance of *Acmena smithii* and only occasional individuals of *Drypetes* and *Cassine. Podocarpus* was not even listed. Furthermore, the site contains a number of tree species more typical of the northern lowland subtropical rainforest — *Argyrodendron actinophyllum, Daphnandra micrantha* and *Elaeocarpus obovatus.* Just north of the Hawkesbury River on Bouddi National Park there are also littoral rainforest pockets dominated by *Acmena smithii.*

ILLAWARRA-SHOALHAVEN

On the Illawarra in the Flora and Recreation Reserve at Shellharbour, Bass Point, the canopy consists mainly of *Acmena smithii* and *Podocarpus elatus* with *Endiandra sieberi, Guioa semiglauca* and *Celtis paniculata.* Common smaller trees and tall shrubs are *Cassine australis, Sarcomelicope simplicifolia* and *Diospyros australis* (Species List, Microfiche). Although present, epiphytes are uncommon.

A little to the south at Crooked River and Seven Mile Beach, the rainforest is fragmented and in a rather disturbed state with only 30 species of trees and shrubs recorded in contrast to 44 species at Shellharbour and 42 species at Beecroft Peninsula. There are emergents of *Banksia integrifolia* above a canopy of *Acmena smithii, Ficus macrophylla, F. obliqua, Podocarpus elatus, Glochidion ferdinandi* and *Guioa semiglauca.* Other common species are *Cryptocarya microneura* and *Pittosporum undulatum.* This site is the southern known limit of two tree species, *Euodia micrococca* and *Pararchidendron pruinosum.*

By its very situation, Comerong Island Nature Reserve at the entrance of the Shoalhaven River, has escaped severe wildfires and contains much rainforest of this suballiance. However, it has been a ready source of oyster stakes from cabbage tree palms *(Livistona australis).* The felling of these palms has created gaps in the rainforest which are now choked with *Lantana camara.* There is a protective emergent stratum

of *Eucalyptus botryoides* and *Banksia integrifolia* with a main canopy of *Livistona australis, Podocarpus elatus, Cryptocarya glaucescens, Endiandra sieberi, Glochidion ferdinandi* and *Polyscias elegans* (Species List, Microfiche). Other diagnostic species such as *Acmena smithii* and *Ficus coronata* are less abundant.

Cassine australis is a common sub-canopy tree, and *Eupomatia laurina* is the most common shrub. Vines are of typical species, except that *Cissus* is absent.

The poor representation of readily bird-dispersed species such as *Acmena smithii, Ficus coronata* and *Cissus* species is puzzling, particularly since they all occur along Seven Mile Beach immediately to the north. One possible explanation might be heavy usage and modification by Aborigines in the past, with consequent frequent but light fires which would have favoured rough-barked species. The lack of epiphytes could also be a result of Aboriginal occupation, but it is far more likely to be evidence of poaching by Europeans.

One shrub species, *Duboisia myoporoides,* reaches its known southern limit at this location.

BEECROFT PENINSULA

On the northern peninsula at Jervis Bay, there are seven elongated rainforest remnants on the western side (Helman 1979). Because the peninsula is only joined by a narrow isthmus to the mainland to the north, the rainforest has virtually the same degree of protection from fire which is afforded at Comerong Island. Any serious fires on the peninsula would burn eastwards, driven by the hot, dry north-westerlies; the rainforest, however, is upwind on the western side. The rainforest patches are retreating, however, due to more frequent fires lit on the peninsula by Aborigines and then Europeans. There is also a threat from wind damage because of the long, narrow shapes of these remnants (Helman 1979). From the floristic viewpoint, this is the most southern, well-developed littoral rainforest in Australia. Eight of the 34 tree species and one vine are at their known southern limit. These species are *Podocarpus elatus, Pisonia umbellifera, Acacia binervata, Euroschinus falcata, Scolopia braunii, Syzygium oleosum, Polyscias elegans, Canthium coprosmoides* and *Cissus sterculiifolia.* As usual on the South Coast, *Eucalyptus botryoides* is a common emergent above a closed canopy of *Acmena smithii, Livistona australis, Podocarpus elatus, Syzygium oleosum, Litsea reticulata, Euroschinus falcata* and *Diospyros pentamera* (Species List, Microfiche).

Among the many species of small trees, the most important are *Ficus coronata, Claoxylon australe, Cassine australis, Guioa semiglauca* and *Diospyros australis.*

The shrub, herb and vine layers are typical for this suballiance. Epiphytes are common in this rather isolated area, in contrast to Comerong Island to the north and the other occurrences further south to Batemans Bay. The most common epiphyte is *Platycerium bifurcatum.*

BATEMANS BAY

In Murramarang National Park, just north of Batemans Bay, there are three small coastal rainforest areas. All are close to the sea and backed by a line of cliffs or hills which give some protection from fires to the west, which must burn downhill to reach the rainforests. There is often a narrow band of littoral rainforest, which can cope with the salt spray; behind it is typical warm temperate rainforest of the *Ceratopetalum-Acmena-Doryphora* Suballiance No. 37. Generally, there is an overstorey of *Eucalyptus botryoides, E. paniculata* and/or *Banksia integrifolia* which protects the rainforest from excessive salt spray. However, some of these trees were logged many years

ago on the eastern base of Durras Mountain. This disturbance led in turn to much storm damage upslope and the development of a heavy vine shroud on the remaining trees.

At this site as well as at Pebbly and Oaky Beaches, the canopy consists mainly of *Acmena smithii, Livistona australis* and *Pittosporum undulatum* with *Ficus coronata* very common at Durras Mountain (Species List, Microfiche) and Pebbly Beach. The typical shrubs, herbs and vines are at all three sites. The floristic diversity steadily decreases with increasing latitude. *Guioa semiglauca* reaches its known southern limit at Pebbly Beach. *Glochidion ferdinandi, Rhodamnia rubescens, Clerodendrum tomentosum* and *Smilax glyciphylla* extend to Oaky Beach.

BUNGA HEAD

The most southern record of littoral rainforest is at Bunga Head in Mimosa Rocks National Park, 15 km north of the Bega River entrance. In a gully with a moist southern aspect, to the west of the trig point, the canopy is composed mainly of *Acmena smithii, Ficus coronata, Livistona australis* and *Claoxylon australe.* The latter species and *Ehretia acuminata* as well as the smaller trees of *Synoum glandulosum, Notelaea longifolia* and *Myoporum acuminatum* are all at their known southern limit. In addition, the shrubby *Citriobatus pauciflorus* is also at its limit.

On the eastern side of the headland, there is a very unusual rainforest on the steep rocky cliffs and slopes in full sun and exposed to the salt-laden breezes. Although only 6 m tall, the trees are of considerable stem diameter. It is a very simple forest of *Acmena smithii* and *Ficus rubiginosa,* the latter of grotesque form (Photo 72) with snaking aerial roots and horizontal major branches like miniature Lord Howe Island banyan trees *(Ficus columnaris).* Growing on the bases of these trunks is *Arthropteris tenella,* not previously known south of Mt Dromedary. The ferns, *Asplenium australasicum* and *Platycerium bifurcatum,* grow on rhyolite boulders in full sun. These also were only known south to Mt Dromedary. The other common lithophyte is *Dendrobium speciosum* (Photo 73), which extends south to Eden (Species List, Microfiche).

This interesting and unusual remnant occupies a special, fire-free niche on soil supposedly derived from the less-fertile rhyolite rock, but possibly derived from one of the more basic rocks known in this area such as gabbro or syenite. It is also possible that additional nutrients are provided in aerosol form from the sea.

CHAPTER 2

Dry Rainforest

This subform occurs where rainfall is low for rainforest development, only 800–1 100 mm annually with a marked dry spring. There are two tree strata, the upper being of scattered emergents such as *Araucaria cunninghamii, Brachychiton discolor* and *Flindersia australis*. The lower strata is a dense main layer which may contain 10 to 30 species.

Leaves or leaflets are characteristically hard and small, commonly under 7.5 cm long. Woody vines are very common, as may also be stranglers. Other tropical features such as plank buttressing, palms and large epiphytes are rare. There is a well developed prickly shrub layer and a very sparse herbaceous ground cover.

In New South Wales, there are three dry rainforest alliances and also vine thicket representing 12 suballiances (Fig. 12). The *Drypetes-Araucaria* alliance occupies basaltic soils south to Milton, where rainfall is relatively high but seasonal. By contrast, the *Castanospermum-Waterhousea* alliance occurs where rainfall is inadequate for rainforest development but is supplemented by groundwater due to its riverine habitat. The *Choricarpia-Backhousia* alliance is generally on poorer soils and is subject to occasional fires, particularly on the South Coast.

Because of its reduced height, vine thicket cannot be strictly described as a forest, although it is otherwise structurally and floristically referable to rainforest. Soil moisture is seasonally low due to either the shallow soil or the low rainfall or a combination of both. Vine thicket is commonly found in fire-free niches such as in gorges or on stony rises.

***Drypetes-Araucaria* Alliance**

Areas on fertile soil with protection from fire, but with a marked spring or summer drought, support this alliance rather than subtropical rainforest. The alliance ranges from sea level to about 700 m altitude in the north. The soils are fertile brown or black earths derived from or enriched by basalt, dolerite or latite if underlaid by sandstone, siltstone or conglomerate. North from the Bellinger River, *Araucaria* and *Flindersia* spp. are the major canopy or emergent species, but further south to Yatteyatah near Milton, their place is taken by *Ficus* spp. and *Dendrocnide* (Fig. 12). The smaller tree layer consists of many species in the families Euphorbiaceae, Sapindaceae and Rutaceae. *Drypetes* has been chosen as representative of this stratum because it is commonly, but not invariably, important in all suballiances. This alliance exhibits optimal development in floristics, structure and physiognomy for dry rainforest in New South Wales; with less favourable rainfall, soil and fire protection, it gives way to the other alliances.

There are three suballiances:

21. *Araucaria*
22. *Flindersia* spp.-*Araucaria*
23. *Ficus* spp.- *Streblus-Dendrocnide-Cassine*

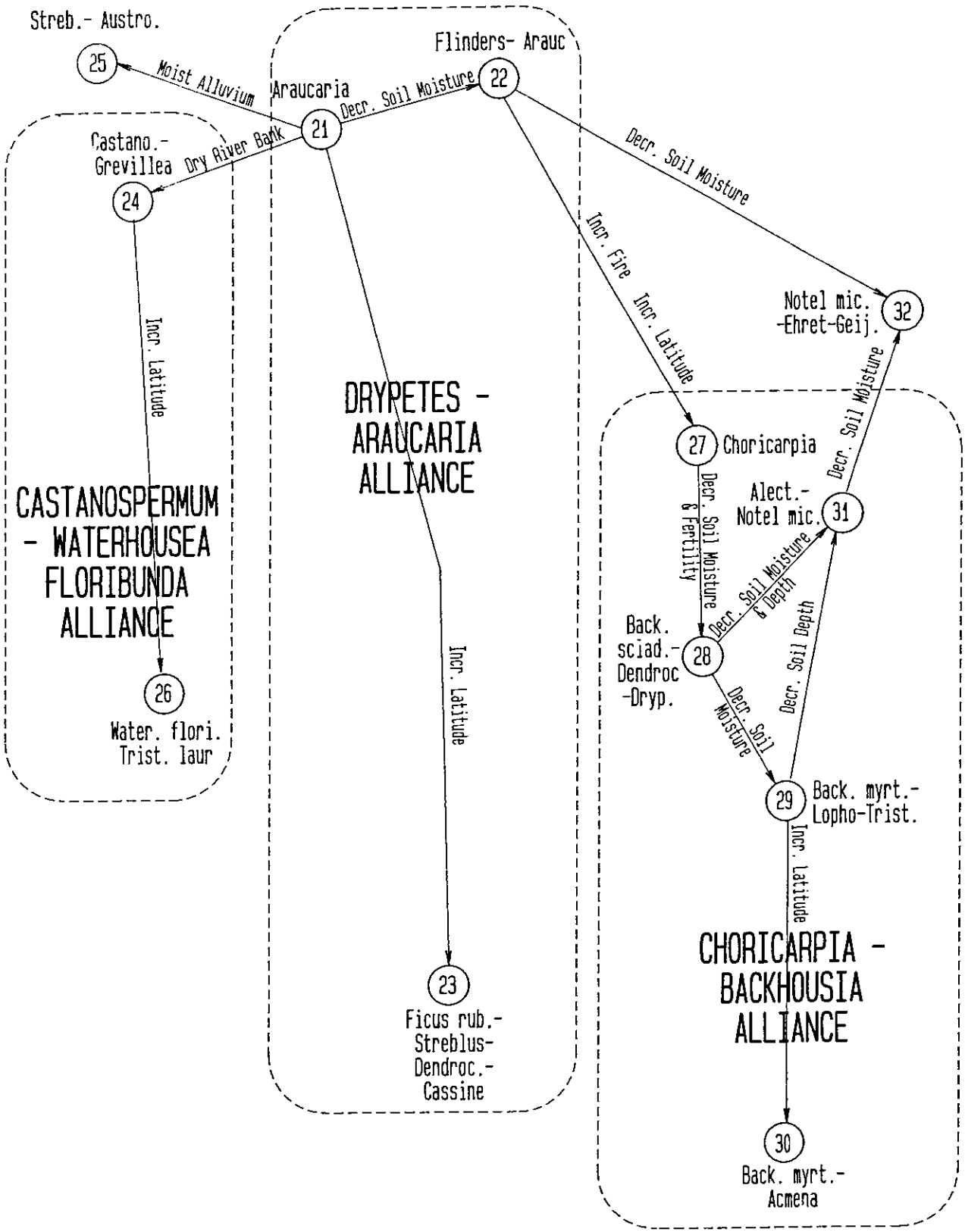


Fig. 12. Floristic classification of dry rainforest.

Suballiance No. 21: Araucaria

This suballiance exhibits the best height, structural and floristic development within the alliance and hence within the dry rainforest subform, as exemplified at Rotary and Wilson Parks, Lismore. The suballiance occupies the well-drained, boulder-strewn, basaltic plateaux edges and steep slopes north from the Bellinger River where free from all but the most infrequent fires. The mean annual rainfall is commonly more than 1 000 mm, but the dry spring and the often shallow, well-drained soil produce periods of low soil moisture. The steep, narrow spurs coming off the McPherson, Tweed and Richmond Ranges, particularly those with a northern or western aspect, often support this suballiance. The more moist, intervening areas are of Suballiance No. 1, *Argyrodendron trifoliolatum,* Suballiance No. 7, *Argyrodendron actinophyllum,* or Suballiance No. 8, *Argyrodendron actinophyllum-Araucaria.*

Araucaria is a geologically ancient genus extending back at least 80 million years and showing a present-day preference for temperate rainforests in South America, New Caledonia and New Guinea. Its southern sites are more typical of the genus than the dry rainforests of far northern New South Wales and southern Queensland. However, *A. cunninghamii* does have relatively shorter, thicker leaves than the other Australian and New Guinean species which would aid it in surviving under these more arid conditions.

Both this suballiance and No. 22, *Flindersia* spp.-*Araucaria,* have supported the valuable hoop pine logging industry for many years. Today, outside reserves, only inaccessible areas remain intact. However, *Araucaria cunninghamii* is a shade tolerant species, and it is regenerating in many logged areas even if initially beneath the canopy of the secondary forest.

Araucaria is typically a clear emergent, either as scattered individuals or in fairly dense groups or larger patches. The dense canopy beneath this species is composed of many small tree species, the most common being *Croton verreauxii, Drypetes australasica, Austromyrtus bidwillii, Polyscias elegans, Euroschinus falcata, Guioa semiglauca, Elattostachys nervosa, Toona australis, Diospyros australis* and *D. pentamera.* The shrub layer is composed of small-leaved, prickly species, including *Capparis arborea* and *Citriobatus pauciflorus* with *Cordyline petiolaris* in the moister gullies. The herb layer is very sparse, consisting mainly of hard ferns such as *Doodia aspera* and *Pellaea* spp. with *Adiantum formosum* in the moister areas. Vines are particularly well developed, especially lianes such as *Cissus antarctica, Tetrastigma nitens* and *Rauwenhoffia leichhardtii* and also wiry vines including *Ripogonum album* and *Smilax australis.* Because of the seasonally dry conditions, epiphytes tend to be inconspicuous except where in a mist belt. They are, however, floristically quite diverse, the most common being *Asplenium australasicum* and *Dendrobium speciosum.*

ACACIA PLATEAU AND THE WESTERN McPHERSON RANGE

These New South Wales border areas west from Levers Plateau to Wilsons Peak receive less rain than the eastern McPherson Range and Tweed Range which are closer to the seaboard's rain-bearing winds. It has been estimated that the eastern escarpment edge may receive about 3 500 mm of rain annually; the Wiangarie Plateau, 2 000 mm; Levers Plateau, further west, only 1 500 mm; and Acacia Plateau, 1 300 mm. Accordingly, dry rainforest, and particularly that of the *Araucaria* and *Flindersia* spp.-*Araucaria* suballiances, is common.

The recently described *Rhodamnia whiteana,* formerly incorrectly referred to the North Queensland *R. costata,* is endemic to the crest of these ranges at Acacia Plateau, Mossy Gardens, Mt Lindesay, Levers Plateau, Mebbin Rock, The Sphinx and Bushrangers Cave.

At Acacia Plateau Flora Reserve on the Great Dividing Range, this suballiance is immediately above and below the trachyte cliffs on basalt. Wherever accessible, it has been logged. The drier northern aspect has a dense small tree layer of *Streblus brunonianus, Geijera salicifolia* var. *latifolia, Alstonia constricta, Drypetes australasica, Brachychiton discolor, Grevillea robusta* and *Euroschinus falcata.* Another species of restricted distribution occurring here is the small tree, *Citriobatus lancifolius,* which is found only in the upper Clarence, Richmond-Tweed and Main Range west of Brisbane. The shrub, *Casearia multinervosa,* is also present here but is uncommon in New South Wales.

On the western McPherson Range, a number of high peaks support rainforest. The most extensive undisturbed area of Suballiance No. 21 in New South Wales, 220 ha, occurs on the steep, basalt slopes above and below the trachyte cliffs of Mt Clunie Flora Reserve 900–1 100 m altitude. Associated trees beneath the *Araucaria* include *Grevillea robusta, Dendrocnide excelsa, Rhodamnia argentea, Drypetes, Acronychia oblongifolia, Pittosporum undulatum* and *Denhamia celastroides.* Shrubs include *Croton verreauxii, Dianella caerulea* and *Cordyline petiolaris.* It is too dry to support a ground fern cover, and epiphytes are restricted to small xerophytic ferns such as *Pyrrosia confluens* and *P. rupestris.*

A little to the east and south-west of Mt Nothofagus at 700–825 m altitude on the state border, there is a small area on very steep dry slopes with shallow soil among rocks. Associated trees are mainly *Baloghia inophylla, Arytera divaricata* and *Diospyros pentamera.* Shrubs are mainly *Citriobatus pauciflorus* and *Capparis arborea,* and the major epiphyte is *Asplenium australasicum.*

Further east on the eastern and western lower flanks of Mt Lindesay, and particularly on the dry, north-east side in Queensland below the rhyolite cliffs, there are typical examples of this suballiance. The canopy below the *Araucaria* consists of *Streblus, Dendrocnide excelsa, Baloghia, Denhamia celastroides, Cassine, Rhodamnia argentea, R. rubescens* and *Capparis arborea.*

The finest example of Suballiance No. 21 in New South Wales occurs at Levers Plateau, in the head of Long and Surveyors Creeks. The site provides basaltic soil below the rhyolite of Mt Glennie at only 500–700 m altitude. Very old trees of *Araucaria* are so abundant as to form a complete upper canopy (Photo 74). Nearer to the state's border, there are stands of *Araucaria* which are obviously even-aged and younger. This magnificent and unusual forest probably originated after a severe fire several centuries ago, burning up the dry sclerophyll forest on the north-facing slopes from Running Creek in Queensland to the border. There is a low saddle on the border range at this point, where the dry sclerophyll forest consists of *Eucalyptus melliodora, E. rummeryi* and *E. tereticornis* with an inflammable, grassy ground cover of *Imperata cylindrica.* This dry forest persists along the contours to the top of the Long Creek Falls and was burnt between 1972 and 1977. Across the creek, a steep, dry, northerly slope supports dry rainforest. The main *Araucaria* stand is towards the top. Although the elevation in the saddle on the border is only 600 m, that of the *Araucaria* ridge is 720 m. It is feasible that a fire could have burnt right to the top, initiating this magnificent *Araucaria* forest.

The lower tree layer consists mainly of *Austromyrtus bidwillii* and *Polyscias elegans* as well as *Dendrocnide excelsa, Grevillea robusta, Lophostemon confertus* and *Diospyros australis* (Species List, Microfiche).

There is a harsh shrub layer of *Nyssanthes diffusa, Acalypha capillipes, Carissa ovata* and *Psychotria daphnoides.* The ground cover is sparse, consisting mainly of *Doodia aspera.* Major vines are grapes such as *Cissus antarctica* and *Tetrastigma nitens.* Epiphytes are confined to hardy lichens on the branches and trunks and the diminutive, local,

endemic *Bulbophyllum globuliforme* reported on *Araucaria* branches here and in lower Gradys Creek. Also present is the shrub, *Croton stigmatosus*, which is restricted to dry rainforests from the Hastings River to South-east Queensland.

TWEED VALLEY

Although the rainfall of the Tweed Valley is generally in excess of that required by dry rainforest, there is a rain shadow to the west and north-west of Mt Warning. On the Springbrook Plateau to the north, the mean annual rainfall is 2 500 mm with 75 mm in the driest month, September. Mt Warning may possibly receive a similar rainfall. However, at Brays Creek to the west, rainfall is 1 600–1 750 mm with only 37 mm in the driest month. During the critical period of the year, the rainfall in this part of the valley is only half that on the mountains. In addition, this example of the *Araucaria* Suballiance occurs on the steep, stony, northern slopes.

West of Toenail Point on Limpinwood Nature Reserve, an example of the suballiance occurs on steep, rhyolite slopes at 700–800 m altitude with basaltic enrichment coming from above. Most of this forest was logged for its *Araucaria*, resulting in dense *Lantana*. The logs were shot down the rhyolite cliff face. The major tree species with *Araucaria* are *Drypetes* and *Baloghia*. *Pittosporum undulatum*, *Cuttsia viburnea* and *Croton verreauxii* are also common. *Lantana* dominates the understorey. On the steeper, more stony slopes the forest is reduced in height to a dry scrub of *Streblus*, *Drypetes*, *Scolopia*, *Cupaniopsis foveolata*, *Actephila lindleyi*, *Argophyllum nullumense*, *Randia chartacea* and *Acrotriche aggregata*. The trunks and branches are often festooned with the hanging moss, *Papillaria*.

On Mebbin State Forest along Bog Onion and Forty Spur Roads at elevations of only 175–200 m, there are fine examples of this suballiance on mudstones and coal below basalt. There is an overstorey of *Eucalyptus siderophloia* mixed with and above the *Araucaria* which, at Bog Onion Road, has been selectively logged. Main canopy species are *Dendrocnide photinophylla*, *Austromyrtus bidwillii*, *Diospyros pentamera*, *D. australis* and *Polyscias elegans* (Species List, Microfiche). Typical indicator dry rainforest species include *Cryptocarya bidwillii*, *Ixora beckleri* and *Canthium odoratum*. Shrubs other than *Ancana stenopetala* are rare, as also are herbs. Vines are common, particularly *Ripogonum album* and *Rauwenhoffia leichhardtii*. Epiphytes are uncommon.

Bog Onion Road was named after the onionwood, *Owenia cepiodora*, which is a rare and endangered species found from the Richmond Range to just north of the border at Cainbable and Stockyard Creeks. Although this species was relatively common 70 years ago, not a single wild tree was known by 1977.

Because the local forester, Mr Pope, wrote in 1911 that it was "found scattered in nearly all the brush forests of the Tweed, wherever the soil is inclined to be rich," it was assumed that it occurred in subtropical rainforest which was searched accordingly without success. However, a small specimen was found in 1977 at Sawpit Creek — in dry rainforest of the *Araucaria* Suballiance. All subsequent sightings were also in this suballiance. It would appear that in Forester Pope's day, there were three rainforest tree species with an onion smell in the bark and wood and hence known as "bog onion" or "onionwood". These were *Dysoxylum muelleri* and *Anthocarapa nitidula* in the subtropical rainforest and *Owenia cepiodora* in the dry rainforest. Hence the confusion. Another puzzling feature was that although the Government Botanist, J. H. Maiden, described the species as a large tree in 1911, only small trees and seedlings can be found today.

According to information supplied by a former forester at Kyogle, onionwood was included in the lowest class when assessing royalty on logs. If an onionwood log

was soaked in a creek, however, the tell-tale smell was removed and the sawn timber could be sold as red cedar. Hence onionwood *(Owenia cepiodora)* was in great demand and was soon cut out, leaving only the regrowth.

BIG SCRUB

Rocky, dry, steep slopes on the edge of the basalt of the Big Scrub which originally extended from Lismore to Byron Bay supported many areas of this suballiance. Only three significant remnants survive.

Within the city of Lismore, there are 19.3 ha of rainforest in Wilson Park and 10.5 ha in Rotary Park. It is probable that both areas originally had a well-developed emergent layer of *Araucaria,* which is still evident in much of Wilson Park (Photo 75). It is likely that this layer has been largely removed by logging at Rotary Park, where there is considerable disturbance in the canopy with consequent invasion by *Ligustrum lucidum* and *Anredera cordifolia.*

The main canopy level is often only 20 m high, consisting of medium-size trees except for the occasional large *Ficus* spp. Despite their rather uniformly average appearance, these two areas contain a large number of species — 224 at Rotary Park and 213 at Wilson Park. The combined total is 267 species in all strata, of which 139 species are trees and 63 are vines (Species List, Microfiche). Five families are very well represented — Moraceae (10 species), Rutaceae (17), Euphorbiaceae (15), Sapindaceae (18) and Myrtaceae (14). The most common species in the main canopy are *Aphananthe philippinensis, Cryptocarya bidwillii, C. triplinervis* var. *pubens, Pentaceras australis, Actephila lindleyi, Croton verreauxii, Drypetes australasica, Mallotus philippensis, Euroschinus falcata, Elattostachys xylocarpa, Arytera distylis, A. divaricata* and *Austromyrtus bidwillii.*

The predominantly wiry spiny shrub layer consists mainly of *Capparis arborea, Deeringia amaranthoides, Desmodium acanthocladum, Bouchardatia neurococca, Microcitrus australasica* and *Acalypha capillipes.* The herb layer is very sparse. Vines and scramblers are very conspicuous, particularly where the canopy has been disturbed. The most common species are *Caesalpinia subtropica, Cissus antarctica, Hoya australis* and *Lantana camara.* Although 12 species of epiphytes are recorded, none are common.

Several trees are of record size at Wilson Park, including *Olea paniculata* (90 cm stem diameter), *Siphonodon australe* (30 m tall and 50 cm diameter) and *Citriobatus lancifolius* (25 m tall and 30 cm diameter). Three species are at their known southern limit — *Acronychia pauciflora, Bouchardatia neurococca* and *Parsonsia lilacina.*

There are also several rare and endangered species. The slender climber, *Clematis fawcettii,* occurs at both sites but is known elsewhere only at Apsley Falls, Tyalgum Creek and Lamington National Park. Another rare vine found at both Lismore sites is *Parsonsia lilacina,* which had not been sighted in New South Wales since 1916 until found in 1980. *Austromyrtus fragrantissima* is confined to the Mt Warning Shield volcano, where it is rare. It is found at Rotary Park, which is the only location in New South Wales for the southern Queensland tree, *Diplospora cameronii.*

The third significant remnant of this suballiance on the Big Scrub is east of Bangalow at Hayters Hill, on the steep basaltic drop-off to the ancient cliff line of Jurassic sandstone and Devonian metasediments. It consists of a mere 4.5 ha. Following heavy logging for *Araucaria* many years ago, there are many gaps choked by *Calamus, Maclura* and *Lantana.* Another problem is the combustible tall grass along the lower boundary adjoining the Casino-Murwillumbah railway. This tiny area contains 103 species of trees and 28 species of vines. It has many floristic similarities to Rotary and Wilsons Parks, but *Argyrodendron trifoliolatum* and *Pseudoweinmannia lachnocarpa* are common trees in this more maritime environment. The latter species is here at its known southern limit.

Rare and endangered species include *Floydia praealta, Owenia cepiodora, Archidendron hendersonii* and *Tapeinosperma pseudojambosa.*

A. hendersonii is essentially a maritime species and occupies the coastal strip from Pimlico Island to Burleigh Heads, hence its occurrence on this old Holocene cliffline. Many of its 13 current recorded localities are under threat, so the recent addition to the national estate by purchase of Hayter's Hill is justified.

Tapeinosperma pseudojambosa has a very restricted distribution in New South Wales from Skennars Head, Broken Head, Hayters Hill and Billinudgel as well as Mt Wagawn and Springbrook on the Queensland Border.

UPPER CLARENCE

In the Paddys Flat-Rivertree area of the dry upper Clarence Valley, there are some steep narrow gullies whose lower slopes are naturally protected from fire. Pockets of the *Araucaria* Suballiance occur here on leasehold land at Frazers and Eaglehawk Gullies, Rivertree (Photo 76) and west of the southern section of Yabbra State Forest.

Aspects vary from west to north, the skeletal soils being derived from mesozoic sediments. Rainfall is probably lower than that of the other areas discussed — the mean annual rainfall at Pretty Gully is only 890 mm. Accordingly, species associated with the typically emergent *Araucaria* are more xerophytic and there is less floristic diversity.

The most common taller trees are *Drypetes, Baloghia inophylla, Lophostemon confertus, Euroschinus falcata* and *Olea paniculata.* Among the more xerophytic species are *Croton insularis, Geijera salicifolia* var. *latifolia, Brachychiton discolor* and *Grevillea robusta.* The smaller trees are typically *Diospyros australis, Hibiscus heterophyllus, Cleistanthus cunninghamii* and more xerophytic species such as *Acronychia laevis* and *Maytenus bilocularis.* The shrub layer is dominated by *Alchornea ilicifolia, Psychotria daphnoides* and *Canthium odoratum.* Herbs are very sparse and mostly restricted to *Doodia aspera.* Vines are conspicuous, including the wiry *Ripogonum album* and *Smilax australis* and also woody lianes such as *Maclura cochinchinensis* and *Tetrastigma nitens.* Epiphytes are generally of the smaller, hardier species such as *Dendrobium aemulum, D. linguiforme, Plectorrhiza tridentata, Rhinerrhiza divitiflora* and *Sarcochilus hillii.*

LOWER NYMBOIDA-MANN RIVERS

In the southern section of the Clarence catchment on the Nymboida-Mann Rivers between Nymboida and Dalmorton, there are numerous steep, narrow gullies, generally on the moister south to east-facing slopes where fires are infrequent. A major reason why fires are uncommon is the almost complete absence of ground cover on the steep, rocky surface which consists of patches of rock faces or scree slopes.

Above the dry rainforest is dry sclerophyll forest of *Eucalyptus maculata* with a dense understorey of *Macrozamia moorei,* elsewhere known only from Carnarvon Gorge in south-central Queensland. (*Macrozamia lucida,* which is recorded with it, is suggested to be merely a juvenile form of *M. moorei,* growing just within the rainforest and hence adapted to the lower light available.)

Rainfall at Dalmorton is only 975 mm annually. *Araucaria* is particularly adapted to this environment because its well-developed tap root ensures physical stability for this emergent tree as well as deep penetration of the soil and rocks in search of water and nutrients. The narrow, short, thick leaves are efficient water misers. Its one great weakness is its susceptibility to fire. The result can be seen at Hortons Creek, where

fires starting from the cleared valley below have killed the basal, up-slope side of many mature *Araucaria* which are now badly infected by fungal rot and will eventually collapse as the decay rapidly spreads through this non-durable timber. On very steep, boulder covered slopes, similar decay can result from physical damage to the butts of trees by falling boulders.

The soil is essentially derived from metasediments such as greywacke, but at both Hortons Creek and Sailors Hill Flora Reserve on Boundary Creek State Forest, it appears to have received some enrichment from a now-eroded basalt cap.

The vegetation at these sites is clearly related to Suballiance No. 28, *Backhousia sciadophora-Dendrocnide-Drypetes*, which extends to Dungog well south of the range of *Araucaria*. At Sailors Hill and Chandlers Creek Flora Reserves on Boundary Creek State Forest as well as at Hortons Creek, on a lease recently converted to freehold, *Araucaria* up to 40 m and 60 m tall tower above a medium-to-low, dense rainforest.

The main canopy is composed of *Dendrocnide excelsa, Drypetes australasica* and *Backhousia sciadophora* as well as *Argyrodendron actinophyllum, Streblus* and *Guioa* (Species List, Microfiche). Among the smaller trees are *Capparis, Sarcomelicope, Croton insularis, C. stigmatosus, C. verreauxii, Alchornea, Canthium odoratum* and *C. vacciniifolium*. A total of 91 tree species are listed for the two Boundary Creek State Forest sites.

The shrub layer is mainly *Abutilon oxycarpum, Hibiscus heterophyllus* and *Solanum densevestitum*. The sparse herb layer is of *Pellaea falcata, Peperomia leptostachya* and *Doodia aspera*.

Vines and scramblers are quite common. Apart from the ubiquitous *Lantana*, they consist of wiry species including *Ripogonum album* and *Smilax australis* as well as woody grapes such as *Cissus antarctica, C. hypoglauca* and *Tetrastigma*.

The presence of *Backhousia sciadophora* ensures an excellent assemblage of epiphytes — 18 species in the two Flora Reserves. *Asplenium australasicum, Platycerium superbum, Pyrrosia rupestris* and *Dendrobium speciosum* are most common.

There are several outstanding trees at Hortons Creek:

Croton stigmatosus. Usually only a shrub but here up to a record 15 m tall.

Rhysotoechia bifoliolata. A record stem diameter of 60 cm was estimated with a height of 22 m.

Flindersia australis. A large tree had been felled and a short log removed. No other trees were seen at this site which is close to its southern limit.

WOOLGOOLGA-BELLINGER RIVER

The median annual rainfall in dry rainforest sites of this suballiance on the lower Mann and Nymboida Rivers is about 950–1 000 mm, but remaining sites south to the head of the Bellinger River are in higher rainfall areas of 1 400–1 800 mm annually.

At Madmans Creek Flora Reserve in Conglomerate State Forest north-west of Woolgoolga, rainfall is 1 400 mm. This is the most southern of these Araucarian dry rainforest sites. It is on a steep southern aspect, with soil derived from conglomerate. The typically emergent *Araucaria* has been partly logged. It consists of a midslope forest of this suballiance. Suballiance 27: *Choricarpia leptopetala* occupies the upper zone which is penetrated by fires at fairly long intervals, and are sufficient to wipe out any *Araucaria* regeneration. Seedlings are to be found beneath the *Choricarpia* as well as in the upslope dry sclerophyll forest of *Eucalyptus rummeryi, E. propinqua* and *E. maculata*.

On the lower slopes and in the gullies, the forest is dominated by *Argyrodendron trifoliolatum, Syzygium francisii* and *Ficus watkinsiana.* This *Araucaria* Suballiance contains *Drypetes, Elattostachys nervosa* and *Lophostemon confertus* as associated canopy species, *Pellaea falcata* and *Doodia aspera* as herbs, *Tetrastigma* and *Morinda jasminoides* as the main vines but with few epiphytes.

Two typical, dry rainforest species which reach their known southern limit here are *Alstonia constricta* and *Petalostigma triloculare.*

Further south, Suballiance No. 21 occurs at localized dry sites — on the dry, basaltic edge of seral to subtropical rainforest or on steep sites and landslips with skeletal soils within warm temperate rainforest.

Just below the crest of Mt Coramba, on the eastern side's steep, rocky feldspathic sandstone slopes where rainfall is at least 1 700 mm annually, the suballiance is surrounded by warm temperate rainforest. Indeed, the main canopy is dominated by *Schizomeria ovata, Pittosporum undulatum, Lophostemon confertus* and *Tristaniopsis laurina.* The smaller tree layer is a mixture of warm temperate species such as *Anopterus macleayanus, Synoum glandulosum* and *Rhodamnia rubescens* as well as typical dry rainforest species including *Austromyrtus bidwillii, Backhousia myrtifolia* and *Scolopia braunii.* The shrub and herb layers are also more mesophytic than is usual in this suballiance and vines are mainly *Arthropteris tenella* and *Ripogonum discolor.* Epiphytes are well represented by 14 species, many of them small, rock-loving species such as *Dendrobium kingianum, Liparis reflexa* and *Peperomia tetraphylla.*

Similar areas occur within the Nymboida River Gorge and east of The Crescent at New England National Park in the upper Bellinger Valley. The latter is a localized landslip area where the shallow soil is derived from an igneous complex of rocks (Photo 77).

DORRIGO

Within the Dorrigo area, small, residual basaltic cappings often consist of a treeless plain surrounded by subtropical rainforest of *Toona australis, Daphnandra micrantha* and *Argyrodendron actinophyllum* of Suballiance No. 8. There is usually an ecotone or transition zone dominated by *Araucaria* as well.

Teak Tree Flora Reserve in Wild Cattle Creek State Forest is a good example of a site where *Araucaria* overtops a closed canopy of subtropical rainforest trees such as *Toona australis, Dysoxylum fraserianum* and an infrequent *Argyrodendron actinophyllum* (Species List, Microfiche). Dry rainforest elements are *Flindersia australis* (as a single large tree at its southern limit), *Geijera salicifolia* var. *latifolia* and *Euroschinus falcata.* Seral species include *Eucalyptus saligna* and *Lophostemon confertus.* Warm temperate rainforest elements *Caldcluvia paniculosa* and *Schizomeria ovata* complete a very dynamic picture.

Due to the fertile soil, the lower layers are subtropical species including shrubs such as *Cordyline petiolaris* and *Psychotria loniceroides* and herbs such as *Adiantum formosum* and *Alpinia caerulea.* Epiphytes are common, particularly the larger, more conspicuous species such as *Asplenium australasicum, Platycerium bifurcatum* and *P. superbum.*

Suballiance No. 22: *Flindersia* spp.*-Araucaria*

The previous suballiance is found where rainfall is commonly above 1 000 mm annually, but the *Flindersia-Araucaria* suballiance extends into drier areas and drier aspects within the 800–1 200 mm rainfall zone. There are four major areas of this suballiance in New South Wales — at Ettrick (1 200 mm), Sawpit Creek and Mahoneys Spur

(1 175 mm), Mallanganee Flora Reserve, Steel Box Flora Reserve and Rose Creek (1 050 mm), and Flagstone and Captains Creeks (850 mm). Despite this range in rainfall values, rainfall for August, the driest and most critical month of the year, varies only from 39 mm to 32 mm respectively. All sites are at low altitudes of 150–600 m and on soils derived from fine-grained sediments with basaltic enrichment. In area, they range from 280 ha at Rose Creek in Richmond Range State Forest to 67 ha at Ettrick.

In Suballiance No. 21, *Araucaria* is the most common large tree, but in Suballiance No. 22 it occurs as scattered emergents. Caution must be exercised lest areas selectively logged for *Araucaria* many years ago are mistakenly classified as Suballiance No. 22.

Because of the dry nature of the suballiance and its proximity to Queensland, being in the heads of the Clarence and Richmond watersheds, the suballiance has floristic affinities to the microphyll vine forest or softwood scrubs of South-east Queensland. Typical species in common include *Flindersia australis, F. collina, Erythrina vespertilio, Siphonodon australe, Casearia multinervosa, Acronychia laevis, Planchonella cotinifolia* and *Canthium odoratum.* The main canopy consists of *Flindersia australis, F. collina, Dendrocnide photinophylla, Melia azedarach* var. *australasica* and *Drypetes australasica.*

The more common smaller trees are *Aphananthe philippinensis, Austromyrtus bidwillii, A. hillii* and *Casearia.* The rigid, often prickly shrub layer is dominated by *Nyssanthes diffusa, Capparis arborea* and *Alchornea ilicifolia.* Herbaceous ground cover is absent or sparse and consists mainly of *Pellaea falcata* var. *nana. Lantana* is a rampant scrambler in any openings or on the rainforest margin. Major vines are *Rauwenhoffia leichhardtii* and *Cissus antarctica.* Epiphytes are generally uncommon or insignificant in this dry environment, the most common being *Platycerium superbum* and *Pyrrosia confluens.*

UPPER CLARENCE

In the dry upper Clarence Valley near Legume on the Queensland border, there are examples of this suballiance at Flagstone and Captains Creeks (Species List, Microfiche). The former is freehold land, and the latter is a Flora Reserve on Beaury State Forest. Both were selectively logged for *Araucaria,* Captains Creek as recently as the 1950s.

Flagstone Creek has been a major roosting site for flying foxes over the last 20 to 30 years, from whence they would raid the orchards on the Queensland granite belt. Despite shooting parties from the north, these animals have virtually wiped out the canopy in the upper main gully. Tree species with brittle branches such as *Dendrocnide* spp. are particularly vulnerable, but species with tough branches such as *Siphonodon, Diospyros pentamera, Grevillea robusta* and *Brachychiton discolor* have shown better survival with reduced breakage. As a result of the destruction of their shade and shelter, it would appear that the flying foxes move into the adjoining intact rainforest. Where the available rainforest is relatively large, as in the 166 ha at Flagstone Creek, there is time for it to recover from damage which is akin to that of a localized cyclone with a similar sequel of impenetrable vine thickets. As previously noted, smaller areas can suffer irreversible damage and eventual destruction by weedy vines.

There is an ecotone at Flagstone Creek, where *Eucalyptus moluccana* forms an overstorey for a dense, tall shrub layer of *Citriobatus lancifolius, Croton insularis, Canthium odoratum* and *Psychotria daphnoides.* Just within and bordering on the rainforest is the main occurrence of *Araucaria.*

Plants of special interest include *Alectryon diversifolius,* a small shrub which is more common in the vine thickets west of the Great Dividing Range in Northern New

South Wales and in Queensland. *Phyllanthus subcrenulatus* is a small shrub 20–30 cm tall which is rare in New South Wales, being confined to the northern dry rainforests. *Hypserpa decumbens* is a vine common in similar rainforests in Queensland but uncommon in New South Wales.

Captains Creek Flora Reserve on Beaury State Forest is a similar dry area but with a northern aspect. The most common canopy trees are *Flindersia collina* and *Siphonodon australe.* It, too, has links with the inland vine thickets through the smooth-leaved form of *Alstonia constricta.* There is also an undescribed daisy bush, *Olearia* sp. nov. aff. *lirata,* which is known only from the rainforest edge here and also from three collections in South Queensland.

UPPER RICHMOND

In the western section of the Border Ranges National Park at Sawpit Creek and Mahoneys Spur off Findon Creek with dry northern or western aspects, there are good examples of this suballiance in the rain-shadow of the Tweed and McPherson Ranges (Species List, Microfiche). When still part of Roseberry State Forest, they were selectively logged in about the 1950s for *Araucaria, Flindersia australis, F. xanthoxyla, Grevillea robusta, Siphonodon* and *Planchonella pohlmaniana.* The latter species is near its known southern limit at this site. *Owenia cepiodora* occurs as scattered clumps of regrowth in Sawpit Creek in both this and the previous suballiance. The shrub, *Pavetta australiensis,* was first found in a logged section of Sawpit Creek in the 1950s. It was not recollected in New South Wales until 1985, when it was found at Terrace Creek, immediately to the south.

Thirty kilometres to the south on Peter Fin Wildlife refuge below Toonumbar Dam, there is a good example of this suballiance (Species List, Microfiche). It was probably logged for *Araucaria* from about 1904 until 1950. The aspect is mainly southerly except for a burnt area of 3 ha facing north. The size and condition of the smaller site is unfortunate since *Siphonodon, Harpullia hillii* and *Capparis sarmentosa* appear to be restricted to this northern aspect, and *Ailanthus triphysa, Owenia cepiodora, Toona* and *Planchonella myrsinoides* are more common on this aspect. The largest known *Owenia cepiodora* occurs near the ridge crest and was estimated at 25 m tall and 75 cm diameter.

On the southern aspect, there is well developed rainforest with trees up to 25 m tall of *Erythrina vespertilio, Flindersia australis* and *F. xanthoxyla. Austromyrtus hillii* was very common among the smaller trees, reaching a record height of 15 m and 22 cm diameter. The area is floristically diverse, with six species of *Ficus* and uncommon New South Wales trees such as *Cryptocarya bidwillii* and *Strychnos arborea.* Among the shrubs are six species of the family Euphorbiaceae. Vines are represented by 22 species. *Platycerium superbum* and *Pyrrosia confluens* are the most abundant of the seven species of epiphytes.

As at Flagstone Creek, a large resident flying fox colony causes some breakage of the canopy in the centre of the rainforest.

RICHMOND RANGE

Another major area of this suballiance occurs in Mallanganee Flora Reserve on the eastern slopes of the Richmond Range near Mallanganee, in Steel Box Flora Reserve slightly to the south on Mt Pikapene State Forest, and at Rose Creek west of Casino. The median annual rainfall is approximately 1 050 mm (Mt Pikapene receives only 33 mm in the driest month, August.)

The main canopy consists of *Flindersia xanthoxyla, F. australis, Melia azedarach* and *Siphonodon australe* with *Araucaria* emergents (Species List, Microfiche). Many species

of the families Celastraceae and Euphorbiaceae are present as small trees, particularly *Cassine, Maytenus bilocularis, Cleistanthus* and *Mallotus philippensis.* Vines are well represented by 34 species. These include species which are less common in New South Wales — *Tinospora smilacina, Capparis sarmentosa, Hippocratea barbata* and *Morinda acutifolia.* Although seven species of epiphytes are recorded, all are uncommon.

Suballiance No. 23: *Ficus-Streblus-Dendrocnide-Cassine*

This suballiance mainly occurs to the south of the Bellinger and Nambucca Valleys which are the southern limits of *Araucaria.* It occupies dry, rocky slopes, ravines, rocky off-shore islands and headlands on fertile but often shallow soils derived from or enriched by basic igneous rocks such as basalt, rhyodacite, latite and monzonite. It does not occupy a streamside niche as does the *Castanospermum-Waterhousea* alliance, and it is not dominated by trees in the family Myrtaceae as is the *Choricarpia-Backhousia* spp. alliance.

There are, however, two areas of this Suballiance No. 23 within the latitudinal limits of *Araucaria.* At Glenugie Peak, south-east of Grafton, there is an isolated dolerite outcrop without any *Araucaria* in the surrounding area or on the peak itself. At Coolgardie, south-west of Ballina on the south-east edge of the Alstonville basalt plateau or Big Scrub, there are steep rocky slopes where *Araucaria* is present but not common. Possible explanations for these anomalies are repeated fires from open forests at the base of the plateau or selective logging for *Araucaria* in the previous century.

The main canopy is relatively low at 15–20 m with emergent *Ficus* spp. and *Dendrocnide excelsa.* The most common larger tree species are *Ficus rubiginosa, F. superba* var. *henneana, Streblus brunonianus* and *Podocarpus elatus* with *Dendrocnide excelsa* and *Drypetes australasica.* Smaller trees include *Cassine australis, Mallotus philippensis* and *Claoxylon australe.* The shrub layer is sparse as also is the herb layer where only *Pellaea falcata* is consistently present. Vines are well developed particularly woody vines such as *Tetrastigma nitens, Cissus antarctica* and *Maclura cochinchinensis.* Wiry vines include *Malaisia scandens* and *Geitonoplesium cymosum.* The introduced scrambler, *Lantana camara,* usually dominates all gaps in the forest. Epiphytes are neither common nor conspicuous; only *Pyrrosia confluens* is consistently present.

COOLGARDIE ROAD, WARDELL

On the southern edge of Big Scrub basalt, steep stony slopes with shallow but fertile soil support a floristically diverse rainforest of this suballiance with 131 tree species recorded (Species List, Microfiche). Twenty-seven tree species are common to very common; accordingly, there is no clear species dominance. *Streblus* is very common, and *Ficus coronata* and *F. rubiginosa* are both common among the figs. Other very common tree species are *Mallotus philippensis, Cupaniopsis anacardioides* and *Commersonia bartramia.* The shrub layer consists mainly of secondary species which could indicate past disturbance. Herbs are primarily the hardy ferns. Only in this most northern example of the suballiance is the vine *Calamus muelleri* present. Other common woody vines include *Flagellaria indica, Maclura* and *Pandorea pandorana.* Wiry vines typical of this suballiance are common as well as the rampant *Lantana.* The main epiphyte is *Platycerium bifurcatum.*

This site is noteworthy for the large number of species at or near their known southern limit. These include *Macadamia tetraphylla, Acronychia laevis, Bouchardatia neurococca, Sterculia quadrifida, Flindersia xanthoxyla, Archidendron muellerianum, Geijera paniculata, Macaranga tanarius, Atalaya salicifolia, Planchonella chartacea, Microcitrus australasica, Cupaniopsis flagelliformis, Carissa ovata* and *Cayratia acris.* In 1984, *Medicosma cunninghamii* was recorded here for the first time since 1876 at any site south of the Brunswick River.

In one gully at Wardell are several trees of *Corynocarpus rupestris*. This distinctive tree with spiny, toothed juvenile leaves and large, globular, red, fleshy fruit (Photo 78) is one of only six species in the only genus of the family *Corynocarpaceae*. There is a single species confined to each of the following areas: New Zealand, New Caledonia, Vanuatu, New Guinea, North Queensland-New Guinea and South Queensland-New South Wales. The southern species was only named in 1984, although it had been known from the type locality at Glenugie Peak near Grafton since 1950. It was believed to be restricted to this isolated peak until 1981–82 when it was discovered at Mt French south-west of Brisbane, and on the Ban Ban Range, west of Maryborough, Queensland. The Queensland populations were described in 1984 as subsp. *arborescens* because of their greater height than the generally shrubby subsp. *rupestris* on Glenugie Peak. In 1983, several more plants were found near Lennox Head on a stony basalt slope. It was not until after its formal published description that the first fruits were ever seen, on the trees at Wardell. The Glenugie Peak population appears to suffer repeated attacks by a stem borer which causes resprouting from near the base of the plants and a bushy habit rather than a tree. More recently subsp. *arborescens* has been found at upper Coopers Creek, New South Wales, and at Natural Arch, South Queensland.

GLENUGIE PEAK

This dolerite volcanic neck south-east of Grafton rises to only 300 m above the plain. The eastern and northeastern sides were blasted and removed for ballast during construction of the North Coast railway. Although the surrounding plain consists of a yellow podsolic clay derived from siltstones and claystones, the soil on the dome is a fertile, brown earth, a derivative of dolerite. On the warm and protected north to east aspects, there is a dense but relatively low rainforest of Suballiance No. 23. At 1 138 mm annually, rainfall is adequate.

The most common tree species are *Ficus rubiginosa, F. superba* var. *henneana, Drypetes, Mallotus philippensis, Olea paniculata* and *Aphananthe philippinensis* (Species List, Microfiche). Other common species include *Ficus macrophylla, Streblus, Dendrocnide excelsa* and *Cassine*. The shrub layer is sparse, herbs are mainly *Pellaea falcata* and *Proiphys cunninghamii*. Woody vines are common, particularly *Caesalpinia subtropica, Austrosteenisia blackii* and *Tetrastigma nitens*. On the sunny rock pile, *Hoya australis* is very common. *Lantana* dominates all open areas. There are some epiphytes, most species growing on the large boulders which cover the ground. These include *Asplenium australasicum, Dendrobium gracilicaule, D. speciosum* and *Peperomia leptostachya*.

This isolated area of fertile soil contains several rare and endangered species in addition to the previously discussed *Corynocarpus rupestris*. *Cryptocarya bidwillii* occurs from the dry rainforests of North Queensland to South-east Queensland and in the upper Clarence and Richmond. It next appears at the Clarence Gorge, Glenugie Peak and at Tulipwood Flora Reserve on the Nymboida River to the south-west. At both Mt French in South-east Queensland and at Glenugie Peak, this species occurs in association with *Corynocarpus rupestris* and with one of two related but specifically distinct species of *Cryptocarya*. At Mt French the *Cryptocarya* has recently been described as *C. sclerophylla*.

Glenugie Peak is the type locality of *C. floydii*, which has a most interesting distribution. The species occupies niches somewhat drier than those usually inhabited by *C. bidwillii*, except at Glenugie Peak where they cohabit. *C. floydii* is only known to produce fertile seed at Glenugie Peak, although it extends south into the gorges of the Guy Fawkes and Macleay Rivers and north into Queensland at Mt Dumaresq, north-east of Warwick, and at Mt Kiangarow in the Bunya Mountains. It would be reasonable to expect to find the species in the Upper Clarence also.

Glenugie Peak contains one of only two New South Wales populations of the bulbous *Proiphys cunninghamii,* which is otherwise endemic to southern Queensland. Its other southern location is at Carnham, well up the Clarence River.

The vine, *Secamone elliptica,* occurs with *C. floydii* at both Glenugie Peak and Guy Fawkes National Park, which is its southern limit. It also extends into Queensland.

All these distributional records strongly suggest a current series of refuges extending from the Macleay and Guy Fawkes gorges, Glenugie Peak, the Upper Clarence and the Great Dividing Range in Queensland north to the Bunya Mountains. These would appear to be of considerable age in view of the speciation which has occurred around *Cryptocarya bidwillii.*

MANNING VALLEY

There are two quite different examples of the suballiance in the Manning Valley. There is a very small area of this suballiance at Boorganna Nature Reserve, on the steep, dry slopes above Upper Rawson Falls with a northern aspect and only skeletal soil. The most common tree species are *Streblus* and *Dendrocnide excelsa. Ficus rubiginosa* and *Backhousia myrtifolia* are not uncommon.

Near the tidal limit of Lansdowne River on the Lansdowne Recreational Reserve, there is a badly disturbed example on sandy alluvium. The site supports only 32 species of native rainforest trees, of which the most common are *Aphananthe, Mischocarpus pyriformis, Elaeocarpus obovatus* and *Planchonella australis.* It therefore has some affinities with the littoral *Drypetes-Sarcomelicope-Cassine-Podocarpus* Suballiance, but none of its key species are abundant. By contrast, this *Ficus-Streblus-Dendrocnide-Cassine* Suballiance is represented by *Streblus* being common, *Ficus coronata* being occasional and by a rare specimen of *F. macrophylla.* Secondary species such as *Glochidion ferdinandi* and *Commersonia fraseri* are common. The main shrubs are *Citriobatus pauciflorus, Breynia oblongifolia* and *Croton verreauxii.* The herbaceous stratum consists mainly of *Oplismenus aemulus, Doodia aspera* and the exotic *Tradescantia albiflora.* Major vines are *Flagellaria, Parsonsia straminea* and *Pandorea pandorana. Lantana* dominates any open areas. Epiphytes are very scarce, with only a few specimens of *Pyrrosia confluens.* This degraded area is in urgent need of rehabilitation.

WALLIS LAKE-PORT STEPHENS

A most interesting series of sites support this suballiance in the Wallis Lake-Myall Lakes-Port Stephens area. Where tolerance of high salt levels due to salt spray is not a necessary prerequisite, Suballiance No. 23 takes over from littoral rainforest of the *Drypetes-Sarcomelicope-Cassine-Podocarpus* Suballiance.

Exposed headlands such as Cape Hawke and Seal Rocks, and also possibly low offshore islands such as Broughton Island before European disturbance, are typical examples of littoral rainforest. However, Cabbage Tree Island (or John Gould Island Nature Reserve), more than 1 km off the coast is of the *Ficus-Streblus-Dendrocnide-Cassine* Suballiance. The island presents almost sheer cliffs to the east and is orientated north–south in the shelter of Boondelbah Island only 1.5 km to the south. The rainforest on the west to north-west side of the island is well protected from the destructive south-east storm seas. Shallow but fertile soil derived from the toscanite volcanics gives this site the distinction of being the only off-shore rainforest along the New South Wales coast. Rainforest occupies 14 ha of the island and contains 38 species of trees with a low canopy up to 15 m. The most common species are *Ficus fraseri, F. rubiginosa, Streblus, Guioa* and *Claoxylon* (Species List, Microfiche). In the two most sheltered gullies, the canopy is formed by *Livistona, Pisonia umbellifera* and *Claoxylon.* This site is the only known breeding colony of the Gould Petrel *(Pterodroma leucoptera)* which nests

between and under the toscanite boulders covered by dead *Livistona* fronds which may provide some protection from avian predators. There are less than 1 000 breeding pairs present.

Pisonia umbellifera, or bird lime tree, produces sticky, cylindrical fruits up to 4 cm long which are dispersed by entanglement in the feathers of birds. It is found along the Australian East Coast north from the Illawarra and out into the Pacific to Lord Howe and Norfolk Islands and New Zealand. To the west, it is found on Christmas Island and in Africa. Its Pacific distribution falls within that of the known range of the Gould Petrel. Its sticky fruit ripen between February and May, coinciding with the end of the bird's breeding season. (The chicks fledge in April.) The fruiting cycle coincides with the start of migratory flights from the breeding ground. Although some ornithologists believe that these fruits may be the cause of death of some birds in late summer (*Reader's Digest* 1977), the theory would be difficult to prove. There is no doubt, however, that the seeds would be a burden to weak birds and would contribute to their deaths. Birds which die during migration may eventually be washed up on beaches where a few of the seeds might be able to grow.

Concern has been expressed about the possible link between the lack of regeneration in this rainforest and the rabbits introduced to the island as a single pair in 1906 for research purposes. Mr A. D'Ombrain, a keen ornithologist, reported in 1971 that the rainforest canopy had become thinner during the previous 44 years. There was a scarcity of regeneration in 1978, and much of that present appeared to have been browsed. Clough and Werren (pers. comm.) produced evidence in support of a link between browsing and the failure of the *Livistona* palms to regenerate. The rabbits are now being eliminated.

The most common sub-canopy trees are *Pittosporum undulatum, Cassine australis, Notelaea longifolia, Diospyros pentamera* and *Cupaniopsis anacardioides* near the margin. Shrubs and herbs are virtually absent, in contrast to the equivalent suballiance on the protected northern side of Yacaaba Head on the mainland nearby. The tree strata are comparable, but there are only 15 species of herbs on John Gould Island Nature Reserve and 32 species at Yacaaba Head, where rabbits have not been a problem. Vines are well represented at both sites, the most common being *Malaisia scandens, Cayratia clematidea, Cissus antarctica* and *Jasminum volubile.*

On the mainland north of the island site is Mungo Brush, on the eastern shores of The Broadwater of the Myall Lake system. It is estimated that Mungo Brush was also an island as recently as 17 000 to 30 000 years ago. *Pisonia umbellifera* is found on John Gould Island, Cape Hawke and at Mungo Brush. As noted in discussion of the *Drypetes-Sarcomelicope-Cassine-Podocarpus* Suballiance of the littoral rainforest, Mungo Brush is intermediate between that suballiance and *Ficus-Streblus-Dendrocnide-Cassine.* It is probable that the latter suballiance assumes importance as the maritime influence wanes.

Within the Wallis Lake and Port Stephens estuarine areas, Yahou and Snapper Islands are floristically similar. Both are low islands with fertile soils derived from tuffaceous sandstone containing 30% to 45% basalt fragments or from toscanite respectively. They are subject to saline tidal fluctuations and support a mangrove fringe where tidally inundated. Yahou Island is only 4 km from the coast, and Snapper Island is 19 km. The dominant trees on both islands are *Ficus fraseri, F. rubiginosa, Streblus, Dendrocnide* spp., *Livistona, Drypetes, Olea* and *Planchonella australis.* The most common small trees are *Cassine* and *Capparis arborea.* The main vines are *Malaisia scandens, Cissus antarctica* and of course the ubiquitous *Lantana.*

Yahou Island shares several southern records with its littoral counterpart at Cape Hawke, namely the species *Austromyrtus bidwillii* and *Planchonella myrsinoides* which

have already been dealt with under the *Drypetes-Sarcomelicope-Cassine-Podocapus* Suballiance. In addition, Yahou Island is the known southern limit of *Monococcus echinophorus,* a shrub which has a readily disseminated burr fruit. This monospecific genus occurs to the north at Yessabah Caves, Yarrahapinni and Cherry Tree State Forest in New South Wales and in South-east Queensland and New Caledonia. A scarcity of shrubs, herbs and epiphytes on Snapper Island may be associated with previous fires evidenced by the charred palm trunks and dense *Lantana,* particularly on the western portion of the island. Otherwise, the 13 ha of rainforest shows excellent regeneration.

A further example of the suballiance occurs on Johnsons Island within Myall Lake. It is 7 km from the sea and surrounded by near-fresh water. As at Yahou Island, the soil is derived from tuffaceous sandstone, but there are rock fragments and ash of the nutritionally poorer rhyolite and rhyo-dacite.

Most prominent among the 27 species of trees are *Ficus rubiginosa, F. superba* var. *henneana, Dendrocnide excelsa, Pittosporum undulatum, Mallotus philippensis, Cassine* and *Elattostachys nervosa.* Shrubs, herbs and epiphytes are uncommon. Vines are well represented by *Cissus antarctica, Parsonsia straminea* and *Lantana camara* as well as *Smilax australis* and *Malaisia scandens.* The low-lying fringes of the island support *Casuarina glauca* and *Melaleuca quinquenervia,* but there are no mangroves.

The preceding examples illustrate that at dry sites on fertile soil protected from fire, such as islands off-shore, in tidal estuaries or in freshwater lakes, it is possible to find dry rainforest provided there is protection from wind-borne salt.

LOWER HUNTER

On the northern side of the Hunter Valley from Muswellbrook to Paterson, there are refugial rainforest pockets in gullies with moist south and east aspects. Soils are derived from conglomerate and sandstone with possible rhyodacite lavas. These numerous remnants were grouped by Vernon (1985), into three zones according to rainfall.

In the east near Paterson are Cabbage Brush Creek and Moonabung Creek Falls, sites of 25 ha and 16 ha respectively. They receive approximately 1 000 mm of rain annually. They are about 37 km from the sea. The lowest rainfall period in the valley is July to September, and this pattern produces a critical moisture stress in early spring. For example, the lowest monthly rainfalls at Paterson are August, 53 mm and September, 62 mm. Further west and north of Branxton at about 53 km from the coast are Sandy Waterholes Creek and Cranky Corner, Mt Durham of 48 ha and 30 ha respectively. The mean annual rainfall here is only 850 mm, and rainfall for the critical months is July, 30 mm, August, 40 mm and September, 40 mm. These would appear to be minimum rainfall requirements for rainforest; but still further west again at 95 km from the coast and east of Muswellbrook, there are two smaller remnants of 9 ha and 6 ha at Foy Brook and Cedar Creek where annual rainfall is only 790 and 720 mm respectively. However, rain in this locality is distributed more effectively, with lower monthly maxima in the summer wet season and slightly higher rainfall in the critical July to September period. In the gullies and on lower slopes where soil depth and moisture are greatest, there is subtropical rainforest of the *Ficus* spp.-*Dysoxylum fraserianum/Toona-Dendrocnide* Suballiance.

The most common tree species throughout these three zones are *Ficus rubiginosa, F. superba* var. *henneana, Streblus, Dendrocnide* spp., *Drypetes, Mallotus philippensis* and *Olea.* Shrubs and herbs are sparse, but vines are conspicuous, particularly *Cissus antarctica* and *Tetrastigma nitens.*

The best development of the suballiance occurs at Cabbage Brush Creek, where there is a well-developed, intact canopy with many large emergent *Ficus macrophylla* and *Elaeocarpus kirtonii* (Photo 79). An unusual feature is the abundance of *Podocarpus elatus* present in all sizes up to large, tall, straight trees. There are also several very large and tall *Geijera salicifolia* var. *latifolia, Citronella moorei* and *Dysoxylum fraserianum* (Combined Species List on Microfiche for Cabbage Brush and Moonabung Creeks). Cabbage Brush Creek is named after the occasional cabbage tree palms *(Livistona australis)* which are apparently restricted to this single gully in all the areas inspected. This site is a rather dry gully head with few herbs, vines and epiphytes. The extreme headwaters consist of an open eucalypt forest invaded by *Backhousia myrtifolia* which is regenerating by coppice shoots following repeated burning and grazing.

To the west at Cranky Corner and Sandy Waterholes, where the rainfall is lower, the canopy is of reduced height and consists mainly of *Dysoxylum, Drypetes, Elaeocarpus obovatus* and *Olea.* There are also large specimens of *Geijera salicifolia* which appear to be intermediate between var. *latifolia* and var. *salicifolia* of the dry Liverpool Range.

The foregoing locations sustain subtropical rainforest of the *Ficus-Dysoxylum fraserianum/Toona-Dendrocnide* Suballiance in the moister gullies. Immediately downstream from Moonabung Creek Falls, the rainforest occurs on very steep slopes with only a narrow gully. Accordingly, it is all dry rainforest. Only 39 tree species are recorded in comparison with 45 at Cranky Corner and 50 at Cabbage Brush Creek. The rainforest below Moonabung Creek Falls contains many species typical of such a dry site, including *Brachychiton discolor* (at its known southern limit), *Scolopia braunii, Backhousia myrtifolia, Austromyrtus acmenoides, Croton insularis* and *Morinda acutifolia* (southern limit). Also at their known southern limit are *Cleistanthus cunninghamii, Drypetes australasica* and *Elattostachys nervosa.*

The most western remnants, at Foy Brook and Cedar Creek, include a reduced number of species. The remnants are so much smaller in size, however, that comparison with the more eastern areas would be invalid.

ILLAWARRA

The Illawarra Plain between the escarpment and the sea, on the rich red loams derived from the volcanic rock latite, originally carried extensive subtropical rainforest of the *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona* Suballiance. Virtually all of the prime agricultural land has long been cleared, but there are still a few steep stony hillsides and gorges remaining. They support dry rainforest of this *Ficus-Streblus-Dendrocnide-Cassine* Suballiance and have sheltered north to east aspects.

Whispering Gallery is a gorge near Jamberoo which is used by local landholders as a rubbish dump. Any openings in the canopy are choked with *Lantana* or, if along the creek, by *Ageratina riparia.* Being freehold land, this unique remnant with its great diversity of 51 species of trees is in steady decline. The low canopy consists mainly of *Ficus macrophylla, F. rubiginosa, Streblus, Dendrocnide excelsa, Baloghia inophylla, Melia* and *Alphitonia excelsa* (Species List, Microfiche). Smaller, subdominant trees include *Cassine, Alectryon subcinereus, Hibiscus heterophyllus* and *Diospyros australis.* The shrub layer is mainly composed of *Eupomatia laurina, Notelaea venosa* and the introduced *Olea africana.* The ground cover is mainly of ferns such as *Lastreopsis decomposita, Asplenium flabellifolium* and *Pellaea falcata,* but *Plectranthus parviflorus* is also present. The most common vines are *Malaisia scandens* and *Lantana,* with wiry vines such as the exotic *Senecio mikanioides* and the native *Smilax australis.* The climbing fern, *Arthropteris tenella,* is common on the bases of trees. Although there are 11 species of epiphytes, none are common.

West of Jamberoo on the dry, stony ridges and gully heads facing north, there is an impoverished example of the suballiance. The most common trees are *Cinnamomum oliveri* and *Brachychiton acerifolius. Podocarpus* and *Dendrocnide excelsa* are also common, and *Ficus rubiginosa* and *F. coronata* are occasionally recorded. *Hibiscus heterophyllus* is still a very common small tree, as is *Melaleuca armillaris* on shallower soils. Shrubs and herbs are very sparse, although *Plectranthus parviflorus* is common. Shade vines are restricted to *Arthropteris tenella* with *Lantana* in the openings. No epiphytes have been recorded.

A somewhat better-developed example of the suballiance is found on the basaltic north-east scree slopes of Saddleback Mountain. The canopy consists of *Ficus macrophylla, F. obliqua, Dendrocnide excelsa, Elaeocarpus kirtonii, Podocarpus* and *Pennantia cunninghamii.* Smaller trees are represented by *Pittosporum undulatum* and *Claoxylon australe.* Shrubs are again sparse, and herbs are confined mainly to *Doodia aspera* and the exotic *Ageratina riparia.* As at Whispering Gallery, the most common vine is *Malaisia scandens,* with *Lantana* as a rampant scrambler. *Marsdenia rostrata* is also common. Of the four species of epiphytes recorded, only *Pyrrosia rupestris* is very common.

YATTEYATTAH

The steep-sided gully of Currowar Creek at Yatteyattah near Milton is on the northern edge of a large monzonite outcrop. The gully bottom corresponds to the original vegetation of the Illawarra plain around Jamberoo, referable to the *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona* Suballiance. However, the 19 ha of dry rocky slopes are dry rainforest of Suballiance No. 23. The mean annual rainfall of 1 275 mm is well distributed, with the driest months being August, 70 mm and September, 75 mm.

Floristically and topographically, the site has much in common with Whispering Gallery. As a Recreation Reserve, the Yatteyattah site is less at risk than the freehold at Whispering Gallery. Its reserve status was of no help in 1964. A swathe was cut through the rainforest for a high voltage transmission line, even though the forest is surrounded by cleared country (Photo 80). The resulting regeneration was later sprayed and also brushed. Emergent trees are mainly *Ficus obliqua* and *Dendrocnide excelsa. Ficus superba* var. *henneana* and *F. rubiginosa* are uncommon. The main canopy trees include *Streblus, Baloghia* and *Diospyros pentamera.* In the subcanopy, *Cassine* and *Diospyros australis* are the most common species. *Citriobatus pauciflorus* is the only common shrub, and herbs are sparse. Vines comprise mainly *Malaisia, Smilax australis* and *Cissus hypoglauca.* There are five species of epiphytes recorded, with *Asplenium australasicum, Platycerium bifurcatum* and *Sarcochilus olivaceus* being common.

This monzonite belt is the southern limit for the suballiance and also for many of its characteristic species — *Ficus superba* var. *henneana, Streblus brunonianus, Litsea reticulata, Elaeocarpus kirtonii, Pollia crispata, Maclura cochinchinensis* and *Legnephora moorei.* The attendant fauna — several species of pigeons or fruit doves and the flying foxes which congregate annually — are also at their southern limit.

Castanospermum-Waterhousea floribunda Alliance

This group of communities forms a narrow fringe along the banks of streams and is variously known as gallery or riparian rainforest. Two factors which may determine their distribution are groundwater and floodwater.

Groundwater supplements inadequate rainfall during the critical months. This is typical of the upper and middle Richmond Valley, where mean annual rainfall is only

950–1 100 mm with only 32 mm in the driest month. The valley supports *Castanospermum-Grevillea robusta* and *Streblus-Austromyrtus* suballiances. Further south in the Dungog area, *Waterhousea floribunda-Tristaniopsis laurina* Suballiance occurs in similar conditions (Fig. 12).

Strong-flowing floodwaters necessitate species with willowy non-breakable branches. Typical examples are on the middle Richmond flood plains (*Streblus-Austromyrtus* Suballiance) and in the Bellinger Valley (*Waterhousea floribunda-Tristaniopsis laurina* Suballiance). Where the banks are high, there may be critically low soil moisture levels in spring due to excessive drainage and exposure of the stream margin to the sun. Many associated species are therefore typical of dry rainforest.

Three suballiances are included within this alliance:

24. *Castanospermum-Grevillea robusta*
25. *Streblus-Austromyrtus*
26. *Waterhousea floribunda-Tristaniopsis laurina*

Suballiance No. 24: Castanospermum-Grevillea robusta

This suballiance forms the widespread gallery rainforest of the upper and middle Richmond and Clarence valleys, on basaltic alluvium where annual rainfall is only 950–1 100 mm. In the critical, driest month of August, rainfall may be as low as 32 mm. Rainforest can only grow under such dry conditions if there is adequate subsoil moisture, as supplied on alluvial banks. The forest is a drier phase of the subtropical rainforest *Castanospermum-Dysoxylum muelleri* suballiance.

The most common canopy trees apart from *Castanospermum* and *Grevillea robusta* are *Ficus coronata, Aphananthe, Streblus* and *Syzygium australe.* Subcanopy trees include *Baloghia* and *Mallotus philippensis.* Shrubs and herbs are sparse. Vines are vigorous and conspicuous, but unfortunately are mainly introductions such as *Cardiospermum grandiflorum* and *Lantana.* Epiphytes are scarce.

UPPER RICHMOND

Moore Park Nature Reserve (formerly a Council Recreation Reserve) of 9 ha is at the junction of Findon Creek and the Richmond River. Mean annual rainfall is estimated at 950 mm with mean monthly rainfalls for the two driest months being 32 mm in August and 34 mm in September. Hence there is a marked dry spring which excludes rainforest from all sites except these alluvial flood plains. There are some subtropical rainforest elements present, showing affinities with the lowland subtropical rainforest of the flood plains around Lismore (*Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance). The fact that they are not common indicates that Moore Park is a drier relative of this suballiance.

The canopy at Moore Park consists of the two indicator species as well as *Podocarpus* and smaller subcanopy trees such as *Aphananthe, Streblus* and *Baloghia* (Photo 81 and Species List, Microfiche). Between 1972 and 1977 the Shire Council cleared undergrowth to enhance the appearance of the rainforest. The shrub layer is accordingly rather young. Herbs are mainly *Lastreopsis munita* and *Pseuderanthemum variabile.* The clearing has assisted entry by the exotic vine, *Cardiospermum grandiflorum,* which is a recognized pest in many flood plain rainforests. *Cissus antarctica* is also common. Epiphytes are represented by five species of which only *Platycerium superbum* is not uncommon. Although this is the best example of the suballiance in New South Wales, its past management as a recreation area has downgraded its scientific importance.

Nearby but approaching the McPherson Range on Sawpit Creek where rainfall is probably higher and the valley is much narrower, this suballiance can be observed

grading into the *Argyrodendron actinophyllum-Dysoxylum muelleri-Syzygium francisii* Suballiance. There are emergent *Eucalyptus grandis* with a main canopy of *Syzygium francisii, Castanospermum, Grevillea robusta, Argyrodendron actinophyllum, A. trifoliolatum, Dysoxylum fraserianum, Dendrocnide excelsa, Daphnandra micrantha* and *Syzygium australe* (Species List, Microfiche). In the subdominant tree layer are *Guilfoylia monostylis, Baloghia inophylla, Arytera divaricata* and *Elattostachys nervosa.* Immediately up-slope is an extensive area of the *Flindersia* spp.-*Araucaria* Suballiance as described previously.

A typical example of Suballiance No. 24 occurs along lower Lynchs Creek near Wiangaree, where there is a narrow fringing strip of the two key species with no subtropical rainforest elements. Rainfall here would be as low as at Moore Park.

Further upstream on the Richmond River at Dairy Flat, the increasingly critical spring soil moisture stress precludes *Castanospermum* in the canopy, because it is not adapted for reducing evapotranspiration water losses at this time by shedding its leaves, as is the strategy adopted by *Grevillea robusta.*

CASINO-MT PIKAPENE

About 9 km south of Casino, on Deep Creek at Yorklea, the suballiance occurs on deep alluvium derived from sandstone and basalt. Rainfall is 1 100 mm annually with mean monthly rainfalls of 44 mm and 47 mm in August and September respectively. The lush, dense dark green crowns of the *Castanospermum* contrast sharply with the grey-green open canopies of the surrounding *Eucalyptus tereticornis* woodland. Floristically, this is a simple rainforest where *Castanospermum* predominates. The only other common tree species are *Cryptocarya triplinervis* and the rheophytic form of *Acmena smithii* overhanging the water (Species List, Microfiche). In this particular area, *Grevillea robusta* is not common. The ground cover — a dense layer of introduced *Tradescantia albiflora* — is buried by alluvium with each flood. Vines and scramblers are very common but are once again mainly exotics such as *Cardiospermum* and *Lantana.*

Along Busbys Creek east of Mt Pikapene at the base of the Richmond Range, there are further streamside gallery forests on alluvium of basaltic and sandstone origin. Although the mean annual rainfall of 1 050 mm is greater than at Moore Park, the critical minimum monthly rainfalls are remarkably similar and represent a pronounced drought period. Commonly, there are scattered emergents of *Angophora subvelutina, Eucalyptus grandis, E. tereticornis* and *Lophostemon confertus.* The main canopy is dominated by *Grevillea robusta* and *Castanospermum. Araucaria, Aphananthe, Toona* and *Melia* are also common. There is a small tree layer composed of typical dry rainforest members of the families Euphorbiaceae, Sapindaceae and Celastraceae. The shrub layer is mainly composed of *Alchornea ilicifolia, Alyxia ruscifolia* and *Psychotria loniceroides.* The ground cover is of *Alocasia macrorrhizos* and *Dianella caerulea.* Vines are common, mainly *Ripogonum discolor, Smilax australis, Cissus hypoglauca, Embelia* and *Pandorea pandorana.* There are equivalent areas in the Clarence Valley, along Little Creek west of Mallanganee and Bean Creek north of Bonalbo.

Suballiance No. 25: *Streblus-Austromyrtus*

Along stream banks subjected to flooding and damage to vegetation by debris, there is a fringe of a distinctive rainforest community characterized by pliable trunks and branches. These can withstand the impact of flood debris without breaking. This suballiance occurs on fertile basaltic alluvium in areas of high rainfall, 1 250 to 1 350 mm annually, such as those near Lismore. The minimum monthly rainfall, which is in August to September, is about 60 mm. However, there could be localized soil moisture stress when stream banks are high and the river is low, particularly if the sun can penetrate from the stream side. Suballiance No. 25 is generally backed by subtropical rainforest of the *Argyrodendron trifoliolatum* Alliance, but species are

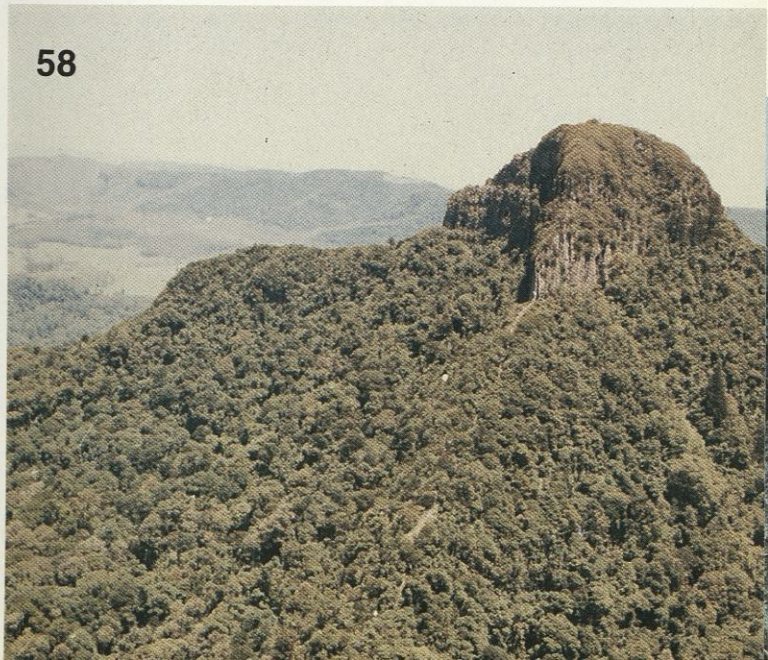
Photo 54. Well developed Subtropical Rainforest. Fluted trunk on left — *Planchonella australis*. Plank buttresses — *Argyrodendron trifoliolatum*. Liane — *Parsonsia fulva*. Suballiance No. 1. Johnstons Scrub, Eureka. *Photo: A. Floyd.*

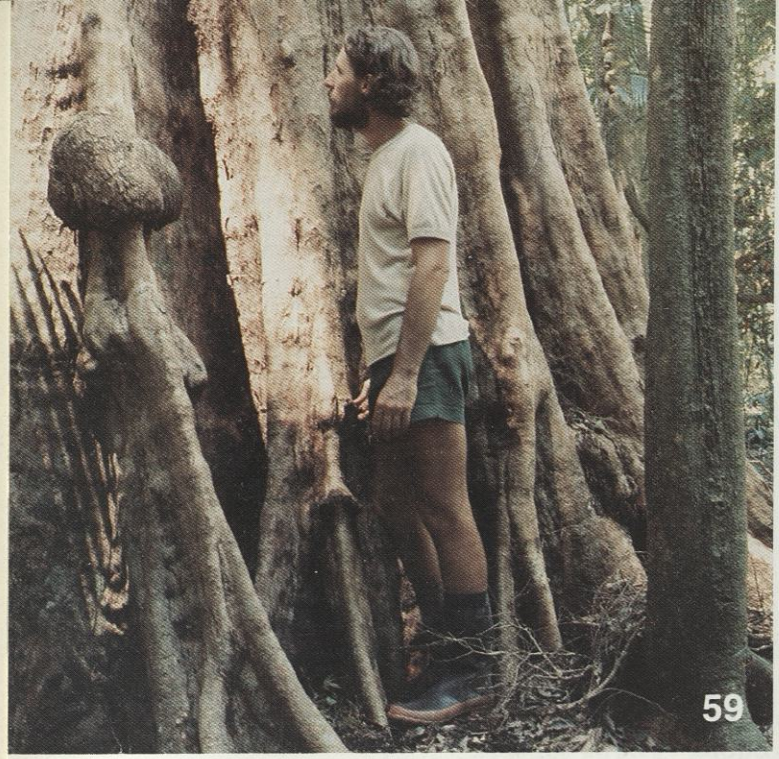
Photo 55. Irregular canopy of emergent *Ficus macrophylla* and *F. obliqua*. Suballiance No. 3. Boatharbour Nature Reserve. *Photo: A. Floyd.*

Photo 56. Austromyrtus fragrantissima. A rare and endangered species from Richmond River to Currumbin Creek. Suballiance No. 3. Boatharbour Nature Reserve. *Photo: A. Floyd.*

Photo 57. Archontophoenix cunninghamiana palm forest. Suballiance No. 6. Mt Warning National Park. *Photo: G. G. Biddle.*

Photo 58. Argyrodendron actinophyllum in subtropical rainforest on basalt beneath trachyte cliffs. Suballiance No. 7. Wilsons Peak Flora Reserve. *Photo: A. Floyd.*





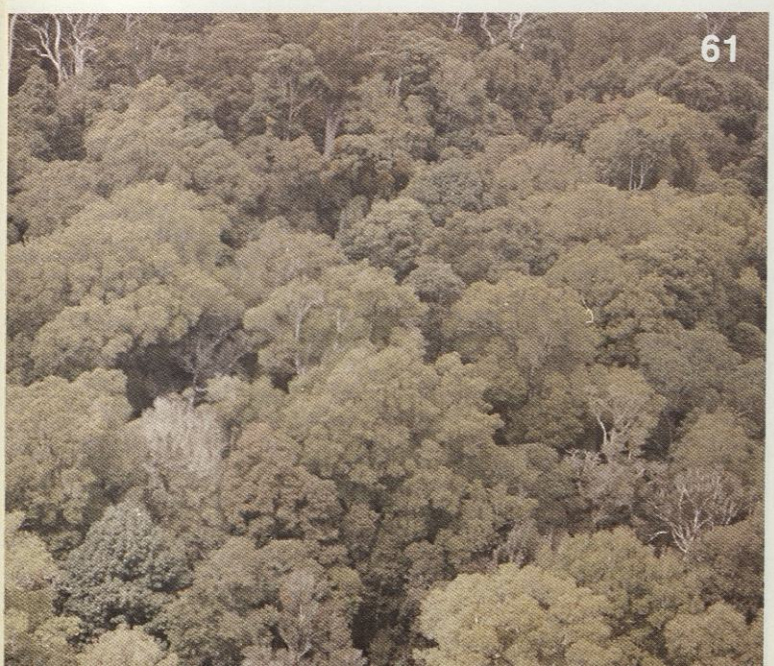


Photo 59. Syzygium francisii with *Archontophoenix* understorey. Suballiance No. 9. Pretty Gully Reserve. *Photo: A. Floyd.*

Photo 60. Acradenia euodiiformis in flower with tall *Caldcluvia paniculosa* beyond. Suballiance No. 11. Tweed Range, Border Ranges National Park. *Photo: A. Floyd.*

Photo 61. Large, light green crowns of *Sloanea woollsii.* Munningyundo Mountain, Nymboida National Park. *Photo: A. Floyd.*

Photo 62. Protected gorge with Suballiance No. 15 in otherwise Dry Rainforest as in upper right. Pilchers Mountain, Dungog. *Photo: A. Floyd.*

Photo 63. Littoral Rainforest with strangler fig, woody vines and sparse ground cover. Suballiance No. 16. Iluka Nature Reserve. *Photo: G. G. Biddle.*

Photo 64. Dieback in rainforest due to unrestricted camping and fires. Suballiance No. 16. Broken Head Nature Reserve. *Photo: A. Floyd.*

Photo 65. Encroachment into rainforest by exotic bitou bush *(Chrysanthemoides monilifera)* planted along dunes. Suballiance No. 16. Iluka Nature Reserve. *Photo: M. J. Dodkin.*

Photo 66. Cupaniopsis anacardioides thicket on windswept Island. Suballiance No. 17. Cook Island Nature Reserve. *Photo: A. Floyd.*

Photo 68. Ridges dominated by *Lophostemon confertus* running down to the sea. Suballiance No. 18. Broken Head Nature Reserve. *Photo: A. Floyd.*

Photo 67. Rutile mining of littoral rainforest. Suballiance No. 17. Mitchell Island, Manning River. *Photo: M. J. Dodkin.*

Photo 69. Littoral rainforest behind dunes on a sheltered beach. Suballiance No. 19. Gap Beach, Arakoon State Recreation Area. *Photo: A. Floyd.*

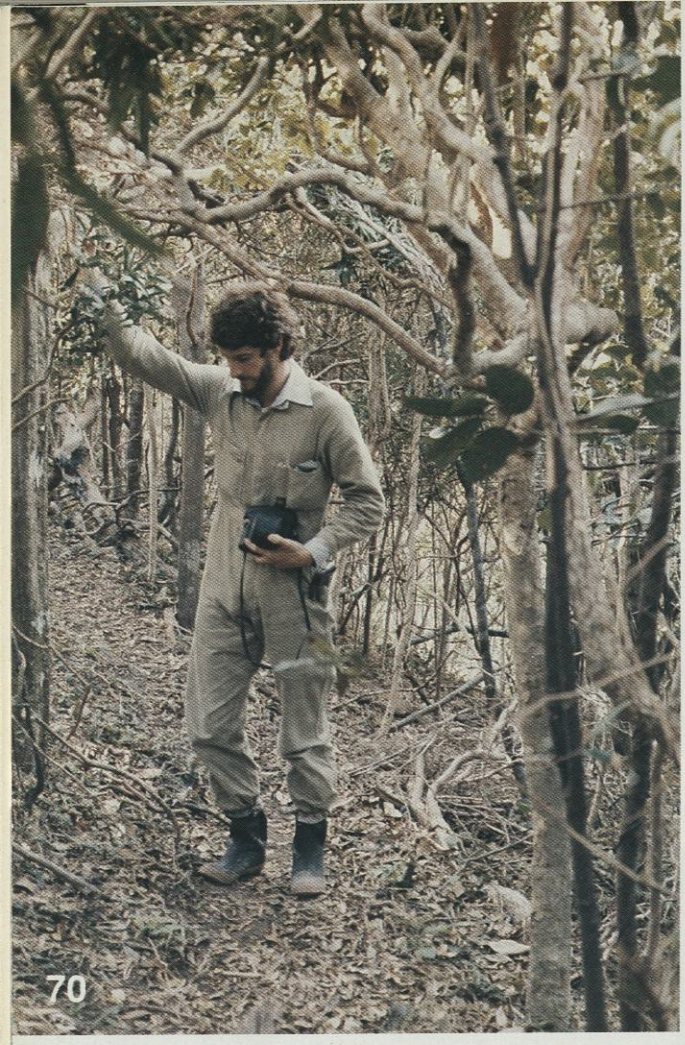


Photo 70. Stunted rainforest on seaward midslope. Suballiance No. 19. Cape Hawke, Booti Booti State Recreation Area. *Photo: M. J. Dodkin.*

Photo 71. Littoral Rainforest on one-time hilly island in foreground. Suballiance No. 19. Mungo Brush, Myall Lakes National Park. *Photo: M. J. Dodkin.*

Photo 72. Ficus rubiginosa on steep bouldery slope overlooking the sea. Suballiance No. 20. Bunga Head, Mimosa Rocks National Park. *Photo: A. Floyd.*

Photo 73. Platycerium bifurcatum among rocks at known southern limit, with *Ficus rubiginosa* below, nearer the sea. Suballiance No. 20. Bunga Head, Mimosa Rocks National Park. *Photo: A. Floyd.*

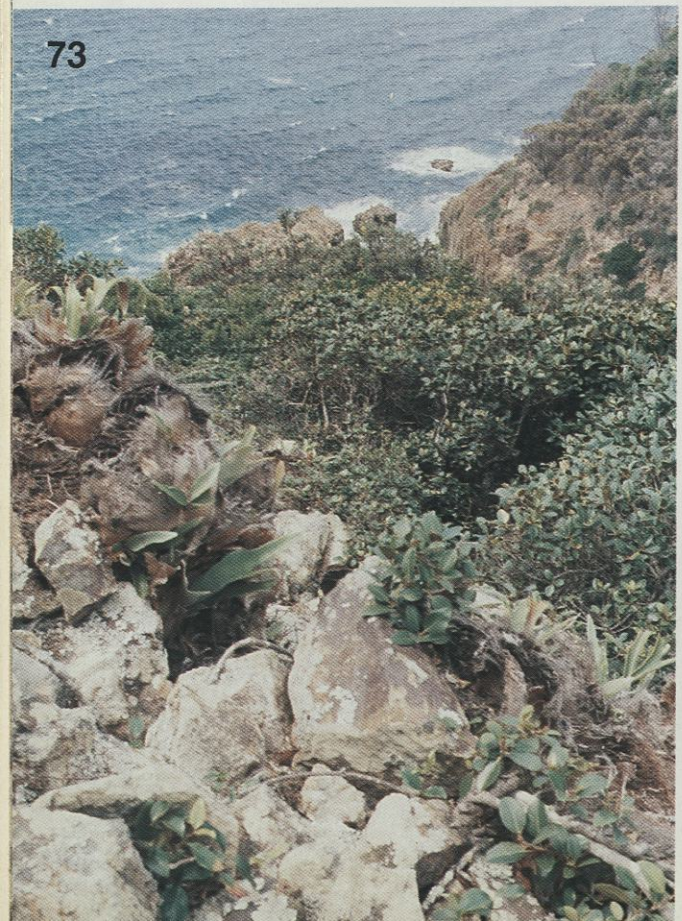


Photo 74. Complete canopy of *Araucaria*, possibly resulting from fire. Suballiance No. 21. Levers Plateau, Border Ranges National Park. *Photo: A. Floyd.*

Photo 75. *Araucaria* emergents. Suballiance No. 21. Wilson Park, Lismore. *Photo: A. Floyd.*

Photo 76. Dry Rainforest, Suballiance No. 21 with emergent *Araucaria* in a gully protected from fire. Rivertree. *Photo: A. Floyd.*

Photo 77. *Araucaria* on dry, shallow soil beside a landslip on otherwise Warm Temperate Rainforest. The Crescent, New England National Park. *Photo: A. Floyd.*

Photo 78. Fruit of *Corynocarpus rupestris*. A rare and endangered species. Suballiance No. 23. Wardell. *Photo: A. Floyd.*

Photo 79. Emergent crowns of *Ficus macrophylla* and *Elaeocarpus kirtonii*. Suballiance No. 23. Cabbage Brush Creek. *Photo: A. Floyd.*

Photo 80. Clearing for power line through remnant rainforest in Recreation Reserve. Note original vegetation on left. Suballiance No. 23. Yatteyattah. *Photo: A. Floyd.*

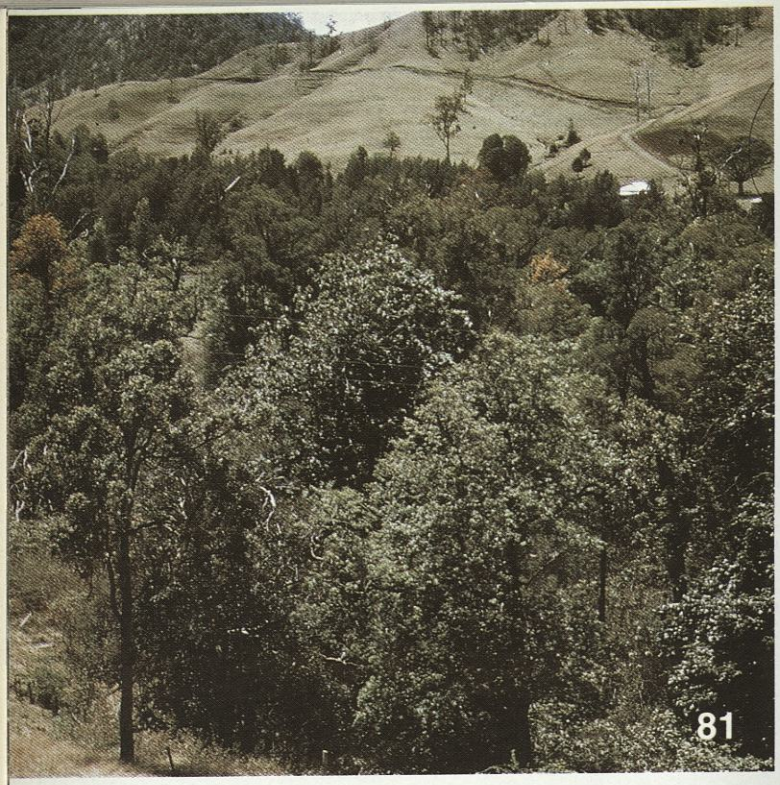


Photo 81. Castanospermum australe (dark green) and *Grevillea robusta* (yellow). Suballiance No. 24. Moore Park Nature Reserve. *Photo: A. Floyd.*

Photo 82. Desmodium acanthocladum, a rare and endangered shrub. Suballiance No. 25. Boatharbour Nature Reserve. *Photo: A. Floyd.*

Photo 83. Choricarpia leptopetala. Suballiance No. 27. Coramba Mountain. *Photo: A. Floyd.*

Photo 84. Dense epiphytic growth on *Backhousia sciadophora* and *Drypetes australasica.* Suballiance No. 28. Smalls Creek, Kunderang, Werrikimbe National Park. *Photo: A. Floyd.*

Photo 85. Cryptocarya williwilliana. A narrow endemic on limestone. Suballiance No. 28. Willi Willi. *Photo: A. Floyd.*

Photo 86. Simple coppice forest of *Backhousia myrtifolia* with sparse understorey following fire. Suballiance No. 30. Burra Creek, Deua River. *Photo: A. Floyd.*

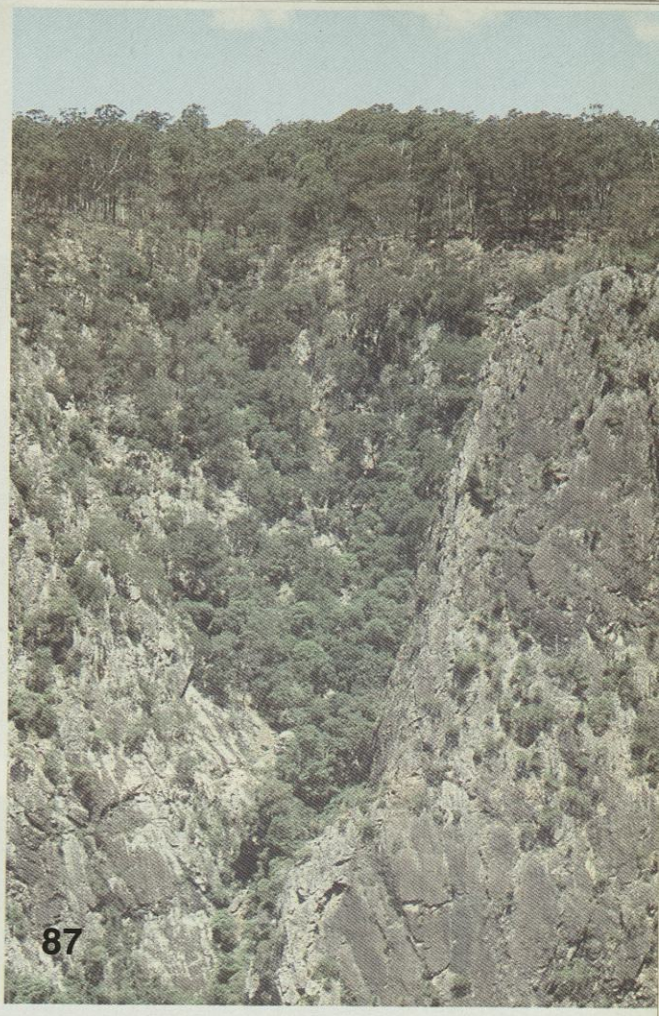


Photo 87. Alectryon forsythii and *Notelaea microcarpa* var. *velutina* on steep scree slope. Suballiance No. 31. Wollomombi Gorge, Oxley Wild Rivers National Park. *Photo: A. Floyd.*

Photo 88. Ceratopetalum apetalum and *Livistona australis.* Suballiance No. 34. Wheeny Creek, Wollemi National Park. *Photo: A. Floyd.*

Photo 89. Ceratopetalum apetalum, Acmena smithii and *Archontophoenix cunninghamiana.* Suballiance No. 34. Kioloa Forest Preserve, Kioloa State Forest. *Photo: A. Floyd.*

Photo 90. Ceratopetalum apetalum-Schizomeria ovata mature Warm Temperate Rainforest. Suballiance No. 35. Moonpar State Forest. *Photo: R. S. Faggotter.*

Photo 91. Pink-fruited crowns of *Ceratopetalum apetalum* with yellow-green *Doryphora sassafras*. Suballiance No. 36. Mt Bajimba. *Photo: A. Floyd.*

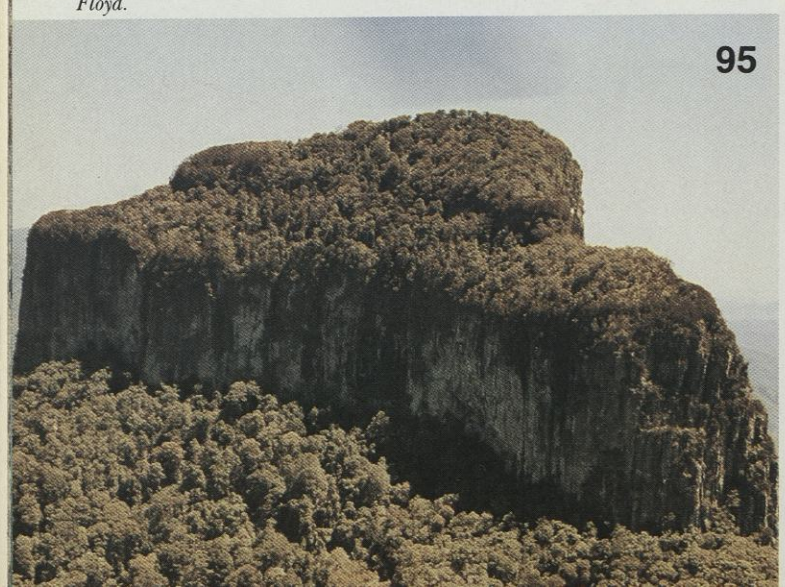
Photo 92. Doryphora (centre), *Acmena* (dark bark) and *Ceratop* (blotchy bark on right). In slot canyon. Suballiance No. 37 Creek tributary, Wollemi National Park. *Photo: A. Floyd.*

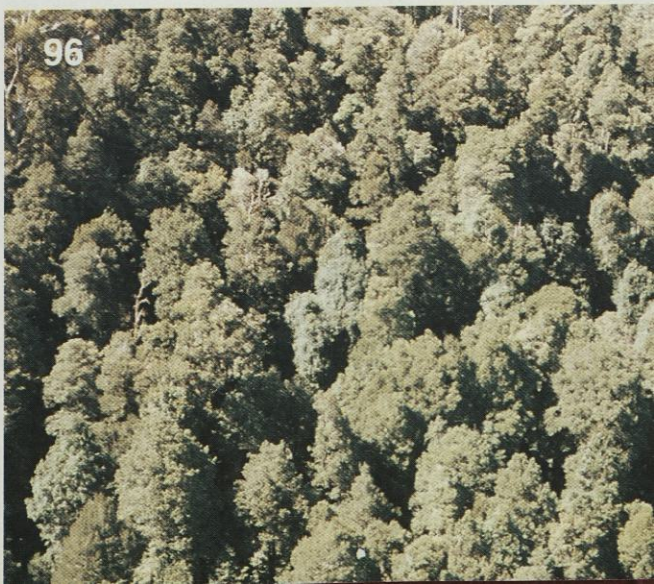
Photo 93. Luxuriant ferns of *Leptopteris fraseri* and *Dicksonia antarctica* in slot canyon. Suballiance No. 37. Emu Creek tributary, Wollemi National Park. *Photo: A. Floyd.*

Photo 95. Schizomeria-Doryphora-Caldcluvia-Orites Suballiance No. 39 on poor soil at base of rhyolite cliffs. Closed scrub of *Leptospermum-Notelaea venosa-Prostanthera* Suballiance No. 46 on top of cliffs. South side of Mt Lindesay, Border Ranges National Park. *Photo: A. Floyd.*

Photo 94. Ceratopetalum apetalum at its known southern limit alliance No. 37. Lyons Creek Forest Preserve. *Photo: A. Floy*

Photo 96. Virtual single-species forest of *Doryphora sassafras*. alliance No. 40. Butterleaf State Forest. *Photo: A. Floyd.*





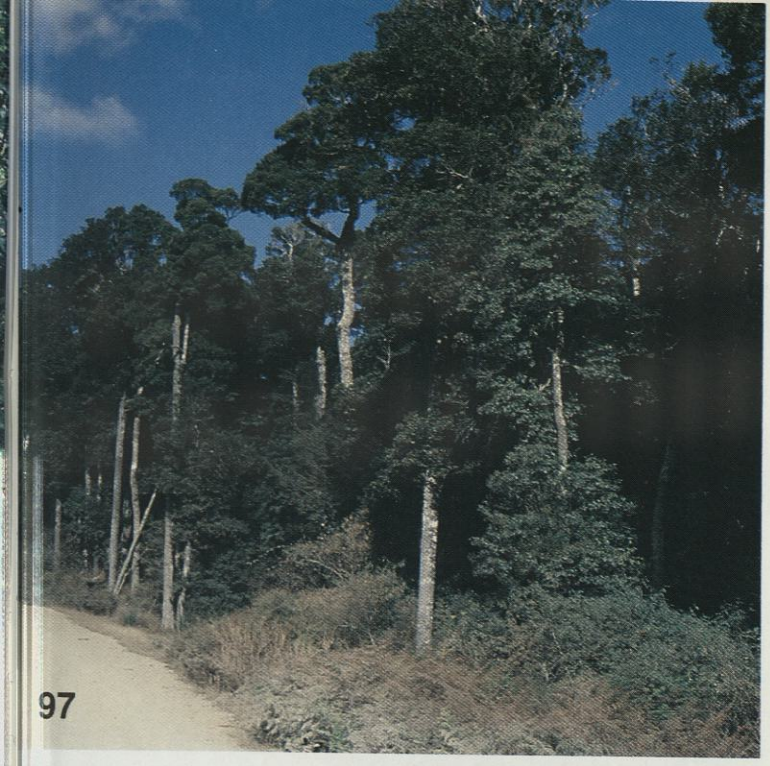


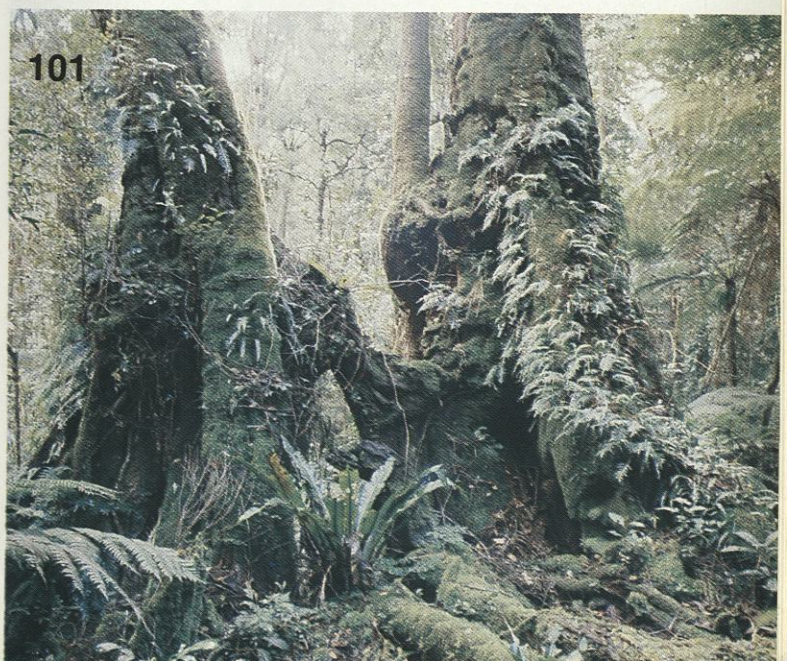
Photo 97. *Doryphora-Quintinia sieberi* Suballiance No. 40 with foreshortened trunks due to exposure. *Cryptocarya foveolata* is also a common canopy tree. Mt Hyland Nature Reserve. *Photo: A. Floyd.*

Photo 98. Canopy of dark green *Doryphora* crowns on upper slopes with *Ceratopetalum* (pink) along the more sheltered creek line. Suballiance No. 40. Mt Irvine. *Photo: A. Floyd.*

Photo 99. Scattered fire-damaged *Doryphora* with epicormic secondary crowns. Suballiance No. 44. Wandella Forest Preserve, Murrabrine State Forest. *Photo: A. Floyd.*

Photo 100. *Leptospermum petersonii* and *Prostanthera incisa* scrub on a rocky ridge. Suballiance No. 46. Willowie Scrub, Washpool National Park. *Photo: A. Floyd.*

Photo 101. Mosses and ferns concealing the bases of *Nothofagus moorei.* Suballiance No. 47. Brindle Creek, Border Ranges National Park. *Photo: G. G. Biddle.*



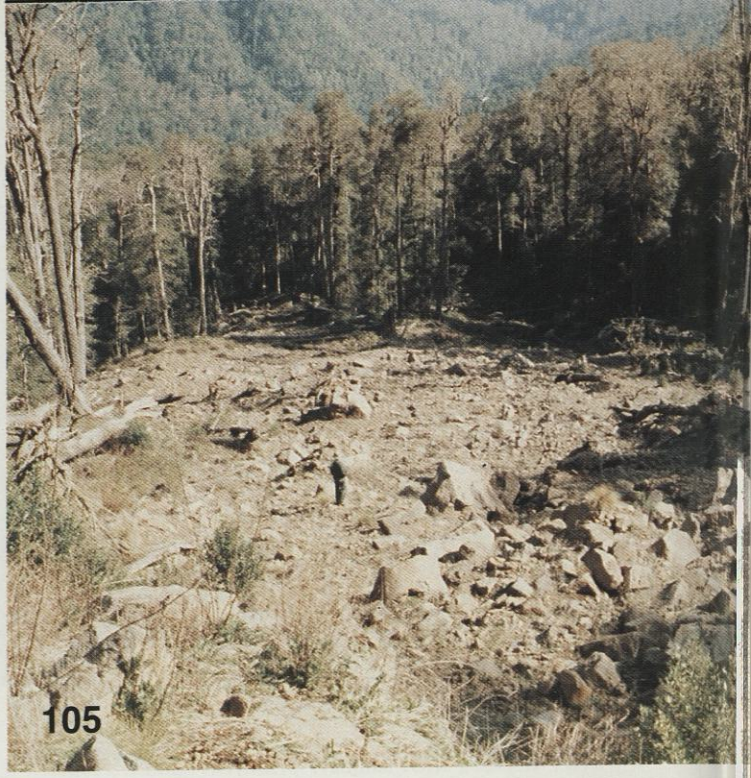


Photo 102. Denhamia moorei, endemic to the Bellingen Escarpment and Mt Hyland. Suballiance No. 48. Dorrigo. *Photo: A. Floyd.*

Photo 103. Atherosperma moschatum, entire-leaved northern form. Suballiance No. 50. Head of Moppy River, Barrington Tops National Park. *Photo: A. Floyd.*

Photo 104. Ferny understorey of *Dicksonia antarctica* and *Blechnum* spp. Suballiance No. 51. Deervale. *Photo: R. S. Faggotter.*

Photo 105. Landslip below Carey's Peak four years previously (1978), with dense *Nothofagus* regrowth from previous slips. Suballiance No. 51. Barrington Tops National Park. *Photo: A. Floyd.*

Photo 106. Flowers of *Eucryphia moorei,* related to Cunoniaceae but with large petals and numerous stamens. Mt Dromedary Flora Reserve. *Photo: A. Floyd.*

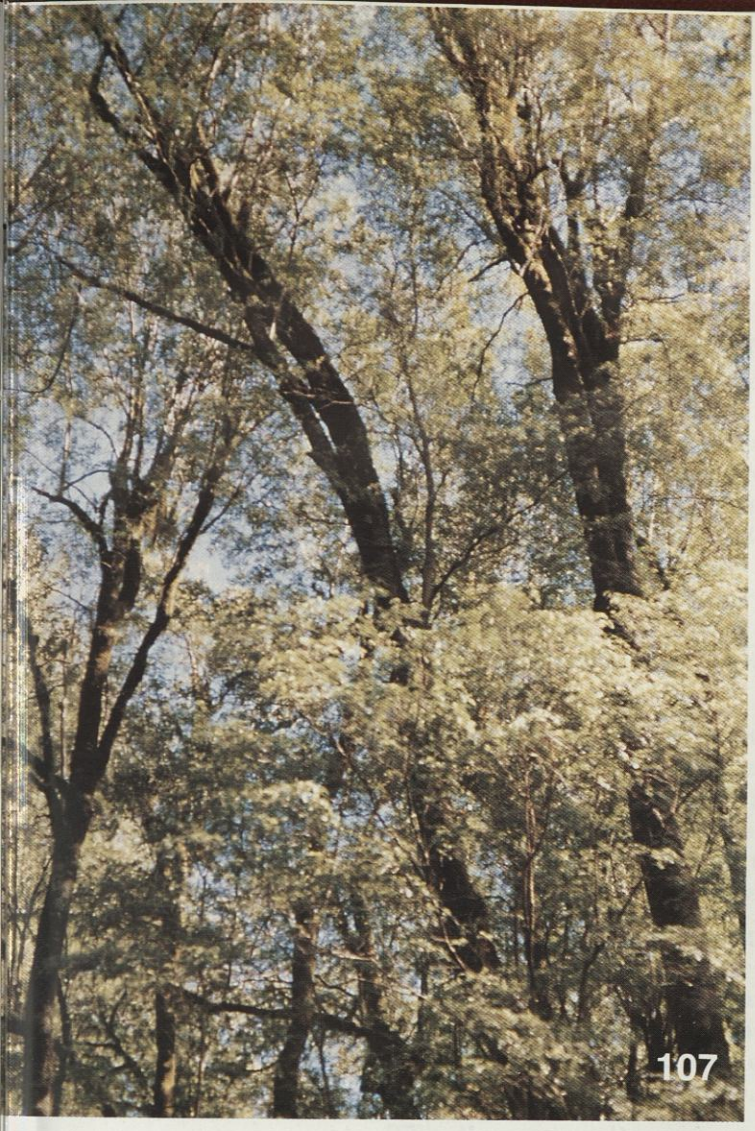


Photo 107. Attractive, light green, feathery foliage of *Eucryphia moorei.* Currowan Creek. Freehold. *Photo: A. Floyd.*

Photo 109. Lycopodium myrtifolium, an epiphyte in cool temperate rainforest extending from the Queensland border to Tasmania. Suballiance No. 57. Cathedral Rocks National Park. *Photo: A. Floyd.*

Photo 108. Eucryphia moorei with ring of coppice stems. Currowan Creek. Freehold. *Photo: A. Floyd.*

Photo 110. Elaeocarpus holopetalus on steep sandstone scree slope untouched by fire. Suballiance No. 57. Mt Imlay National Park. *Photo: A. Floyd.*

essentially those of the dry rainforest such as *Aphananthe, Streblus, Capparis arborea, Austromyrtus acmenoides* and *A. bidwillii.* Other common tree species are *Austromyrtus fragrantissima, Cryptocarya obovata, C. triplinervis, Endiandra pubens, Alphitonia excelsa, Cinnamomum camphora* and *Ligustrum* spp. Of these species, *Austromyrtus fragrantissima* is regarded as rare and endangered, as noted in discussion of the *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance. The shrub layer is dominated by *Desmodium acanthocladum* (Photo 82) which forms dense, wiry thickets along the stream banks in the Richmond-Tweed area only. This species is classified as rare and endangered. Other common shrubs are *Randia chartacea* and *Solanum mauritianum.* Herbs and epiphytes are scarce, but vines are conspicuous. Particularly obvious are the scramblers, *Maclura* and *Lantana.* Other common vines are *Parsonsia straminea* and *Morinda jasminoides.*

At Boatharbour on the junction of Wilsons and Coopers Creeks, both the main channels and the overflow channels through the *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* Suballiance are lined with rainforest of Suballiance No. 25. In addition to the shrubs already listed, *Rivina humilis* and *Cryptocarya laevigata* are also very common (Species List, Microfiche). Additional vines include *Calamus muelleri, Malaisia scandens, Legnephora moorei* and *Cissus antarctica.*

Currie Park is in a similar situation about 5 km downstream from Boatharbour, but it was virtually cleared many years ago. Although regenerated, it contains many exotic species such as *Cinnamomum camphora, Ligustrum lucidum, L. sinense, Cardiospermum* and *Lantana.* Other than the exotics, the tree cover is mostly *Aphananthe* and *Streblus* with *Desmodium* as the major shrub, forming thickets around the rainforest margin (Species List, Microfiche). *Austromyrtus fragrantissima* is present but rare.

The Recreation Reserve on Pelican Creek at Ruthven is a rather deceptive example of the suballiance. At first glance, it appears to be mainly *Casuarina glauca* forest with a dense shrub and vine understorey. On closer inspection, it is found to be composed of *Streblus* and three species of *Austromyrtus,* the most common being the rare *A. fragrantissima.* Also present are *A. acmenoides* and *A. bidwillii* (Species List, Microfiche). Other common tree species are *Cupaniopsis parvifolia* and *Cryptocarya triplinervis.* Among the small trees, *Randia chartacea* is very common. In addition to *Desmodium acanthocladum,* the shrub stratum consists of many typical dry rainforest species such as *Alchornea ilicifolia, Croton verreauxii* and *Carissa ovata.* Vines are very conspicuous, the most common being *Maclura cochinchinensis, Jasminum volubile* and the exotic *Ipomoea cairica.* Other common vines are *Geitonoplesium cymosum, Derris involuta, Austrosteenisia glabristyla* and *Parsonsia straminea.*

Suballiance No. 26: *Waterhousea floribunda-Tristaniopsis laurina*

This suballiance differs from the two predecessors — although a riverbank community, it occurs on poorer alluvial soils derived from predominantly siliceous rocks such as sandstone, shale, slate and granite. Both indicator species are adapted to bending under the force of strong floodwaters and accumulated debris.

In the Bellinger Valley, the suballiance occurs under high rainfall conditions of 1 400–1 500 mm annually, but on the mid-Richmond and in the Dungog area, rainfall is only 970–1 100 mm. South of the Clarence Valley, the suballiance is therefore in part a floristically simplified extension of Suballiances Nos. 24 and 25. To the north, it is differentiated by the edaphic factor.

The major canopy species is *Waterhousea floribunda* with varying abundances of *Tristaniopsis laurina* which shows a preference for dominance in the narrower gullies further upstream. Apart from the exotic *Cinnamomum camphora,* the only consistent canopy species are *Alphitonia excelsa* and *Cryptocarya glaucescens.* Trees in the

subcanopy level are *Ficus coronata, Euodia micrococca* and *Glochidion ferdinandi.* The sparse shrub layer contains *Ervatamia angustisepala.* The most common ground cover species are *Oplismenus aemulus* and *Lomandra longifolia.* Vines, except for the wiry *Smilax australis* and the exotic *Passiflora edulis,* are of the thick woody type, including *Cissus antarctica, C. hypoglauca, Parsonsia straminea* and *Morinda jasminoides.* The only occasional epiphytes are *Asplenium australasicum, Platycerium bifurcatum* and *Pyrrosia confluens.*

RICHMOND RIVER

Myrtle Creek south of Casino has a low rainfall of only 1 100 mm annually with a marked dry period of 44 mm and 47 mm in August and September respectively. The soil is mainly derived from sandstone and therefore is poorer than that nearby at Yorklea where it is basaltically enriched and supports the *Castanospermum-Grevillea robusta* Suballiance.

Waterhousea and *Grevillea robusta* are the most common canopy trees, with *Alphitonia excelsa* (Species List, Microfiche). Smaller trees are *Cryptocarya microneura, Acacia fimbriata* and *Leptospermum brachyandrum.* Although *Tristaniopsis laurina* is present, it is uncommon. There is a typical sparse shrub layer and a ground cover mainly of *Oplismenus aemulus, Adiantum aethiopicum* and *Pseuderanthemum variabile. Lantana* and *Morinda jasminoides* are most common in the typical assemblage of vines. No epiphytes are recorded.

BELLINGER RIVER

Along the Never Never River at Tallowwood Point, on coarse sand derived from granite, there is a tall fringing forest of *Casuarina cunninghamiana* above a dense canopy of *Waterhousea, Tristaniopsis* and *Backhousia myrtifolia* (Species List, Microfiche). *Guioa semiglauca* and the exotic *Cinnamomum camphora* are also common trees. The shrub layer is moderately dense, particularly on the margins where the exotic *Ligustrum sinense* and *Solanum mauritianum* are common. Additional ground cover species to those already listed are *Sticherus flabellatus* and *Tripladenia cunninghamii.* There is the typical vine flora and an absence of epiphytes.

At Martells Road, Brierfield, the alluvium in a southern tributary of the Kalange River is derived from slate and phyllite with much quartz gravel. *Waterhousea* is virtually the only canopy species present, but it is associated with the smaller *Rhodomyrtus psidioides. Tristaniopsis* is absent (Species List, Microfiche). The lower layers are similar to those at Tallowwood Point, except that *Blechnum nudum* and *Carex appressa* replace *Sticherus flabellatus* and *Tripladenia cunninghamii* in the herb layer. The vines are as previously listed, except that *Malaisia scandens* is common rather than *Cissus hypoglauca.* There are only three species of epiphytes of which *Pyrrosia confluens* is common though not conspicuous.

DUNGOG

Further south in the Dungog area, there are remnant streamside strips along major streams such as the Karuah, Chichester, Williams and Allyn Rivers where they meander across the coastal plain. The alluvium is derived from sandstone, siltstone and shale. Because of higher latitude than other areas supporting this alliance, there are fewer canopy species. Although mean annual rainfall is only 972 mm at Dungog, precipitation is fairly evenly distributed, with 60 mm and 65 mm received in the driest months of August and September respectively. Hence the rainforest of the foothills extends out on to the drier plains along the streams. Although *Tristaniopsis laurina* is often the most common canopy species upstream in the narrower gullies, the broad lower sections are clearly dominated by *Waterhousea.* The only other common species recorded at Main Creek, Dungog was *Neolitsea dealbata,* although *Tristaniopsis* is

occasionally encountered (Species List, Microfiche). The shrub layer consists of *Eupomatia laurina* and *Psychotria loniceroides*. The only common vine is *Cissus antarctica*. Epiphytes are better represented, with *Asplenium australasicum* and *Platycerium bifurcatum* common.

Choricarpia-Backhousia spp. Alliance

This alliance occurs on steep, stony slopes or in dry, stony gullies south of the Richmond River. It often adjoins sclerophyll or open forest and is subject to infrequent fires. The ready coppicing habit of the key tree species contrasts with that of the *Drypetes-Araucaria* and *Castanospermum-Waterhousea* alliances and imparts a competitive advantage to the *Choricarpia-Backhousia* Alliance (Fig. 12). Although the *Drypetes-Araucaria* Alliance is found on kraznozem soils and the *Castanospermum-Waterhousea* Alliance on fertile alluvial soils, the *Choricarpia-Backhousia* spp. Alliance is on a variety of generally poorer soils.

The major tree species are in the family Myrtaceae and consist of *Choricarpia leptopetala, Backhousia myrtifolia, B. sciadophora, Lophostemon confertus, Tristaniopsis laurina* and *Acmena smithii*. Other species include *Dendrocnide* spp. and *Drypetes australasica*. The herbaceous layer is sparse; epiphytes are plentiful upon *Backhousia myrtifolia* and *B. sciadophora* but are sparse on *Choricarpia*.

There are four suballiances in New South Wales:

27. *Choricarpia leptopetala*. Fire-prone but burnt only rarely because there is minimal fuel on the ground.
28. *Backhousia sciadophora-Dendrocnide-Drypetes*. As for the preceding but on drier and poorer soils.
29. *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis*. More fire-prone than Suballiances Nos. 27 and 28, being in dry gullies with poor soil on the mid-North Coast.
30. *Backhousia myrtifolia-Acmena smithii*. The South Coast equivalent of the previous suballiance.

Suballiance No. 27: Choricarpia leptopetala

Although in a fire-prone zone, fires are infrequent due to the scarcity of fuel on the ground. The suballiance may occupy margins of wet or dry sclerophyll forest or adjoin Suballiance No. 14: *Doryphora-Daphnandra-Dendrocnide-Ficus-Toona*, Suballiance No. 21: *Araucaria*, or Suballiance No. 22: *Flindersia-Araucaria*. It requires moderately fertile, dry, steep slopes at low altitudes up to 300 m on soil derived from siltstone, sandstone and shale.

Along seasonally dry creek banks, it is replaced by *Backhousia myrtifolia* as in Suballiances Nos. 29 and 30.

Choricarpia suckers and coppices freely after fire. It occurs at Buderim Mountain in South-east Queensland, Mebbin State Forest, Woolgoolga to Bellingen, Hastings Valley, Stroud to Newcastle, Watagan Mountains, Wheeny Creek and Stanwell Park.

The major tree species is, of course, *Choricarpia* (Photo 83). Also common are *Araucaria* (north from Bellingen), *Drypetes australasica* and *Lophostemon confertus* (north of the Hunter River) and *Syncarpia* (to south of the Hunter River).

Tree species occasionally encountered include *Acacia maidenii, Cassine australis, Guioa semiglauca, Alphitonia excelsa, Diospyros australis, D. pentamera* and *Notelaea longifolia*. Shrubs are sparse and mainly limited to *Cordyline stricta* and *Citriobatus pauciflorus*. The scattered herbs are coarse ferns such as *Adiantum hispidulum, Doodia*

aspera and *Pellaea paradoxa*. Vines are only moderately well developed, the major wiry types being *Geitonoplesium cymosum* and *Smilax australis*. Woody vines are mostly species of grapes such as *Cissus antarctica, C. hypoglauca* and *Tetrastigma nitens* as well as *Morinda jasminoides*. Epiphytes are generally scarce.

WOOLGOOLGA-EASTERN DORRIGO

At Madmans Creek Flora Reserve near Woolgoolga, Suballiance No. 27 forms the main canopy beneath emergent *Araucaria* bordering on the dry sclerophyll forest upslope. The major tree species apart from *Choricarpia* are *Drypetes, Lophostemon confertus, Planchonella australis* and *Diospyros australis* (Species List, Microfiche). The most abundant shrubs are *Cordyline petiolaris, C. stricta, Alyxia ruscifolia* and *Alchornea ilicifolia*. The most common herbs are *Pellaea paradoxa, Doodia aspera, Adiantum hispidulum* and *Gahnia aspera*. Vines are conspicuous, particularly *Tetrastigma nitens, Cissus antarctica* and *Morinda jasminoides*. Epiphytes are extremely rare, which is not surprising in such a dry ecotonal situation.

Other examples in the Coffs Harbour area are in dry rainforest gullies near the base of Mt Coramba with a westerly aspect and often with an overstorey of *Araucaria*. There are other small areas further to the north-east in dry rainforest, usually in association with *Araucaria* and at elevations of 300 m to 350 m at Timbertop and Tulipwood Flora Reserve. With increasing dryness, the suballiance is often replaced by the *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis* Suballiance No. 29.

HASTINGS-HUNTER

Further south, the suballiance occurs as scattered trees on the lower Hastings at Bril Bril State Forest and at Comboyne. There is a small coastal occurrence at Blueys Beach, 20 km south of Forster on the western side of a main ridge only 1 km from the sea. Other main canopy species are *Pittosporum undulatum, Guioa semiglauca* and *Planchonella australis* (Species List, Microfiche). The typical shrub, herb and vine layers are present. Further south, the suballiance is found at Myall Lakes, Bulahdelah, Stroud, Paterson River and Newcastle.

WATAGAN MOUNTAINS

There are some excellent examples of this suballiance south of the Hunter Valley in the Watagan Mountains west of Wyong. At Gap Creek Forest Preserve in Olney State Forest, it occupies the steep, dry slopes immediately below subtropical rainforest on a bench. There are scattered emergents of *Acacia maidenii, Eucalyptus saligna* and *Syncarpia glomulifera* showing evidence of a fire about 50 years ago (Species List, Microfiche). The small tree layer consists mainly of *Choricarpia*. The additional 13 tree species are not common. Shrub and herb layers are typical for this suballiance, but there are only four species of vines, all classed as rare except for *Tetrastigma* which is occasional. The absence of epiphytes may also indicate the fire-prone nature of this location. Similar sites occur at Little Jilliby Creek, where one large tree of *Choricarpia* was estimated at a record 20 m tall and 35 cm diameter, and also at Askania Park, Ourimbah. However, at Richters Caves Flora Reserve in Ourimbah State Forest, there is an estimated 220 ha of this suballiance (D. Thomas, pers. comm.) which is certainly the largest area known. There is pure *Choricarpia* on the ridges and upper slopes below the caves with large *Choricarpia* up to 18 m tall and 45 cm diameter on a midslope bench. Elsewhere, the species occurs beneath emergent *Eucalyptus saligna* and *Syncarpia glomulifera*. Unlike other Watagan Mountain sites, there is a good representation of epiphytic orchids, presumably on the lower slopes. They include *Dendrobium tetragonum, Plectorrhiza tridentata* and *Sarcochilus falcatus*.

BLUE MOUNTAINS

There is only one other record of *Choricarpia* along the coast further south — at Stanwell Park. Since the seeds have limited dispersal capabilities, there must in the past have been a connecting corridor. The discovery of this species on Wheeny Creek at Wollemi National Park indicates a lower Blue Mountains connection. This low forest is distinguished by grey-blue crowns of *Acacia binervia* and thickets of *Choricarpia* (Species List, Microfiche). Other common trees are *Alphitonia excelsa* and *Syncarpia glomulifera.* The most common shrub is *Cordyline stricta,* here at its known southern limit. The remaining strata are typical for the suballiance, except that *Asplenium australasicum* is the common and sole epiphyte. Wheeny Creek is also of special significance because it is the southern limit of both *Parsonsia velutina* and *Dendrocnide photinophylla,* which originally were known only as far south as Ourimbah and Wyong respectively. At this site is the only known occurrence in the Blue Mountains of *Diospyros pentamera,* which otherwise occurs south to Gosford and then again in the Illawarra. This refugium probably exists because of its sheltered warm situation at low altitude and because of the basaltically enriched alluvial soil from Mountain Lagoon upstream.

Suballiance No. 28: *Backhousia sciadophora-Dendrocnide-Drypetes*

The key species, *Backhousia sciadophora,* is known as shatterwood in many districts because of its tendency to split when felled. In the Gloucester-Gangat area, it is known by the Aboriginal name, "curricabark". The suballiance is thus known locally as "curricabark scrub". The species is restricted to New South Wales, from Dungog to Nightcap National Park, often forming almost pure stands on dry, steep, stony slopes. The tree forms a typically irregular, crooked, leaning trunk with a grey-brown scaly bark which is a favoured substrate for many epiphytic ferns and orchids. The soil on these steep slopes is shallow and rather poor, being derived from sedimentary rocks (sandstone, siltstone, mudstone and limestone) or metasediments (phyllite, slate and greywacke). Often the loose rock fragments form a scree slope with little or no ground cover — and little likelihood of fires in what is otherwise a fire-prone environment. The mean annual rainfall is typically 940–990 mm with a pronounced dry spring of 30–60 mm monthly from July to September.

This suballiance often grades into Suballiance No. 10: *Argyrodendron actinophyllum-Dendrocnide-Ficus,* in the moister and deeper soils of the gully bottoms. Among dry rainforest suballiances, it is closly related floristically to No. 23: *Ficus-Streblus-Dendrocnide-Cassine,* which occupies more fertile soils due to enrichment by igneous rocks. It is an extension on to shallower and drier soils of No. 27: *Choricarpia* (Fig. 12).

Floristically, the suballiance is typified by the clear predominance of *Backhousia sciadophora,* with *Dendrocnide excelsa, D. photinophylla* and *Drypetes* also common. Sometimes, there may be scattered emergent *Ficus macrophylla* and other *Ficus* spp. In the small tree layer, *Capparis and Mallotus philippensis* are most common. The shrub layer consists mainly of *Nyssanthes diffusa, Citriobatus pauciflorus, Cleistanthus cunninghamii, Alchornea ilicifolia, Croton verreauxii* and *Diospyros australis.* The herb layer is very sparse indeed (Photo 84), consisting mainly of the sickle ferns (*Pellaea falcata* and *P. paradoxa*). Vines are often conspicuous in the canopy, particularly the grapes (*Cissus antarctica* and *Tetrastigma nitens*). *Lantana camara* fills the forest gaps and margins. Epiphytes are outstanding in this suballiance despite the dry sites. There are commonly 12 to 18 species of ferns and orchids present, the most abundant being *Asplenium australasicum, Pyrrosia confluens, Dendrobium beckleri* and *D. speciosum* (Photo 84).

CLARENCE RIVER

At Carnham, 13 km south-west of Baryulgil, there is an area of exceptional botanical interest. It appears to be a refugium of the past dry rainforest corridor from

the Richmond Range to the more southern areas of Kangaroo River, Guy Fawkes and the Macleay Gorges. Many species typical of the Richmond Valley were recorded last century to have as their southern limit "Clarence River", but no recent, more precise locations were known until this 130 ha dry rainforest at Carnham was inspected. Five species of trees at that time only known as far south as the Richmond Valley were located: *Erythrina vespertilio, Zanthoxylum brachyacanthum, Atalaya salicifolia, Acalypha capillipes* and *Siphonodon australe.* The reason for their occurrence would appear to be that although the soil is mainly derived from metasediments, such as phyllite and slate, it is enriched by basic igneous intrusive rocks which are mapped for the general area. The rich red soil and rampant *Lantana* growth are reliable indicators of the enriched soil. Many other species typical of more fertile soils to the north and south are also present:

Flindersia australis. Here, it is common as a large spreading emergent, whose crown could be mistaken on aerial photos for that of a *Ficus.*

Austromyrtus sp. aff. *acmenoides.* This undescribed species is a common associate of *Flindersia australis* further north.

Harpullia pendula. Found further south at Tulipwood Flora Reserve and downstream at Susan Island Nature Reserve.

Proiphys cunninghamii. Previously only recorded for the Brisbane area, Mt Warning and Glenugie Peak on dolerite.

Ailanthus triphysa. Otherwise known only in the Clarence from Iluka Nature Reserve.

Alstonia constricta. Very common tree at Carnham, but occurs south to Madmans Creek Flora Reserve, west of Woolgoolga.

Dendrobium monophyllum. Close to its southern limit.

Canthium vacciniifolium. Large specimens up to 5 m tall and 20 cm stem diameter.

Two large tree species which are strangely absent here and also at Glenugie Peak are *Araucaria cunninghamii* and *Argyrodendron actinophyllum.* One explanation could be their ineffective seed dispersal and their susceptibility to fire which has prevented their recolonization of former sites following an unfavourable climatic cycle. A similar situation applies in the Washpool National Park, where they are absent although occurring in nearby Cangi State Forest.

In addition to the key tree species already listed for this suballiance, the following are common: *Flindersia australis, Melia, Atalaya salicifolia, Alphitonia excelsa, Diospyros pentamera* and *Alstonia constricta* (Species List, Microfiche). The small tree layer is as described previously, as also is the shrub layer with the addition of *Acalypha capillipes* and *Actephila lindleyi.* Herbs and vines are also as described, but with the addition of the bulbous herb *Proiphys.* The 12 species of epiphytes comprise the typical species listed and also *Platycerium superbum* and *Dendrobium monophyllum.*

To the south of the Boyd and Nymboida Rivers between Dalmorton and Nymboida, there are many steep, stony gullies facing south to east — sites which are relatively moist with infrequent fires. These are the Blandford, Chandlers and Marara Creeks which include Chandlers Creek and Sailors Hill Flora Reserves. The soil is shallow or even replaced by scree slopes of only moderate fertility, derived from greywacke metasediments of acid to intermediate volcanic source. There are magnificent emergent *Araucaria* up to 60 m tall beneath which is the typical canopy species as well as *Streblus, Daphnandra* and *Backhousia myrtifolia* (Species List, Microfiche). The small tree and shrub strata are of typical species, with the addition of *Cordyline petiolaris.* The herb layer, although sparse, is quite diverse — the ferns *Adiantum formosum, Doodia aspera, D. caudata, Pteris tremula* and *Pellaea falcata* are quite common

with the flowering *Aneilema acuminatum* and *Pollia crispata.* Vines are conspicuous and include *Ripogonum album, Celastrus subspicatus* and *Cayratia clematidea* in addition to the typical grapes and *Lantana.* Epiphytes are particularly well represented by 19 species, those already listed for the suballiance being most common in addition to *Asplenium australasicum.* Commonly, *Macrozamia moorei* occurs immediately upslope of this rainforest and some seedlings can be found within the shade of the rainforest which fit the description of *M. lucida,* having arching twisted fronds without a gradual reduction in the length of the basal pinnae and with stomata on the underside only. However, no fruiting plants have ever been found of *M. lucida.* The mystery was solved when a shade plant was found beside a recent landslip and showed a change from *M. lucida* type leaves to *M. moorei* type. Hence, *M. lucida,* in New South Wales, at least, is only a shade form of *M. moorei.*

At Burns Scrub in Kangaroo River State Forest, the rainforest is on and below a residual basalt capping with a dry northerly aspect. Because of the rich basaltic soil, this forest is intermediate between Suballiances 28 and 10 *(Argyrodendron actinophyllum-Dendrocnide-Ficus)* — there is an equal abundance of *Backhousia sciadophora, Argyrodendron actinophyllum* and *Planchonella australis.* Both species of *Dendrocnide* are common. *Bridelia exaltata* is the most common tree species. The small tree layer consists mainly of *Mallotus philippensis, Baloghia inophylla* and *Cupaniopsis parvifolia. Phaleria chermsideana* is a most attractive small tree at its southern limit. Other strata comprise typical species of this suballiance. An indication of affinities with the *Flindersia* spp.-*Araucaria* Suballiance of the Richmond Valley is the presence of *Araucaria, Flindersia australis* and *Melicope erythrococca.*

About 8 km south-east at Averys Creek, there are small pockets of rainforest on steep slopes where the soil is derived from sandstone with some basaltic enrichment. In the somewhat moister areas, the rainforest grades into the previous Suballiance No. 27: *Choricarpia.*

Eucalyptus rummeryi is the overstorey, while equally common in the canopy are *Backhousia sciadophora* and *Choricarpia.* However, *Dendrocnide* spp. were not recorded, and *Drypetes* was only occasional. *Flindersia australis* was also present but rare. The small tree stratum consists of *Petalostigma triloculare* as the most common species (here at its southern limit), *Scolopia, Hibiscus heterophyllus* and *Cupaniopsis parvifolia.* Shrubs and herbs are very sparse. Grapes are not recorded, but the most common vines are *Ripogonum album* and *Derris involuta.* There are only six species of epiphytes recorded, with *Platycerium bifurcatum* and *P. superbum* accounting for most sightings.

Equidistant but north-west of Burns Scrub on basaltically enriched sandstone is Tulipwood Flora Reserve. The rainforest here is clearly dominated by *Backhousia sciadophora,* but there is a great diversity of other commonly occurring canopy tree species including *Dendrocnide excelsa, D. photinophylla, Drypetes, Ficus macrophylla, Streblus, Harpullia pendula, Argyrodendron actinophyllum, Brachychiton discolor* and *Diospyros pentamera.*

This is the known southern limit for *Cryptocarya bidwillii* which occurs on Glenugie Peak, the Clarence Gorge and Rivertree in the upper Clarence as well as the upper Richmond and into Queensland. *Melicope erythrococca* occurs in this vicinity at its southern limit, while to the north it is at Burns Scrub, Carnham and the Richmond Range. *Harpullia pendula,* after which the Flora Reserve is named, is here at its known present southern limit. An old record for the Bellinger River cannot be relocated. It would appear that these three species at this high latitude require fertile basaltic soils which are absent in the dry rainforests further south. The small trees, shrubs, herbs, vines and epiphytes are typical of this suballiance.

DORRIGO

This suballiance is also found on the Dorrigo escarpment at several restricted sites with shallow, stony soil on steep slopes on metasediments. These are Cedar Falls, Dorrigo National Park and Water Gum Creek Falls on Bellinger River State Forest. The floristic diversity is limited with the canopy consisting mainly of *Backhousia sciadophora.* Also common are *B. myrtifolia* and *Araucaria. Dendrocnide excelsa* is only occasionally present. There is a typical sparse assemblage of shrubs and herbs. Vines are well represented by *Geitonoplesium, Austrosteenisia blackii, Malaisia scandens, Tetrastigma nitens, Embelia australiana* and *Pandorea pandorana.* Epiphytes are well represented by 11 species, and although *Platycerium* spp. are absent, *Asplenium australasicum* is common.

MACLEAY

Postmans Creek, south of Hillgrove, is typical of a number of gorge situations on the steep scree slopes of slate and shale with southern or eastern aspects. The canopy consists mainly of *Backhousia sciadophora, Rhodosphaera* and *Streblus* with *Dendrocnide excelsa* and *Ficus* spp. less common. The small tree layer is typical, except that *Alectryon subdentatus* is also common, as is often found in the very steep gorges. The typical shrubs are reinforced on the rainforest margins by a thick, shrubby form of *Backhousia myrtifolia.* Ground cover is absent. Vines are mainly the typical grapes, but the gorge-loving *Jasminum volubile* is also present. Epiphytes are few and restricted to *Pyrrosia rupestris* and *Dendrobium speciosum.*

By contrast with the floristically simple community just described on the drier western sides of the Macleay Valley, sites at Kunderang Brook on similar soils and slopes on the higher rainfall areas on the east side of the valley are relatively complex. These southern tributaries of Kunderang Brook have very dry and steep screen slopes with virtually no ground cover and only scattered shrubs. This situation gives protection from fires in the dry, open forests above. The moister subtropical rainforest of Suballiance No. 7 *(Argyrodendron actinophyllum)* in the gullies below provides a similar fire barrier. Because of their predominantly northern aspect, these upper gullies are very dry. Vegetation ranges from communities of *B. sciadophora* and *Dendrocnide excelsa* up to 25 m tall on the better sites down to almost semi-evergreen vine thicket of *B. sciadophora* and *Drypetes* where soil is almost non-existent between the plates of the scree.

Despite this edaphic drought, the epiphytes receive adequate rainfall and mist to produce an amazing display. The trunks and branches of trees and shrubs are almost completely obscured from ground level upwards by the thick growth of epiphytic hanging mosses, orchids and ferns (Photo 84). A total of 10 species of ferns have been recorded, of which *Dictymia brownii* and *Pyrrosia confluens* are most abundant. There are 13 species of orchids with *Dendrobium pugioniforme, D. speciosum* and *Sarcochilus falcatus* most common.

These forests extend from 990 m down to 270 m altitude and have now been added to Werrikimbe National Park. The typical vines of the suballiance form tangles in the canopy. Among the more interesting plants are *Rhodosphaera rhodanthema* at its southern limit and *Cryptocarya floydii.* Yard Creek is the only known site east of the Macleay River for this latter species, with a series of disjunctions north to the Bunya Mountains. *Acacia diphylla* is also well to the east of its known territory in the Wollomombi and Chandler gorges.

West of Kempsey, a narrow outcrop of limestone extends west and broadens from Yessabah Caves to the Carrai Plateau. The steep slopes with a southern aspect support dry rainforest of this suballiance and range from 860 m altitude at Hogsback Mountain to 80 m at Yessabah Caves.

Although *Backhousia sciadophora, Dendrocnide excelsa* and *Drypetes* are the most common canopy species throughout this altitudinal range, there is a distinct zoning of the other tree species. These rainforests may be considered under three altitudinal headings.

The high altitude locations at 640–860 m on Hogsback Mountain and Stockyard Creek contain only 36 dry rainforest tree species. Tree species absent in this altitudinal zone include *Dendrocnide photinophylla, Melia, Cleistanthus, Mallotus philippensis, Harpullia hillii* and *Olea paniculata.* Others much less common than at lower altitudes are *Cryptocarya williwilliana, Geijera salicifolia* var. *latifolia, Cassine, Alectryon subdentatus, Cupaniopsis parvifolia, Hibiscus heterophyllus, Planchonella australis* and *Diospyros pentamera.* Many of the lowland vines such as *Malaisia scandens, Derris involuta, Austrosteenisia blackii, Cayratia eurynema* and *Cissus opaca* are also less common at these higher altitudes. However, the increased rainfall in these mountain areas favours the development of epiphytes. Although *Platycerium superbum* and *Dendrobium gracilicaule* are less common than at the lower elevations, there are 28 species recorded in comparison with 14 to 15 species at lower altitudes. In addition to the typical epiphytes listed earlier for this suballiance, there are moisture-loving species such as *Dictymia brownii, Asplenium australasicum, Dendrobium pugioniforme, Liparis coelogynoides* and *Sarcochilus falcatus.*

At medium to low altitudes of 360 m to 580 m, as at Block and Tackle Spur and Micks Gully on the road from Willi Willi to Carrai, there are 53 tree species (Species List, Microfiche). This is the major area of occurrence of *Cryptocarya williwilliana,* a tall shrub virtually confined to this limestone outcrop in the Macleay Valley (Photo 85). The only known exception is two seedlings on Anderson's Sugarloaf in this same suballiance, on metasediments with some basaltic enrichment on the northern side of the valley. No mature plants were seen at the second site, and hence the ultimate future of these seedlings cannot be gauged. With these exceptions, major species in each stratum are typical for the suballiance. On the lower dry margin of this rainforest, *Acacia diphylla* is quite common, as at the Kunderang Brook.

At low altitudes of 430 m at Willi Willi through Mt Sebastopol and Temagog to Yessabah Caves at 80 m, there are about 48 tree species, with *Ficus* spp. and *Aphananthe* becoming common. Plants of special interest include *Harpullia hillii.* At Mt Sebastopol, it reaches a record size of 20 m and 50 cm diameter. This is the only area south of Coffs Harbour to have a possibly viable population. This lowland limestone belt is an important refugium, the only known site for *Alectryon tomentosus* between Glenugie Peak and Cape Hawke, for *Canthium odoratum* between Guy Fawkes River and Woko National Park, and the disjunct southern limit for the vines *Hoya australis, Caesalpinia subtropica, Tragia novae-hollandiae* and *Rauwenhoffia leichhardtii.* Unfortunately, none of these lowland limestone areas are conserved with the exception of 2.2 ha at Willi Willi Caves Nature Reserve and all are at risk from present or future mining.

HASTINGS-CAMDEN HAVEN

On Mt Seaview Nature Reserve in the upper Hastings, a significant area of this suballiance occurs on the steep eastern slopes and ridges on shallow stony soils derived from chert, quartzite and schist. This rainforest is less than 15 m in height, but it is an important refugium between Kunderang Brook in the north and the Woko-Gangat area to the south near Gloucester. The most abundant species in each stratum are typical of the suballiance generally, but there is a bias towards the more xerophytic species such as *Dendrocnide photinophylla, Geijera salicifolia* var. *latifolia, Croton insularis, Canthium vacciniifolium* and *Morinda acutifolia.* Although 19 species of epiphytes are listed, *Platycerium superbum* is less abundant than usual. Species of special interest are the vine, *Morinda acutifolia,* which is confined to dry rainforests, and *Canthium*

vacciniifolium as part of a disjunct population at its southern limit in the Hastings Valley.

In the Black Creek Flora Reserve near Kendall, a fine example of this suballiance in soil derived from microgranite is found on steep, dry slopes with a southern aspect.

Some trees of *Backhousia sciadophora* are of record size — about 45 m tall and 100 cm diameter. *Drypetes* is the other very common canopy species, with *Dendrocnide photinophylla* less common. Apart from *Capparis arborea,* the small tree stratum is composed of *Mischocarpus pyriformis* and *Canthium coprosmoides.* The shrub layer is mainly of *Alchornea* and *Hibiscus heterophyllus. Doodia aspera* and *Pellaea paradoxa* constitute the herb stratum. Grapes are a major component of the vines, with *Cayratia clematidea* and species typical of the suballiance. *Derris* is also common. Epiphytes are well represented by 14 species of which the most abundant are *Pyrrosia confluens, Asplenium australasicum* and *Dendrobium beckleri.*

GANGAT

Between the Manning River and Gloucester to the south, a line of sites supporting this rainforest suballiance extend from Woko National Park in the west, Camels Hump Nature Reserve and Wirradgurie near Bulliac to Gangat in the east towards Krambach. All these locations are on relatively poor soils and steep slopes. Southern aspects are usual, but eastern and western also support the suballiance at Gangat. These rainforests on Woko National Park are small in area, but Camels Hump Nature Reserve represents about 380 ha, and Gangat is a block of 150 ha on four properties between Bakers and Belbora Creeks.

This forest is clearly dominated by *Backhousia sciadophora* which is 10–15 m high and known as "curricabark scrub". There is a remarkable similarity between the species occurring on all sites, and the appended species list on microfiche is a composite for the two largest areas, at Camels Hump and Gangat. In addition to the typical canopy species, *Ficus macrophylla* and *Brachychiton discolor* occur at these sites. The remaining strata consist of the typical species for the suballiance. *Alectryon subdentatus* is of special interest since it reaches its southern limit on Woko National Park. As usual, epiphytes are very conspicuous and comprise 18 to 20 species. Poachers are a constant worry to property owners in this area.

A 7(j) zoning of Environmental Protection — Scientific has been suggested to the private landowners in the Gangat area by Gloucester Shire Council. Response has not been very favourable because the owners do not receive any rate relief as compensation for any restrictions imposed on the use of their land.

LOWER GLOUCESTER AND KARUAH RIVERS

At the northern base of the Gloucester Tops, there are several small patches of this suballiance on very steep, shallow, stony soils derived from mudstone, sandstone and shale.

At Dannys and Mine Creeks, tributaries of the Gloucester River, rainforest is restricted in area but is quite tall. The main canopy is of *Backhousia sciadophora* and *Dendrocnide excelsa* as well as an occasional *Brachychiton acerifolius* at a height of about 25 m. Standing above this are occasional large spreading *Ficus macrophylla* and *F. watkinsiana.* The shrub and herb layers are sparse except along the creeks where subtropical rainforest occurs. Typical vines for this suballiance are present, as are epiphytes which include 11–14 species but show better development in the moister creek situation. The Mine Creek site is on the boundary of the Barrington Tops National Park extension, and Dannys Creek is on Chichester State Forest.

Jilliby Gully is located on a tilted rock sheet with minimal soil and a hot, dry, northern aspect in the Karuah Valley. There are no emergent figs but rather a dense,

even canopy of *Backhousia sciadophora* and *Dysoxylum fraserianum* with *Brachychiton acerifolius, Planchonella australis* and *Backhousia myrtifolia* on drier sections. Typical shrubs and herbs are present but very scattered. Vines, however, are conspicuous, particularly *Celastrus subspicatus* as well as *Austrosteenisia blackii* and *Cissus antarctica.* Despite the dry site, epiphytes on the upper trunks and branches of *Backhousia sciadophora* are in luxuriant profusion. The most conspicuous species is *Asplenium australasicum.* Equally abundant although less obvious is *Dictymia brownii* and *Pyrrosia confluens.* Among the other 12 species recorded, *Dendrobium pugioniforme* and *D. speciosum* are common. Jilliby Gully is located within Chichester State Forest.

DUNGOG

The most southern occurrence of this suballiance is on freehold land at Tabbil Creek, 9 km west of Dungog. The site consists of 85 ha with an easterly aspect on steep, dry, stony slopes with shallow soil derived from sandstone and siltstone. Much of the area has an overstorey of *Eucalyptus punctata* ssp. *canaliculata,* particularly on the spurs. *Backhousia sciadophora* and *Dendrocnide excelsa* are the most common canopy species, but *D. photinophylla, Ficus macrophylla* and *Brachychiton discolor* are also common (Species List, Microfiche). There are typical small tree, shrub, herb and vine species. The fact that only five species of epiphytes are recorded may reflect poaching rather than any ecological factor. The most common epiphytes are *Dendrobium beckleri* and *D. speciosum.*

Suballiance No. 29: *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis* spp.

This suballiance is found on poorer soils derived from sedimentary rocks which are sometimes enriched by basaltic or doleritic rocks. It occurs on the mid-north coast in seasonally dry gullies or on very shallow and dry soils over rock on hillsides. These are drier sites than those supporting Suballiance No. 27: *Choricarpia leptopetala.* Suballiance No. 29 is better equipped to survive more frequent fires because of the coppicing ability of its major tree species. It may grade into Suballiance No. 28: *Backhousia sciadophora-Dendrocnide-Drypetes,* which also grows on very dry sites, but generally on bare scree slopes which will not support a ground fire. There are commonly seven to 10 herbaceous species present in Suballiance No. 29 which provide fuel for fire.

The mean annual rainfall may be as low as 920 mm in the Clarence Valley to 1 940 mm on the Dorrigo and Comboyne plateaux. In the dry spring months, the mean monthly rainfall is 29 mm and 91 mm respectively, a fact which emphasises the dominating role of soil moisture in determining the distribution of this suballiance.

On the South Coast where *Lophostemon* is absent and *Tristaniopsis* is generally not common, those species are replaced by *Acmena smithii* as the associate of *Backhousia myrtifolia* to form Suballiance No. 30 (Fig. 12).

Because of the harsh environment, there are fewer tree species in Suballiance No. 29 than in those described previously. The most diverse site sampled was at Morgans Gully near Evans Head, with 21 species. The most simple was at Rawson Falls in Boorganna Nature Reserve, on the Comboyne Plateau.

The canopy is of myrtles, particularly *Backhousia myrtifolia* with occasional *Lophostemon confertus* and *Tristaniopsis laurina.* In the sub-canopy tree level are *Streblus, Pittosporum undulatum, Trochocarpa laurina* and *Notelaea longifolia.* The shrub layer is sparse and mainly *Alyxia ruscifolia.* There are commonly seven to 10 species of herbs, the most common being *Doodia aspera, D. caudata, Pellaea falcata, Lomandra longifolia, Peperomia leptostachya* and *Plectranthus parviflorus.* Although there may be as many as 10 vine species, none are very common. The most frequent are *Cissus antarctica, Parsonsia straminea* and *Pandorea pandorana.* The epiphytes reflect the rainfall and humidity of each area rather than the soil moisture conditions and range from 14

species in narrow, deep gullies to only six on dry, exposed slopes at Kunderang Brook. The main species are *Pyrrosia rupestris, Dictymia brownii* and *Peperomia tetraphylla.*

RICHMOND RIVER

At Morgans Gully on freehold land close to the north-west corner of Bundjulung National Park, the soil is derived from shale. The rainforest is floristically well developed. The tree canopy is predominantly of *Backhousia myrtifolia* and *Tristaniopsis laurina* with occasional *Lophostemon, Archontophoenix* and *Livistona* (Species List, Microfiche). The sub-canopy consists of *Leptospermum polygalifolium, Trochocarpa* and *Petalostigma triloculare.* There are typical shrub and herb layers, and the vines are well represented, particularly by *Hoya australis* and *Morinda jasminoides.*

The scarcity of epiphytes could indicate a history of relatively frequent fires. Despite this, there are three scientifically interesting epiphytic species present. The orchid, *Oberonia palmicola,* occurs here and in Dorrigo National Park on the branches of *Backhousia myrtifolia* despite its specific name. On rocks in the creek bed, the tiny, filmy fern, *Gonocormus saxifragoides,* is found at its southern limit. The only other known records of this species in New South Wales refer to Uralba Nature Reserve and Minyon Falls Flora Reserve. Similarly, *Belvisia mucronata* occurs on one rock slab at Morgans Gully, on the Moonanbah Range at Tweed Heads and then up the coast to North Queensland. It is indeed difficult to explain why these tropical species should be in this small, isolated niche which appears to be in very real danger of annihilation by the next fierce fire.

MID-CLARENCE RIVER

At Arandin Flora Reserve on Glenugie Creek upstream from the Pacific Highway, a narrow rainforest fringes the ephemeral creek. Alluvium is derived mainly from sandstone, possibly with some doleritic enrichment from Glenugie Peak. If this had been a permanent watercourse, the rainforest would probably have been classifiable as Suballiance No. 26: *Waterhousea floribunda-Tristaniopsis laurina.* It is a good example of the Forestry Commission's myrtle forest type, with 10 genera of this family present. There are emergents of *Lophostemon suaveolens, Angophora subvelutina* and *Eucalyptus tereticornis* above a diverse canopy of 22 tree species. Most common are *Backhousia myrtifolia* and the rheophytic or narrow-leaved form of *Acmena smithii* which appears to be replacing *Lophostemon confertus.* Other frequent canopy species are *Cryptocarya glaucescens, Acronychia oblongifolia, Tristaniopsis laurina, Callistemon salignus* and *Melaleuca alternifolia.* Major shrubs are *Baeckea virgata* and *Psychotria loniceroides.* The herb layer is well developed, particularly *Oplismenus imbecillis, Lomandra longifolia* and *Viola hederacea.* Vines are well represented by 11 species consisting of all those typical of the suballiance as well as *Maclura cochinchinensis.* By contrast, epiphytes are virtually non-existent except for one *Platycerium bifurcatum.* Because of the narrowness of this fringing forest and evidence of damage to the butts of the larger *Acmena smithii* as well as signs of more recent fire incursions around the perimeter, it appears reasonable to assume that past fires may have selectively eliminated most epiphytes.

At Frenchmans Creek, south-west of Chandlers Creek Flora Reserve, there is a narrow, steep gully with skeletal soil derived from siliceous mudstone and siltstone. The canopy consists of *Backhousia myrtifolia, Lophostemon confertus* and *Syzygium australe* rather than *Tristaniopsis* (Species List, Microfiche). The sub-canopy trees consist of *Ficus coronata, Streblus, Alectryon subcinereus* and *Trochocarpa laurina.* The most common shrubs are *Diospyros australis* and *Alyxia.* Herbs and vines are of typical species with the addition of *Tetrastigma nitens* as a common vine. Epiphytes are particularly well represented; the 14 species include *Asplenium polyodon, Platycerium superbum, Dendrobium*

aemulum and *D. beckleri* in addition to typical species. At Stockyard Creek in the same general area, *Lophostemon confertus* is replaced by *Araucaria* where fires are less prevalent.

DORRIGO

In this high-rainfall area, dry rainforest is found only on very shallow soils over the hard, steep Moombil Beds of argyllite. Examples occur at Flaggy and Mobong Creeks as well as Cedar Falls on Dorrigo National Park. In the canopy layer, *Syzygium australe* replaces *Tristaniopsis laurina* at Cedar Falls and is found with *Planchonella australis.* Major smaller trees are *Capparis, Ficus coronata, Pittosporum undulatum* and *Denhamia celastroides.* The major shrubs are *Phebalium elatius* and *Alyxia.* The herbs, vines and epiphytes are typical of this suballiance.

Flaggy and Mobong Creeks have narrow, steep, rocky gullies which support a simple forest of *Backhousia myrtifolia* and *Tristaniopsis laurina.*

Along the banks of the lower Rosewood Creek and Never Never River on the shallow soil between the great boulders and rock walls, there is a simple forest dominated by *Backhousia myrtifolia* but with *Tristaniopsis laurina* and *Syzygium australe* also common. *Ficus coronata* is very common in the sub-canopy stratum.

Of special interest is the occurrence of the small orchid *Oberonia palmicola* on the branches of *Backhousia,* particularly those leaning out over the water.

MACLEAY RIVER

Although much of the vegetation in the drier, steep sections of the Macleay Valley may consist of the *Backhousia sciadophora* Suballiance, these species are replaced by the more fire-tolerant *B. myrtifolia* Suballiance where undergrowth is sufficient to sustain fire.

A typical example is on Bull Creek, a tributary of Kunderang Brook in Werrikimbe National Park. Beneath emergent *Lophostemon confertus* is a canopy consisting mostly of *Backhousia myrtifolia, Geijera salicifolia* var. *latifolia* and *Olea paniculata* (Species List, Microfiche). Associated canopy species are *Dendrocnide excelsa* and occasional *Backhousia sciadophora.* The extreme dryness of the site is illustrated by the presence of typical gorge species such as *Acacia diphylla* in the sub-canopy, the shrub, *Nyssanthes diffusa,* and the grass, *Stipa ramosissima.* There is a typical assemblage of vines, but only six species of epiphytes which are mostly inconspicuous with thick, small leaves. Examples are *Dictymia, Pyrrosia confluens* and *P. rupestris.*

There is a similar rainforest along Threadneedle Creek, on the dry northern aspect in shallow, poor soils derived from greywacke and siltstone.

Further east, on the steep, stony slopes and in the dry gullies of Jinker Creek, on the southern side of Double Head, there is a similar community to that already described at Bull Creek. Additional canopy trees include *Syzygium australe* and *Tristaniopsis collina.*

MANNING RIVER

In the major valleys further south from the Macleay, this suballiance is reduced in extent and also in species diversity because it is confined to skeletal soils with solid rock at or near the surface. Such a limited occurrence is found above the two sets of falls at Rawson Falls on Boorganna Nature Reserve. The soil is derived from mudstone and shale with basaltic enrichment. The canopy above the upper falls on the steep, rocky slopes consists of *Lophostemon confertus* and *Tristaniopsis laurina* above minor

warm temperate rainforest species (Species List, Microfiche). The top of the lower falls, where conditions are drier, is dominated by *Backhousia myrtifolia*. The shrub layer consists of *Phebalium elatius, Alyxia* and *Helichrysum rufescens*. There are the typical herbs, but only three species of vines, all occurring infrequently. Epiphytes are well represented by 12 species, which is understandable given the humid microclimate above the waterfalls.

LOWER BARRINGTON

Midway upslope from the Wangat River, towards the Mountaineer on a dry northern aspect, there are sheets of fine-grained sedimentary rocks covered by shallow soil in places. On this seasonally-droughted site in a high rainfall zone, the vegetation is mainly *Backhousia myrtifolia* with *Trochocarpa* and an occasional *Syncarpia glomulifera*. Floristically, the site is very poor with only 12 species of trees. The shrub, herb and vine strata are of typical species, although the grape vine *Cissus* is not recorded. As at Rawson Falls, the microclimate favours epiphytes — 11 species are recorded. Some of these species, such as the filmy fern *(Hymenophyllum cupressiforme)* which is common here, require consistently high humidity levels. Hence the vegetation is adapted to an edaphic drought only.

Suballiance No. 30: *Backhousia myrtifolia-Acmena smithii*

South of the Hunter Valley, *Backhousia myrtifolia* has *Acmena smithii* as its major associated species. On the South Coast in particular, it is the broad-leaved form of *A. smithii* which replaces *Lophostemon confertus* and to a large extent *Tristaniopsis laurina* in the steep, narrow gullies on seasonally dry, poor soil. Such areas are subject to periodic wild fires. The hard, fissured bark of *B. myrtifolia* and its strong coppicing habit ensure survival. The *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis* spp. Suballiance on the North Coast occupies many sites of equivalent mean annual rainfall to those of this *B. myrtifolia-Acmena smithii* Suballiance on the Central and South Coast. There is, however, a significant difference in monthly distribution of rainfall. For example, Moruya and Grafton have a similar annual rainfall of 920 mm to 1 000 mm, but mean monthly rainfall in the spring is about 30 mm at Grafton and 67 mm at Moruya. As a result, areas further south have a seasonally uniform distribution of rainfall which means relatively drier, hotter and more fire-prone summers than those in the north.

The canopy of Suballiance No. 30 consists predominantly of *Backhousia myrtifolia*, and *Acmena smithii* is often the only other common species. In the sub-canopy, there may be 18 to 30 species of trees north of Sydney but only five to 12 species to the south, of which none are very abundant. Typical species are *Ficus coronata, Pittosporum undulatum, Claoxylon australe, Alectryon subcinereus, Hymenanthera dentata, Rapanea howittiana* and *Notelaea longifolia* forma *longifolia*. The shrub layer is fairly sparse with *Pittosporum revolutum* and *Solanum prinophyllum* representative of the six to 12 species recorded. The herb layer is highly variable, depending particularly upon the fire frequency. There are 22 to 23 species north of Sydney but only four to 17 to the south. *Doodia aspera* is the most common herb; other representative species are *Pellaea falcata, Asplenium flabellifolium, Oplismenus imbecillis, Lomandra longifolia, Urtica incisa, Stellaria flaccida* and *Plectranthus parviflorus*. Vines, too, are more diverse north of Sydney with 17 to 19 species, but only 10 to 12 species further south. With the exception of *Aphanopetalum resinosum*, species are mainly large, woody vines such as *Cissus antarctica, Parsonsia straminea, Marsdenia rostrata, Pandorea pandorana* and *Morinda jasminoides*. Epiphytes are represented by two to nine species. Although sites on the more fire-prone South Coast generally contain fewer species, a somewhat more moist site, such as Stony and Paddys Creeks on Wandella State Forest is actually as rich as the Watagan Mountains near Wyong.

This suballiance occurs in seven broad localities — Hunter and Capertee Rivers, Watagan and Blue Mountains, Batemans Bay, Deua and Tuross Rivers.

HUNTER RIVER

There are examples of the suballiance at several localities on the southern tributaries of the Hunter River, on sandstone alluvium.

At Appletree Creek and Woodlands Hill in Wollemi National Park, gorges formed by non-permanent streams contain sandy alluvium with basaltic enrichment. The rainforest microclimate has been assured by the large emergent *Casuarina cunninghamiana* beneath which is a canopy of *Backhousia myrtifolia* and *Acmena smithii* (Species List, Microfiche). There is also a stratum of small, spreading trees which includes *Notelaea microcarpa, Ficus rubiginosa, Pittosporum undulatum, Alectryon subcinereus* and *Diospyros australis.* Although the shrub layer contains 11 species, none are common. A diverse, typical herbaceous layer contains 22 species. Among 17 species of vines, *Cissus antarctica* and *Stephania japonica* are most common. Epiphytes are uncommon with only two species recorded. This is understandable in view of the intermittent nature of the streams and the low humidity in dry periods. Woodlands Hill is drier than Appletree Creek, consisting of fewer tree species (22 versus 29) and vines (11 versus 16).

One small tree of interest at Woodlands Hill is *Codonocarpus attenuatus,* which only occurs further south at Mt Wareng and Warrawolong Flora Reserve.

Further west in the Hunter Valley at Wollemi National Park, Myrtle Creek is obviously named after the dense, single-species canopy of *Backhousia myrtifolia* in the bottom of a gorge surrounded by very dry open forest of *Eucalyptus albens* and *Callitris endlicheri.* Among the 17 non-canopy species of trees are *Allocasuarina torulosa, Ficus coronata, F. rubiginosa, Bursaria spinosa, Euodia micrococca* and *Claoxylon australe.* The shrub layer is sparse with only *Trema aspera* being common among the seven species recorded. In addition to the typical herbs, *Adiantum aethiopicum and Bidens pilosa* are very common. Vines are uncommon with only eight species being recorded. Epiphytes are represented only by an occasional *Pyrrosia rupestris.* Myrtle Creek is probably intermittent, which would once again explain the lack of diversity in its vegetation.

Hayes Creek is further east than the areas previously described. It is south of Singleton in a steep gully on sandy alluvium possibly enriched by the basalt upstream at "California". The luxuriance of the vegetation suggests that the rainfall may possibly be higher than the other areas. Thirty-three tree species were recorded, a figure which exceeds all other examples of this suballiance. The unusually high diversity is due to the presence of several subtropical rainforest species such as *Daphnandra micrantha, Hymenosporum flavum* and *Euroschinus falcata.* In the well developed shrub layer, *Hibiscus heterophyllus* is the most abundant, and *Canthium odoratum* occurs at its southern limit. (Its nearest occurrence to the north is on Woko National Park, north-west of Gloucester.) The herbs are indicative of a moderately moist site, being mainly the ferns *Adiantum aethiopicum, A. formosum* and *Doodia aspera.* Vines are conspicuous, particularly the woody *Cissus antarctica,* but also wiry types such as *Clematis glycinoides* and *Rubus hillii.* Hayes Creek is the known southern limit of *Jasminum volubile.* Epiphytes are confined to an occasional inconspicuous *Pyrrosia rupestris.*

Emu Creek on Wollemi National Park differs from the previous sites in being a wide gorge which is interrupted by steep, vegetated slopes in places. It is both drier and more fire-prone, with low floristic diversity. Only seven tree species are recorded, including the typical species and also *Ceratopetalum apetalum.* The shrub layer is very sparse. Herbs are restricted to the moister creek bank and include *Adiantum formosum* and *Lastreopsis decomposita* as well as tough ferns such as *Blechnum cartilagineum* and *Doodia aspera.* Vines are poorly represented, and there are only two species of epiphytes and lithophytes.

The narrow slot canyons leading into this broad gorge from the north are in sharp contrast, with little sunlight penetrating between the overhanging cliffs. There is much seepage from the walls and a lush rainforest of the *Ceratopetalum-Acmena-Doryphora* Suballiance of the warm temperate rainforest, which has a dense shrub layer of tree ferns.

CAPERTEE RIVER

Downstream from Glen Davis, the Capertee River flows through a broad gorge before narrowing into the Colo River. The cliffs are of typical sandstone and shale, but there is one area with a moist, southern aspect on a thin basalt flow about one-third upslope. Emergent trees of *Toona australis* and *Acacia elata* occur on the better situations, with the typical *Backhousia* and *Acmena* canopy below and smaller *Ficus coronata* and *Hymenosporum flavum* along the gullies. On the steeper scree slopes, there is a viney scrub with stunted, sprawling *Ficus rubiginosa.*

WATAGAN MOUNTAINS

These mountains to the west and north-west of Wyong have a mean annual rainfall greater than that of the town, which has approximately 1 150 mm. The mountains can and do support warm temperate rainforest, but where the soil is shallow due to rock near the surface, there are also occurrences of dry rainforest of this suballiance on soils derived from claystone, sandstone and shale.

At Gap Creek Forest Preserve in Olney State Forest, there is an example of this suballiance well downstream from the falls where the rainforest adjoins frequently burnt, grassy, open forest. There are only 21 tree species present, and although *Backhousia myrtifolia* is the most common, the next three are all typical warm temperate or subtropical rainforest species — *Archontophoenix cunninghamiana, Callicoma serratifolia* and *Ceratopetalum apetalum.* It would appear that infrequent burning of the rainforest is favouring *Backhousia* at the expense of the other species. The only common shrub is *Cordyline stricta,* of the warm temperate rainforest. Of the seven species of herbs, only the ferns *Adiantum silvaticum* and *Blechnum cartilagineum* are common. The vines are not typical of this suballiance, and neither is the high recording of nine species of epiphytes.

By contrast, the Basin at Olney State Forest supports a particularly fine example of this suballiance on a drier northern aspect, with *Backhousia myrtifolia* estimated at a record height of 30 m. Of the 20 tree species, major canopy trees are *Backhousia myrtifolia* and *Acacia prominens* with *Trochocarpa laurina* in the sub-canopy (Species List, Microfiche). The shrubs, herbs and vines show excellent species diversity and abundance of the typical species. Epiphytes are particularly conspicuous, consisting of nine species including the ferns, *Hymenophyllum cupressiforme* and *Pyrrosia rupestris,* and the orchids, *Bulbophyllum crassulifolium, B. exiguum, Dendrobium speciosum* and *Plectorrhiza tridentata.*

At the Boarding House Dam on Watagan State Forest, the canopy is composed of *Backhousia myrtifolia, Allocasuarina torulosa, Ceratopetalum apetalum, Acacia elata, Acmena smithii, Syncarpia glomulifera* and *Tristaniopsis laurina.* Among the smaller trees are *Lomatia myricoides, Doryphora sassafras, Cryptocarya glaucescens* and *Trochocarpa laurina.* Thus, as at Gap Creek, there is a strong warm temperate rainforest component.

BLUE MOUNTAINS

At Bindook Chasm on Kanangra Boyd National Park, conditions favour rainforest development in that the soil is relatively fertile — derived from porphyry, dacite and

tuff — and the steep slopes are relatively well protected from fire. Rainfall is low, however, and soil is shallow on the steep scree slopes. All these features suit the species of Suballiance No. 30.

Along the main creek, there are tall *Casuarina cunninghamiana.* In the dry side gullies and on the slopes, there is mainly *Backhousia myrtifolia* showing horizontal growth in company with *Ficus coronata.* Other smaller tree species include *Acacia falciformis, Claoxylon australe, Alectryon subcinereus, Hymenanthera dentata, Rapanea howittiana* and *Notelaea longifolia* (Species List, Microfiche). The herb layer is diverse but scattered, consisting mainly of *Adiantum aethiopicum, Urtica incisa, Stellaria flaccida, Hydrocotyle geraniifolia* and *Sigesbeckia orientalis.* Vines are conspicuous, particularly those which are thick and woody. There is a typical assemblage of epiphytes and lithophytes.

BATEMANS BAY

One of the few small examples of the suballiance in the Batemans Bay area is at Musgrave Creek in Budawang National Park. It forms a fringe along the creek on the steep lower slope, on shallow, dry soil derived from sandstone, quartzite and conglomerate. The canopy is of *Backhousia myrtifolia* and *Schizomeria ovata* which grades into typical warm temperate rainforest of *Cryptocarya glaucescens, Doryphora sassafras* and *Callicoma serratifolia* on the deeper, moister soils. The only epiphyte recorded is *Platycerium bifurcatum,* and it is not common.

DEUA RIVER

A typical example occurs at The Burra, on freehold land in a dry creek tributary on the western side of the Deua River to the west of Moruya. There is shallow soil derived from rhyolite, dacite and basalt on the steep, stony slopes and in the gully bottoms. A wildfire burnt right through this rainforest in 1980, but the lignotubers and rough, thick bark have enabled the canopy species of *Backhousia* and *Acmena* to survive. There are only seven tree species recorded, of which *Pittosporum undulatum* is important in addition to *Backhousia myrtifolia* and *Acmena smithii* (Species List, Microfiche). Upslope of the rainforest is a dry scrub on the steep, dry, stony slopes beneath *Eucalyptus elata.* The scrub is perpetuated by regular fires to form a fire disclimax of *Acacia silvestris, Eriostemon trachyphyllus* up to 10 m tall and 12 cm diameter and the shrubby *Beyeria lasiocarpa.* The only common species in the sparse shrub layer of Suballiance No. 30 is *Notelaea venosa,* and *Doodia aspera* is the only very common herb. Photo 86 depicts this simple coppice forest with its minimal understorey following fires. Typical woody vines are conspicuous but *Cissus antarctica* is absent. Epiphytes are rare, probably as a result of fires which have simplified all strata in this rainforest. Further south on Dampier State Forest is a small strip preserved on Wamban Creek Forest Preserve.

TUROSS RIVER

On chert, slate and granite along the Tuross River and its tributaries west of Mt Dromedary, there are areas similar to The Burra. Welshs Road in Wandella State Forest is one of these (Species List, Microfiche).

At Bourkes Road in Wadbilliga National Park, there are only seven tree species including the dry scrub species, *Acacia silvestris* and *Eriostemon trachyphyllus.* The most common tree species on this particularly dry, stony site are *Pittosporum undulatum* and *Ficus rubiginosa,* although *Backhousia myrtifolia* and *Claoxylon australe* are also common. *Acmena smithii* is not recorded at this site. The shrub and herb layers consist of the typical species, as do the vines, although *Cissus* appears to be absent. There are four species of epiphytes, mainly *Sarcochilus olivaceus* and *Pyrrosia rupestris* with dense moss growth.

A further two areas, at Stony Creek and Paddys Creek Forest Preserve in Wandella State Forest are somewhat moister than the preceding sites because of their southerly aspect. Accordingly, they have escaped some of the fires. Upslope is dry scrub similar to what occurs on Welshs and Bourkes Roads. Below the scrub, rainforest approaches the warm temperate rainforest Suballiance No. 42 of *Acmena-Doryphora-Dendrocnide-Ficus* wherever there are improved soil conditions and reduced fire frequency.

There are only 10 tree species of Suballiance No. 30 at this southern locality, all of them typical of the suballiance. In addition to the typical shrubs, the tree ferns *Cyathea australis* and *Dicksonia antarctica* are common. The herb layer consists of other moisture-loving ferns such as *Lastreopsis acuminata, Blechnum patersonii* and *Diplazium australe.* Similarly, the epiphytic ferns are well represented. *Polyphlebium venosum, Hymenophyllum cupressiforme* and *Tmesipteris parva* are common on the trunks of the tree ferns, as is the flowering plant, *Fieldia australis.* This site illustrates the interraction between moister locations, fewer fires and greater development of the vegetation, particularly in such a fire-prone area as the South Coast.

MICROPHYLL VINE THICKET

On marginal rainforest sites such as those in the Guy Fawkes-Macleay Gorges and on basalt remnants on the western slopes, there are communities whose low height strictly precludes their classification as forest. Instead, they are assigned to microphyll vine thicket or closed scrub. However, because these are structurally and floristically related to taller rainforest suballiances, they have been included here. Two suballiances can be recognized in New South Wales:

31. *Alectryon forsythii-A. subdentatus-Notelaea microcarpa*

32. *Notelaea microcarpa-Ehretia membranifolia-Geijera parviflora*

Suballiance No. 31: *Alectryon forsythii-A. subdentatus-Notelaea microcarpa*

On areas of greater soil depth and moisture, this suballiance merges into Suballiance No. 28: *Backhousia sciadophora-Dendrocnide-Drypetes,* with trees 10–15 m tall. However, Suballiance No. 31 in the Guy Fawkes and Macleay Gorges ranges in height down to 2.5–4 m, where it may be called a microphyll vine thicket (Webb 1978), closed scrub (Specht 1974) or microphyll mossy thicket (King 1980). The latter author also recognizes a low microphyll mossy vine forest in the Macleay Gorges which is the *Backhousia sciadophora-Dendrocnide-Drypetes* Suballiance No. 28. The use of the adjective "mossy" is supported by the predominance of this life form.

In the Macleay Gorges, King (loc. cit.) recorded 706 stands totalling 4 900 ha of these two suballiances. More than 60% of the rainforest is on slopes of 21–40 degrees, with the best development in height, floristics and epiphytic luxuriance at 31–35 degrees, which is the limit for soil stability but allows maximum availability of ground water along the fracture planes of the metamorphic greywacke, slate and phyllite rocks (Photo 87).

Rainfall is generally minimal for rainforest, grading from 800 mm annually at Apsley and Gara Rivers gorges with a mean of 56 mm for each of the dry spring months to Guy Fawkes River with 890 mm and only 40 mm for each of the driest months. Rainfall distribution is markedly seasonal, with a summer maximum due to the moist, warm east to south-east winds and a winter minimum resulting from the dry westerlies. King (loc. cit.) observed that mists are a common feature towards the top of the gorges in winter, and that fog drip may significantly increase the total moisture received by the rainforests and thickets on these upper slopes. This would

be particularly beneficial to the epiphytic mosses, ferns and orchids. However, the best height development of the rainforest is on the mid slopes, where King (loc. cit.) found that the winter air temperatures are higher than those near the rim.

These gorges represent niches in a hostile environment — protected from fires and desiccating winter westerly winds, with increased availability of ground water and prevalence of fogs on the upper slopes.

The three major occurrences of this suballiance are at Guy Fawkes River, Wollombi-Chandler Rivers and Apsley-Tia Gorges.

Floristically, these sites contain 59 small tree-tall shrub species, the most common being *Notelaea microcarpa* var. *velutina, Alectryon forsythii, Geijera salicifolia* var. *salicifolia* and *Diospyros australis*. The small shrub layer contains a total of 40 species of which only *Deeringia amaranthoides, Nyssanthes diffusa* and *Breynia oblongifolia* are common to all areas. The herb layer of 31 species is sparse, with *Pellaea falcata, Stipa ramosissima* and *Plectranthus graveolens* being most common. Of 38 species of vines, the most common are *Aphanopetalum resinosum, Celastrus australis, Jasminum volubile* and *Pandorea pandorana,* while the family Vitaceae is represented by five species, Apocynaceae by four and Asclepiadaceae by six species. Epiphytes and parasites are diverse, with 23 species of which seven are ferns and 12 orchids. The most common are *Pyrrosia confluens, P. rupestris, Dendrobium cucumerinum* and *D. speciosum.*

A number of species found mainly on the western slopes of New South Wales occur also in these gorges. A western connection, and possibly an expansion towards the coast during a previous arid cycle, is indicated. Typical examples are small trees and tall shrubs such as *Callitris endlicheri, Hovea lanceolata, Brachychiton populneus* and *Notelaea microcarpa.* The small shrubs include *Rhagodia parabolica, Beyeria viscosa, Pimelea neoanglica, Sarcostemma australe, Goodenia grandiflora* and *Cassinia laevis.* The herb, *Zygophyllum apiculatum,* and the vine, *Parsonsia lanceolata,* also occur.

As discussed in the context of the origin of dry rainforest (Vol. 1), the gorges are a most important phytogeographical unit, representing at one time a north–south corridor during moister cycles and a refuge in periods of aridity for many rainforest elements. Some species currently exhibit great disjunctions (Fig. 6, Vol. 1), such as *Cryptocarya floydii* (Macleay Gorges-Guy Fawkes-Glenugie Peak-Mt Dumaresq-Bunya Mountains), *Acacia diphylla* or *A. blakei* of Pedley (Gloucester-lower Wilson River-Willi Willi-Macleay Gorges-Guy Fawkes-Nymboida River-Tenterfield-South-east Queensland), *Geijera salicifolia* var. *salicifolia* (Upper Hunter-Macleay Gorges-Guy Fawkes-Darling Downs-Rockhampton), *Notelaea microcarpa* var. *velutina* (Apsley-Macleay Gorges-Guy Fawkes-Clarence Valley-Warwick) and *Hakea fraseri* (Apsley Gorge and Darling Downs). In most cases, there is a closely related and more widely distributed species or variety beyond the Macleay Gorges-Guy Fawkes area, namely *Cryptocarya bidwillii, Acacia blakei, Geijera salicifolia* var. *latifolia* and *Notelaea microcarpa* var. *microcarpa.* Clearly, species have been isolated in these gorges and other areas for a lengthy period. In addition, there are examples of species only found in some refuges, such as *Acacia ingramii* (Macleay Gorges only) and *Alectryon forsythii* (Nundle-Macleay Gorges-Guy Fawkes) as shown in Fig. 7, Vol. 1. These further emphasize the long period of isolation.

GUY FAWKES RIVER NATIONAL PARK

There are four significant areas of this rainforest, all with protected easterly aspects and on steep and stony but not precipitous slopes as in the Wollomombi, Chandler and Apsley Gorges. The tree and tall shrub cover is dense, with deceptively uniform, xeromorphic, small, thick leaves. (It is quite likely that the reason for the non-recording of *Cryptocarya floydii* in these areas until recently was its uncanny resemblance in bark, branching and leaves to the quite unrelated *Diospyros australis*).

At a small area on Housewater Creek, the most common canopy species are *Alectryon subdentatus, Streblus, Drypetes australasica* and *Mallotus philippensis.* There are 32 tree and tall shrub species recorded, fewer than in larger rainforest patches such as Bees Nest and Big Scrub Creek, where there are 52 species. Except for *Nyssanthes diffusa,* small shrubs and herbs are not common. There is a high diversity of vines (14 species), of which the grapes, *Cissus antarctica* and *Tetrastigma nitens,* are very common in addition to the typical vines listed previously. Epiphytes are represented by only two ferns, with *Pyrrosia confluens* very common, and six orchids, with *Sarcochilus australis* and *S. hillii* also very common.

The larger areas at Bees Nest and Big Scrub Creek have a sharp boundary, often where topography becomes very steep. The distinct borderline is maintained by repeated fires in the adjoining open forest.

Species diversity is greater in the Guy Fawkes River area than in the Macleay-Apsley Gorges, probably because of the deeper soil and increased soil moisture on the less precipitous Guy Fawkes slopes. There are many species from the dry rainforest *Backhousia sciadophora-Dendrocnide-Drypetes* Suballiance No. 28 to which Suballiance No. 31 is clearly related.

Among commonly occurring trees and tall shrubs at Bees Nest and Big Scrub Creek are many which are either absent or of rare occurrence in the Macleay Gorges system. Examples are *Dendrocnide excelsa, Geijera salicifolia* var. *latifolia, Sarcomelicope simplicifolia, Baloghia inophylla, Alchornea ilicifolia, Drypetes australasica, Alectryon subcinereus, Austromyrtus bidwillii, Backhousia myrtifolia, Alyxia ruscifolia* and *Clerodendrum floribundum* (Species List, Microfiche). Indeed, all the most common vines are in this category — *Cissus antarctica, Tetrastigma nitens, Marsdenia flavescens* and *Secamone elliptica* (at its southern limit which was previously considered to be Glenugie Peak). Similarly, the four most common species of epiphytes in the Guy Fawkes River area are all ferns and are all of little importance in the Macleay. They are *Asplenium flabellifolium, Dictymia brownii, Platycerium bifurcatum* and *Pyrrosia confluens.* The important horticultural and timber tree, *Grevillea robusta,* reaches its southern limit in the Guy Fawkes Valley.

Even if these species are disregarded, the Guy Fawkes still contains 41 tree and large shrub species with *Notelaea microcarpa* var. *velutina* and *Alectryon subdentatus* being common, a typical assemblage of small shrubs and herbs, 17 species of vines and 15 species of epiphytes. On the other hand, there are common xeromorphic species from the Macleay Gorges which have only minor representation in the Guy Fawkes. These include *Acacia diphylla, Alectryon forsythii, Geijera salicifolia* var. *salicifolia* and *Olea paniculata.* In addition, there are other typical, smaller species which have not been recorded at all from the Guy Fawkes, such as *Solanum stelligerum, Olearia canescens, Stipa ramosissima, Rhagodia nutans, Diplocyclos palmatus* and *Sicyos australis.*

These dissimilarities between the two gorge systems require an explanation. It is unlikely that these gorge species could have occupied the intervening, undulating tableland area in the last few million years. Bird and wind dispersal would be necessary to span the 30 km from Guy Fawkes River National Park to Wollomombi Falls. Bird dispersal would probably require the larger fruit-eating birds such as pigeons and currawongs, and these could well account for the very occasional large-fruited *Alectryon forsythii, Cryptocarya floydii, Geijeri salicifolia* var. *salicifolia* and *Olea paniculata* migrating north-east. Smaller birds could find such a crossing very hazardous, and the smaller juicy-fruited species would be less likely to be transported. Wind dispersal would tend to be due to updraughts in the gorges which would carry the seeds further inland rather than north-east. There is, however, the possibility that some of the tiny

rainforest-vine thickets further upstream on the Guy Fawkes River where there are precipitous slopes similar to those in the Macleay Gorges may contain populations of these species. Dispersal by smaller birds could have occurred by island hopping using these thickets as protection.

WOLLOMOMBI FALLS-CHANDLER GORGE

The actively eroding eastern rim of the uplifted New England tableland consists of a series of deep gorges terminating in spectacular waterfalls where quiet tableland streams are suddenly transformed into plunging, rushing, gouging white water. This remarkable transformation extends from the Wollomombi-Chandler Rivers in the north to the Apsley and Tia Rivers in the south. This gorge system has been dedicated as the Oxley Wild Rivers National Park. Bakers Creek and Dangar Falls are two intermediate popular scenic areas. The vertical or near-vertical gorge walls are attributed to the erosion of the slates along their vertical cleavage planes, causing sheets of slate to fall or slip into the gorge and shatter to form loose scree slopes near their critical angle of rest.

On the rims of the gorges are two eucalypts of quite restricted distribution, Hillgrove box (*E.* sp. aff. *cypellocarpa*) and northern brittle or Hillgrove gum (*E. michaeliana*). Although the gorge sides are mainly composed of rock and scree, there is some persistent shallow buildup of soil between the rocks where heath may develop. There are many interesting and restricted species here. *Acacia ingramii* is confined to the gorges of Chaelundi Bluff, Oaky, Chandler, Wollomombi, Gara and Dangar Falls. Also restricted to these gorges are *Baeckea* sp. aff. *virgata*, *Phebalium squamulosum* var. *verrucosum* and *Leucopogon* sp. aff. *fraseri*. Other plants appear to have their centre of distribution in these gorges but also occur to the north and south. Examples are *Acacia diphylla* from the Nymboida to Manning Rivers, *Alectryon forsythii* from Guy Fawkes to Nundle, *Westringia glabra* from Northern Tablelands to Wimmera in Victoria, *Olearia canescens* from South-east Queensland to Northern Tablelands and *Cassinia laevis* from Northern Tablelands to Western New South Wales (Figs 6 and 7, Vol. 1).

On the more sheltered sites with increasing accumulation of soil and soil moisture, pockets of vine thicket may develop. They are dominated by *Alectryon forsythii*, *Notelaea microcarpa* var. *velutina*, *Geijera salicifolia* var. *salicifolia* (with distinctive grey-green, narrow leaves), *Diospyros australis* and *Olea paniculata* (Species List, Microfiche).

Among the other 34 species of trees and tall shrubs recorded at Wollomombi Falls-Chandler Gorge, *Acacia diphylla*, *Streblus*, *Rhodosphaera rhodanthema* and *Dodonaea viscosa* are also common. There is a great diversity of small shrubs, totalling 35 species but including the heath vegetation discussed earlier. The most common species are *Solanum stelligerum*, *Deeringia amaranthoides*, *Gonocarpus teucrioides* and *Olearia canescens*. The 25 species of herbs include those typical of this suballiance, as do the 32 species of vines which also include the cucurbits *Diplocyclos palmatus* and *Sicyos australis*. The epiphytes, too, are well represented; among the 16 species, *Dendrobium cucumerimum* and *D. linguiforme* on the hard, corky bark of *Notelaea microcarpa* are particularly conspicuous.

APSLEY GORGE

In the southern portion of the Macleay catchment are the Apsley and Tia Gorges, which have very dry, precipitous or steep scree slopes with a consequent reduction in species diversity. There are only 12 recorded species of small trees and tall shrubs, and these include several species of the drier western slopes such as *Callitris endlicheri*

and *Brachychiton populneus* (Species List, Microfiche). The rather low canopy consists of *Alectryon forsythii, Notelaea microcarpa* var. *velutina* and *Geijera salicifolia*. The most common of the 11 species of small shrubs are *Deeringia amaranthoides, Bursaria spinosa, Indigofera australis* and *Olearia canescens*. The herbs (six species) and vines (eight species) are typical for this suballiance. Epiphytes are uncommon and restricted to three species of orchids in addition to two species of mistletoes. The shrub, *Hakea fraseri,* is only recorded from the Apsley and Tia Falls and then further north on the Darling Downs.

Suballiance No. 32: *Notelaea microcarpa-Ehretia membranifolia-Geijera parviflora*

This suballiance may be classified structurally as semi-evergreen vine thicket (Webb 1978), or more commonly by land managers in Southern Queensland as "softwood scrub" or "bottle tree scrub". The bottle trees (*Brachychiton rupestris* and *B. australis*) do not occur in New South Wales. In the latter state, this vegetation type may be known as "ooline scrub" or "western black plum scrub", depending upon whether *Cadellia pentastylis* or *Planchonella cotinifolia* var. *pubescens* predominates. There are, however, other examples where *Notelaea microcarpa* predominates, as at Mt Dangar.

The mean annual rainfall is lower than the accepted level for rainforest in New South Wales, ranging from 575 mm at Mt Dangar near Sandy Hollow and Terry Hie Hie near Moree to 650 mm at Planchonella Hill between Warialda and Yetman. The mean monthly rainfall for the critical dry spring months is only 33–40 mm. Vegetation at these sites exhibits various water-conserving adaptations such as thick, small leaves and the ability to shed leaves during prolonged dry periods.

This suballiance is usually found on rocky sites, particularly on basalt but sometimes on sandstone as at Terry Hie Hie. The low fuel levels confer a measure of protection against wildfire.

In New South Wales, the suballiance occurs in the dry upper Hunter Valley at Mt Dangar and Glenbawn Dam as well as along the Western Slopes from the Liverpool Range and north through Moree. It extends to at least Toowoomba and Rolleston in Central Queensland.

Floristically, Suballiance No. 32 may vary greatly between sites. Generally, there is a sparse and variable canopy of emergent trees such as *Eucalyptus albens, E. melanophloia, E. pilligaensis, E. populnea, Callitris glaucophylla, Acacia harpophylla, Casuarina cristata* and *Brachychiton populneus*. There is a dense understorey of small trees and tall shrubs 2–10 m tall consisting of any of the following: *Planchonella cotinifolia* var. *pubescens, Cassine australis* var. *angustifolia, Cadellia pentastylis, Ehretia membranifolia, Geijera parviflora, Alectryon oleifolius, Alphitonia excelsa, Notelaea microcarpa* var. *microcarpa* and *Capparis mitchellii*. Below these species is a stratum of shrubs up to 2 m tall, including some species from the dry sclerophyll forest or woodland (*Maireana microphylla* and *Dodonaea viscosa*) and others derived from the dry rainforest (*Carissa ovata, Abutilon oxycarpum, Spartothamnella juncea, Citriobatus spinescens* and *Croton phebalioides*). There is a sparse herb layer of grasses such as *Aristida caputmedusae* and *Stipa ramosissima* in addition to *Boerhavia diffusa*. Of the 15 species of vines, *Gymnema dunnii* is the most common followed by *Parsonsia eucalyptophylla*. Epiphytes are restricted to an infrequent *Cymbidium canaliculatum* and several parasitic mistletoes.

WARIALDA-YETMAN

The most northern occurrences of the suballiance in New South Wales are in the Warialda-Yetman area, where a survey was conducted by G. Holmes in 1979.

Although he identified four significant areas of this suballiance, three of them had been cleared by their owners for wheat by 1983. The one remaining area is Planchonella Hill at Yallaroi, 48 km north of Warialda. This is the only undisturbed site of *Planchonella cotinifolia* var. *pubescens* in New South Wales. There are 440 ha of this vine thicket on leasehold land surrounded by wheat and occupying a low, residual basalt hill. It consists of a dense shrubby understorey in a woodland of *Eucalyptus albens* and *E. melanophloia.* The 28 species of small trees and tall shrubs include *Planchonella cotinifolia* var. *pubescens, Notelaea microcarpa, Ehretia membranifolia, Geijera parviflora, Cassine australis, Dodonaea viscosa, Citriobatus spinescens* and *Capparis mitchellii* (Species List, Microfiche). Of the 19 species of small shrubs, the most common are *Carissa ovata, Olearia elliptica, Beyeria viscosa, Croton phebalioides* and *Cassinia laevis.* Practically all of these genera have allied species in the dry rainforest on the North Coast, indicating a common origin and subsequent retreat from a much more widespread distribution due to advancing aridity. The 12 species of herbs include the typical species listed previously, as do the eight species of vines and six species of epiphytes.

TERRY HIE HIE

At Terry Hie Hie on a Travelling Stock Route 48 km south-east of Moree, there is a good example of ooline scrub on soil derived from sandstone. This community type also occurs on Deriah State Forest, east of Narrabri and in Queensland north of Injune. It consists of an overstorey woodland of *Eucalyptus pilligaensis, E. albens, E. populnea* and *Casuarina cristata* beneath which is a dense thicket of 14 species of small trees and tall shrubs (Species List, Microfiche). The most common species is *Cadellia pentastylis,* with which is associated *Notelaea microcarpa, Alectryon oleifolius* and *Geijera parviflora.* The shrub layer consists of small, thick-leaved plants with affinities to the more coastal rainforests *(Carissa ovata),* the dry western woodlands (*Cassia eremophila, Dodonaea cuneata, Solanum ellipticum*) and the saltbush plains , (*Maireana microphylla, Sclerolaena birchii, S. muricata* var. *villosa*). Herbs are sparse, and of the six species recorded, three are grasses. Of the three vines, only *Parsonsia eucalyptophylla* is not uncommon. Epiphytes are understandably uncommon and are represented by *Cymbidium canaliculatum* and a common mistletoe, *Lysiana subfalcata.*

MT DANGAR

In the Hunter Valley to the south, on the dry, eastern slopes of Mt Dangar at Goulburn River National Park, near Sandy Hollow, there is a remnant of this sub-alliance. Although uninteresting aesthetically, it is of considerable importance botanically. Both this site and that on the northern side of the valley and 52 km to the north-east at Glenbawn Dam represent an incursion of the flora of the western slopes on to the coastal side of the Great Dividing Range. The migration probably occurred during a previous arid period. With the return of wetter conditions, only these two small areas on particularly dry, fire-free sites have persisted where the moister rainforest suballiances cannot survive.

Mt Dangar is the most eastern and southern occurrence known of *Alectryon oleifolius, Abutilon tubulosum* and *Sida corrugata.* In addition, it is the known southern limit of the coastal dry rainforest vines, *Cissus opaca* and *Gymnema dunnii.* This vine thicket owes its existence to location at the base of the basalt cliffs, where they rest upon the older sandstone and conglomerate. The soil is enriched by the basalt above, although immediately downslope, there is only sand which supports a forest of *Callitris endlicheri.* In addition, there could be seepage from the basalt. The small tree-tall shrub layer consists mainly of coastal rainforest affiliates such as *Ficus rubiginosa, Bursaria spinosa, Hymenanthera dentata* with occasional *Melia azedarach* and *Alphitonia excelsa* (Species List, Microfiche). The vine thickets of the western slopes of New South

Wales are represented here by *Notelaea microcarpa* var. *microcarpa* as the most common species, *Geijera parviflora, Alectryon oleifolius* and *Brachychiton populneus.* There is a well-developed small shrub layer of coastal species such as *Nyssanthes diffusa, Abutilon exycarpum* and *Spartothemnella juncea* but there are also western species including *Abutilon tubulosum* and *Sida corrugata.* The herbs are typical of the coast, being mainly *Adiantum aethiopicum, Pellaea falcata* and *Plectranthus parviflorus.* Vines are very common with eight species, of which *Cayratia clematidea* and *Gymnema dunnii* are most common. Also common are *Cissus hypoglauca* and *Pandorea pandorana.* The only epiphyte sighted was a single specimen of *Dendrobium speciosum.*

CHAPTER 3

Warm Temperate Rainforest

This rainforest contains fewer species than the subtropical and dry rainforests. Three to 15 tree species are commonly present, forming a more uniform canopy of only two strata than the rainforests already discussed. The leaves are mostly simple, many being toothed and ranging up to 12.5 cm long. The warm temperate rainforest occurs in cool, moist areas which favour lichens rather than large epiphytic ferns and orchids. Ground ferns are well developed. Tropical features such as stranglers, palms, plank buttresses and woody vines are rare or absent.

In New South Wales, this rainforest subformation is represented by three floristic alliances — *Ceratopetalum apetalum, Acmena smithii* and *Doryphora* as determined by temperature, soil fertility and fire. These alliances can be further subdivided into 14 suballiances (Fig. 13).

Ceratopetalum apetalum Alliance

This alliance occurs in the north, on the cool, moist slopes of the Mt Warning shield volcano's less fertile rhyolite flows. Just over the border in Lamington National Park, at Daves Creek and Lightning Falls, the alliance is sandwiched between subtropical rainforests on basalt. A similar occurrence is found on the southern flanks known as the Nightcap Range and on the equivalent rocks (syenite) halfway up the central volcanic core of the mountain itself. It is also present on the older Chillingham Volcanics which form a narrow band in the floor of the Tweed Valley, running north–south. To the west, along the Macpherson Range where influenced by the slightly better soils from the Mt Barney series of rhyolite lavas, *Ceratopetalum* is replaced by *Schizomeria* as on Levers Plateau, Mt Glennie, and the southern slopes of Mt Lindesay. This sensitivity of these two species to the rock type and its derived soil is well illustrated on the granites south-east of Tenterfield. Warm temperate rainforest dominated by *Ceratopetalum* occurs on the poorer soils derived from adamellite, whereas *Schizomeria* is on the slightly richer soils from the adamellite porphyrite.

In Washpool National Park 30 km to the south-east, the Willowie Scrub (also on adamellite) consists of 3 000 ha of undisturbed *Ceratopetalum* rainforest. It is the largest such area in Australia. Other significant areas, much of which have been logged, occur on Cangi State Forest, Mt Hyland, the eastern Dorrigo, Styx River State Forest, Carrai Plateau and the headwaters of the Hastings River west of Port Macquarie. The soils are derived from either metamorphic or granite rocks. In the Dorrigo area *Araucaria cunninghamia* often overtops the main canopy, as do native pines in structurally similar forests in North Queensland and New Guinea.

At Barrington Tops, *Ceratopetalum* is confined to the poorer soils derived from sandstone as on Chichester State Forest. The somewhat more fertile mudstones with basaltic enrichment from upslope support *Schizomeria, Caldcluvia* and *Orites.*

South of the Hunter River, the *Ceratopetalum* Alliance occurs on the moister southern sides of the higher mountains, as on Mounts Monundilla and Coricudgy, or deep in the slot canyons on sandstone and shale. The exposed sandstone plateau with its frequent fires effectively restricts the rainforest to these refuges. In the Blue Mountains, the alliance occurs in the gully heads of the gorges with a moist, south to east aspect, such as those beneath Horseshoe Falls at Govetts Leap and at Wentworth Falls. It also occupies a similar niche along the Illawarra escarpment, often on the shales below the sandstones. South from the Hunter River to the southern limit of *Ceratopetalum apetalum* at Currowan Creek near Batemans Bay, there is a change in the major associated canopy trees; *Acmena smithii* and *Doryphora sassafras* replace *Schizomeria, Caldcluvia* and *Orites.*

Six suballiances are recognized within the *Ceratopetalum apetalum* Alliance as determined by soil fertility, temperature and latitudinal sifting (Fig. 13).

33. *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea*
34. *Ceratopetalum-Diploglottis-Acmena*
35. *Ceratopetalum/Schizomeria-Caldcluvia*
36. *Ceratopetalum-Doryphora*
37. *Ceratopetalum/Schizomeria-Acmena-Doryphora*
38. *Ceratopetalum-Eucryphia-Doryphora-Acmena*

Suballiance No. 33: *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea*

This community is intermediate between the subtropical rainforest suballiances of *Argyrodendron trifoliolatum* (Suballiance No. 1) and *Sloanea woollsii-Dysoxylum fraserianum-Argyrodendron actinophyllum-Caldcluvia* (Suballiance No. 12) and those of the warm temperate rainforest, *Ceratopetalum/Schizomeria-Caldcluvia* (Suballiance No. 35). Because there is a complete series of intergradations from communities which are predominantly subtropical to those which are predominantly warm temperate in floristic composition, Suballiance No. 33 could either be discussed under the heading of warm temperate rainforest within the *Ceratopetalum apetalum* Alliance as has been done here, or under subtropical rainforest such as the Booyong-Coachwood forest type of Baur (1965). The author considers that emphasis should be placed on its interconnecting nature rather than its precise location in a rigid system of classification.

The "gully rainforests" of the North Coast are referable to this suballiance and have been aptly described by Baur (1965) as "The sheltered localities with moist soils enriched by alluvium are generally sub-optimal for the development of more typical Subtropical Rainforest, but somewhat better than those where Warm Temperate Rainforest normally occurs in the region, resulting in a merging of species from both leagues."

In these gullies, the canopy will consist of an intimate mixture of the two elements, but there are other situations where each may occupy or dominate a particular stratum in the forest.

For example, in the Middle Creek Flora Reserve on Marengo State Forest, there is an overstorey of subtropical rainforest such as *Sloanea woollsii-Dysoxylum fraserianum-*

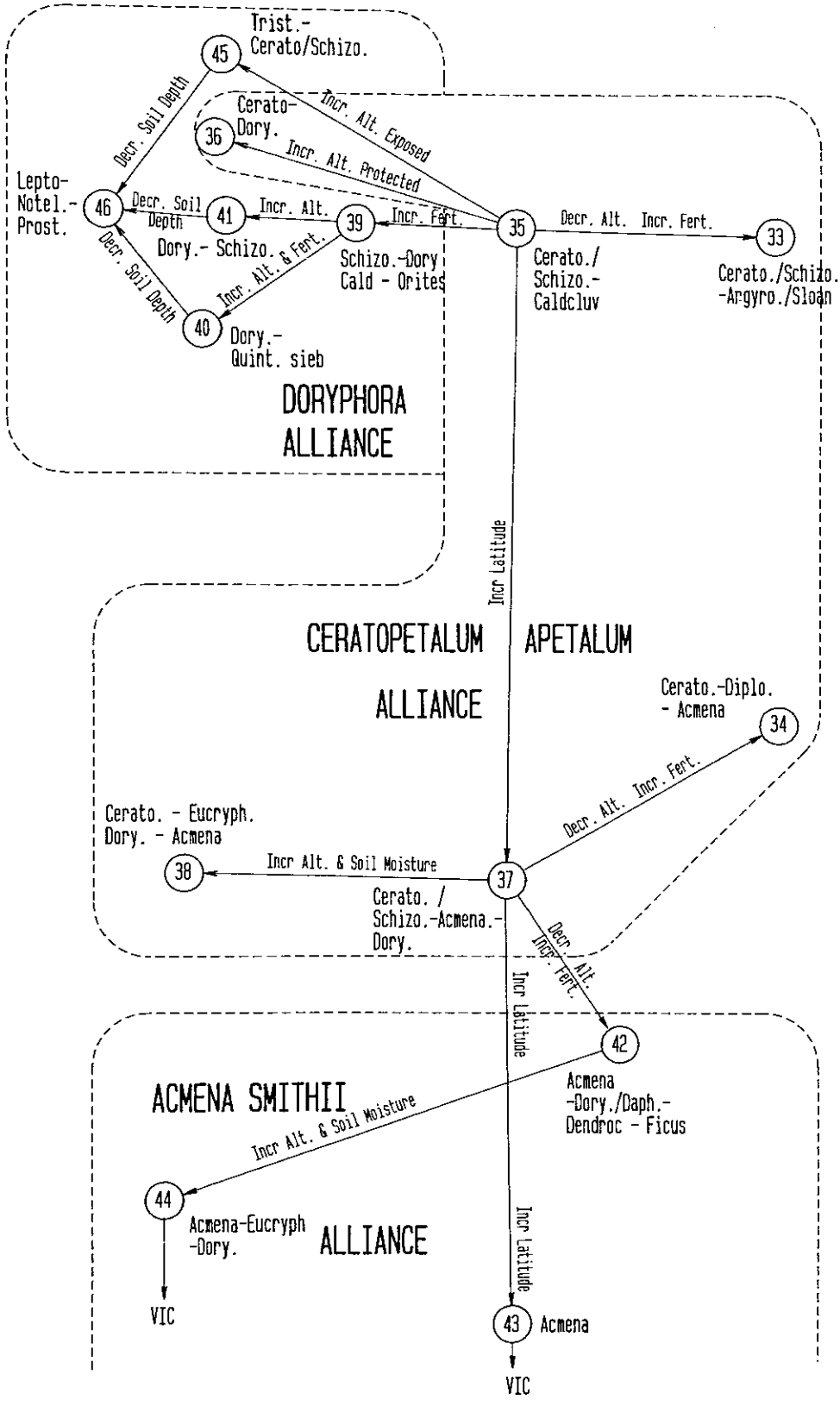


Fig. 13. Floristic classification of warm temperate rainforest.

Argyrodendron actinophyllum-Caldcluvia (Suballiance No. 12). The well-developed medium tree layer is of warm temperate rainforest such as *Ceratopetalum apetalum, Doryphora sassafras* and *Orites excelsa* (Suballiance No. 36) which also constitutes most of the regeneration. It would be expected that the subtropical rainforest overstorey will be progressively replaced by the well developed, warm temperate rainforest lower canopy. Increasingly unfavourable climatic conditions could possibly be the cause of the replacement of the subtropical rainforest. However, there is a more stable situation nearby in Opossum Creek, where subtropical rainforest occurs only in the very sheltered gully heads but elsewhere forms an understorey to the well developed warm temperate rainforest of the *Ceratopetalum-Doryphora* Suballiance No. 36. The subtropical rainforest component appears to be able to persist only if sheltered by the warm temperate rainforest canopy. Both these examples of admixture are included under this Suballiance No. 33 although their floristic stratifications are quite different.

This suballiance contains four threads of floristic gradation representing the various combinations of the four major species.

(1) *Ceratopetalum apetalum-Argyrodendron* spp.

These species are generally at the lower altitudes north of Taree on alluvial or colluvial soils mainly derived from metasediments, granite or sandstone with occasional enrichment.

COFFS HARBOUR

At Woolgoolga Creek and Wonga Wanga Flora Reserves in the Coffs Harbour area, *Ceratopetalum* is common but *Schizomeria* is only occasional to rare. Both *Argyrodendron actinophyllum* and *A. trifoliolatum* are well represented but *Sloanea woollsii* is only occasional. At Wonga Wanga Flora Reserve, there is a very large tree of *Gmelina leichhardtii* measured at 1.69 m diameter and 42 m height.

MACLEAY-CAMDEN HAVEN

Further south in the Macleay to Camden Haven Rivers area, *Argyrodendron actinophyllum* alone is present with *Ceratopetalum.* Once again, *Schizomeria* and *Sloanea woollsii* occupy a minor role. Double Head at Carrai is too dry and exposed for well-developed subtropical rainforest, but the site is adequate for hardy species such as *Argyrodendron.* Because of the high altitude of 675–975 m, *Doryphora* is very common. The soil at this site is derived from mudstone and sandstone, but at Jacobs Mount just to the north at the same altitude, it is probably enriched by limestone strata. Rainforest there is predominantly sub-tropical, with no *Ceratopetalum.*

Daisy Patch Flora Reserve on Enfield State Forest is also at a relatively high altitude, but on a steep sheltered, southern aspect where the metasediments receive some enrichment from the basalt above to form a rather shallow soil. Once again, *Argyrodendron* and *Ceratopetalum* are the more common species.

At low altitudes such as Pappinbarra Field Studies Centre and Black Creek Flora Reserve, where there is some enrichment by porphyry and micro-granite respectively, these two species are most common while *Schizomeria, Doryphora* and *Sloanea woollsii* are uncommon.

(2) *Schizomeria ovata-Argyrodendron actinophyllum*

The two situations where *Schizomeria* will replace *Ceratopetalum* are where soil fertility is increased and where there is a history of infrequent fires. These factors will be discussed in greater detail under Suballiance No. 35: *Ceratopetalum/Schizomeria-Caldcluvia.*

Along the alluvial flats of Averys Creek at Twelve Sixty Flora Reserve, where the sandstone has been enriched by basalt, *Schizomeria* is common with *Daphnandra micrantha,* while *Argyrodendron* is occasional. The soil fertility would appear to be too high for *Ceratopetalum.*

However, on Weelah Nature Reserve, where the soil is derived from non-enriched mudstone and conglomerate, the same common species are found. In this case, periodic fires may favour the rough-barked, dormant-seeded *Schizomeria* over *Ceratopetalum* (Species List, Microfiche).

(3) *Ceratopetalum apetalum-Sloanea woollsii*

This is the most common species combination extending from the Queensland border to Taree and from sea level to 1 000 m altitude.

RICHMOND-TWEED

There are four typical areas in the Richmond-Tweed. Because of their geographical location and mixed nature, they are among the most floristically diverse rainforests in New South Wales.

Hogans Scrub Wildlife Refuge on the lower Tweed contains the state record of 136 species of trees (Species List, Microfiche). Curiously, both *Ceratopetalum* and *Schizomeria* do not occur on these basaltically enriched metasediments. However, the site contains many *Ceratopetalum* associates such as *Cryptocarya glaucescens, Anopterus macleayanus, Doryphora sassafras, Helicia ferruginea, Canarium australasicum* and most importantly, *Corokia whiteana* which is otherwise endemic to the Nightcap Range on the southern flanks of the Mt Warning shield volcano. The subtropical rainforest component includes *Sloanea woollsii, Argyrodendron trifoliolatum, Syzygium moorei, Flindersia bennettiana* and *Castanospermum australe.*

Further upstream on the Tweed River near Chillingham is the interesting area of lower Couchy Creek. It is situated on the rhyolite of the Chillingham Volcanics but with basaltic enrichment on the alluvial flats. The warm temperate rainforest components include *Ceratopetalum, Callicoma* and *Tristaniopsis laurina,* and the subtropical element consists of *Toona australis, Diploglottis australis* and *Sloanea woollsii* with no *Argyrodendron.*

Along Christies Creek on Mooball State Forest, there are 118 tree species present. Warm temperate rainforest species such as *Ceratopetalum apetalum* and *Canarium australasicum* are common on the metasediments of the lower slopes, but sub-tropical rainforest elements — *Pseudoweinmannia lachnocarpa, Syzygium hodgkinsoniae, S. moorei* and *Sloanea woollsii* — occur in the narrow gullies.

At Wanganui on upper Coopers Creek in the Richmond Valley as well as at Terania Creek, Tuntable and Minyon Falls, there are rhyolite cliffs above the basalt on the valley floor. The resultant soil of intermediate fertility supports this suballiance of *Ceratopetalum* with some *Schizomeria* and *Canarium* mixed in varying frequencies with *Sloanea woollsii, Toona, Dysoxylum muelleri, Syzygium crebrinerve* and *Argyrodendron trifoliolatum.* Although at these sites, it is certainly possible to recognize various suballiances such as *Argyrodendron trifoliolatum* (No. 1), *Toona-Flindersia* (No. 2), *Elaeocarpus grandis* (No. 4), *Archontophoenix-Livistona* (No. 6) and *Ceratopetalum-Caldcluvia* (No. 35) as small discrete communities, there are other patches where the boundaries are blurred and hence the *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea* Suballiance is the most appropriate classification.

MT HYLAND-WASHPOOL

Inland and at higher elevations of 850–1 000 m such as on Gibraltar Range and Washpool National Parks, Munningyundo Mountain and Middle Creek Flora Reserve

— where the soil is more fertile than required for the *Ceratopetalum/Schizomeria-Caldcluvia* or *Ceratopetalum-Doryphora* suballiances — *Sloanea woollsii* may occur as a co-dominant or even as the dominant canopy with *Ceratopetalum* (Photo 61, Species List, Microfiche).

At such elevations, *Sloanea woollsii* may represent the only subtropical rainforest element in the canopy. This species has a very wide ecological tolerance. Although restricted to the sheltered southeastern section of the Barrington Tops, it extends north to Gympie in Southern Queensland. Within this latitudinal range, it is found from lowland subtropical rainforest on the coastal alluvial plains to an associate of *Nothofagus moorei* in cool temperate rainforest, as on Mt Banda Banda. Unlike *Ceratopetalum apetalum* and *Schizomeria ovata,* it withstands exposure very well. Isolated remnant trees in parts of the cyclone-damaged areas within the Willowie Scrub on Washpool National Park still have healthy crowns. On Richardsons Creek in Gibraltar Range National Park, heavy logging of the *Ceratopetalum* component of the canopy in 1964–66 has resulted in a healthy overstorey of *Sloanea* which is ensuring good regeneration beneath its protective canopy. Because the potential maximum height and crown spread of *Sloanea* exceeds that of *Ceratopetalum, Schizomeria* and *Orites,* a mature and undisturbed forest will generally consist of a main canopy of these three species with scattered larger and taller trees of *Sloanea.* Although this may well be a normal stable climax forest condition, there are indications of change, on Middle Creek Flora Reserve, for example, where the subtropical rainforest component of *Sloanea* and *Argyrodendron actinophyllum* is not regenerating and appears to be being replaced. A subtropical rainforest lower tree storey species, *Akania lucens,* was here estimated at a record 25 m height. *Doryphora* is common in this forest and may replace *Sloanea* as the overstorey in time. Individual trees of *Doryphora* at Eaglehawk Creek on Washpool National Park and at Middle Creek Flora Reserve have been estimated at 50 m tall, a height well above that of other warm temperate rainforest species. This situation will be discussed more fully under Suballiance No. 36: *Ceratopetalum-Doryphora.*

COFFS HARBOUR-NAMBUCCA

Lower-altitude examples of the suballiance are found in the Coffs Harbour to Nambucca coastal area. They occur on soils derived from metasediments with basalt or adamellite enrichment (New England National Park, Way Way State Forest) or on well developed alluvial soils as at Bruxner Park (Species List, Microfiche). At these mid-north coastal areas, *Argyrodendron actinophyllum* is common only on the most fertile soils and is largely replaced by *Sloanea* on the sites just described.

On Ringwood Flora Reserve in the Kalang Valley, *Backhousia anisata* is common. This species is confined to the Bellinger Valley, except for an isolated occurrence in the Nambucca Valley to the south and one tree in the Orara Valley to the north.

HASTINGS-MANNING

In the Hastings and Upper Wilson River Valleys, on either mudstone and sandstone with granite or on the more fertile porphyry soils, there are a number of examples of this suballiance including the Wilson River Primitive Reserve, Waterfall (Species List, Microfiche) and Cockerawombeeba Creeks. Once again, *Sloanea* is far more common than *Argyrodendron. Ceratopetalum* predominates over *Schizomeria,* but *Doryphora* becomes common. *Acradenia euodiiformis* is a very common small tree.

An additional, more southern example is at Lansdowne on freehold land. This community occurs on sandstone at the base of conglomerate cliffs associated with seepage lines. Floristically, it is similar to the Wilson River Primitive Reserve, but it is not as well developed and is restricted to the cliff base and creek banks.

(4) *Schizomeria ovata-Sloanea woollsii*

Where soil fertility is too high for *Ceratopetalum,* the species is replaced by *Schizomeria.* This situation occurs at Uralba Nature Reserve on basaltically-enriched sandstone. It is also seen in locations which are too cold and exposed for *Ceratopetalum.* Examples are Flat Top and Hogsback Mountain, Carrai.

LOWER RICHMOND

Uralba Nature Reserve is of special botanical interest as it includes several gullies just below the southeastern edge of the Lismore basalt on the enriched sandstone. It is the known southern limit of several plants of the Big Scrub, such as *Archidendron muellerianum, Aristolochia praevenosa, Millettia megasperma* and *Harpullia alata.* In addition, there are plants of the rhyolite soils of the Mt Warning complex present here, near their southern limits on the equally silica-rich sandstones. These are *Helicia ferruginea, Canarium australasicum, Elaeocarpus eumundi* and *Rapanea subsessilis.* More common warm temperate rainforest components at the site are *Schizomeria, Helicia ferruginea* and *Neolitsea dealbata.* Subtropical rainforest is represented by *Sloanea woollsii, S. australis, Syzygium luehmannii* and *Citronella moorei.*

CARRAI

The Flat Top and Hogsback Mountain area on the Carrai Plateau west of Kempsey is cold and exposed at 900–1 050 m altitude. *Ceratopetalum* is common on nearby Double Head at a much lower elevation, but on Flat Top, it is replaced by the more exposure-tolerant *Schizomeria* and by *Doryphora.* The subtropical component of *Sloanea woollsii* and also *Argyrodendron actinophyllum* may be at risk, since they are poorly represented in the regeneration. These communities could be undergoing conversion to warm temperate rainforest of the *Doryphora-Schizomeria* Suballiance No. 41.

Suballiance No. 34: *Ceratopetalum-Diploglottis-Acmena*

South of the Hunter River, where neither *Argyrodendron* nor *Sloanea woollsii* occur, their place is taken in the subtropical rainforest element by *Diploglottis, Toona* and *Diospyros pentamera.* Soils are similar to those which support the previous Suballiance No. 33 — derived from relatively poor sandstone and trachyte with enrichment by basalt or shale. Because of the cooler conditions at these southern latitudes, the subtropical rainforest component requires warm sheltered sites and is generally found below 400 m altitude except at Green Scrub, Mountain Lagoon, where it is seen at altitudes up to 600 m.

BLUE MOUNTAINS

There are several examples of this suballiance in the Blue Mountains. At Green Scrub near Mountain Lagoon, in Wollemi National Park, it is situated on three small basalt remnants with sandstone above and below it. The pristine glory of these sites has long since departed due to heavy logging and repeated fires, the latest being in the mid 1970s and in about 1982–83. Consequently there are gullies of vine-shrouded trees and slopes densely forested in *Acacia* spp., possibly originating from a fire about 50 years ago. The original forest was probably dominated by *Doryphora, Acmena* and *Toona,* with *Ceratopetalum* more common towards the basalt edge. Further downstream in the deep valley of Wheeny Creek the altitude is only 40–200 m and soil derived from sandstone has been enriched by the more fertile Wianamatta shales and basalt upstream. There is well-developed rainforest below the seepage line on the boundary of the Hawkesbury and Narrabeen sandstones (Species List, Microfiche). Extensive

stands of *Livistona australis* occur and the warm temperate rainforest components consists of *Ceratopetalum, Doryphora* and *Schizomeria* (Photo 88). The sub-tropical rainforest element is represented by *Toona, Gmelina leichhardtii, Dendrocnide photinophylla* (southern limit) and *Diospyros pentamera* as well as the vine *Piper novae-hollandiae.*

SYDNEY

At Walkers Garden in Royal National Park the rainforest in the gully is on the Narrabeen shales. Upslope is the less fertile Hawkesbury sandstone. Warm temperate rainforest is represented by *Ceratopetalum, Doryphora, Polyosma* and *Cryptocarya glaucescens,* whereas subtropical rainforest elements include *Diploglottis australis, Sloanea australis, Brachychiton acerifolius, Gmelina leichhardtii* and *Citronella moorei* (Species List, Microfiche). On the slopes leading up to the sandstone, vegetation is warm temperate rainforest of the *Ceratopetalum-Schizomeria-Acmena-Doryphora* Suballiance.

ILLAWARRA

On the Illawarra escarpment, where rainfall and temperatures are high and altitudes are below 550 m, soils are of intermediate fertility due to the admixture of latite, trachyte and coal measures with the less fertile tuff and sandstone. Once again, *Ceratopetalum, Doryphora, Schizomeria, Cryptocarya glaucescens* and *Acmena* are the more common warm temperate tree species, while *Toona, Dendrocnide excelsa, Diploglottis, Elaeocarpus kirtonii, Pennantia* and *Brachychiton acerifolius* are typical subtropical rainforest elements. Representative sites are at Macquarie Pass, Minnamurra Falls, Jamberoo Pass, Browns Mountain and Berry Mountain (Species List, Microfiche).

SOUTH COAST

On the South Coast, there are sheltered gullies where soil fertility is moderate due to either siltstones (Mares Hill Forest Preserve on Yadboro State Forest and Wallaby Forest Preserve on Currowan State Forest), or to sandstone enriched by basalt (Musgrave Creek, Budawang National Park and Kioloa Forest Preserve). These sites are the most southern examples of the suballiance known.

The lower valley slopes and more rocky areas carry mainly warm temperate rainforest elements such as *Ceratopetalum* if free of fires, or otherwise the more fire-resistant, rough-barked species such as *Schizomeria, Doryphora, Acmena* and *Cryptocarya glaucescens* as at Musgrave Creek and Wallaby Forest Preserve. However, the more fertile but narrow alluvial creek banks support mainly subtropical elements such as *Dendrocnide excelsa, Citronella, Baloghia inophylla, Diploglottis* and *Polyscias murrayi* with *Adiantum formosum* as ground cover. Typical subtropical rainforest vines include *Piper, Malaisia scandens* and *Cissus antarctica.* Large epiphytes such as *Asplenium australasicum* and *Dendrobium speciosum* are a conspicuous feature in the deep gullies at Musgrave Creek. The latter site is the known southern limit of *Emmenosperma alphitonioides* and *Pennantia cunninghamii.*

Perhaps the most interesting area of this suballiance on the South Coast is Kioloa Forest Preserve in the head of Higgins Creek on the western base of Durras Mountain in Kioloa State Forest. Although some sections have been reduced by fires to virtually impenetrable vine thickets, the unaffected patches contain possibly the only viable area of *Archontophoenix* south of Sydney (Photo 89). There is excellent development of large *Citronella, Cryptocarya glaucescens, Polyscias murrayi, Schizomeria, Doryphora* and *Ceratopetalum* which is very common (Species List, Microfiche). The basaltically enriched soil and the ameliorating maritime climate have enabled several subtropical tree species such as *Diploglottis australis* and *Diospyros pentamera* to exist here, when the nearest individuals are otherwise well to the north on the Illawarra. The vine, *Palmeria*

scandens, is also at its southern limit here. Epiphytes are well-developed, particularly *Asplenium australasicum* and *Platycerium bifurcatum*.

Suballiance No. 35: *Ceratopetalum/Schizomeria-Caldcluvia*

This suballiance occurs north from the Barrington Tops area to the Queensland Border. Further south, *Caldcluvia* is replaced by *Acmena* and *Doryphora*, as in Suballiance No. 37 *(Ceratopetalum-Schizomeria-Acmena-Doryphora)*. The suballiance prefers moister, sheltered south–to–east aspects on soils which are not sufficiently fertile for subtropical rainforest. Examples are the southern slopes of Mt Warning on the syenite ring dyke and the trachyandesite rock above, the rhyolite of the southern caldera rim in Nightcap National Park, Big Scrub Flora Reserve and below Minyon, Quandong and Boomerang Falls. Further west along the border, the suballiance favours the related trachyte at the head of October Creek and on Mt Glennie. In the Washpool and Gibraltar Range National Parks, it is on the poorer granite and adamellite soils. From Munningyundo Mountain through the Eastern Dorrigo, Georges Creek Nature Reserve to Carrai, it occupies favourable sites on metasediments of slate, phyllite, greywacke and argillite. It also occupies the infertile sandstones at lower altitudes along Cabbage Tree Creek, Mt Neville and in the Chichester-Telegherry catchments. At higher altitudes, it is replaced by the *Doryphora* Alliance.

The major commercial forests of *Ceratopetalum* belong to this suballiance. Although *Ceratopetalum apetalum* is generally the most abundant canopy species, there are two areas where it is either absent or rare.

On the southern base of Clarence Peak, south-east of Maclean, a stream-side rainforest on sandy soil has a fine palm understorey of *Archontophoenix* and *Livistona*. The smooth-barked *Ceratopetalum apetalum* is quite uncommon, but its rough-barked relative, *C. gummiferum*, and other similarly barked species such as *Schizomeria, Synoum* and *Endiandra discolor* make up the canopy. This rainforest has suffered fires in the past as seen by the blackened *Livistona* trunks. It appears reasonable to assume that this exposure to fire has killed most of the *Ceratopetalum apetalum* which may have been present. *Schizomeria*, on the other hand, is often found as a pioneer in the rainforest-sclerophyll forest ecotone. In addition to its insulating bark, this species has the capability to produce vigorous coppice shoots after fire.

The second area where *Schizomeria* is the major canopy species is on rhyolitic Mt Glennie, at the base of Mt Lindesay and on Mt Nothofagus. However, in the case of Mt Lindesay and Mt Nothofagus, the rhyolite is undoubtedly enriched by the more basic lava overlay. Accordingly, these communities should be included in Suballiance No. 39 of the *Doryphora* Alliance rather than in the *Ceratopetalum* Alliance. The rainforest on the rhyolitic soils of the area from Mt Glennie to October Creek are somewhat different. There is less *Doryphora*, but *Callicoma serratifolia* and *Tristaniopsis collina* are very common with eucalypt emergents of *E. andrewsii* ssp. *campanulata, E. deanei* and *E. oreades* (Species List, Microfiche). These features and the dominance of *Schizomeria* could indicate an advanced seral community resulting from past fires which have eliminated the fire-sensitive and poorly dispersed *Ceratopetalum*. An alternative hypothesis is that since this rhyolite originated from sources associated with Mt Barney (Focal Peak) rather than Mt Warning, it may have a somewhat different chemical composition favouring *Schizomeria* over *Ceratopetalum*. The Mt Glennie Plateau is unusual in that it has a very dense, almost pure understorey of midginbil palms *(Linospadix monostachyus)* about 2 m tall which limits visibility to only a few metres. The central creek contains the best known occurrence of the rare tree fern, *Dicksonia youngiae*.

BORDER RANGES-MOUNT WARNING

On Mt Warning (Species List, Microfiche) and its rhyolite flanks (such as Nightcap National Park) there is a blend of more northern species at or close to their southern limit. These include *Elaeocarpus eumundi, Canarium australasicum, Alphitonia petriei* and *Acronychia laevis,* such species of the northern New South Wales mountains north of Barrington Tops as *Anopterus macleayanus, Austrobuxus swainii, Acradenia euodiiformis, Endiandra introrsa, E. crassiflora* and *Triunia youngiana,* and endemics including *Acacia orites, Argophyllum nullumense, Acronychia baeuerlenii, Corokia whiteana* and *Helicia ferruginea.*

It is interesting that the endemic species of this area are predominantly found within this suballiance with very few indeed referable to subtropical rainforest. This seems to indicate that the area has functioned as a cool montane refugium for a considerable period. Apart from *Ceratopetalum,* other major canopy species may include *Caldcluvia, Orites, Callicoma* and *Schizomeria.* The understorey is often dominated by *Cyathea leichhardtiana* and *Linospadix.*

WASHPOOL-GIBRALTAR RANGE

In the mountains west of Grafton, there are extensive areas of this suballiance on Washpool and Gibraltar Range National Parks and on Cangi State Forest. The Willowie Scrub of 3 000 ha within Washpool National Park is regarded as the largest unlogged area of this *Ceratopetalum/Schizomeria-Caldcluvia* suballiance anywhere. The suballiance constitutes the greater part of the scrub. Major canopy species are the same as in the Mt Warning area (Species List, Microfiche). *Acradenia* is also present in the lower tree layer but not on the poorer granitic soils.

EASTERN DORRIGO

The next major area of importance to the south is the eastern Dorrigo Plateau (Photo 90) which contains several tree species only found elsewhere in the Mt Warning area. These include *Austrobuxus, Endiandra introrsa* and the shrub *Triunia youngiana.* Major canopy species are similar to the preceding areas, with *Anopterus* and *Acradenia* in the lower tree layer (Species List, Microfiche). The suballiance is well-represented in Dorrigo National Park and in scattered unlogged patches on the nearby state forests and south on the Carrai Plateau. Many of the smaller occurrences are narrow strips between gullies of subtropical rainforest with wet sclerophyll forest upslope. Often, as at Georges Creek Nature Reserve, *Schizomeria* may be equally common. Its presence could indicate rainforest in an advanced seral stage. In the upper Hastings west of Port Macquarie, *Ceratopetalum* is associated with *Doryphora* because of the cooler conditions. It will be discussed in the following suballiance.

CHICHESTER

Suballiance No. 35's most southern occurrence is in the Chichester-Telegherry catchments, as found at Jerusalem Creek Flora Reserve on the poorer, coarser sediments. However, species of the more southern and cooler situations are of increasing importance here, particularly *Acmena* and *Doryphora* (Species List, Microfiche). Both *Acradenia* and *Orites excelsa* are very common and are close to their southern limits.

Suballiance No. 36: Ceratopetalum-Doryphora

Under cooler conditions than those required for the previous *Ceratopetalum/Schizomeria-Caldcluvia* Suballiance, *Ceratopetalum* can only survive where sheltered by the taller *Doryphora.* This is generally the case above about 700 m altitude on the North Coast, or somewhat lower in the Blue Mountains. On the South Coast, *Acmena smithii*

is the more common associate of *Ceratopetalum* (Suballiance No. 37). *Ceratopetalum* particularly needs protection from the drying west and north-west winds and from fires. In many of the repeatedly burnt gullies in the Blue Mountains, *Doryphora,* with more fire-resistant bark, is replacing *Ceratopetalum.*

The soils which support this suballiance are relatively poor, being derived from metamorphics, sandstone, shale, adamellite and porphyry, or with some basaltic enrichment.

MT BAJIMBA

There is a very fine forest of *Ceratopetalum* and *Doryphora* up to 40 m tall and 140 cm diameter (Photo 91) on the eastern fall of the Great Dividing Range south-east of Tenterfield. The site is at Mt Bajimba (Coolamangera Flora Reserve) at 1 100–1 250 m altitude.

The boundary or ecotone with the wet sclerophyll forest is mainly composed of *Callicoma* and *Banksia integrifolia* var. *compar.* At increasing altitude towards the top of the range, conditions are too extreme for *Ceratopetalum,* but the species is replaced by *Quintinia sieberi* to form the *Doryphora-Quintinia sieberi* Suballiance No. 40. Smiths Scrub at 980 m altitude to the north-east is a small area on a crown lease dominated by *Ceratopetalum* and *Doryphora* (Species List, Microfiche).

CANGI

Further south in the north-west section of Cangi State Forest, on poor soils derived from granite and metamorphic rocks at 940–990 m altitude, there are further communities where *Ceratopetalum* and *Doryphora* are very common and *Orites excelsa* and *Sloanea woollsii* are common. In the head of Wollomogo Creek, the canopy trees are very large and tall. *Caldcluvia, Callicoma and Schizomeria* are also included. The understorey is quite sparse, consisting mainly of *Linospadix, Cyathea leichhardtiana* and *Tasmannia insipida.*

MT HYLAND

In Mt Hyland Nature Reserve at 1 000–1 200 m altitude, there is an altitudinal gradation from the *Ceratopetalum-Doryphora* community without *Sloanea* at the lower elevations to one including *Cryptocarya foveolata, Quintinia sieberi* and *Vesselowskya rubifolia* above 1 150 m. The species diversity of trees declines with altitude, and at Mt Hyland averages only 10 species per site (Species List, Microfiche).

GEORGES RIVER

South of New England National Park in Cunnawarra Flora Reserve at 1 100 m altitude, the canopy species are similar to those at Wollomogo Creek. The difference is that *Sloanea* is replaced by *Nothofagus* at this higher altitude near the escarpment (Species List, Microfiche).

UPPER HASTINGS

On Werrikimbe National Park in the upper Hastings catchment at Cobcrofts Creek, both *Sloanea* and *Nothofagus* occur along the creek. Cleghorns Scrub contains *Cryptocarya foveolata* and *Citronella.* At the head of the Forbes River, an eastern tributary of the Hastings, there is an unusual occurrence of the filmy king fern, *Leptopteris fraseri.* Apparently this fern is restricted to only two gullies beneath a dense creekside *Nothofagus* canopy. This very delicate fern is otherwise found only from the Budawang Range west of Batemans Bay to Wollemi National Park south of the Hunter River where it frequents deep canyons and the shady precincts of waterfalls. Fenwicks

Scrub Flora Reserve at 990–1 100 m altitude exhibits the ultimate in high-altitude floristic simplification — 98% of the trees in the overstorey are either *Ceratopetalum* or *Doryphora.*

MANNING

In Boorganna Nature Reserve north of Wingham at only 500 m altitude, the typical northern associated species such as *Caldcluvia* and *Orites* are not recorded. The more important southern species, *Acmena smithii,* is common, however.

WOLLEMI

To the south of the Hunter River, this suballiance is confined to moist, fire-free slopes and gorges. It occurs on the poorer sandstone soils, often with slight basaltic enrichment from the residual peaks such as Mt Monundilla, Mt Coricudgy (Species List, Microfiche) and Nullo Mountain. In addition to *Ceratopetalum* and *Doryphora,* there is an increase in *Acmena* and *Quintinia sieberi* in the tree layers and of *Dicksonia antarctica* in the undergrowth when compared with the more northern occurrences.

BLUE MOUNTAINS

In the northern section of the Blue Mountains near Mt Wilson and Mt Irvine, there are excellent examples of this suballiance. At Waterfall Reserve and Happy Valley, Mt Wilson, on the sandstone below the basalt capping are cool temperate rainforest associates such as *Atherosperma moschatum* and *Elaeocarpus holopetalus.* There are also ferns rare in Australia, such as *Lastreopsis hispida, Sphaerocionium lyallii* and *Hymenophyllum rarum* whose affinities are with either New Zealand or Tasmania (Species List, Microfiche).

During summer an aerial view of Waterfall Reserve reveals the pink-fruited crowns of *Ceratopetalum* with an upper green band of the *Doryphora-Quintinia sieberi* Suballiance on the basalt. In northern New South Wales, *Ceratopetalum* is confined to the non-basaltic soils, and it is therefore strange that at Waterfall Reserve it should be associated with the basaltic capping. McLuckie and Petrie (1926–27) found that these floristic changes are related to soil moisture levels rather than soil fertility; and that the clays from the basalt have a high water retention capacity, thereby ensuring a reliable percolation throughout the year from the basalt capping down to the creek.

Further downstream on Bowens Creek below the basalt cap of Mt Irvine is a basin of this suballiance, where a major tributary from the nearby mountain joins the main stream. This forest is equally as tall as that at Waterfall Reserve. In addition to the two type species, it contains many specimens of *Stenocarpus salignus* including one estimated at 45 cm diameter. *Acmena* is occasionally present. The ferns once again are of great importance, with *Leptopteris* beneath the waterfalls upstream on the tributary. Two filmy ferns are of special interest: *Craspedophyllum marginatum* occurs only on the McPherson Range, in the Blue Mountains and in Tasmania; *Hymenophyllum pumilum* is known from three sites only, at Mt Tomah, Bowens Creek and Kiama.

In the gorges of the Grose River at Koombanda Brook and Horseshoe Falls, the Megalong Valley at Blackheath Glen and the Jamison Valley at Wentworth Falls, this suballiance is situated on the more easily eroded shale below the massive sandstone cliffs. These Illawarra Coal measures weather to a clay with water retaining capacity and nutrient status superior to that of sandstone. There is also considerable seepage along this geological boundary. These rainforests are in the process of being modified by an accelerated fire regime which favours *Doryphora* over *Ceratopetalum* because of the rough thick bark of the former and which perpetuates *Eucalyptus oreades* as an overstorey.

One example of this floristic change due to increased burning can be seen at Koombanda Brook where *Doryphora* is the most common canopy species except in less fire-prone sites. The 1982 ground fire has produced dense coppicing on all species which also show evidence of earlier coppicing from fires. Similarly at Horseshoe Falls, a series of fires is favouring *Doryphora* and *Acmena* at the expense of *Ceratopetalum;* and *Cyathea australis* rather than *Dicksonia antarctica.* The same trend is evident at Blackheath Glen, where *Doryphora* is the major canopy species and *Acacia elata* is common, indicating regeneration from a fire about 40 years ago in this narrow creekside strip.

There is a contrasting situation at Wentworth Falls, where there have been no recent fires. Consequently, the dominant trees are *Ceratopetalum* and *Callicoma,* while *Doryphora, Acmena* and *Quintinia* are only occasionally represented. All four species of tree ferns recorded for the Blue Mountains are present. *Cyathea leichhardtiana* occurs only at the lower elevation, towards Vera Falls.

Both Horsehoe Falls and Wentworth Falls have a pollution problem from upstream urbanization. At Wentworth Falls, excess runoff, sedimentation and nutrients from leaking sewer pipes are promoting algal growth on vegetation at the base of the falls and affecting the health of *Microstrobus fitzgeraldii,* a very rare and endangered conifer which is restricted to this spray zone along the south-facing escarpment of Jamison Valley. There are only 203 known plants of which the greatest population of 90 is at Wentworth Falls (Smith 1981). The only other species in the genus is in the Tasmanian highlands. Control of these sources of pollution is obviously essential, but it is both difficult and costly.

Suballiance No. 37: *Ceratopetalum/Schizomeria-Acmena-Doryphora*

South of the Hunter River, *Acmena smithii* becomes increasingly more important in place of *Caldcluvia.* It is at least as common as *Doryphora* and often more common at low to moderate elevations below about 750 m. Accordingly, this suballiance extends to the southern limit of *Ceratopetalum apetalum* near Batemans Bay. It is restricted to the poorer quartz-rich soils derived particularly from sandstone but also from siltstone and shale. Like the immediately preceding suballiances, No. 37 requires protection from drying winds and from fires.

WOLLEMI

In the northern section of Wollemi National Park, major gorges such as those in Emu Creek and Widden Brook are too wide to protect this rainforest suballiance from drying winds and fires. In the narrow canyons leading off the gorges to the north and west, there are some very fine examples of the suballiance. These slot canyons have overhanging cliffs which provide much seepage and shade. *Ceratopetalum, Acmena* and *Doryphora* up to about 30 m tall form the canopy, beneath which is a dense regeneration layer of these and other species (Photo 92). The small cascading creeks and the luxuriant ground ferns are exceptional (Photo 93). In one canyon off Emu Creek, 20 species of ground ferns were recorded (Species List, Microfiche). This listing includes four species of tree ferns, of which *Dicksonia antarctica* and the delicate *Leptopteris fraseri* were most common. In addition to the 16 species of delicate, shade and moisture-loving, smaller ground ferns, the tree fern trunks hosted masses of fragile, filmy ferns such as *Hymenophyllum cupressiforme, Macroglena caudata* and *Polyphlebium venosum.*

WATAGAN MOUNTAINS

Towards the coast in the Watagan Mountains, in the bottoms of deep gullies where fires are a very rare event, there are well-developed rainforests of this

suballiance beneath huge, scattered *Eucalyptus saligna* and *Syncarpia glomulifera.* Although *Ceratopetalum* is the undoubted major canopy species, *Schizomeria* and *Acmena* are also common. *Doryphora* is less common. Three areas of particular merit are Bar Flora Reserve, an area along the Wyong River below Hessies Point and The Basin on Olney State Forest (Species List, Microfiche). At the Bar Flora Reserve on one of the side creeks, there is one of the tallest *Callicoma* seen by the author. It is estimated at 25 m with 60 cm diameter. Also in the same area, a *Tristaniopsis laurina* is estimated at 35 m tall in comparison with the previous record of 27 m. At the Wyong River site, in and overhanging the eastern tributary, there occurs the only true *Tristania* in the world, *Tristania neriifolia,* at its northern limit.

The shrub layer consists mainly of *Tasmannia insipida* with occasional tree ferns such as *Cyathea australis* and *Todea barbara.* The ground layer is well developed with a range of 14 to 16 species, of which the most common are *Adiantum formosum, A. silvaticum, Lastreopsis decomposita* and *Blechnum cartilagineum.* Vines may be common shade-loving species on the butts of the trees such as *Microsorum scandens* and occasionally *Arthropteris tenella,* or larger vines in the canopy gaps such as *Palmeria scandens, Cissus antarctica, C. hypoglauca* and *Morinda jasminoides.* Epiphytes consist of shade-lovers such as *Hymenophyllum cupressiforme,* or those in the canopy or on trunks and branches which are well lit, such as *Bulbophyllum crassulifolium, B. exiguum* and occasionally, *Asplenium australasicum.*

SYDNEY-ILLAWARRA

South of Sydney from Royal National Park to the Illawarra, from 100 m to 500 m altitude, this suballiance is found on moist lower valley slopes and at the base of the sandstone cliffs of the escarpment.

Among the trees, *Acmena* is of increasing importance at higher latitudes, as is *Cryptocarya glaucescens.* However, the canopy is still composed mainly of *Ceratopetalum, Cryptocarya glaucescens* and occasional *Doryphora* except at Belmore Falls, where the latter is rated as very common (Species List, Microfiche). In areas remote from the escarpment, as at Walkers Garden in Royal National Park and upper Cataract Creek, the soft tree fern *(Dicksonia antarctica)* is absent and *Tasmannia insipida* is uncommon. However, on the Illawarra escarpment at Mt Keira, Mt Kembla, Minnamurra Falls, Macquarie Pass and Belmore Falls, these latter two species are quite common, while *Quintinia sieberi* and *Eucryphia moorei* are occasionally recorded at the last two localities only. The upper Cataract Creek site may be unusual in that there are occasional decadent *Acacia melanoxylon,* possibly indicating that this forest is in an advanced seral stage. This assessment is supported by the absence of *Dicksonia* and the sighting of only one epiphyte, *Pyrrosia rupestris.*

All the escarpment sites are on the poorer sandstone slopes, with more luxuriant subtropical rainforest elements on benches of deeper soil. With their high rainfall and warm sheltered topography, the escarpment sites exhibit a dense growth of ground and epiphytic ferns, particularly at Macquarie Pass. They also have occasional to common occurrences of *Fieldia australis,* which requires uniformly moist conditions.

SHOALHAVEN-CLYDE

Further south between the Shoalhaven and Clyde Rivers, this suballiance occupies moist, sheltered, unburnt sites in steep-sided gullies (Mt Tianjara, Oaky Creek on Yadboro State Forest and Lyons Creek Forest Preserve on Currowan State Forest) or at the base of cliffs with a cool, moist, easterly aspect (George Boyd Lookout on McDonald State Forest). Each of these areas represents a fire-free niche. At Mt Tianjara, the suballiance occupies a small gorge terminating in a waterfall. Oaky Creek

is also in a gorge. Lyons Creek Forest Preserve has a steep ridge to the west which has protected that side of the gully although the eastern side is fire-prone open forest. George Boyd Lookout is only a bench with cliffs above and below it.

Ceratopetalum maintains its dominance to its known southern limit in Lyons Creek Forest Preserve west of Batemans Bay (Photo 94), where its growth and form is equal to that in areas on the North Coast (Species List, Microfiche). *Acmena* and *Doryphora* are common to occasional. *Quintinia sieberi* is an occasional tree, reaching its southern known limit at Oaky Creek. *Tristaniopsis laurina* is also occasionally recorded at all sites visited. At Mt Tianjara, there are cool temperate rainforest elements such as *Eucryphia, Dicksonia* and *Blechnum wattsii* (Species List, Microfiche). The shrub layer is dominated by *Tasmannia insipida* and tree ferns, particularly *Dicksonia, Cyathea australis* and *C. leichhardtiana.* At some sites, climbing ferns such as *Microsorum* spp. are common on the shady butts of the trees. *Palmeria scandens* and *Cissus hypoglauca* are common gap vines. Characteristic shade epiphytes are *Hymenophyllum cupressiforme* and *Fieldia australis.*

Suballiance No. 38: *Ceratopetalum-Eucryphia-Doryphora-Acmena*

In particularly cool and sheltered locations on the shale and coal seams where the derived soil is a little more fertile than on the sandstone, this suballiance is found to be intermediate between the warm and cool temperate rainforests. It differs from the *Ceratopetalum/Schizomeria-Acmena-Doryphora* Suballiance in that the cool temperate rainforest species, *Eucryphia moorei,* is a common associate of *Ceratopetalum.* Two examples were given for the previous Suballiance No. 37 where *Eucryphia* was only occasionally present. Those sites, at Belmore Falls and Mt Tianjara, represent another point along the intergrade.

Two examples of Suballiance No. 38 occur on or near the boundary of Barren Grounds Nature Reserve, near the base of the Illawarra sandstone escarpment with a southern aspect.

Along Foxground Creek, there are many cascades and falls as the stream descends very quickly over large rock blocks and bars. This is a well-developed forest with tall *Ceratopetalum* and good specimens of *Acmena* up to 20 m tall and 70 cm diameter as well as *Quintinia.* Along the creek and near the cliff face are large trees of *Eucryphia* and fine *Dicksonia* (Species List, Microfiche). *Cyathea leichhardtiana* is also very common. Growing in the spray of the waterfall near the cliffs is the delicate tree fern, *Leptopteris fraseri.* The rock blocks and bases of the trees are largely concealed by a dense growth of shade-loving ferns including four climbing ferns (*Arthropteris beckleri, A. tenella, Microsorum diversifolium, M. scandens), Blechnum patersonii* and *B. wattsii.* The native nettle, *Elatostema reticulatum,* also testifies to the perpetually damp soil. *Cephalaralia* is a characteristic vine in *Nothofagus* cool temperate rainforest on the North Coast and reaches its southern limit here.

***Doryphora sassafras* Alliance**

At exposed high altitudes above 1 000 m on the North Coast or 750 m on the Central Coast, the *Ceratopetalum* Alliance is replaced by the *Doryphora* Alliance. On more fertile soils, the *Doryphora* Alliance may also replace the cool subtropical rainforest *Caldcluvia* Alliance at these altitudes north of the Hunter River. At very high and/or exposed locations where soil is shallow, it in turn may be replaced by closed scrub of the *Leptospermum-Notelaea venosa-Prostanthera* Suballiance No. 46 (Fig. 13).

The alliance occurs from the McPherson Range along the high points of the Great Dividing Range east and south-east of Tenterfield, on the Gibraltar Range,

eastern Dorrigo and Mt Hyland and Doyles River west of Wauchope to the Wangat River. South of the Hunter River, it occurs on the basaltic cappings of Wollemi National Park, the Blue Mountains and the Illawarra to Morton National Park.

Three suballiances can be recognized:

39. *Schizomeria-Doryphora-Caldcluvia-Orites*
40. *Doryphora-Quintinia sieberi*
41. *Doryphora-Schizomeria*

Suballiance No. 39: *Schizomeria-Doryphora-Caldcluvia-Orites*

At moderaterly high altitudes of 700–1 100 m, but where not excessively exposed to cold and/or drying winds, this suballiance is found on shallow soils, of fair fertility often due to basaltic enrichment from upslope.

WESTERN McPHERSON RANGE

Along the western McPherson Range, the suballiance occurs on the southern, moist, steep slopes of Wilsons Peak, Mt Clunie and Mt Lindesay as well as Glennies Chair, at the base of trachyte or rhyolite cliffs where soil has received some basaltic enrichment (Photo 95). Major species, as found at Mt Lindesay, are *Schizomeria, Doryphora, Caldcluvia* and *Orites* (Species List, Microfiche). Wilsons Peak is unusual in that *Schizomeria* is not recorded, but *Syzygium oleosum* is common there and also on Mt Clunie. On the top of the range just south of Mt Nothofagus on the relatively poor soil derived from tuff, a typical example of the suballiance contains *Litsea reticulata* and *Geissois benthamii. Banksia integrifolia* var. *compar* is present in the sandy soil at the base of Mt Lindesay, on Glennies Chair and on Mt Glennie through to Levers Plateau. Because of seepage from the cliffs above, as at Mt Lindesay, there are some cool temperate species present, such as *Quintinia sieberi, Dicksonia antarctica* and *Todea barbara.* The plateau on the top of Mt Glennie is the same elevation as the base of the Mt Lindesay cliffs and the two sites have many of the hardier rainforest species in common. However, there is no *Doryphora* on the rather dry, occasionally burnt plateau where soil is derived from rhyolite without any basaltic enrichment. For this reason, the vegetation has been classified as Suballiance No. 35: *Ceratopetalum/Schizomeria-Caldcluvia.*

EASTERN McPHERSON RANGE

Along the eastern McPherson Range there are further areas of Suballiance No. 39 at the base of rhyolite cliffs where the soils have received basaltic enrichment from above. Examples are Mt Wagawn to Numinbah Gate, and beneath the Springbrook cliffs, where *Doryphora, Caldcluvia* and *Orites* are all occasional to common and *Schizomeria* is absent. Also present are *Tristaniopsis collina, Anopterus macleayanus* and the Mt Warning near-endemic, *Argophyllum nullumense.* In this suballiance at the base of Springbrook is *Ardisia bakeri,* an endemic small tree, and *Tapeinosperma pseudojambosa,* here at one of its few known localities south of Brisbane.

Also in the eastern McPherson Range, there is a distinctive community of short, dense, upswept forest above the cliffs on the caldera rim. In November, this zone appears red from the floor of the Tweed Valley, due to the distinctive new leaves of *Caldcluvia* and *Geissois benthamii* (Species List, Microfiche). It extends from the Pinnacle to Mt Wagawn at about 800–1 000 m altitude on shallow, steep, basalt soil. Once again, *Schizomeria* is absent, although *Doryphora, Caldcluvia* and *Orites* are common. Other typical species are *Acmena smithii, Melicope octandra, Geissois, Oreocallis pinnata, Tristaniopsis collina, Anopterus* and *Argophyllum.*

The canopy trees have butts of considerable diameter although they are shorter than usual. Their branches are often festooned with hanging mosses and lichens due

to the misty updraft. Typical localities are Mt Durigan and the heads of Gradys and Tyalgum Creeks.

EAST OF TENTERFIELD

This suballiance is well-developed east and south-east of Tenterfield on the Great Dividing Range at 900–1 000 m altitude. On Girard State Forest, it occurs on mudstones enriched by the Drake Volcanics. At Wingfields and Scrub Creeks on Forest Land State Forest, it is found on soils derived from adamellite porphyrite. Both soils are more fertile than those from adamellite and metasediments which are present where *Ceratopetalum* dominates. In all the areas cited, *Schizomeria* is very common while *Doryphora, Caldcluvia* and *Orites* are also common. *Acmena smithii* is common at Wingfields and Scrub Creeks (Species List, Microfiche). *Dicksonia* is the common tree fern. Both Wingfields and Scrub Creeks have been logged — Scrub Creek was heavily logged for *Orites* and *Doryphora* during the Second World War.

DORRIGO

On the finer-grained metasediments of the eastern Dorrigo Plateau, as on Dome Mountain in Dorrigo National Park, at 800–1 000 m altitude, the four diagnostic species are common with *Callicoma, Araucaria cunninghamii, Acmena, Cryptocarya glaucescens* and *Acradenia euodiiformis.* Apart from the emergent *Araucaria,* there are large canopy trees of *Schizomeria, Doryphora* and *Litsea reticulata.*

NORTHERN HUNTER

In the northern Hunter region, the suballiance occurs on mudstones at Whispering Gully in the upper Karuah River and on the Wangat River. On Mt Royal, the mudstones have been enriched by the basalt capping above. The altitudinal range is 730–1 100 m with moist south or east aspects, on steep slopes with shallow soils. The four key species are common to all three sites as well as *Callicoma, Acmena* and *Tristaniopsis.* At Whispering Gully (Species List, Microfiche) there is evidence of charring from occasional fires and a consequent absence of epiphytes. At Wangat River and Mt Royal, *Pyrrosia rupestris* and *Dendrobium pugioniforme* are present.

***Suballiance No. 40:** Doryphora-Quintinia sieberi*

Unlike the preceding suballiance, this community occurs mainly on rich basaltic soils at high altitudes of 1 050–1 400 m altitude north of Sydney, or down to 700 m to the south on the more exposed upper mountain slopes or plateaux. It often adjoins tall, open forest of typical tablelands species such as *Eucalyptus fastigata, E. obliqua, E. viminalis* or *E. laevopinea.* It may consist of a canopy of virtually pure *Doryphora,* as at the Magistrate (1 470 m), Butterleaf State Forest east of Tenterfield (Photo 96) and on Mt Coriaday in Wollemi National Park.

EAST OF TENTERFIELD

East of Tenterfield at Coolamangera Flora Reserve on Forest Land State Forest this suballiance extends above the *Ceratopetalum-Doryphora* Suballiance, from 1 250 m to the crest of the Great Dividing Range at 1 350 m, on metasediments perhaps enriched by the nearby leuco-adamellite. Floristically, it is a very simple forest of *Doryphora* with some *Acacia melanoxylon* and occasional *Cryptocarya foveolata.* The upper margin consists of *Banksia integrifolia* var. *compar* intermixed with *Doryphora* and occasional *Eucalyptus viminalis* and *E. obliqua.* The shrubby understorey is mainly of *Dicksonia* with *Coprosma quadrifida* and *Tasmannia stipitata* in the gaps. The latter species represents a link with the cool temperate rainforests of the Bellinger escarpment. Similarly, the vine, *Berberidopsis beckleri,* occurs here and also in the *Nothofagus* forests

of the Bellinger escarpment and the McPherson Range. In cooler geological times, these areas could have been part of a more continuous cool temperate rainforest belt.

Dingo Creek Flora Reserve on Little Spirabo State Forest 12 km to the south, is at 1 070–1 240 m altitude. The more-fertile soil is derived from dacite and andesite. *Doryphora* is still the major canopy species — being up to 50 m tall and 90 cm in diameter — but canopy species also include *Quintinia, Orites, Callicoma, Schizomeria* and *Cryptocarya foveolata* (Species List, Microfiche). At this site, the latter species attains a height of 45 m and 120 cm diameter, and an *Acmena smithii* was estimated at 30 m tall and 60 cm diameter. This less-exposed site supports a well-developed shrub and ground cover, mainly of ferns which are also common climbers on the butts of the trees. Three species of epiphytes which occur in all sites of this suballiance over its entire geographic range to as far south as Morton National Park are *Pyrrosia rupestris* and *Dendrobium pugioniforme* (in the crowns of the trees) and *Fieldia australis* (on the lower trunks).

MT HYLAND

West of Dorrigo on the upper slopes of Mt Hyland and Chaelundi Mountain as well as the head of Big Bull Creek, there are good examples of this suballiance at 1 250–1 400 m altitude. In the protected gully heads on the southern slopes of Mt Hyland and Chaelundi Mountain, the canopy trees of *Doryphora sassafras* and *Cryptocarya foveolata* may be up to 30 m tall (Species List, Microfiche).

One specimen of *Elaeocarpus holopetalus* is estimated at a record 25 m tall on Mt Hyland. This species is a common associate of *Nothofagus moorei* from the Barrington Tops to the Bellinger escarpment at Barren Mountain. It is also associated with the *Eucryphia moorei* Alliance along the mist belt at the edge of the Southern Tablelands and in East Gippsland, with *Atherosperma moschatum.* However, its northern limit is on Mt Hyland and Chaelundi Mountain, where it occurs without *Nothofagus. Vesselowskya rubifolia* and *Trochocarpa* sp. nov. are other typical *Nothofagus* associates reaching their northern limit here. Other associates such as *Quintinia sieberi, Cryptocarya foveolata* and *Cryptocarya nova-anglica* extend north to the McPherson Range. There are also filmy ferns such as *Hymenophyllum flabellatum* and *Polyphlebium venosum* which occur on Mt Hyland and Chaelundi Mountain as well as in *Nothofagus* forests from the McPherson Range to Victoria, Tasmania and New Zealand. The presence of all these typical associates of *Nothofagus moorei* is strong evidence that it, too, was probably once growing here. Being more sensitive to unfavourable conditions of desiccation and perhaps of fire, it has died out during past arid periods and has not been able to recolonize these areas. Further support for this contention has recently been forthcoming from a site at the bottom of a gorge on Hyland Creek (Blicks River Flora Reserve). Only 6 km downstream from the summit of Mt Hyland, there are several *Nothofagus* still surviving. The nearest forest of this *Nothofagus moorei* Alliance is 20 km to the south-east, at Deervale. On the more exposed slopes and spurs, there is a depauperate form of this suballiance with a dense, dark green canopy formed by small-leaved canopy species such as *Doryphora, Cryptocarya foveolata* and *Elaeocarpus holopetalus.* These trees have unusually short, dense crowns and fore-shortened trunks as shown in Photo 97. Floristically, this community is similar to the more sheltered areas, except that *Trochocarpa* sp. nov. is more common.

YARROWITCH

On the edge of the basalt plateau at 1 100–1 150 m altitude in Daisy Patch Flora Reserve, Enfield State Forest, there is an exposed example of this suballiance where major canopy species are *Doryphora, Acmena smithii* and *Cryptocarya foveolata* with *Orites* also common. Among the smaller trees, *Daphnandra micrantha* and *Quintinia verdonii*

are very common. Shrubs are mainly *Tasmannia insipida* and *Aristotelia australasica*. Because of infrequent fires on the site, *Acmena, Schizomeria* and *Q. verdonii* possibly represent a seral stage. Tree ferns and the delicate epiphyte, *Fieldia australis*, are absent. There are scattered emergents and windthrows of *Eucalyptus viminalis*. Coco Creek Forest Preserve is a similar area further south, on Nowendoc State Forest.

NORTHERN WOLLEMI

South of the Hunter River in Wollemi National Park, there are a series of basaltically capped peaks such as Mts Pomany, Monundilla, Coriaday, Coricudgy and Cameron — all above 1 000 m altitude. They are characterized by tall eucalypt forests of *E. fastigata, E. viminalis, E. bicostata* and *E. radiata* on the drier, more fire-prone northern and western slopes as well as the summit, with a sharp boundary due to fire separating it from the *Doryphora-Quintinia sieberi* Suballiance on the southern and eastern flanks. There are three possible reasons for the absence of *Ceratopetalum* from these sites, although the species is present in the gullies further downslope.

1. *Ceratopetalum* does not normally grow on basaltic soils.
2. Because of its smooth bark, *Ceratopetalum* is readily killed by fire, although the rough-barked *Doryphora* can survive moderate fires (as can be seen near the summit of Mt Monundilla, on the southern side).
3. The crown of *Ceratopetalum* suffers from exposure at these high altitudes, resulting in crown dieback and replacement of the species by *Doryphora* in particular.

The protective eucalypt forests of *E. fastigata* at Mt Monundilla and *E. viminalis* at Mt Corricudgy have been logged, as has been the rainforest at the latter site. The other peaks were regarded by loggers as inaccessible. All sites are characterized by a canopy of *Doryphora, Quintinia sieberi* and *Acacia melanoxylon*, with smaller trees of *Hedycarya angustifolia* and *Rapanea howittiana*. The shrub layer is mainly *Dicksonia, Coprosma quadrifida* and *Hymenanthera dentata*. The moist ground cover is of ferns and nettles, particularly *Polystichum proliferum, Lastreopsis acuminata, Diplazium australe, Australina muelleri* and *Urtica incisa*. Vines are mainly the stem climber *(Microsorum diversifolium)*, the wiry *(Smilax australis)* and the liane, *(Pandorea pandorana)*. Typical epiphytes for this alliance such as *Pyrrosia* and *Dendrobium pugioniforme* are fairly common with their drought-resistant, small, thick, fleshy leaves, but the tender *Fieldia* is absent.

Mt Coriaday differs from the other sites in its extreme floristic simplicity. *Doryphora* is almost the only canopy tree except for an occasional *Quintinia* and some very large *Acacia melanoxylon* (Species List, Microfiche). The *Doryphora* canopy trees have large stem diameters but are relatively short in stature. The hanging moss, *Papillaria*, is a feature of this rainforest where it drapes every support available. There is no *Ceratopetalum* on Mt Coriaday, possibly due to the lack of protective gullies and the severe fire regime which has probably caused the many gaps in the rainforest and is converting the *Doryphora* along the lower edge to *Acacia melanoxylon*. This rainforest is at a critical stage in its history and could easily be eliminated by any increase in burning.

NORTHERN BLUE MOUNTAINS

In the northern Blue Mountains, there are a number of flat basalt cappings extending north-east from Mt Wilson to Mt Irvine and Mt Tootie, comprising 230 ha. Mt Tomah is an additional site to the south-east. These sites have been completely cleared except for a tiny area at "Kookatonga" on Mt Irvine (Photo 98). Because of the high altitudes of approximately 800 m and attendant low temperatures, sub-tropical rainforest elements are unable to develop except in the understorey as, for example, *Asplenium australasicum, Platycerium bifurcatum* and *Pteris umbrosa*.

At "Kookatonga" on Mt Irvine, the remnant has an exposed western edge which is subjected to cold winds in winter and hot, dry winds in summer. There is no ground cover near this edge, and there are many dead tree ferns. As can be seen in Photo 98, the *Ceratopetalum* (with pink fruit) is restricted to the shelter of the central gully. The canopy elsewhere is predominantly *Doryphora,* but *Quintinia sieberi* and *Acmena* are also common (Species List, Microfiche). The site is similar floristically to the cappings further north on Wollemi National Park, but the epiphyte, *Fieldia,* is well represented. A second area once existed at Wynnes Rocks, Mt Wilson, but it has been so degraded by fires that it is now unrecognizable.

ROBERTSON

On the edge of the tablelands west of the Illawarra, there is a tiny remnant of 4.5 ha, known as Robertson Nature Reserve. On basalt at 740–750 m altitude the site is all that remains of a once extensive stand of the suballiance. Floristically, the reserve is similar to Mt Irvine, but it also supports *Elaeocarpus holopetalus* of the cool temperate rainforest (Species List, Microfiche). Although occasional live soft tree ferns *(Dicksonia antarctica)* are present there are the remains of many others which were originally hosts for the very common *Quintinia sieberi.* Possibly this reserve has been a source of tree fern plants for horticultural purposes. Because of its isolated situation and small size, the reserve is subject to infestation by many exotic plants such as *Ligustrum sinense, L. lucidum, Ilex aquifolium* and *Rubus procerus.*

MORTON NATIONAL PARK

An even smaller remnant of Suballiance No. 40 occurs at The Vines in Morton National Park, south-west of Nowra at 700 m altitude on a small basalt outlier. Part of the area was cleared for a now abandoned sawmill, and the entire area burnt in the 1980 wildfire. Heavy browsing of the regeneration by wallabies is now occurring. Floristically, the site is similar to the preceding examples, but its long-term viability is very much in doubt.

Suballiance No. 41: *Doryphora-Schizomeria*

This suballiance is closely related to No. 39: *Schizomeria-Doryphora-Caldcluvia-Orites,* but it occurs at a slightly higher altitude of 900–1 150 m and is usually more exposed, being close to mountain tops. The soil is of moderate fertility — better than required by *Ceratopetalum* — and the suballiance could therefore be likened to a high-altitude equivalent of the *Schizomeria-Sloanea* Suballiance, No. 33. Apart from *Doryphora* and *Schizomeria,* other common canopy species may include *Quintinia sieberi, Cryptocarya foveolata, Callicoma, Caldcluvia, Sloanea woollsii* and *Orites.* The shrub layer consists of few species, the most common being *Tasmannia insipida* and *Citriobatus pauciflorus.* The sparse ground cover is of ferns with no one species dominating. Of the vines, only *Palmeria scandens* and *Arthropteris tenella* are consistently represented. Epiphytes are inconspicuous, with *Pyrrosia, Dendrobium pugioniforme* and *Fieldia* being most common.

EAST OF TENTERFIELD

On Little Spirabo State Forest south-east of Tenterfield and below the altitudinal limit of the *Doryphora-Quintinia sieberi* Suballiance No. 40 in Dingo Creek Flora Reserve, and also in the north of the State Forest, the suballiance occurs on acid and intermediate volcanics which have high calcium levels in their felspars. There, *Schizomeria* rather than *Ceratopetalum* occurs at this altitude of 1 070–1 130 m, and because of the exposed upper-slope locations, protection is afforded by *Doryphora* (Species List, Microfiche). Some subtropical rainforest elements such as *Sloanea woollsii* and *Pteris umbrosa* are present as an understorey.

GIBRALTAR RANGE

At The Summit on Gibraltar Range National Park, where elevation is equivalent to the preceding locations, a similar situation exists. This exposed high-rainfall area is dominated by *Doryphora* and *Schizomeria,* the latter species rather than *Ceratopetalum* preferring this soil derived from fine-grained sediments (Species List, Microfiche).

UPPER HASTINGS

Another example occurs in the head of Cedar Creek, at Mount Seaview Nature Reserve on the upper Hastings. Here, on exposed south-east upper slopes at 915–1 030 m elevation, is a canopy of *Doryphora* and *Schizomeria* with a lower tree layer of *Acradenia euodiiformis, Quintinia verdonii* and *Caldcluvia* (Species List, Microfiche).

Acmena smithii Alliance

On the South Coast of New South Wales and in Gippsland, Victoria, wildfires become a major factor in rainforest distribution and composition. Repeated fires may completely eliminate sensitive canopy species such as *Ceratopetalum* and *Eucryphia* and favour *Acmena* with its superior coppicing ability over *Doryphora.* Although individual rainforest areas are small, they extend from the Liverpool Range at the head of the Hunter Valley to Wilson's Promontory, Victoria.

The rainforests south of Batemans Bay characterized by *Acmena smithii* have posed a problem for those engaged in forest typing, particularly if they are using the Forestry Commission of New South Wales Research Note No. 17. This publication only lists under warm temperate rainforest those communities containing *Ceratopetalum apetalum.* Moist *Acmena* forests, because of their obvious temperate floristic affinities, have been classified as cool temperate rainforest in the 1981 Rainforest Inventory, even though true cool temperate rainforest species such as *Eucryphia moorei* and *Elaeocarpus holopetalus* are either absent or rare. The drier phase, where *Acmena* may be associated with *Backhousia myrtifolia,* is appropriately regarded as Myrtle type No. 23, a member of the Dry and Depauperate Rainforest league. There is clear evidence from the presence of associated species, however, that the *Ceratopetalum-Acmena-Doryphora* Suballiance No. 37, the *Ceratopetalum-Diploglottis-Acmena* Suballiance No. 34 and the *Ceratopetalum-Eucryphia-Doryphora-Acmena* Suballiance No. 38 north of Batemans Bay have their equivalents to the south, but without *Ceratopetalum* in the three suballiances of the *Acmena* Alliance (Fig. 13). With decreasing soil moisture, this alliance gives way to the *Backhousia myrtifolia-Acmena smithii* Suballiance (No. 30) of the dry rainforest; with increasing coastal exposure, to littoral rainforest of the *Acmena smithii-Ficus-Livistona-Podocarpus* Suballiance (No. 20); with increasing soil fertility and protection, to subtropical rainforest of the *Doryphora-Daphnandra micrantha-Dendrocnide-Ficus-Toona* Suballiance (No. 14); with cooler and wetter conditions, to cool, temperate rainforest of the *Eucryphia moorei* Alliance (Appendix 2).

This classification is in accordance with Forbes, Walsh and Gullan (1982) and Seddon and Cameron (1985) in which the Gippsland rainforests are referable to either cool temperate rainforest with *Atherosperma* and *Elaeocarpus holopetalus* predominating or to the more coastal, warm temperate rainforest dominated by *Acmena smithii.*

On the more fertile soils such as those enriched by basalt or monzonite, there is an infusion of subtropical rainforest elements, if conditions are not too cold (*Acmena-Doryphora-Dendrocnide-Ficus* Suballiance No. 42), or of cool temperate species where conditions are wetter and cooler (*Acmena-Eucryphia-Doryphora* Suballiance No. 44). Accordingly, three suballiances can be recognized in New South Wales:

42. *Acmena-Doryphora-Dendrocnide-Ficus*

43. *Acmena*

44. *Acmena-Eucryphia-Doryphora*

Suballiance No. 42: *Acmena-Doryphora-Dendrocnide-Ficus*

South of the Hunter River, Suballiance No. 34: *Ceratopetalum-Diploglottis-Acmena,* occurs on soils of moderate fertility where protected from cold and dry winds as well as fire. It consists of both warm temperate and subtropical rainforest elements. Because of the southern latitude, it lacks the typical subtropical key species such as *Argyrodendron* and *Sloanea woollsii.* Because *Ceratopetalum* reaches its southern limit near Batemans Bay, any examples of this warm temperate-subtropical rainforest mixture further south are dominated by *Acmena,* or jointly by *Acmena* and *Doryphora* on Mt Dromedary. However, there are also situations between the Hunter Valley and Batemans Bay where *Ceratopetalum* is either absent or of minor importance due to exposure, fire or low rainfall.

LIVERPOOL RANGE

At Warrah Creek in the Liverpool Range on basaltic soil at 600–680 m altitude, there is a riverbank rainforest protected by a spur from the main range. Rainfall is less than 1 100 mm annually, but there is some additional precipitation from low cloud. Major warm temperate rainforest trees are *Acmena smithii, Acronychia oblongifolia, Pittosporum undulatum* and *Rapanea howittiana.* Subtropical species include *Daphnandra micrantha* and *Hymenosporum flavum.* The major ground cover is of *Adiantum formosum,* with other ferns of drier conditions also common such as *Pellaea falcata* and *Doodia aspera.* The more common epiphytes are *Pyrrosia confluens* and *P. rupestris.*

ILLAWARRA ESCARPMENT

On the Illawarra escarpment behind Wollongong there are a number of sites on a considerable mixture of rocks due to exposure in the cliff faces of horizontal strata of sandstone, shale and volcanic rocks. The *Ceratopetalum-Acmena-Doryphora* Suballiance No. 37 occurs on the poorest soils such as those derived from sandstone and tuff. On richer soils derived from latite (related to basalt), there is subtropical rainforest of the *Doryphora-Daphnandra-Dendrocnide-Ficus-Toona* Suballiance No. 14. Between these two extremes, there is a complete gradation of soils and of rainforest vegetation. The *Ceratopetalum-Diploglottis-Acmena* Suballiance No. 34 is one such intermediate, occupying moist, relatively fire-free sections where soil enrichment is only minimal. On the somewhat better soils such as those derived from the coal measures at Macquarie and Jamberoo Passes, the most common tree species are *Acmena* and *Doryphora.* The subtropical element is represented by *Dendrocnide excelsa, Pennantia cunninghamii* and *Diploglottis.* These benches are at 400–540 m altitude.

At other sites such as Mt Kembla and Minnamurra Falls, *Acmena, Doryphora* and *Ceratopetalum* are common temperate rainforest trees associated with the subtropical species listed, and they occur with large specimens of *Ficus obliqua* and *F. macrophylla.* These two localities could be placed with equal justification in the *Ceratopetalum-Diploglottis-Acmena* Suballiance No. 34 because of the substantial *Ceratopetalum* component. Minnamurra Falls in its lower river section has a very well-developed subtropical rainforest element, with huge *Ficus obliqua, Citronella moorei, Brachychiton acerifolius, Diploglottis* and *Dendrocnide excelsa* occupying the fertile alluvial flats enriched by the latite band upstream.

MT DROMEDARY

South of Batemans Bay at cooler latitudes, there are no examples of pure subtropical rainforest, but only this mixture of subtropical and warm temperate rainforests. Even on the most fertile volcanic soils such as those derived from monzonite on the lower slopes of Mt Dromedary, there are only 24 tree species of which eight are subtropical and 11 of temperate affinities (Species List, Microfiche). This site is the southern limit for 12 species, since there are no other more southern occurrences of fertile soil at low altitude close to the sea. It has a rich fern flora of 15 species, 22 species of vines and 14 species of epiphytes. It has suffered considerable disturbance over the years from clearing of the lower slopes, gold digging, harvesting of epiphytic ferns and orchids and the disastrous series of bushfires culminating in those of 1942 when many of the rainforest gullies were destroyed (Duggin 1976) and again in 1952 when all the eucalypt ridges and presumably part of the rainforest gullies were burnt.

MORUYA

North-west of Moruya on rhyolite, dacite and basalt volcanic rocks, soils are more fertile than those on the sedimentary or metamorphic rocks. These sites contain some subtropical rainforest elements. On Wandera Mountain, north-west of Moruya, there is a degraded rainforest in a repeatedly burnt gully on the western slope. The forest consists of *Acmena, Synoum glandulosum* and *Ficus coronata* in addition to *Dendrocnide excelsa, Claoxylon australe, Backhousia myrtifolia* and *Tristaniopsis laurina* (Species List, Microfiche). Three years after the last fire, this rainforest is merely a billowing, viny tangle. Each bulge in the greenery is a still-living strangulated tree beneath a blanket of vines such as *Cissus hypoglauca, Rubus* sp. aff. *moorei* and *Smilax australis.* West of Moruya on Coondella Trig, there is a floristically similar forest with poor development and a very broken canopy.

NAROOMA

Somewhat less fertile soils may also support this suballiance, as occurs on metasediments at West Boundary Road in Moruya State Forest, High Ridge in Dampier State Forest and Kianga Creek, Narooma. These communities are floristically poorer than the preceding sites on better soils, having only eight to 12 tree species and virtually no epiphytes apart from the inconspicuous *Pyrrosia rupestris. Acmena* is clearly the most common tree species, but *Ficus coronata* and *Pittosporum undulatum* may be common. *Polyscias murrayi* is conspicuous as an emergent on all sites, and other subtropical rainforest species recorded are *Alphitonia excelsa* at Kianga Creek and *Dendrocnide excelsa,* which is very common on West Boundary Road. The herb layer is mainly *Lastreopsis microsora* and *Pellaea falcata,* with *Pseuderanthemum variabile* reaching its southern limit at Kianga Creek. The most common vines are *Cissus hypoglauca, Smilax australis, Marsdenia rostrata, Pandorea pandorana* and *Morinda jasminoides.* At West Boundary Road, the 1980 fire burnt right through the rainforest, causing many deaths and promoting a smothering blanket of vines. At Kianga Creek, the rainforest has suffered from fill where the widened highway now extends to the creek itself.

Suballiance No. 43: Acmena

In this suballiance, there is a clear predominance of *Acmena* both in numbers and in size — some trees reaching 25 m. Other tree species such as *Rapanea howittiana, Acronychia oblongifolia* and *Tristaniopsis laurina* are only occasional except at Wapengo Creek in Mumbulla State Forest, where both *Backhousia myrtifolia* and *Doryphora* are common (Species List, Microfiche). The suballiance occurs in narrow gullies, generally at low altitude but occasionally up to 700 m on poor alluvial soils derived from metasediments, sandstone or granite. Its range is from Moruya through Gippsland to Wilson's Promontary in Victoria.

MORUYA-BEGA

At Diamond Creek in Dampier State Forest and Wadbilliga River in Wadbilliga National Park at 560–730 m altitude, there are only six recorded tree species (Species List, Microfiche). However, at Wapengo Creek where the altitude is only 60–120 m, there are 15 species with isolated specimens of several subtropical rainforest species. Like so many rainforest gullies in this area, the site was badly burnt in the 1980 fire and is now shrinking as a result of successive fires. Despite this damage, Wapengo Creek provides a new southern limit for *Backhousia myrtifolia* and *Psychotria loniceroides*. This site is also at the southern limit of *Symplocos thwaitesii* and *Citriobatus pauciflorus*.

EDEN

Further south, at Bellbird Creek Nature Reserve on sandstone, there are eight tree species including *Ficus rubiginosa* at its known southern limit, as well as the vine, *Stephania japonica* var. *discolor* (Species List, Microfiche).

There is a maximum of only four species of epiphytes on each site, with *Polyphlebium venosum* and *Fieldia australis* common on the higher altitude sites whereas *Pyrrosia rupestris, Plectorrhiza tridentata* and *Sarcochilus olivaceus* are common on the low-altitude, coastal site at Wapengo Creek.

Suballiance No. 44: Acmena-Eucryphia-Doryphora

This suballiance includes some cool temperate rainforest species such as *Eucryphia* and *Dicksonia* because of its increased altitude (400–800 m, except at Nadgee where altitude is only 140–300 m). It benefits from these cooler conditions, increased rainfall and fire-free niches in gullies or on scree slopes where the fire-sensitive *Eucryphia* is safe. It is found on alluvial yellow earths derived from metasediments or granite in moist cool gullies from south of Moruya to the Victorian border.

MORUYA-BEGA HINTERLAND

At Bumbo and German Creeks in Dampier State Forest, fires have been sufficiently infrequent (1939 and then 1968) to allow the rainforest on the slopes to become well-established before being burnt out again.

This suballiance is best regarded as intermediate between the typical warm temperate rainforest (*Acmena* Alliance) and the cool temperate rainforest (*Eucryphia* Alliance). For instance, at Bumbo Creek there is a warm arm of the creek at the base of a west-facing cliffline on scree where the common tree species all have thick, rough bark and a strong coppicing ability (*Doryphora, Acmena, Cryptocarya glaucescens*). This site is a new southern limit for *Tasmannia insipida* and *Rubus* sp. aff. *moorei*. However, where this arm meets the main creek in a deep cool gully, *Eucryphia* becomes a common canopy component while *Dicksonia* replaces *Cyathea australis* in the understorey (Species List, Microfiche). At German Creek, nearby in the broad headwaters of the Deua River at a higher altitude of 650–700 m, the tree layer consists of a strong cool temperate rainforest component of *Eucryphia*, with occasional warm temperate species such as *Acmena, Pittosporum undulatum, Tristaniopsis laurina* and *Rapanea howittiana* (Species List, Microfiche). It has, therefore, closer affinity to cool temperate than to warm temperate rainforest.

On the southern slopes of Wandella Mountain in Paddys Creek Forest Preserve, there are two major rainforest pockets. The upper site, at 680–860 m, is typical cool temperate rainforest consisting almost exclusively of *Eucryphia*. By contrast, the lower occurrence, at 420–470 m altitude, is mainly *Doryphora* and *Acmena* with only occasional *Eucryphia* along the creekline where free from fires (Species List, Microfiche).

On Wandella Forest Preserve at the head of Wandella Creek in Murrabrine State Forest, south-west of Narooma, the rainforest is on a very coarse granite at a high altitude of 540–860 m. The rainforest is confined by repeated fires to the moister south-east aspect of the gullies. The effect of very hot fires in 1952, 1968 are 1980 are threatening this type of rainforest. The upper sections are mainly large *Doryphora*, many with burnt butts from the 1968 fire when they also lost their crowns. Mortality was high, and those which survived have narrow, epicormic crowns (Photo 99). *Acmena* becomes more common towards the lower elevations of these patches since both it and *Doryphora* are relatively fire-resistant. *Eucryphia* is present but only along the creeks where fire damage would be minimal. If fire was excluded for a lengthy period, *Eucryphia* might possibly dominate the higher *Doryphora* areas. The mortality in the canopy due to the fires has allowed additional light to penetrate to the forest floor and thus encourage a most luxuriant growth of *Urtica incisa* and *Rubus rosifolius* which, with the dense growth of ground ferns, completely blankets the soil surface (Species List, Microfiche).

NADGEE

Near the Victorian Border on Nadgee State Forest and Nadgee Nature Reserve, there are rainforest gullies on either side of Table Ridge. The ridge runs north-east from the Victorian Border through Mt Nadgee. Being the first line of hills inland from the coast and from 350 m to 500 m high, this area probably has a higher rainfall due to cloud uplift and condensation than surrounding lower areas. This could explain why *Eucryphia* occurs here along the streams at only 140–300 m altitude, even though *Acmena* is the dominant tree species as would be expected. At Royds Creek in Nadgee State Forest and on Nadgee River at Nadgee Nature Reserve, *Eucryphia* is restricted to the creeks due to repeated fires. In 1980, the fire burnt right through both rainforest patches. Only in two locations on Nadgee State Forest is *Eucryphia* the major species, that is at Maxwells and Watergums Flora Reserves. These sites escaped the 1980 fires although there was some perimeter scorching. These locations will be discussed later under Suballiance No. 55: *Eucryphia-Acmena*, which is included in the cool temperate rainforest subform.

At both Royds Creek and Nadgee River, the fire opened up the canopy and produced a dense weed growth of *Solanum aviculare, Bidens pilosa, Phytolacca octandra. Pomaderris aspera* and *Goodenia ovata* (Species List, Microfiche). Royds Creek is very vulnerable to fires burning up the creek from the west, whereas Nadgee River is susceptible to fires from the coastal plain below. Both sites show severe signs of structural deterioration due to the combined effect of successive fires and old logging, which has opened up the rainforest canopy. The understorey has been desiccated, thereby increasing the fire risk. Following logging, Nadgee River contained very little overstorey of either eucalypts or rainforest. The isolated rainforest trees were smothered by columns of vines. Possibly, the next major fire will eliminate what remains of these rainforests.

LOW FOREST AND CLOSED SCRUB

Both warm temperate and cool temperate rainforests may be reduced to either low forest or closed scrub under cold, exposed, wet conditions which usually occur at 900–1 400 m altitude where the soil is very shallow and derived from the less fertile igneous rocks (granophyre, rhyolite, tuff), metasediments or sedimentary rocks (Fig. 13). These communities occur from the Barrington Tops north to the McPherson Range. Where associated with cool temperate rainforest, these low forests and closed scrubs are described under Suballiance No. 49: *Nothofagus-Callicoma-Tristaniopsis.*

Suballiance No. 45: *Tristaniopsis collina-Ceratopetalum/Schizomeria*

WESTERN McPHERSON RANGE

Although much of the low, closed forest of the McPherson Range is associated with *Nothofagus*, there is an area on Donaldson State Forest, east of Mt Nothofagus, where *Tristaniopsis collina, Lophostemon confertus* and *Schizomeria ovata* form most of the overstorey. *Callicoma* and *Banksia integrifolia* are also common on this shallow soil derived from acid tuff (Species List, Microfiche).

DORRIGO ESCARPMENT

At Dibbs Head in Dorrigo National Park, the canopy consists mainly of *Callicoma, Banksia integrifolia* and *Acacia melanoxylon* with occasional trees of *Ceratopetalum, Tristaniopsis, Orites* and *Doryphora*. The lower tree layer is of *Acradenia euodiiformis, Acmena* and *Anopterus macleayanus*. Common vines are *Smilax australis* and *Cissus hypoglauca* (Species List, Microfiche).

On the steep, narrow ridges leading down from points on the Dorrigo escarpment where the soil is too shallow for taller trees, there is a low forest on yellow earth derived from metasediments. The canopy in this type of forest in the head of Bishops Creek at New England National Park consists of *Tristaniopsis, Cuttsia* and *Polyosma cunninghamii*. Other species include *Ceratopetalum, Pittosporum* and *Acmena*. Vines are rare (Species List, Microfiche).

COMBOYNE

All the above examples are at exposed high altitudes above 900 m, but on Boorganna Nature Reserve, this suballiance occurs on the steep rocky slopes fringing Mumfords Creek at only 490 m altitude (Species List, Microfiche). *Tristaniopsis* is the dominant tree. *Acradenia, Pittosporum* and *Cuttsia* are the most common small trees. No vines are recorded, and as in the other examples, epiphytes are rare.

Suballiance No. 46: *Leptospermum* spp.*-Notelaea venosa-Prostanthera* spp.

Where the soil, between the outcropping rocks or in minor depressions is both shallow and seasonally dry on the high-altitude exposed ridge tops, vegetation is mainly of shrubs designated as a closed scrub. The canopy can be 2–5 m high, and it consists of *Leptospermum polygalifolium* or *L. petersonii, Notelaea venosa* and *Prostanthera incisa* or *P. ovalifolia*. Smaller shrubs may include *Acacia obtusifolia* and *Callistemon comboynensis*. The herb layer is not well developed and vines are absent or rare. Epiphytes are mainly mosses near the cliff edge, but there may be clumps of orchids on the rock faces, such as *Liparis reflexa* and *Dendrobium kingianum*.

WESTERN McPHERSON RANGE

There are a number of closed scrubs along the McPherson Range. The vegetation on the summit of Wilsons Peak (1 233 m), where the McPherson Range meets the Great Dividing Range, consists of rigid wiry shrubs 2–3 m high above the trachyte cliffline. Major species are *Leptospermum petersonii, Prostanthera incisa, Stenocarpus salignus, Pittosporum undulatum* and *Lomatia arborescens*. In a depression on the southwest side of the summit, there is a pure thicket of dwarfed *Rapanea variabilis* up to 50 cm stem diameter. Further east on Mt Nothofagus Flora Reserve, on a granophyre dyke at 1 200–1 260 m elevation, there is a further example consisting of 2–3 m-high shrubs of *Lepotospermum petersonii, Acacia obtusifolia* with *Notelaea venosa* and *Cryptocarya nova-anglica* which also occurs in New England and Werrikimbe National Parks. *Dendrobium kingianum* is common on the rock faces (Species List, Microfiche). The rhyolite cliffs of Mt Lindesay resemble those of Wilsons Peak but on a grander scale,

as does the scrub above these cliffs to the summit at 1 100 m (Photo 95). The low, brown vegetation on the shoulders of the cliffs is dry heath dominated by *Allocasuarina rigida.* Major species in the closed scrub are *Leptospermum petersonii, Notelaea venosa, Banksia integrifolia* and *Allocasuarina rigida.* Also common are *Prostanthera incisa, Leucopogon lanceolatus, Lomatia arborescens, Acacia obtusifolia* and *Callistemon comboyensis* (Species List, Microfiche). The latter species is also on the summit of Mt Warning, the rhyolite cliffs of the Nightcap Range and similar cliffs on the Comboyne Plateau. This suballiance is also found on Glennies Chair, only 5 km to the east.

MT WARNING

The central core of Mt Warning consists of trachy-andesite, which is chemically related to trachyte and rhyolite. The site is covered with closed scrub from 930 m to the summit at 1 105 m altitude. The more common species are the same as on Mt Lindesay except that *Banksia integrifolia* and *Allocasuarina rigida* are absent. Additional species are *Acmena smithii, Pittosporum undulatum, Cuttsia viburnea* and *Doryanthes palmeri.* The latter is otherwise restricted to Mt Mistake, Mt Cordeaux in Queensland and Blue Knob. There are a number of shrubby composites commonly present such as *Helichrysum rufescens, H. vagans, H. elatum* and *Cassinia subtropica.* Commonly found on the shady rock faces is the orchid, *Liparis reflexa. Xanthorrhoea latifolia* is also quite common here as well as on the caldera walls at The Pinnacle to the west and the Nightcap Range to the south.

WASHPOOL-GIBRALTAR RANGE

In Washpool National Park, this suballiance occurs on the high, exposed ridges where *Leptospermum petersonii* and *Prostanthera incisa* predominate with *Acacia obtusifolia.*

Three seral stages can be recognized following fire. At Rock Top north of Haydens Trig, a wildfire 20 years earlier killed many of the old *Eucalyptus andrewsii* ssp. *campanulata.* In its place, there is a dense forest of *Acacia irrorata* up to 15 m tall with some *A. obtusifolia* which is now beginning to die out. However, there is a well established understorey of *Leptospermum petersonii, Prostanthera incisa, Bursaria spinosa* and *Cassinia aculeata* ready to take over, as is the case at Haydens Trig. On the rocky ridge at 1 050 m altitude separating Oorooroo and Willowie Creeks, there are patches of a wetter scrub surrounded by well-developed rainforest which has probably never burnt (Photo 100). The *Leptospermum* and *Prostanthera* are the major species, while the scattered overstorey consists of *Tristaniopsis, Baloghia, Pittosporum undulatum* and *Lophostemon confertus.* The small shrub layer and ground cover consists of *Cordyline rubra, Gymnostachys anceps, Cryptocarya meissneriana* and *Acronychia oblongifolia.* Vines are not common and are restricted to the woody *Cissus antarctica* and the wiry *Parsonsia induplicata.*

North-east of The Summit on adjoining Gibraltar Range National Park, at 900–1 170 m, there is a wet scrub in the head of Middle Creek, where fogs are prevalent and the hard metasediment rocks are close to the surface. The scrub is about 5 m tall, consisting of *Leptospermum polygalifolium, Prostanthera incisa* and *Notelaea venosa* with the lower trunks wrapped in moss. There is a small shrub layer of *Alyxia ruscifolia* and *Olearia elliptica.* Herbs are mainly *Pellaea falcata* var. *nana* with *Plectranthus parviflorus* in the crevices (Species List, Microfiche).

At Cangai Boards Flora Reserve on Cangi State Forest nearby, but on a dry knife-edge ridge at only 840 m altitude, *Leptospermum* and *Prostanthera* are still the major species. In addition, there are a number of interesting drier species. *Xanthorrhoea malacophylla, Acacia obtusifolia* and *Acacia "cangiensis"* ms. are common, the latter being a very attractive, feather-leaved wattle only known from this general area and Dandahra Falls. There is also a handsome, undescribed *Callistemon* as well as *Westringia sericea,* which occurs around Brisbane but not elsewhere in New South Wales.

MT HYLAND

To the north of Mt Hyland in the headwaters of Obeloe and Big Bull Creeks, there are scrub areas protected from fires by the surrounding rainforest. The shallow soils on the steep, dry, usually northerly slopes are derived from metasediments. The most common large shrubs are *Leptospermum polygalifolium* and *Notelaea venosa.* The *Leptospermum* and also *Trochocarpa* sp. nov. actually attain tree proportions here — more than 10 m tall and 30 cm diameter. On Big Bull Creek, the normally shrubby *Acrotriche aggregata* grows up to 15 m tall and 30 cm diameter, while *Notelaea venosa* is 10 m tall and 25 cm diameter. These large sizes are possibly a result of the freedom from fires enjoyed by these rocky islands in the rainforest. Other common large shrubs are *Banksia integrifolia, Acacia melanoxylon* and *Leptospermum novae-angliae* (Species List, Microfiche). The more common smaller shrubs are *Citriobatus pauciflorus* and *Alyxia ruscifolia.* There is a sparse ground layer of ferns such as *Lastreopsis decomposita* and the mat rush, *Lomandra spicata.* The vines are mostly of the wiry type, such as *Ripogonum discolor* and *Parsonsia* sp. A. *Pyrrosia rupestris* is a common fern upon the shrubs.

DORRIGO ESCARPMENT

A further example of this suballiance is on Dibbs Head in Dorrigo National Park. It occurs at 925 m on a rocky prominence overlooking the coast. *Leptospermum polygalifolium* and a further two recently described species are present (*L. novae-angliae* and *L. polyanthum*), with *Notelaea, Prostanthera, Acmena smithii, Acrotriche* and *Alyxia.* The ground cover is of *Lomandra longifolia, L. spicata* and an undescribed *Baeckia* related to *B. camphorata.* Apart from *Parsonsia* sp. *A.*, vines are rare. The only common lithophytes are *Dendrobium kingianum* and *Liparis reflexa.*

CHAPTER 4

Cool Temperate Rainforest

This floristically simple forest of only one to three common tree species forms a single or at best two-layered canopy of dense, even and uniform height, most species with simple toothed leaves under 7.5 cm long, although *Eucryphia moorei* is a notable exception. It occurs in cool, reliable moist areas such as along the coastal escarpment where mists are frequent and favour the characteristic development of a dense growth of mosses and lichens on tree trunks and branches as well as a moist ground layer of ferns and tree ferns.

There are many examples in New South Wales cool temperate rainforest communities of single-species dominance by *Nothofagus moorei, Eucryphia moorei* and *Elaeocarpus holopetalus,* but there are also a range of intermediates. Jarman *et al.* (1984) also recognized this continuous variation and regarded 18 communities in Tasmanian cool temperate rainforest as nodes in a continuum.

In New South Wales, two cool temperate alliances are recognized — *Nothofagus moorei* north from the Barrington Tops, and *Eucryphia moorei* south from the Illawarra. Under increasingly unfavourable environmental conditions, a floristically depauperate variant dominated by *Elaeocarpus holopetalus* can be recognized.

In the high altitude rainforests of East Gippsland, Victoria, there is an *Atherosperma moschatum-Elaeocarpus holopetalus* Alliance which may be simplified into a predominantly *Atherosperma* Suballiance along stream banks or to an *Elaeocarpus* Suballiance under less favourable conditions (Cameron 1984). There is also a closed scrub of *Podocarpus lawrencei-Tasmannia* spp. aff. *xerophila* on the Errinundra Plateau which exhibits structural similarities at least to the "Horizontal Scrub" or implicate rainforest of Tasmania. The major cool temperate rainforests in Victoria further west and south at Strzelecki Ranges, Central Highlands and the Otways are in the *Nothofagus cunninghamii* Alliance. In Tasmania, there are four cool temperate rainforest groups comprising 18 communities. Those at lower altitudes and to the north and east of the island are dominated also by *N. cunninghamii,* while at higher altitudes and towards the south-west, the overstorey is often *Athrotaxis selaginoides* or *A. cupressoides.* (Jarman *et al.* 1984).

***Nothofagus moorei* Alliance**

The five discontinuous areas from the Barrington Tops to the McPherson Range have many species in common. Certain families are very well represented, particularly Proteaceae (*Oreocallis, Orites, Stenocarpus, Lomatia* and *Triunia*), Winteraceae (*Tasmannia),* Atherospermataceae (*Doryphora, Atherosperma),* Lauraceae (*Cryptocarya, Endiandra),* Escalloniaceae (*Abrophyllum, Cuttsia, Polyosma, Quintinia)* and Cunoniaceae (*Caldcluvia, Callicoma, Ceratopetalum, Geissois, Schizomeria, Vesselowskya).*

The number of species of trees and shrubs which are mainly restricted to cool temperate rainforest is at a maximum along the Bellinger Escarpment (48 species), closely followed by the upper Hastings (44 species). The southern area on the Barrington Tops (38 species) and the northern areas of eastern McPherson Range (37 species) and western McPherson range (34 species) are less diverse. It would appear that the Bellinger Escarpment-upper Hastings is the refugial core area, since there are six of the above species which only extend north from the upper Hastings to the McPherson Range and a further four species found from the Bellinger Escarpment northwards. Seven species extend from this postulated core area south to Barrington Tops, but not to the north.

Five suballiances are recognized in New South Wales, all with *N. moorei* as the dominant species but with various associated species according to soil type, altitude and exposure (Fig. 14):

47. *Nothofagus-Quintinia sieberi-Doryphora*
48. *Nothofagus-Ceratopetalum*
49. *Nothofagus-Callicoma-Tristaniopsis*
50. *Nothofagus-Doryphora-Orites-Caldcluvia*
51. *Nothofagus-Elaeocarpus holopetalus*

Suballiance No. 47: *Nothofagus-Quintinia sieberi-Doryphora*

Stands of this suballiance include the optimum development of cool temperate rainforest in New South Wales north of the New England National Park, being on fertile krasnozem soils derived from basalt. This community is found in the cooler, moist, high altitudes from 750 m to 1 450 m. At its northern limit on the McPherson Range, 95% of its area is above 1 000 m altitude. *Nothofagus moorei* is the dominant large tree, with a lower tree layer of *Quintinia sieberi* and *Doryphora sassafras. Acacia melanoxylon* may also be common, particularly if there is a history of disturbance. Among the vines, *Berberidopsis beckleri* with its South American linkage is common. Epiphytes are well developed, particularly the orchids *Dendrobium falcorostrum* and *D. pugioniforme* in the canopy. *Fieldia australis* and various filmy ferns conceal the bases of the trees (Photo 101).

Both this suballiance and its high-altitude southern equivalent, No. 51 *(Nothofagus-Elaeocarpus holopetalus),* occupy two distinct ecological niches. They occur either on protected escarpments or in sheltered gully heads to the west. Typical escarpment examples are on the McPherson and Tweed Range caldera rim from Bar Mountain and Warrazambil Creek (Species List, Microfiche) to Mt Durigan, Mt Hobwee and Springbrook. To the south, Suballiance No. 47 occurs from Bishops Creek and Barren Mountain to Point Lookout along the Bellinger Valley escarpment. In Lamington National Park, there are extensive areas of this suballiance on the southern side of spurs such as Mt Widgee and Lost World which run north-west from the caldera rim. Several tree species such as *Quintinia sieberi* and *Oreocallis pinnata* reach their northern limit on the caldera rim, while *Neostelia spectabilis* is confined to the waterfalls of the Bellinger Escarpment. Probably the best example of the suballiance on this escarpment is at Point Lookout, at 1 350 m altitude on the lowest basalt laval flow and tuff layer (Species List, Microfiche). Common shrubs are *Vesselowskya rubifolia* near its northern limit and *Aristotelia australasica.* Typical herbs are *Dianella tasmanica* and *Drymophila moorei,* both with Tasmanian connections.

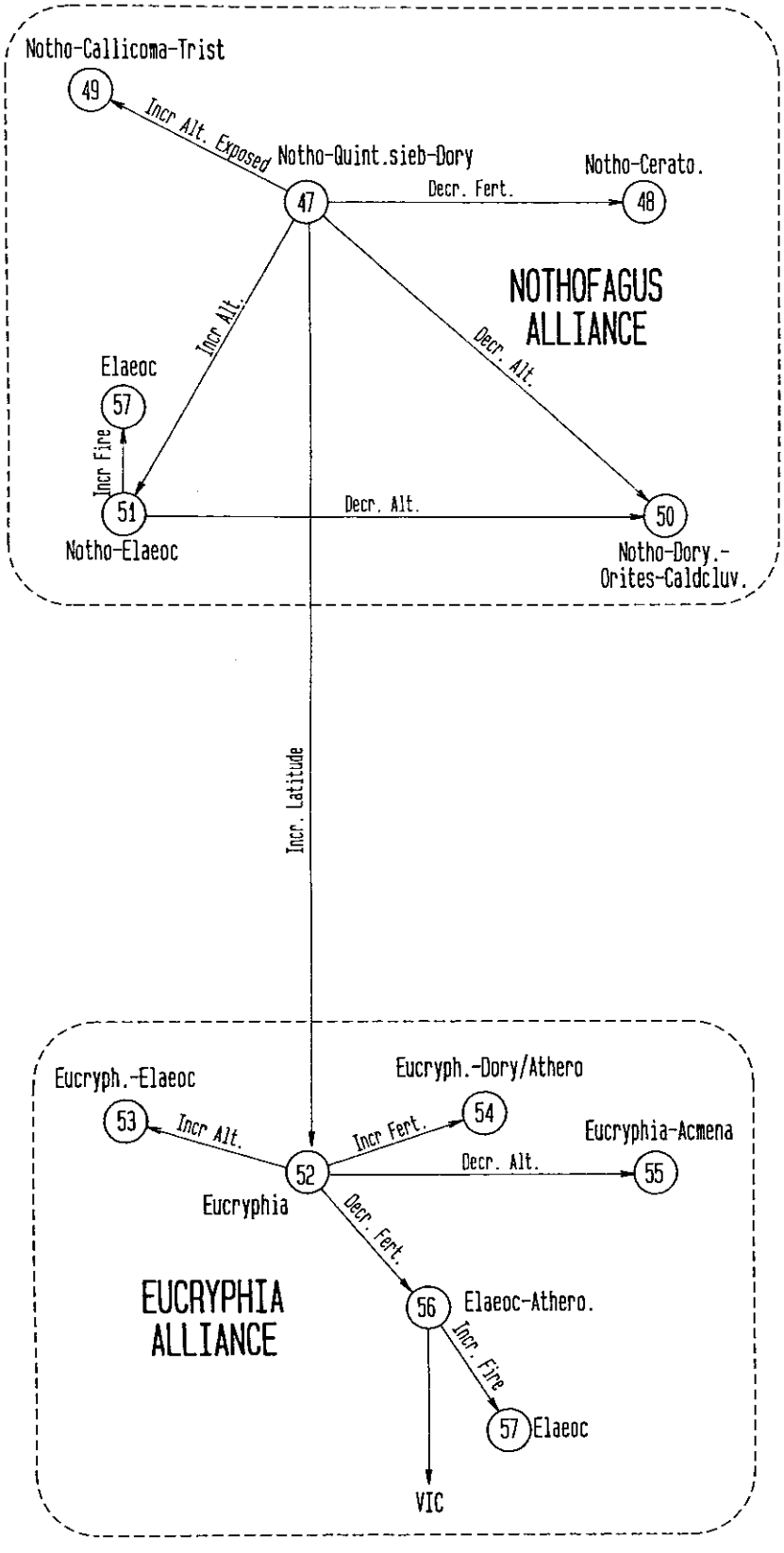


Fig. 14. Floristic classification of cool temperate rainforest.

The gully niches are well developed in the heads of the westward flowing Christmas, Gradys and Brindle (Species List, Microfiche) Creeks in Lamington and Border Ranges National Parks. In the understorey, they contain such endemic species as *Pittosporum oreillyanum* and *Aristolochia deltantha* var. *laheyana* and the disjunct *Dicksonia youngiae.*

On the Dorrigo Plateau in gully heads of Rosewood Creek and at Deervale, there are good, protected examples of this suballiance. Just south of New England National Park in the head of Georges River, with an easterly aspect at the base of a small basalt cliffline, there is a magnificent forest of tall *Nothofagus* trees overtopped by towering *Eucalyptus obliqua* up to 70 m tall on the upper bouldery slopes, or by *E. viminalis* on the lower, moister areas. Small trees include the undescribed species of *Trochocarpa,* which is absent in the northern McPherson Range area. The shrub, *Aristotelia australasica,* and the herb, *Drymophila moorei,* are common components.

Suballiance No. 48: Nothofagus-Ceratopetalum

This suballiance occurs in gully heads, and in locations where climatic conditions are similar to those required by the preceding *Nothofagus-Quintinia sieberi-Doryphora* Suballiance but soil is poorer. The yellow earth is derived from basaltically-enriched acid volcanics, sedimentary or meta-sedimentary rocks.

Nothofagus still dominates, but *Ceratopetalum apetalum* forms a lower tree layer. The altitudinal range is approximately 800–1 150 m. Common associated tree species are *Orites excelsa, Doryphora sassafras, Caldcluvia paniculosa, Callicoma serratifolia* and *Schizomeria ovata.*

At lower altitudes where *Nothofagus* is absent, the community is described as the *Ceratopetalum-Doryphora* Suballiance No. 36, as at Cunnawarra Creek and in the upper Hastings.

McPHERSON RANGE

Because of the almost complete mantle of basalt around the caldera rim on Lamington and Border Ranges National Parks, the *Nothofagus-Ceratopetalum* Suballiance is quite rare in the north. The best example is found between Lightning and Gwahlahla Falls on the south-facing slopes of the left branch of the Albert River in Lamington National Park (Species List, Microfiche). The geology at this site has been determined as porphyritic basalt (W. McDonald, pers. comm.) which because of different weathering rates of the various mineral crystals, could produce a very well drained soil liable to rapid drying out. Chemically, the paler derived soil could differ from that of typical basalt because some minerals are more resistant to weathering. Their availability to the plants may be delayed. The understorey is particularly sparse. There is also a small remnant on the summit of Mt Throakban.

DORRIGO

Upstream from Killungoondie Plain on Dorrigo National Park, there is an interesting sere perpetuated by wildfire from the grassy plain through *Allocasuarina littoralis, Banksia integrifolia* var. *compar, Prostanthera lasianthos, Callitris rhomboidea* and *Eucalyptus viminalis* to *Doryphora, Ceratopetalum* and *Acacia melanoxylon,* and then to the *Nothofagus-Ceratopetalum* Suballiance (Species List, Microfiche). The forest floor here is also very clear. Common associated larger trees are *Doryphora* and *Acacia melanoxylon.* Several small trees present are of interest, particularly the endemic *Cryptocarya dorrigoensis, Acradenia euodiiformis* (the only other species in the genus being in

Tasmania and *Denhamia moorei* (restricted to the Bellinger Escarpment and Mt Hyland) (Photo 102). The beech orchid, *Dendrobium falcorostrum* is a very common epiphyte.

STYX RIVER STATE FOREST

At Cunnawarra Creek in Cunnawarra Flora Reserve, just south of New England National Park, the soil is poorer than in nearby Georges River sites of *Nothofagus-Quintinia sieberi-Doryphora* Suballiance No. 47. It is derived mainly from metasediments with some basaltic enrichment from upslope. This soil supports a fine forest of *Nothofagus* with large *Ceratopetalum* beneath and in the gaps. Other common trees are *Doryphora sassafras, Caldcluvia paniculosa, Orites excelsa, Quintinia sieberi* and *Vesselowskya rubifolia* (Species List, Microfiche). The *Ceratopetalum* appears to be more vigorous than *Nothofagus*. With its prolific seedling regeneration, it would appear to be capable of eventually replacing *Nothofagus*. The *Nothofagus* in turn appears to have virtually replaced an earlier eucalypt forest, now approaching senescence, which consisted of *E. fastigata, E. obliqua, E. andrewsii* spp. *campanulata* and *E. viminalis*.

In this gully, the soil fertility gradient is reflected in the suballiances, which are *Nothofagus-Quintinia sieberi-Doryphora* No. 47 upslope on the basalt, *Nothofagus-Ceratopetalum* No. 48 midslope on enriched metasediments and *Ceratopetalum-Doryphora* No. 36 downslope on metasediments.

KUNDERANG BROOK

Near Spokes Hill in the head of Kunderang Brook, this suballiance is confined by fire to a narrow streambank fringe. Beneath the large old *Nothofagus* trees is a second tree layer of *Ceratopetalum* and *Doryphora*, with *Acacia elata* common near the margins.

UPPER HASTINGS

The upper Hastings contains the largest compact area of the *Nothofagus* Alliance in New South Wales with 490 ha at Mt Banda Banda and 2 260 ha in the heads of the Forbes and Hastings Rivers. Before 1982, Werrikimbe National Park was thought to contain a major occurrence of *Nothofagus*, but in actual fact, this area was only 70 ha. However, subsequent additions have added 2 000 ha of the alliance to the park. Beneath the large spreading *Nothofagus* is a lower layer of predominantly *Ceratopetalum* with occasional trees of *Orites* and *Doryphora*. The soil is only moderately fertile, being derived from porphyry. The best forest development is at Banda Banda Flora Reserve (Species List, Microfiche), but the most extensive area is at a somewhat higher altitude to the south-west in the head of the Forbes River known as Plateau Beech. This site was added to Werrikimbe National Park in 1984. *Eucalyptus obliqua* and *E. saligna* are present here as emergents. Large epiphytes are *Dendrobium falcorostrum, D. pugioniforme* and *Fieldia australis*. The tall shrub or small tree, *Vesselowskya rubifolia*, is found only at lower altitudes here. However, at the highest altitudes above 1 200 m on Plateau Beech is found *Cryptocarya nova-anglica*, which otherwise is known only from New England National Park and Mt Nothofagus Flora Reserve on the western McPherson Range. Normally only a small tree, it is 20 m tall and 45 cm diameter at Plateau Beech.

Suballiance No. 49: *Nothofagus-Callicoma-Tristaniopsis*

In cool wet mountain areas where the soil is shallow due to the proximity of the underlying rock, as on exposed ridgetops, a lower forest is found dominated by *Nothofagus*. *Callicoma serratifolia* and *Tristaniopsis collina* are common in the canopy gaps, however. Other tree species may include *Acacia melanoxylon, Doryphora sassafras, Polyosma cunninghamii* and *Pittosporum undulatum*. This suballiance occurs in the McPherson Range and Eastern Dorrigo regions, often on only moderately fertile or

skeletal soils (Species List, Microfiche). Several understorey species such as *Triunia youngiana, Acradenia euodiiformis* and *Petermannia cirrosa* which are common in this suballiance only in the Eastern Dorigo are restricted to the poorer soils of the warm temperate rainforest alliances on the McPherson Range.

It is possible that this suballiance once occurred along Mumfords Creek on the edge of the Comboyne Plateau. The common associates of *Nothofagus,* such as *Vesselowskya rubifolia, Acradenia eudiiformis, Tristaniopsis collina* and *Callicoma serratifolia,* are present. The absence of *Nothofagus* was puzzling until an old report was found to refer to *Nothofagus* as being "extremely rare although many trees were undoubtedly destroyed during clearing" (Chisholm 1925).

The distribution of *Dendrobium falcorostrum* is interesting since it is only common in this suballiance on Mt Nothofagus, where it receives some protection. The species is found occasionally on the eastern McPherson Range, and it is absent from the very exposed Tuckers Nob site and the narrow, drier site at Bo Bo Creek in the Eastern Dorrigo (Species List, Microfiche).

Along the exposed cliff tops of the caldera rim on the McPherson Range on Limpinwood Nature Reserve, there are various lookout points such as Mt Wagawn, Mt Merino, Wanungara, Toolona, Mt Bithongabel, Cominan, Echo Point, Mt Durigan and Mt Throakban. Here is found a depauperate, low, dense forest of *Nothofagus, Callicoma* and *Tristaniopsis* with smaller trees of *Abrophyllum ornans* and *Polyosma cunninghamii.* This *Nothofagus* thicket (nanophyll moss thicket of Webb 1978) may merge on the rocky outcrops into a scrub of *Pittosporum undulatum, Leucopogon lanceolatus, Trochocarpa laurina, Prostanthera incisa, Xanthorrhoea latifolia, Acomis acoma, Cassinia compacta, Helichrysum vagans* and *Olearia elliptica.*

Suballiance No. 50: *Nothofagus-Doryphora-Orites-Caldcluvia*

On the Barrington Tops, the *Nothofagus* Alliance in the more sheltered and/or lower altitudes contains additional elements of either subtropical or warm temperate rainforest. Soil is derived from basalt or granodiorite, either of which weather to become reasonably fertile. In addition to the four species listed, *Callicoma* is also common. The shrub layer is dominated by *Dicksonia antarctica* throughout.

At lower altitudes of 700–1 000 m, the suballiance contains additional species of the subtropical rainforest, including *Daphnandra micrantha, Dysoxylum fraserianum, Toona australis, Citronella moorei, Pennantia cunninghamii, Diploglottis australis, Sloanea woollsii* and *Ehretia acuminata.* Amongst the vines present, *Cissus hypoglauca* is found only at lower altitudes. Among the herbs, *Elatostema reticulatum, Urtica incisa* and the epiphytic orchids, *Dendrobium falcorostrum* and *D. pugioniforme,* are more common here. Because the base of the basalt flows is generally at about 900 m altitude, this suballiance usually extends a little lower, to about 850 m on the colluvium. However, in the upper Chichester catchment, the granodiorite outcrops down to about 500 m, thereby enabling this suballiance to descend to 700 m to form a magnificent forest in the sheltered valley. There is a canopy of mature to over-mature *Nothofagus* about 35 m tall with a scattering of *Eucalyptus obliqua* and occasional *E. saligna* towering to 60 m tall and providing protection at these altitudes for the subtropical elements below them (Species List, Microfiche). It is not possible to say whether a subtropical rainforest will replace the eucalypts and *Nothofagus* when they finally die, or whether the gaps will permit eucalypt and *Nothofagus* regeneration and thus maintain this multi-layered forest.

Good examples of the suballiance occur also at Mt Allyn (Species List, Microfiche) and along the Kerripit River adjoining the Kerripit Beech Flora Reserve. Although

emergent eucalypts are often present, this is not always the case. In Mt Allyn Forest Park, the overstorey is simply of *Nothofagus*.

At higher elevations of 900–1 250 m on colder, steeper sites or on soils derived from poorer sedimentary rocks, there are no subtropical rainforest elements present in the lower tree layer. Neither are *Orites* and *Caldcluvia* of major importance as they are in the lower-altitude areas just discussed. There are only 13 rainforest tree species compared to 25 at lower altitudes (Species List, Microfiche). *Doryphora* and *Elaeocarpus holopetalus* are the most common larger trees. The understorey is of high-altitude, cool temperate rainforest species such as *Atherosperma moschatum, Trochocarpa* sp. nov., *Tasmannia purpurascens, Notelaea venosa* var. *A.* and *Coprosma quadrifida* (Photo 103). Canopy conditions are less favourable for the epiphytic orchids, *Dendrobium falcorostrum* and *D. pugioniforme,* but smaller, thick-leaved ferns such as *Pyrrosia rupestris* are better adapted to these cold, exposed sites. On the rocks and butts of the trees, there are several ferns of the cold, more southern forests, such as *Microsorum diversifolium* and *Rumohra adiantiformis.* The best examples are in the upper steep valleys of the Dilgry and Moppy Rivers, Gloucester Falls, Mt Nelson and at Carters Brush on the western side of Mt Paterson (Species List, Microfiche). This latter area is on a steep basaltic scree slope with a dry westerly aspect. The canopy is of *Nothofagus, Doryphora* and *Tristaniopsis collina* with emergents of *Eucalyptus saligna* and *E. quadrangulata.* Except for the moist creek lines with *Callicoma, Dicksonia antarctica* and *Vesselowskya,* the undergrowth is of dry, rigid shrubs such as *Citriobatus pauciflorus, Notelaea venosa* var. *A* and *Coprosma quadrifida.* The very sparse ground cover is mainly of *Blechnum cartilagineum, Pteris umbrosa* and *Gahnia sieberana.* Vines are not common. Epiphytes are restricted to *Pyrrosia rupestris* on the more exposed upper tree branches, with *Dendrobium pugioniforme* and *Sarcochilus falcatus* on the smaller trees. *Dendrobium falcorostrum* is apparently absent because of the high degree of exposure. These steep scree hillsides would suffer from extremes of soil moisture, ranging from very dry, which would prevent development of the usual lush fern ground cover, to excessively wet, when hillside slips of as much as 300 m downslope are common.

Suballiance No. 51: *Nothofagus-Elaeocarpus holopetalus*

From about 1 150 m to 1 500 m altitude in the more sheltered valleys and along the plateau creeks on basalt or granodiorite, there occurs a very simple suballiance dominated by *Nothofagus* and *Elaeocarpus holopetalus.* Such altitudes are generally restricted to New England National Park at Point Lookout and to the Barrington-Gloucester Tops. Of 14 sites enumerated in the Tops area, the maximum number of true rainforest tree species (excluding emergent eucalypts) on any site is five, while at Point Lookout, it is only seven.

Trochocarpa sp. nov. is the only small tree consistently present, although *Atherosperma moschatum* may be found in the most sheltered situations on the Barrington Tops. *Doryphora* is sometimes present also. Species of the rainforest margin include *Acacia melanoxylon* and *Banksia integrifolia* var. *compar.* Emergent eucalypts are sometimes observed, but not as commonly as in the other suballiances. Furthermore, they are tableland rather than coastal or mountain species and include *Eucalyptus fastigata, E. obliqua, E. pauciflora, E. nitens* and *E. viminalis.* Because this suballiance appears to be advancing into the eucalypt forest or woodland on the plateau, there are a number of small tree species engulfed in this advancing edge. Typical examples are *Callistemon pallidus* and *Leptospermum argenteum* which often reach quite large dimensions.

Sclerophyll forest remnants are also particularly common in the shrub layer towards the rainforest margin. These include *Coprosma quadrifida, C.* sp. aff. *nitida,*

Tasmannia purpurascens, T. glaucifolia, Gaultheria appressa, Lomatia arborescens, Leucopogon suaveolens, Hymenanthera dentata, Prostanthera lasianthos and *Notelaea venos* var. *A.* The climax shrub layer consists mainly of *Dicksonia antarctica* (Photo 104) with some *Todea barbara.*

The herb layer is quite diverse, although most species are rather small weak individuals. Webb's (1978) classification of microphyll fern forest is apt — not only does the shrub layer consist mainly of tree ferns, but the herb layer is dominated by the more robust and numerous *Blechnum wattsii* and *Polystichum proliferum.* Similarly, both the shade and sun epiphytes are mainly ferns. Most of the 15 sites studied support six to eight species of ferns and two to seven species of flowering herbs. *Cardamine* sp. aff. *lilacina* is one of the more obvious and widespread flowering herbs and is possibly an undescribed species. Although *Blechnum penna-marina* would appear to be a remnant of the adjoining woodland, the easily confused *B. fluviatile* is part of the climax rainforest.

There are few species of vines present (commonly only three to five species at each site). Most are thin and wiry. *Smilax australis* is certainly the most common, with *Parsonsia brownii* and *Berberidopsis beckleri* also well distributed. Although *Fieldia* is common on most of the high-altitude areas of the preceding suballiance, in this suballiance under discussion it is restricted to only three of the 15 sites. It therefore prefers the lower-altitude *Nothofagus* forests.

This also applies to the epiphytes, in that orchids are absent at high altitudes. It is interesting that only on the Barrington Tops are there *Nothofagus* forests devoid of *Dendrobium falcorostrum*; these sites are above 1 130 m altitude. This would suggest that *D. falcorostrum,* despite its almost total reliance on *Nothofagus* as a host, has been unable to adapt to the colder conditions. The genus *Dendrobium* is generally regarded to be of tropical origin, but with its long-distance seed dispersal, it has been able to colonize and adapt very quickly to fill any recently created ecological niches, such as the relatively recent island of New Guinea. If, as suggested by Turner (1976), there has been a recent increase in rainfall enabling *Nothofagus* to move upwards into the colder, open forest, it is reasonable to assume that those associated species whose distribution limits are determined by temperature will be unable to follow. Most of the epiphytic ferns present in this association are on the lower trunks in a well buffered microclimate. The only exception is *Pyrrosia rupestris,* which occupies the upper trunks and branches. However, with its sparse, small, thick leaves, the species can successfully withstand moisture and temperature extremes.

BARRINGTON-GLOUCESTER TOPS

These upland *Nothofagus* forests on the Barrington and Gloucester Tops are found in two different situations, corresponding to the two different types of drainage systems. The plateaux are drained by the Barrington and Gloucester Rivers running east. Their tributaries meander across the plateaux from the western and southern rims in broad, shallow valleys. On approaching the eastern rims, they become more entrenched, and finally drop steeply towards the lowlands. The upland *Nothofagus* in this topographic sequence is found in the upper entrenched valleys, with isolated outliers on protected sections of the plateaux creeks.

Examples of the plateaux creeks occurrences are on Emu Creek and at Black Swamp on the upper Barrington River. Both contain large trees of *Elaeocarpus holopetalus* beneath the *Nothofagus,* thereby appearing as a dense forest on aerial photos.

Examples of *Nothofagus* forests along the entrenched streams at the plateau edge are well illustrated in the head of the Moppy River (Species List, Microfiche), further

down on a tributary of the Moppy near Front Mountain and on Beean Beean Creek. These streams are all tributaries of the Barrington River. These *Nothofagus* forests all have burnt margins. Paddys Brush Flora Reserve is on the western fall into Paddys Creek, and thence to Omadale Brook and the Hunter (Species List, Microfiche). It therefore has a dry western aspect, evidence of fire within the *Nothofagus* forest and no epiphytes except for two species of Hymenophyllaceae near ground level along the creek.

On the Gloucester Tops, which are lower than the Barrington Tops by about 200 m, the upland *Nothofagus* forests occur on the higher mountain slopes such as Mt McKenzie and the head of the Gloucester River. They are, however, in a degenerate condition with much crown dieback, particularly where the adjacent, taller eucalypts have either been logged or are dying of old age. It appears that in this situation, *Nothofagus* requires the protection of these emergents. Epiphytes are virtually absent except for *Pyrrosia rupestris.*

The other major occurrence at Barrington Tops is at the head of the south-flowing streams from the plateau edge or at the base of the escarpment. Sites sampled were at Far Eastern Creek, Williams River, below and to the side of Careys Peak (Species List, Microfiche), and Allyn and Paterson Rivers. Most of these areas indicate the presence of old fires and/or landslips on this steep terrain. In the extreme head of the Paterson River, there is reasonably intact *Nothofagus* on the steep slopes below the top falls. Above the falls, however, there is a fairly large area of fire-killed *Nothofagus* with coppice and snow gum saplings. At Careys Peak, repeated landslips and fires have produced dense areas of small regrowth *Nothofagus* about 30 cm diameter (Photo 105). At Far Eastern Creek in the head of the Williams River, there is a mixture of mature *Nothofagus, Nothofagus* with emergent *E. nitens,* large *Leptospermum argenteum* up to 22 m tall and 25 cm diameter along a creek in well-developed *Nothofagus* and even-sized regeneration of *Nothofagus* without parent trees, thereby indicating previous fires.

POINT LOOKOUT

At 1 500–1 550 m altitude on Point Lookout in New England National Park, above the more widespread *Nothofagus-Quintinia sieberi-Doryphora* Suballiance which extends down to 1 350 m, there is a floristically simplified forest in which *Q. sieberi* is absent and *Doryphora* is only rare (Species List, Microfiche). West from the escarpment edge at Cathedral Rocks, where there is less mist and more frequent fire, *Nothofagus* is absent and *Elaeocarpus* predominates (Suballiance No. 57).

In summary, this suballiance is generally in a very dynamic state, being influenced by fires, landslips and possibly climatic changes.

Eucryphia moorei Alliance

According to Beadle (1981), there are three cool temperate alliances in Australia — *Nothofagus moorei, N. cunninghamii* and *N. gunnii. Eucryphia moorei* was considered to be one of five "related communities" to *Nothofagus*; and accordingly was not included in any of the three alliances. However, a case can be argued in New South Wales for its recognition as a separate alliance.

The family Eucryphiaceae consists of only a single genus with six species. Bentham and Hooker (1865) included it in the Rosaceae, but Engler (1895) incorrectly placed it in the order Malvales and close to Dilleniaceae. In the current Flora of Australia series using the classification of Cronquist (1981), it is returned to the order Rosales and placed beside the family Cunoniaceae because of its opposite, mainly compound leaves with interpetiolar stipules, its floral anatomy and pollen

morphology. It differs from the Cunoniaceae, however, in its single flowers (not in groups) which are large with showy petals, the numerous stamens (not usually only eight to 10) and the four to 14-celled fruit (not two-celled) (Photo 106).

Eucryphia shows a classic Gondwanan distribution consisting of both South American and Eastern Australian species:

Chile — *E. cordifolia, E. glutinosa*

Tasmania — *E. lucida* (Leatherwood), *E. milliganii*

Victoria and New South Wales — *E. moorei*

North Queensland — *E.* sp. nov.

Although *E. moorei* differs from the Tasmanian species in its compound leaves, both types of leaves occur in the Chilean species.

Although *Eucryphia moorei* and *Nothofagus moorei* do not occupy the same sites, there are a number of species common to both alliances (Vol. 1, Table 4). Among the trees of both alliances are *Atherosperma moschatum, Doryphora sassafras, Hedycarya angustifolia, Pittosporum undulatum, Acacia melanoxylon, Elaeocarpus holopetalus, Acmena smithii, Tristaniopsis collina* and *Rapanea howittiana.* The shrub layer includes *Cyathea australis, Dicksonia antarctica, Notelaea venosa* and *Coprosma quadrifida.* However, the greatest similarities are found among the herbs, vines and epiphytes. Eighty per cent of the species of herbs, 50% of the vines and 83% of the epiphytes in the *Eucryphia* Alliance are also present in the *Nothofagus moorei* Alliance. This similarity of the understorey species with the *Nothofagus moorei* Alliance to the north also applies to the *Nothofagus cunninghamii* Alliance in Victoria and in Tasmania, where only one species, namely *Pyrrosia rupestris,* does not extend to the Victorian Alliance and only four out of the 21 species are not represented in the Tasmanian Alliance. Hence, floristically, the *Eucryphia moorei* Alliance is part of the ancient Australian East Coast belt of cool temperate rainforest.

Eucryphia moorei tends to occupy the same ecological niche south of Sydney as does *Nothofagus moorei* to the north, and it is also virtually confined to New South Wales. It extends from Loddon Falls west of Bulli along the coastal escarpment and eastern outliers (Mt Dromedary, Wandella Mountain, Egan Peaks) to the Howe and Nadgee ranges near the Victorian Border and just south to Harrison Creek, Victoria. It usually occurs above about 500 m altitude, except near the Victorian Border on Nadgee State Forest and Nature Reserve, where it is found at 200 m. It generally occurs on the more fertile soils such as those derived from basalt, monzonite and granodiorite, but it is also found on granite and metamorphics.

The *Eucryphia* and *Elaeocarpus holopetalus* forests exhibit the typical features of the cool temperate rainforest. The overwhelming canopy dominance is by a single species, or at most, by two species. The number of tree species is lower than in any other alliance, the most diverse stand being at Werrinook Flora Reserve, Bemboka, where there are six true rainforest tree species. In addition to either *Eucryphia* or *Elaeocarpus,* there may also be *Doryphora* or *Atherosperma* respectively. At Werrinook, *Hedycarya angustifolia* and *Pittosporum bicolor* are also common, while the only other common species are those of the margin such as *Pomaderris aspera, Bedfordia arborescens* and *Olearia argophylla.* On Mt Dromedary, in addition to *Eucryphia, Doryphora* exhibits the characteristic coppice shoots forming a ring from the base of the old trunk long since rotted away. These appear to be a response to very wet, cold conditions and may be displayed elsewhere by many species such as *Nothofagus moorei, N. cunninghamii, Ceratopetalum apetalum, Acmena smithii, Callicoma serratifolia* and *Planchonella australis.* These forests have a high representation of ferns in all strata except the trees, and they impart a mossy, lush, delicate appearance to the understorey. In the shrub layer,

Dicksonia antarctica is certainly the most common, but *Cyathea australis* may be found occasionally on the rainforest edges. *C. leichhardtiana* is only encountered in *Eucryphia* forest on the summit of Mt Dromedary, where it reaches an exceptional height. It is also in the mixed temperate rainforests at Nadgee. *Tasmannia lanceolata* and *Coprosma quadrifida* are the only other shrubs occasionally seen. The herb layer, too, is mainly ferns, particularly *Blechnum wattsii, B. patersonii, Lastreopsis acuminata* and *Polystichum proliferum.* The most common vines are *Microsorum diversifolium* and *M. scandens,* while *Smilax australis, Clematis aristata, Parsonsia brownii* and *Pandorea pandorana* may sometimes be common. *Cissus* is absent. Apart from *Fieldia australis,* epiphytes are predominantly ferns also. The delicate, filmy ferns are the most common, such as *Polyphlebium venosum* and *Hymenophyllum flabellatum. Asplenium bulbiferum* is the most conspicuous epiphyte.

Four suballiances can be recognized, depending upon altitude and soil fertility (Figure 14). In addition, there are a further two suballiances of very simple floristics which are dominated by *Elaeocarpus holopetalus* without *Eucryphia*:

52. *Eucryphia moorei*
53. *Eucryphia-Elaeocarpus holopetalus*
54. *Eucryphia-Doryphora/Atherosperma*
55. *Eucryphia-Acmena*
56. *Elaeocarpus holopetalus-Atherosperma*
57. *Elaeocarpus holopetalus*

***Suballiance No. 52:** Eucryphia moorei*

Probably the largest area of the *Eucryphia* Alliance is south-west of Moruya on Dampier State Forest, where *E. moorei* alone constitutes the canopy. The altitude ranges from 570 m to 750 m, and the soils are relatively infertile, being derived from chert and slate. This virtually pure forest extends discontinuously to north of Bendethera Mountain and south to Wandella Mountain west of Tilba Tilba, and to Burragate Peak, Eagan Peaks Nature Reserve, west of Eden. It forms an attractive simple forest with its uniform, light green, feathery foliage often arising from clumps of coppice stems around a decaying ancestral stem. *Doryphora* and *Atherosperma* are absent (Photos 107 and 108).

The suballiance sometimes occurs on very steep scree slopes close to the angle of rest in the heads of gullies such as at North Bendethera Mountain, Paddys Creek Forest Preserve (Species List, Microfiche) and Burragate Peak, where the lack of ground cover effectively controls fires. The other favoured niche is along streams such as on the upper Deua River which includes the Hanging Mountain Forest Preserve (Species List, Microfiche).

Burragate Peak, in Egan Peaks Nature Reserve, is of special interest. The parent rock is monzonite, as at Milton and Mt Dromedary, and not the less-fertile granite as originally thought. The monzonite has intruded into the older surrounding granite, possibly forming the hardened cliff walls to this hidden gully head of only 10 ha which is virtually fire-proof (Species List, Microfiche). Other less-protected areas north and east of the peak have been burnt in recent years, so that only scattered fire-scarred *Eucryphia* trees remain in a sea of *Bedfordia, Olearia* and *Pomaderris.*

***Suballiance No. 53:** Eucryphia-Elaeocarpus holopetalus*

It is unusual for both *Eucryphia* and *Elaeocarpus holopetalus* to occupy the same site unless *Eucryphia* predominates. However, near the summit of Mt Budawang at

1 059 m on the south-east slope, there is a low forest composed solely of these two species heavily shrouded in mosses. *Elaeocarpus* appears elsewhere to be better adapted to cold exposed sites. It could be that here it is providing some protection for the *Eucryphia*. This is a very simple community consisting of only 11 higher plants and ferns (Species List, Microfiche).

Suballiance No. 54: Eucryphia-Doryphora/Atherosperma

In montane situations (640–975 m) on relatively rich soils derived from basalt, monzonite or granodiorite, are to be found the best examples of the *Eucryphia* Alliance. There are two main areas in the head of Currowan Creek to Monga and a third near the summit of Mt Dromedary.

BUDAWANG-MONGA

On the western side of Currowan Creek, just outside Budawang National Park, there is a fine forest of *Eucryphia* and *Doryphora*. Being at only 500–700 m altitude, it contains many subtropical and warm temperate rainforest trees according to the parent rock which may range from basalt to rhyolite. At Monkey Ropes Scrub, which is probably basaltically enriched, there are *Dendrocnide excelsa, Citronella moorei* and *Pennantia cunninghamii*, while 1 km to the south, there are warm temperate rainforest elements such as *Livistona australis, Acmena smithii, Polyscias murrayi* and *Rapanea howittiana* — suggesting a soil derived from rhyolite or sedimentary rocks (Species List, Microfiche).

A further 15 km south on soils derived from granodiorite at Monga State Forest, this suballiance is much simplified at a higher altitude of 900–1 000 m. On Eucryphia Flora Reserve in the more northern gully, there are only four species of trees present. Only *Eucryphia* and *Doryphora* are common, while *Elaeocarpus holopetalus* and *Hedycarya angustifolia* are rare. The understorey and ground cover is entirely of ferns. In the southern gully of Eucryphia Flora Reserve, there are only three tree species, because *Hedycarya* was absent. Instead of *Doryphora*, this latter area contains the closely related and more southern *Atherosperma*. This represents the only record for *Atherosperma* in this area west of Batemans Bay (Species List, Microfiche). Perhaps sensitivity to fire could explain restriction of the species to this one, presumably unburnt gully.

MT DROMEDARY

Further south and near the summit of Mt Dromedary on fertile soil from monzonite, there are three patches of this suballiance. The central and largest site is in the saddle between the two peaks on gentle topography with a mainly southern aspect, although it does extend to the northern slope. *Eucryphia* and *Doryphora* are co-dominant over much of this patch, both possessing swollen stem bases and numerous coppice shoots (Species List, Microfiche). *Doryphora* does predominate on the lower southern edge and in the saddle, where the trees are shorter and with a broken canopy due to wind damage. A second patch is on the south-east side of the north-west hump of the mountain. Although *Doryphora* is more common than *Eucryphia* on the ridge top, both are of equal importance downslope. As at the previous site, hanging moss (*Papillaria* sp.) is very common on the shrubs and trees due to the persistent fogs around the mountaintops. There are some warm temperate rainforest elements present on the warmer northern aspect, such as *Synoum glandulosum, Acacia melanoxylon* and *Polyscias murrayi*. The third area is south of the trig towards the head of Couria Creek, at only 460–630 m altitude. This is a poorer forest than the other two areas, with a broken canopy and consisting of *Doryphora* and *Eucryphia* with warm temperate elements as at the second patch. The overall picture of this suballiance on Mt Dromedary is that *Eucryphia* prefers the cooler, moister protected sites, while

Doryphora dominates the more exposed margins and crests. It is not possible to determine whether the areas of broken canopy are due to gales, old gold mining disturbance or a combination of both. There are two outstanding trees present which were estimated to be the biggest seen to date. *Hedycarya angustifolia* is generally only a tall shrub or small tree up to 7 m high and 10 cm diameter, but here it was 20 m tall and 40 cm diameter. Similarly, *Acacia melanoxylon* in New South Wales was previously recorded as reaching 30 m high and 90 cm diameter, but on Mt Dromedary, it was 35 m tall and 100 cm diameter.

***Suballiance No. 55:** Eucryphia-Acmena*

On the far South Coast at only 180–220 m altitude on the poorer granite soils, there are a few protected gully heads which have escaped the frequent fires in Nadgee State Forest. These are just below Table Ridge, which runs from the Victorian Border north-east through Mount Nadgee. This is the first line of hills inland from the coast, rising to 350–500 m altitude and probably having a higher rainfall than the surrounding lower areas due to cloud uplift and condensation.

Maxwells Flora Reserve in the head of Maxwells Creek is a reasonably intact example with very large *Acmena smithii* and abundant tall *Cyathea leichhardtiana* which are otherwise only seen south of Batemans Bay in the *Eucryphia-Doryphora* Suballiance on Mt Dromedary. There are also very large specimens of *Eupomatia laurina* up to 15 m tall and 25 cm diameter, which are equal to the largest ever recorded for this species. There is also a rich assemblage of ground ferns and epiphytes (Species List, Microfiche).

Watergums Flora Reserve is a similar area 13 km north of Maxwells Flora Reserve, off the same ridge. Just over the border in Victoria at Harrisons Creek, there is another example. Other gullies such as Royds Creek in Nadgee State Forest and Nadgee River in Nadgee Nature Reserve were burnt in the 1980 wildfire which has favoured *Acmena* and restricted *Eucryphia.* Accordingly, the Royds Creek and Nadgee River sites are assigned to the *Acmena* Alliance under Suballiance No. 44: *Acmena-Eucryphia-Doryphora.*

***Suballiance No. 56:** Elaeocarpus holopetalus-Atherosperma*

This suballiance is only found in New South Wales in the headwaters of the Bemboka River west of Bega at 650–900 m altitude, in the very high rainfall zone along the escarpment. *Eucryphia* is absent, presumably because of the poor granitic soil. *Elaeocarpus* predominates with *Atherosperma* along the creeks. A stand of the suballiance is preserved in the Brown Mountain Flora Reserve, but a larger and better-developed area of 60 ha on Brown Mountain Creek has now been designated as the Werrinook Flora Reserve (Species List, Microfiche). This latter area alone has *Pittosporum bicolor* occurring commonly with *P. undulatum* and *Pittosporum* sp. aff. *bicolor,* an undescribed species also found in South Gippsland and the Otway Ranges of Victoria. The understorey is predominantly of ferns which are so numerous as to impede access. A deep litter layer has developed also. Access has been further impeded by the heads of eucalypts logged in the ecotone. The Brown Mountain Flora Reserve contains the largest *Elaeocarpus holopetalus* known, estimated at 200 cm diameter and 25 m tall. At Werrinook Flora Reserve, there is a record *Rapanea howittiana,* estimated at 23 m high and 60 cm diameter.

A comparable forest is found in gullies on the Errinundra Plateau in East Gippsland on soils derived from granite and metasediments at 950–1 080 m altitude (Species List, Microfiche). This Coast Range Road Rainforest is the largest single stand of rainforest in Victoria, measuring 150 ha and with the canopy at 25–30 m. Subsidiary

tree species common to both the New South Wales and Victorian localities include *Pittosporum bicolor* and *Acacia melanoxylon*. The forest is part of the Errinundra Flora Reserve.

Suballiance No. 57: Elaeocarpus holopetalus

Where soil is shallow as on bouldery steep slopes, is of low fertility as when derived from granite or sandstone, and could be subject to radiation scorch from infrequent wildfires, only the hardiest of rainforest trees can persist in cold situations above 700 m altitude. This suballiance contains forests from which both *Nothofagus moorei* and *Eucryphia* are eliminated by these unfavourable conditions to leave *Elaeocarpus holopetalus* as the sole remaining dominant.

CATHEDRAL ROCKS-MT HYLAND

In Northern New South Wales sites such as in Cathedral Rocks National Park at 1 480–1 530 m altitude, where the only things that will not burn are the granite boulders, *Elaeocarpus* still persists. Between the boulders it forms a low, close forest of unpredictable future (Species List, Microfiche). Also commonly associated with it as a small tree or shrub is the fire-adapted *Trochocarpa* sp. nov. and occasional other rough-barked small trees such as *Banksia integrifolia* var. *compar, Lomatia fraseri, Quintinia sieberi* and *Acacia melanoxylon*. In the shrub layer, *Dicksonia antarctica* and *Tasmannia stipitata* are common while *Gaultheria appressia* is less common. Vines and climbers are mostly represented by *Microsorum diversifolium, Parsonsia brownii* and *Berberidopsis beckleri*. Epiphytes are virtually restricted to the hardy *Pyrrosia rupestris* and the epiphyte/lithophyte, *Lycopodium myrtifolium*, which extends from the *Nothofagus moorei-Quintinia sieberi-Doryphora* Suballiance on the Queensland Border to the *Athrotaxis cupressoides* open montane rainforests of Central Tasmania (Photo 109).

Further north from Cathedral Rocks and west of the Bellinger Escarpment at Mt Hyland and Mt Chaelundi, there is an interesting sifting-out of cool temperate rainforest species. As discussed earlier, the first to drop out is *Nothofagus moorei*, which consists of scattered large trees in a steep, narrow gully 150 m deep in the Blicks River Flora Reserve, 6 km south of Mt Hyland. On the exposed, cold, upper-southern slopes of Mt Hyland, *Elaeocarpus holopetalus, Cryptocarya nova-anglica* and *Trochocarpa* sp. nov. are common with *Vesselowskya rubifolia* along the creeks. The latter species reaches its northern limit only 4 km north of Mt Hyland in Foamy Creek. Just 13 km north on Chaelundi Mountain, only *Elaeocarpus holopetalus* and *Cryptocarya nova-anglica* still persist. This is the last of the high mountain peaks north-west of Dorrigo, and it is the northern limit of *Elaeocarpus holopetalus*. Only *Cryptocarya nova-anglica* occurs further north on Mt Nothofagus in the western McPherson Range.

MT IMLAY

Although at Cathedral Rocks and Mt Hyland, this suballiance is an impoverished relict of the *Nothofagus moorei* Alliance along the Bellinger Escarpment to the east, the second occurrence on Mt Imlay National Park, west of Eden, is similarly a relict, but of the *Eucryphia moorei* Alliance (Species List, Microfiche). The site occupies a mere 2 ha in a deep gully on the sheltered south-east side of the mountain at 700–840 m altitude. There are two peaks of approximately equal height and distance from the sea near Eden, each with a sheltered, narrow, rainforest gully. However, Burragate Peak belongs to the *Eucryphia* Suballiance because of its relatively fertile soil derived from monzonite, while at Mt Imlay, a poor sandy soil from sandstone and conglomerate can only support *Elaeocarpus* with an occasional *Acacia melanoxylon*. The shrub layer is sparse with only *Dicksonia antarctica* and an occasional *Tasmannia lanceolata*. The

ground cover is very sparse on the bouldery scree slope. Other than mosses, only *Blechnum wattsii* is common. The only woody vine present is *Parsonsia brownii,* while *Microsorum diversifolium* may occur on the butts of some trees. Only the epiphytes are well represented (seven species), the most common being *Fieldia. Asplenium bulbiferum* and three species of filmy ferns are also commmon (Photo 110).

Although small in area, these refugia have great phytogeographical importance as indicators of a once more-widespread distribution of rainforest.

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APPENDIX 1

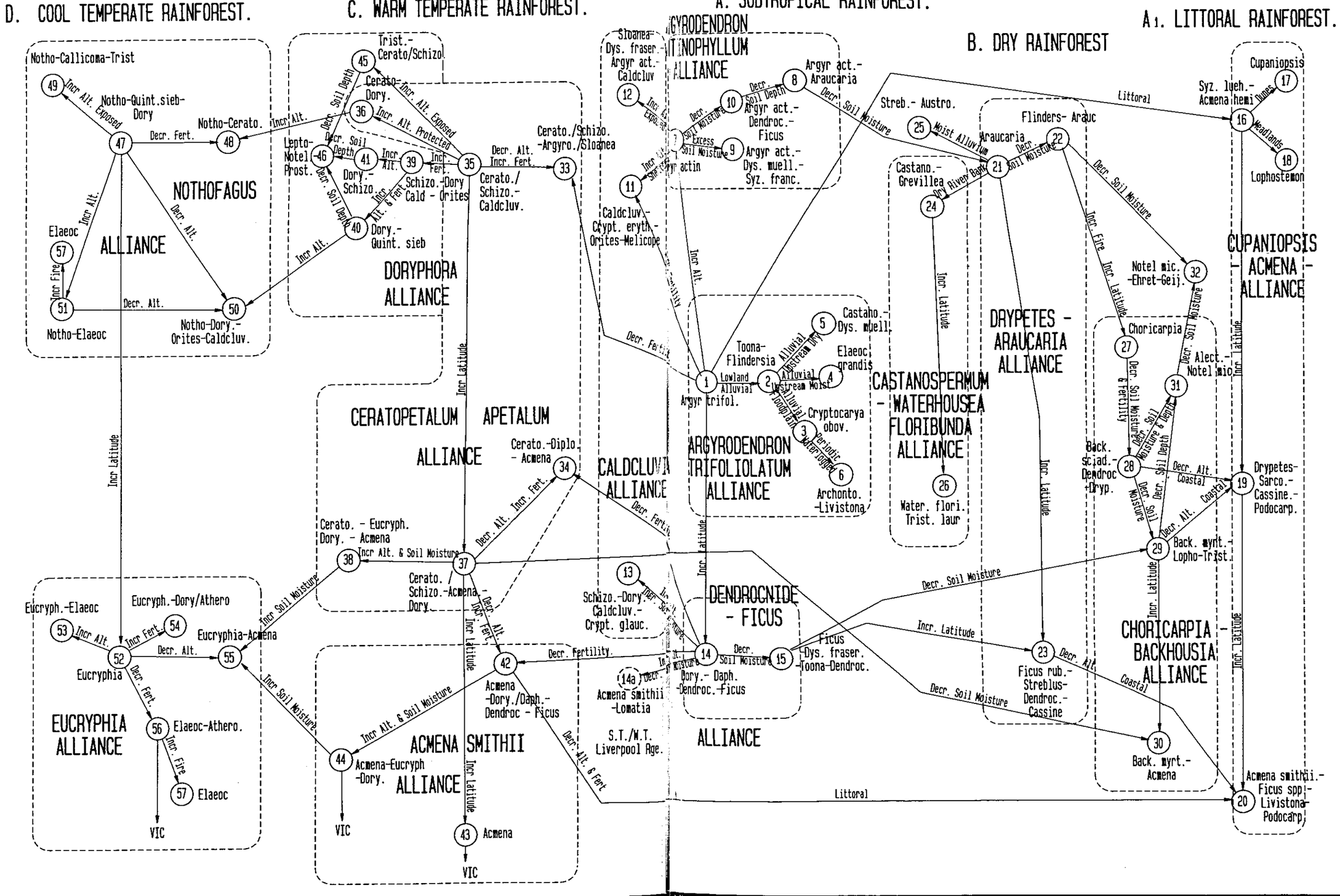
Area of Rainforest in New South Wales

Updated from F.C. Rainforest Inventory (Pople and Cowley 1981). Condition Classes I and II only. (Classes III and IV have suffered structural change or removal and are excluded.)

Land Tenure	Subformation											
	Subtropical		Warm Temperate		Cool Temperate		Dry and Depauperate		Littoral		Total	
	Ha in 1 000	%	Ha in 1 000	%	Ha in 1 000	%	Ha in 1 000	%	Ha in 1 000	%	Ha in 1 100	%
National Park and Nature Reserve prior to October 1982 Cabinet decision	9.3	12.7	5.9	25.1	4.6	25.3	6.0	7.9	0.5	41.7	26.3	13.6
Additions as per Cabinet decisions of 1982 and 1984	23.8	32.4	10.6	45.1	4.6	25.3	9.1	12.0	Nil		48.1	25.0
Additions since 1984 to September 1989	0.4	0.5	0.3	1.3	0.1	0.5	2.0	2.6	0.1	8.3	2.9	1.5
Total National Parks and Nature Reserves	33.5	45.6	16.8	71.5	9.3	51.1	17.1	22.5	0.6	50.0	77.3	40.1
Other Reserves	2.7	3.7	0.9	3.8	0.5	2.8	1.3	1.7	Nil		5.4	2.8
Flora Reserves and Forest Preserves	3.1	4.2	3.1	13.2	2.1	11.5	2.1	2.7	0.1	8.3	10.5	5.5
State Forest and other Crown-Timber Lands	32.4	44.2	1.1	4.7	6.1	33.5	46.5	61.1	Nil		86.1	44.8
Private Land	1.7	2.3	1.6	6.8	0.2	1.1	9.1	12.0	0.5	41.7	13.1	6.8
Total	73.4	100	23.5	100	18.2	100	76.1	100	1.2	100	192.4	100

FLORISTIC CLASSIFICATION OF NEW SOUTH WALES RAINFORESTS

Appendix 2



APPENDIX 3

Floristic classification and conservation status of rainforest in New South Wales

	Alliance	Suballiance	Ecology	Occurrence and conservation status
A.	SUBTROPICAL RAINFOREST			National Park, Nature Reserve, Flora Reserve, Forest Preserve, State Forest, State Recreation Area, Wildlife Refuge
I.	*Argyrodendron trifoliolatum*	1. *Argyrodendron trifoliolatum*	Lowland krasnozem	Border Ranges NP, Limpinwood NR, Numinbah NR, Mt Warning NP, Nightcap NP, Victoria Park NR, Murray Scrub FR, Cambridge Plateau FR, Coramba NR. Conservation status excellent.
		2. *Toona-Flindersia* spp.	Lowland alluvium	Stotts Island NR, *Hortons Creek. Inadequate, mostly cleared for agriculture.
		3. *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp. *Araucaria*	Floodplain alluvium	Stotts Island NR, Boatharbour NR, *Johnstons Scrub, *Bellingen Island, *Wingham Brush, Coocumbac Island NR. Adequate. Council Reserves at Bellingen and Wingham
		4. *Elaeocarpus grandis*	Streambank alluvium	Terania Creek-Nightcap NP, Rocky Creek, Wanganui, Middle Creek-Gibraltar Range NP, Woolgoolga Creek FR. Adequate.
		5. *Castanospermum-Dysoxylum muelleri*	Moist, alluvial flats and benches	Numinbah NR, Lynches Creek access road-Border Ranges NP, Boomerang Falls FR, *Wollongbar, *Johnstons Scrub, Davis Scrub NR, *Maclean. Adequate, although several are in Council Reserves.
		6. *Archontophoenix-Livistona*	Excess soil moisture	Stotts Island NR, Mt Warning NP, Nightcap NP, Minyon Falls FR, Brunswick Heads NR, *Clarence Peak, Sugar Creek FR, Yahou Island NR, Snapper Island NR. Good.
II.	*Argyrodendron actinophyllum*	7. *Argyrodendron actinophyllum*	Mid altitude krasnozem	Tooloom Scrub FR, Border Ranges NP, Black Scrub New England NP, Dorrigo NP, Killiekrankie FR, Leagues Scrub FP, Daisy Patch FR, *Coxs Brush. Adequate.
		8. *A. actinophyllum-Araucaria*	Dry mid altitude krasnozem	Wilsons Peak FR, Mt Clunie FR, Yabbra SF, Mt Lindesay Border Ranges NP, Twelve Sixty FR. Adequate, but not reserved on Yabbra SF.

Appendix 3 — continued

	Alliance	Suballiance	Ecology	Occurrence and conservation status
II.	*Argyrodendron actinophyllum* — continued	9. *A. actinophyllum-Dysoxylum muelleri-Syzygium francisii*	Poorly drained shelf on krasnozem.	Mebbin Lagoons FR, Murray Scrub FR, *Pretty Gully. Barely adequate. No other significant areas known.
		10. *A. actinophyllum-Dendrocnide-Ficus*	Dry mid altitude.	Mt Nothofagus FR, Toonumbar SF, Chandlers Creek FR, Georges Creek NR, The Castles FR, Mt Seaview NR, Woko NP, Camels Hump NR. Adequate.
III.	*Caldcluvia*	11. *Caldcluvia-Cryptocarya erythroxylon-Orites-Melicope octandra-Acmena ingens*	Cool mid altitude on krasnozem.	Mt Lindesay, Tweed and McPherson Ranges, Border Ranges NP, Washpool NP. Adequate.
		12. *Sloanea woollsii-Dysoxylum fraseranum-A. actinophyllum-Caldcluvia*	High exposed locations at 700-1 000 m on krasnozem.	Acacia Plateau FP, Tooloom Scrub FR, Mt Nothofagus FR, Mt Glennie Border Ranges NP, White Beech FR, Washpool NP, Mt Hyland NR, Andersons Mountain, *Carrai SF, Werrikimbe NP, Boorganna NR, Barrington Tops NP. Excellent.
		13. *Schizomeria-Doryphora-Caldcluvia-Cryptocarya glaucescens*	Subtropical/warm temperate rainforest. Mainly on krasnozem below 1 100 m, Hastings River to Barrington Tops.	*Coneac SF, Barrington Tops NP with *Dysoxylum* and *Toona*. Adequate, although not conserved on Coneac SF.
IV.	*Dendrocnide excelsa-Ficus* spp.	14. *Doryphora-Daphandra micrantha-Dendrocnide-Ficus-Toona*	Mainly on sheltered fertile soils south from the Manning River.	Boorganna NR, Woko NP, Barrington Tops NP, Cedar Brush NR, Wollemi NP, *Mt Keira, *Cambewarra Mountain, *Yatteyattah, Budawang NP, Mares Hill FP, *Currowan SF. Good except for the centre of the range.
		15. *Ficus-Dysoxylum fraseranum/Toona-Dendrocnide*	Dry gullies.	*Timbarra River-Girard SF, Bago Bluff SF, *Dungog, Church Creek-Kanangra Boyd NP. Inadequate, not reserved in the north or the major Dungog area.
V.	*Cupaniopsis anacardioides-Acmena* spp.	16. *Syzygium luehmannii-Acmena hemilampra*	Well developed littoral rainforest on deep sand.	Ukerebagh Island NR, Broken Head NR, Iluka NR, *Scrub Creek, Bundagen FR. *Stuarts Point, *Shark Island. Inadequate in the south.
		17. *Cupaniopsis anacardioides*	More exposed to salt spray than No. 16.	Brunswick Heads NR, Broken Head NR, Bundjalung NP, Iluka NR, Mooney Beach NR, Bundagen FR, Arakoon SRA, Limeburners Creek NR, Sea Acre NR, Harrington-Crowdy Bay NP, Seal Rocks and Yacaaba Headland-Myall Lakes NP. Excellent.
		18. *Lophostemon confertus*	Exposed coastal headlands with No. 17 or 19 as understorey.	Broken Head NR, *Moonee, *Korora, Bundagen FR, Hat Head NP, Limeburners Creek NR, Kattang NR, Crowdy Bay NP. Inadequate. Not reserved near Coffs Harbour.
		19. *Drypetes- Sarcomelicope-Cassine-Podocarpus*	Southern extension of No. 16 to the Mid North Coast.	Gap Beach Arakoon SRA, Limeburners Creek NP, Sea Acres NR, Cape Hawke-Booti Booti SRA, *Black Head, Seal Rocks and Mungo Brush-Myall Lakes NP. Good.
		20. *Acmena smithii-Ficus* spp.-*Livistonia-Podocarpus*	Simpler South Coast form of No. 19.	*Shellharbour, Comerong Island NR, *Beecroft Peninsula, Oaky Beach-Murramarang NP, Bunga Head-Mimosa Rocks NP. Barely adequate since not reserved at Shellharbour and Beecroft Peninsula.

Appendix 3 — continued

	Alliance	Suballiance	Ecology	Occurrence and conservation status
B.	DRY RAINFOREST			
VI.	*Drypetes australasica-Araucaria*	21. *Araucaria cunninghamii*	North of the Macleay River on krasnozems on steep slopes and plateaux.	Mt Clunie FR, Mt Nothofagus FR, Border Ranges NP, Limpinwood NR, *Wilson and Rotary Parks, *Mt Pikapene SF, Chandlers Creek FR, Sailors Hill FR, *Hortons Creek, Red Cedar FR, Teak Tree FR, New England NP. Adequate, but could include Lismore sites.
		22. *Flindersia* spp.-*Araucaria*	Upper Clarence and Richmond Rivers on krasnozem with marked spring drought.	*Flagstone Creek, Captains Creek FR, Sawpit Creek-Border Ranges NP, *Peter Fin WR, Mallanganee FR, Burnt Down Creek FR. Adequate.
		23. *Ficus* spp.-*Streblus-Dendrocnide-Cassine*	Central and South Coasts on krasnozem at moderate low altitude.	Glenugie Peak FR, Booti Booti SRA, John Gould Island NR, Myall Lakes NP, Snapper Island NR, *Dungog, *Whispering Gallery, *Saddleback, *Yatteyattah. Inadequate. Not reserved in the south.
VII.	*Castanospermum-Waterhousea floribunda*	24. *Castanospermum-Grevillea robusta*	Gallery rainforest along streams on basaltic alluvium in minimal rainfall areas.	Moore Park NR, Sawpit Creek-Border Ranges NP, *Lynch's Creek, *Yorklea, *Busby's Creek. Inadequate in the south.
		25. *Streblus-Austromyrtus*	Streambank basaltic alluvium with high rainfall. Richmond River.	Boatharbour NR, *Currie Park, *Ruthven. Two of three sites inadequately protected in recreation reserves.
		26. *Waterhousea floribunda/ Tristaniopsis laurina*	Southern extension of No. 24 on less fertile alluvium.	*Mt Warning Road, *Myrtle Creek, *Tallowwood Point, *Brierfield, *Lower Karuah to Allyn Rivers. Not conserved.
VIII.	*Choricarpia-Backhousia* spp.	27. *Choricarpia leptopetala*	In fire-prone zone on margin of Nos. 14, 21 and 22. Krasnozem or enriched earths.	Madmans Creek FR, *Mt Coramba, *Timbertop, *Blueys Beach-Booti Booti SRA, Gap Creek-Olney SF, Richters Caves FR, Wheeny Creek-Wollemi NP. Adequate.
		28. *Backhousia sciadophora-Dendrocnide-Drypetes*	As for No. 27, but on poorer and drier soils.	Burnt Down Creek FR, Chandler's Creek FR, Sailors Hill FR, *Burns Scrub, Tulipwood FR, Dorrigo NP, Guy Fawkes River NP, The Castles FR, Werrikimbe NP, Oxley Wild Rivers NP, Mt Seaview NR, Black Creek FR, Camels Hump NR, Woko NP, *Dungog, *Gloucester River. Inadequate in the south of its range.
		29. *Backhousia myrtifolia-Lophostemon confertus-Tristaniopsis*	Dry gullies on Mid North Coast.	*Morgans Gully, *Frenchmans Creek, Arandin FR, The Castles FR, Kunderang Brook-Werrikimbe NP, Boorganna NR. Wangat River-Barrington Tops NP. Inadequate. Not reserved in the north.
		30. *Backhousia myrtifolia-Acmena smithii*	South Coast in steep, narrow gullies on poor soil.	Gap Creek FP, *The Basin-Olney SF, Wollemi NP, Kanangra-Boyd NP, Budawang NP, *The Burra Deua River, Wamban Creek FP, Wandella SF, Wadbilliga NP. Adequate.

Appendix 3 — continued

	Alliance	Suballiance	Ecology	Occurrence and conservation status
	VINE THICKET	31. *Alectryon forsythii-A. subdentatus-Notelaea microcarpa*	Very low forest or thicket associated with Nos. 28 or 29 but on very shallow and dry soil.	Guy Fawkes River NP, Chandler and Apsley Rivers-Oxley Wild Rivers NP. Excellent.
		32. *Notelaea microcarpa-Ehretia membranifolia-Geijera parviflora*	Usually on krasnozem soil but with low rainfall.	*Planchonella Hill Yallaroi, *Terry Hie Hie, *Deriah SF, Mt Dangar-Goulburn River NP. Poor. No Western Slopes areas preserved.
C.	WARM TEMPERATE RAINFOREST			
IX.	*Ceratopetalum apetalum*	33. *Ceratopetalum/Schizomeria-Argyrodendron/Sloanea*	Warm temperate/subtropical rainforest on alluvium or enriched yellow earth. *Sloanea* above 650 m altitude.	*Couchy Creek, *Mooball SF, Washpool NP, Middle Creek FR, Woolgoolga Creek FR, Bruxner Park FR, Dorrigo NP, New England NP, *Flat Top and *Double Head Carrai, Werrikimbe NP, Daisy Patch FR, O'Sullivans Gap FR. Inadequate in Carrai area.
		34. *Ceratopetalum Diploglottis-Acmena*	South Coast equivalent at low altitude of No. 33.	Wheeny Creek-Wollemi NP, Royal NP, *Berry Mountain, Kioloa FP. Adequate.
		35. *Ceratopetalum/Schizomeria-Caldcluvia*	Most common suballiance on podsolics south to the Manning River at 400–800 m altitude.	Border Ranges NP, Mt Warning NP, Nightcap NP, Washpool NP, Dorrigo NP, New England NP, Werrikimbe NP, Boorganna NR, Jerusalem Creek FR. Excellent.
		36. *Ceratopetalum-Doryphora*	Higher altitude than No. 35 on yellow earth or krasnozem.	Coolamangera FR, Washpool NP, Wollomogo-Cangi SF, Mt Hyland NR, Fenwicks Scrub FR, Werrikimbe NP, Daisy Patch FR, Ralfes Creek FR, Wollemi NP, Blue Mountains NP. Excellent
		37. *Ceratopetalum/Schizomeria-Acmena-Doryphora*	South Coast equivalent of No. 35 on podsolics.	Wollemi NP, Bar FR, Royal NP, *Mt Keira, Macquarie Pass NR, Belmore Falls-Morton NP,*Mt Tianjara, *Oaky Creek-Yadboro SF, Lyons Creek FP. Inadequate. Not reserved in the Upper Clyde.
		38. *Ceratopetalum-Eucryphia Doryphora-Acmena*	Warm temperate/cool temperate rainforest at higher altitude (330–550 m) than No. 37, on moist southern aspects near base of the escarpment.	Barren Grounds NR. Excellent. Only known major area.
X.	*Doryphora sassafras*	39. *Schizomeria-Doryphora-Caldcluvia-Orites*	Basaltically-enriched podsolics. No *Ceratopetalum.*	Mt Clunie FR, Mt Nothofagus FR, Border Ranges NP, *Girard SF, *Forest Land SF, Barrington Tops NP. Adequate except SE of Tenterfield.
		40. *Doryphora-Quintinia sieberi*	At higher altitude and more fertile krasnozem soils than No. 39.	Coolamangera FR, Little Spirabo SF, Mt Hyland NR, Daisy Patch FR, Coco Creek FP, Wollemi NP, *Mt Irvine, Robertson NR, Morton NP. Adequate, although not reserved in the Blue Mountains.
		41. *Doryphora-Schizomeria*	High altitude (above 1 000 m) as in No. 40 but with poorer soil.	Dingo Creek FR, Gibraltar Range NP, Mt Seaview NR. Excellent.
XI.	*Acmena smithii*	42. *Acmena-Doryphora/Daphandra-Dendrocnide-Ficus* spp.	Warm temperate/subtropical rainforest at lower altitude than No. 37 but on more fertile krasnozem.	Cedar Brush NR, Macquarie Pass NP, Minnamurra Falls-Budderoo NP, *Wandera SF, *Moruya SF, *Dampier SF, Mt Dromedary FR, Mimosa Rocks NP, Bellbird Creek NR. Inadequate since not reserved between Illawarra and Narooma.

Appendix 3 — continued

	Alliance	Suballiance	Ecology	Occurrence and conservation status
XI.	*Acmena smithii* — continued	43. *Acmena*	Simplified forest from Moruya to Victoria in narrow gullies below 500 m altitude on poor alluvium.	*Diamond Creek-Dampier SF, Wadbilliga NP, *Wapengo Creek-Mumbulla SF. Inadequate since not reserved at northern and southern limits.
		44. *Acmena-Eucryphia-Doryphora*	Warm temperate/cool temperate rainforest. Higher altitude and rainfall than No. 42.	*German Creek-Dampier SF, Paddys Creek FP, Wandella FP, Hadgee NR. Inadequate, since not reserved in Hanging Mountain FP in the north.
	Low Forest	45. *Tristaniopsis collina-Ceratopetalum/Schizomeria*	At high altitudes, wet, exposed, north of Manning River.	Mt Nothofagus FR, Nightcap NP, Dorrigo NP, New England NP, Boorganna NR. Excellent.
	Closed Scrub	46. *Leptospermum* spp. — *Notolaea venosa-Prostanthera* spp.	Similar to No. 45 but on shallower, poorer soils north of Dorrigo.	Mt Nothofagus FR, Border Ranges NP, Washpool NP, Gibraltar Range NP, Mt Hyland NR, Dorrigo NP. Excellent.
D.	COOL TEMPERATE RAINFOREST			
XII.	*Nothofagus moorei*	47. *Nothofagus-Quintinia sieberi-Doryphora*	North from New England NP on krasnozem	Border Ranges NP, New England NP, Cunnawarra FR. Excellent.
		48. *Nothofagus-Ceratopetalum*	North from Hastings River on less fertile yellow earths.	Lamington NP, Killungoondie Plain-Dorrigo NP, Cunnawara FR, Banda Banda FR, Plateau Beech-Werrikimbe NP. Excellent.
		49. *Nothofagus-Callicoma-Tristaniopsis*	High altitude over 1 000 m on exposed ridges or with shallow, enriched yellow earths.	Mt Nothofagus FR, Limpinwood NR, *Bo Bo Creek, *Tuckers Nob SF. Inadequate since not reserved in the south.
		50. *Nothofagus-Doryphora-Orites-Caldcluvia*	Sheltered lower altitude below 1 000 m on krasnozem.	Gloucester to Paterson Rivers-Barrington Tops NP. Excellent.
		51. *Nothofagus-Elaeocarpus holopetalus*	As for No. 50 but above 1 000 m.	New England NP, Barrington Tops NP, Paddys Brush FR. Excellent.
XIII.	*Eucryphia moorei*	52. *Eucryphia*	South Coast equivalent of No. 48.	Deua NP, Hanging Mountain FP, Paddys Creek FP, Egan Peaks NR. Excellent.
		53. *Eucryphia-Elaeocarpus holopetalus*	Less fertile soils than No. 52 above 100 m altitude.	Mt Budawang-Budawang NP. Excellent. Only location known.
		54. *Eucryphia-Doryphora/Atherosperma*	Krasnozem at high altitude above 550 m.	*Currowan Creek, Eucryphia FR, Mt Dromedary FR. Inadequate since not reserved in the north.
		55. *Eucryphia-Acmena*	Krasnozem at low altitude of 200–700 m.	Maxwells FR, Watergums FR. Excellent.
		56. *Elaeocarpus holopetalus-Atherosperma*	As for No. 53 but at mid altitudes of 700–900 m and on wet sites.	Brown Mountain FP, Werrinook FR, Errinundra Plateau NP (in Victoria). Excellent.
		57. *Elaeocarpus holopetalus*	As for No. 56 but subject to infrequent fires.	Cathedral Rocks NP, Mt Imlay NP. Excellent. Only known sites.

Appendix 3 — continued

KEY TO LAND CLASSIFICATION CATEGORIES

Forestry Commission of NSW

FP	Forest Preserve. Interim measure towards Flora Reserve.
FR	Flora Reserve. Primarily scientific purpose.
SF	State Forest. Primarily timber production if suitable.

NSW National Parks and Wildlife Service

NP	National Park. Recreation and scientific purposes.
NR	Nature Reserve. Scientific purposes only.
SRA	State Recreation Area. Primarily for recreation.
WR	Wildlife Refuge. Voluntary protection by private owner — not binding.

*Localities recommended for dedication for conservation purposes.

KEY TO CONSERVATION STATUS

Excellent	All major areas conserved.
Good	Major areas conserved in all regions.
Adequate	At least one area conserved in all regions.
Barely adequate	Not conserved over full range in one region.
Inadequate	One or several regions not conserved.
Poor	Most regions not conserved.
Not conserved	

APPENDIX 4

Locations of conserved rainforest areas and State Forests, New South Wales

Acacia Plateau FR	20 km NW of Urbenville
Arandin FR	17 km SE of Grafton
Bagawa SF	23 km NW of Coffs Harbour
Bago Bluff FR	25 km WSW of Port Macquarie
Bald Rock NP	22 km N of Tenterfield
Banda Banda FR	40 km WSW of Kempsey
Bar FR	28 km WNW of Wyong
Barcoongere SF	35 km SE of Grafton
Barren Grounds NR	25 km NE of Nowra
Barrington Tops NP	95 km NW of Newcastle
Beaury SF	20 km SW of Urbenville
Bellangry SF	40 km NW of Port Macquarie
Bellbird Creek NR	4 km N of Eden
Bellingen Island R	28 km SW of Coffs Harbour
Bellinger River SF	13 km SSW of Dorrigo
Bemboka SF	66 km NNW of Eden
Bermagui SF	22 km S of Narooma
Bielsdown SF	4 km N of Dorrigo
Big Fella Gum Tree FR	37 km SW of Port Macquarie
Big Scrub FR	24 km SW of Brunswick Heads
Billilimbra SF	35 km SE of Tenterfield
Black Scrub FR	16 km NW of Brunswick Heads
Black Bull FR	38 km WNW of Coffs Harbour
Black Creek FR	30 km SW of Port Macquarie
Blicks River FR	30 km WNW of Dorrigo
Boambee SF	6 km SW of Coffs Harbour
Bodalla SF	8 km NW of Narooma
Boatharbour NR	5 km NE of Lismore
Boomerang Falls FR	22 km WSW of Brunswick Heads
Boonoo Boonoo SF and NP	15 km NNW of Tenterfield
Boorganna NR	32 km N of Taree
Booyong R	22 km NE of Lismore
Border Ranges NP	25 km N of Kyogle
Bouddi NP	45 km NNE of Sydney
Boundary Creek SF	40 km NNW of Dorrigo
Boyne SF	8 km N of Batemans Bay
Bril Bril SF	34 km WNW of Port Macquarie
Broken Bago SF	20 km WSW of Port Macquarie
Broken Head NR	20 km SSE of Brunswick Heads
Brown Mountain FR	65 km NW of Eden
Brunswick Heads NR	1 km N of Brunswick Heads
Bruxner Park FR	6 km NW of Coffs Harbour
Brysons Camp FR	20 km NNW of Bulahdelah
Buckra Bendinni SF	27 km WNW of Macksville
Budawang NP	32 km NW of Batemans Bay
Budderoo NP	30 km SW of Wollongong
Bulga SF	37 km NW of Taree
Bundagen FR	11 km S of Coffs Harbour
Bundjalung NP	70 km NE of Grafton
Bungabee SF	15 km NNE of Casino
Bungdoozle FR	29 km W of Kyogle
Burnt Down Creek FR	50 km NW of Grafton
Butterleaf SF	36 km NE of Glen Innes
Cambridge Plateau FR	35 km NW of Casino
Cambewarra Mountain R	9 km NNW of Nowra
Cangai Boards FR	44 km W of Grafton
Cangi SF	48 km W of Grafton
Captains Creek FR	24 km W of Urbenville
Carrai SF	52 km W of Kempsey
Cathedral Rocks NP	46 km WNW of Dorrigo
Cedar Brush NR	170 km NW of Newcastle
Chandlers Creek FR	48 km SW of Grafton
Chapmans Plain FR	20 km NNW of Dorrigo
Cherry Tree SF	30 km SW of Casino
Chichester SF	53 km WNW of Bulahdelah
Clouds Creek SF	24 km NNW of Dorrigo
Coco Creek FP	100 km WNW of Taree
Comboyne SF	30 km NNE of Taree
Comerong Island NR	14 km ESE of Nowra
Conglomerate SF	21 km NNW of Coffs Harbour
Coocumbac Island NR	1 km W of Taree
Coolamangera FR	26 km SSE of Tenterfield
Coramba NR	16 km NW of Coffs Harbour
Craven SF	40 km NW of Bulahdelah
Crowdy Bay NP	28 km NE of Taree
Cunnawarra FR	40 km SW of Dorrigo
Currie Park R	1.5 km NNE of Lismore
Currowan SF	22 km NW of Batemans Bay
Daisy Patch FR	95 km SSE of Armidale
Dampier SF	32 km NW of Narooma
Davis Scrub NR	35 km E of Casino
Deriah SF	155 km WNW of Armidale
Dingo SF	30 km NW of Taree
Dingo Creek FR	26 km SSE of Tenterfield
Donaldson SF	16 km N of Urbenville
Dorrigo NP	3 km SE of Dorrigo
Doyles River SF	75 km W of Port Macquarie
Edinburgh Castle SF	10 km E of Urbenville
Egan Peaks NR	20 km WNW of Eden
Ellis SF	29 km NW of Dorrigo
Eucryphia FR	27 km WNW of Batemans Bay
Ewingar SF	42 km E of Tenterfield
Fenwicks Scrub FR	73 km WNW of Port Macquarie
Forest Land SF	15 km SE of Tenterfield
Gap Creek FP	30 km N of Wyong
Georges Creek NR	55 km SE of Armidale
Gibraltar Range SF and NP	47 km NE of Glen Innes
Girard SF	32 km NE of Tenterfield
Gladstone SF	23 km NNW of Macksville
Glen Bog SF	69 km NW of Eden
Glenugie Peak FR	19 km SE of Grafton
Glenugie SF	17 km SE of Grafton
Guy Fawkes River NP	45 km NW of Dorrigo

Appendix 4 — continued

Hanging Mountain FP	32 km NW of Narooma
Harrington (Crowdy Bay NP)	21 km ENE of Taree
Hyland SF	31 km WNW of Dorrigo
Illawamba FP	40 km WSW of Narooma
Iluka NR	52 km NE of Grafton
Ingalba SF	18 km SW of Macksville
Jerusalem Creek FR	55 km NW of Bulahdelah
John Gould Island NR	52 km NE of Newcastle
Johnstons Scrub	20 km NE of Lismore
Kangaroo River SF	34 km NW of Coffs Harbour
Kerripit Beech FR	100 km N of Newcastle
Killiekrankie FR	39 km WNW of Macksville
Kioloa FP	20 km NE of Batemans Bay
Kiwarrak SF	5 km S of Taree
Koreelah SF	20 km NW of Urbenville
Leagues Scrub FP	33 km WNW of Macksville
Levers Plateau (Border Ranges NP)	35 km NNW of Kyogle
Limpinwood NR	20 km W of Murwillumbah
Little Jilliby FR	10 km NW of Wyong
Little Spirabo SF	34 km SSE of Tenterfield
Lower Bucca SF	14 km NNW of Coffs Harbour
Lyons Creek FP	23 km NW of Batemans Bay
Maclean R	36 km NE of Grafton
Macquarie Pass NP	28 km SW of Wollongong
Madmans Creek FR	13 km N of Coffs Harbour
Mallanganee FR	30 km SW of Casino
Marengo SF	34 km NW of Dorrigo
Mares Hill FP	30 km NNW of Batemans Bay
Masseys Creek SF	89 km WNW of Bulahdelah
Maxwells FR	42 km S of Eden
McDonald SF	39 km SW of Nowra
Mebbin SF	24 km NNE of Kyogle
Mebbin Lagoons FR	21 km NNE of Kyogle
Middle Creek FR	39 km NW of Dorrigo
Mimosa Rocks NP	55 km NNE of Eden
Minamurra Falls	29 km SW of Wollongong
Minyon Falls FR	22 km SW of Brunswick Heads
Mistake SF	23 km W of Macksville
Mobong Creek FR	16 km NNE of Dorrigo
Monga SF	27 km NW of Batemans Bay
Mooball SF	8 km SE of Murwillumbah
Moonpar SF	16 km NNW of Dorrigo
Moore Park NR	20 km NNW of Kyogle
Morton NP	35 km W of Nowra
Moruya SF	35 km SSW of Batemans Bay
Mt Belmore SF	42 km SW of Casino
Mt Boss SF	55 km WNW of Port Macquarie
Mt Clunie FR	22 km N of Urbenville
Mt Dromedary FR	13 km SW of Narooma
Mt Hyland NR	40 km NW of Dorrigo
Mt Imlay NP	20 km SW of Eden
Mt Kaputar NP	160 km WSW of Glen Innes
Mt Lindesay	19 km NE of Urbenville
Mt Nothofagus FR	20 km NNE of Urbenville
Mt Pikapene SF	39 km SW of Casino
Mt Seaview NR	65 km W of Port Macquarie
Mt Warning NP	10 km SW of Murwillumbah
Mumbulla SF	12 km NE of Bega
Murramarang NP	18 km ENE of Batemans Bay
Murray Scrub FR	27 km NW of Kyogle
Myall Lakes NP	3 km SE of Bulahdelah
Nadgee SF and NR	40 km S of Eden
Nalbaugh NP	45 km W of Eden
Nambucca SF	10 km NNE of Macksville
Never Never SF	11 km E of Dorrigo
New England NP	75 km E of Armidale
Newry SF	19 km N of Macksville
Nightcap NP	30 km N of Lismore
Norfolk Falls FR	110 km SW of Tamworth
Nulla Five-day SF	48 km NW of Kempsey
Nullum SF	20 km WNW of Brunswick Heads
Numinbah NR	17 km NW of Murwillumbah
Nungatta NP	50 km SW of Eden
Nymboida NP	43 km W of Grafton
Oakes SF	40 km NW of Macksville
Olney SF	24 km NW of Wyong
Orara East SF	10 km NW of Coffs Harbour
Orara West SF	18 km W of Coffs Harbour
Ourimbah SF	8 km SW of Wyong
Oxley Wild Rivers NP	80 km SSE of Armidale
Paddys Brush FR	125 km NNW of Newcastle
Paddys Creek FP	32 km WSW of Narooma
Pine Brush SF	24 km NE of Grafton
Pine Creek SF	16 km SSW of Coffs Harbour
Pretty Gully R	50 km NE of Tenterfield
Red Cedar FR	18 km NNW of Dorrigo
Riamukka SF	120 km WNW of Port Macquarie
Richmond Range SF	35 km NW of Casino
Richters Caves FR	10 km W of Wyong
Ringwood FR	27 km NW of Macksville
Robertson NR	34 km SW of Wollongong
Roses Creek SF	35 km NW of Macksville
Rotary Park R	2 km E of Lismore
Rowleys Creek FR	37 km NW of Taree
Royal NP	30 km S of Sydney
Ruthven R	14 km S of Lismore
Sailors Hill FR	40 km SW of Grafton
Scotchman SF	31 km NNW of Macksville
Sea Acres NR	Port Macquarie
Seal Rocks (Myall Lakes NP)	30 km E of Bulahdelah
Shark Island R	27 km NE of Kempsey
Sheas Nob SF	34 km NNW of Dorrigo
Sherwood NR	35 km NNW of Coffs Harbour
Snapper Island NR	36 km NNE of Newcastle
Steel Box FR	36 km SW of Casino
Stotts Island NR	12 km NE of Murwillumbah
Strickland SF	64 km SSW of Newcastle
Styx River SF	53 km E of Armidale
Susan Island NR	1 km SW of Grafton
Tabbimoble SF	65 km NE of Casino
Tanja SF	44 km N of Eden
Teak Tree FR	44 km WNW of Coffs Harbour
Tennyson Creek FR	72 km WSW of Eden
The Castles FR	48 km WNW of Kempsey
Timbarra River (Girard SF)	35 km ENE of Tenterfield
Tooloom SF	19 km SW of Urbenville
Tooloom Scrub FR	14 km W of Urbenville
Toomumbar SF	23 km WNW of Kyogle
Tuckers Nob SF	13 km SW of Coffs Harbour
Tulipwood FR	44 km NW of Coffs Harbour
Twelve Sixty FR	27 km NW of Coffs Harbour
Unumgar SF	14 km NE of Urbenville
Uralba NR	22 km SE of Lismore
Victoria Park NR	35 km W of Casino
Wadbilliga NP	42 km W of Narooma
Waihou FR	25 km NNW of Coffs Harbour
Wallaby FP	23 km NW of Batemans Bay
Wallingat SF	23 km ENE of Bulahdelah
Wamban Creek FP	30 km NNW of Narooma
Wandella FP	40 km WSW of Narooma
Wandella SF	32 km WSW of Narooma
Wandera SF	19 km SW of Batemans Bay
Warrawolong FR	30 km NNW of Wyong

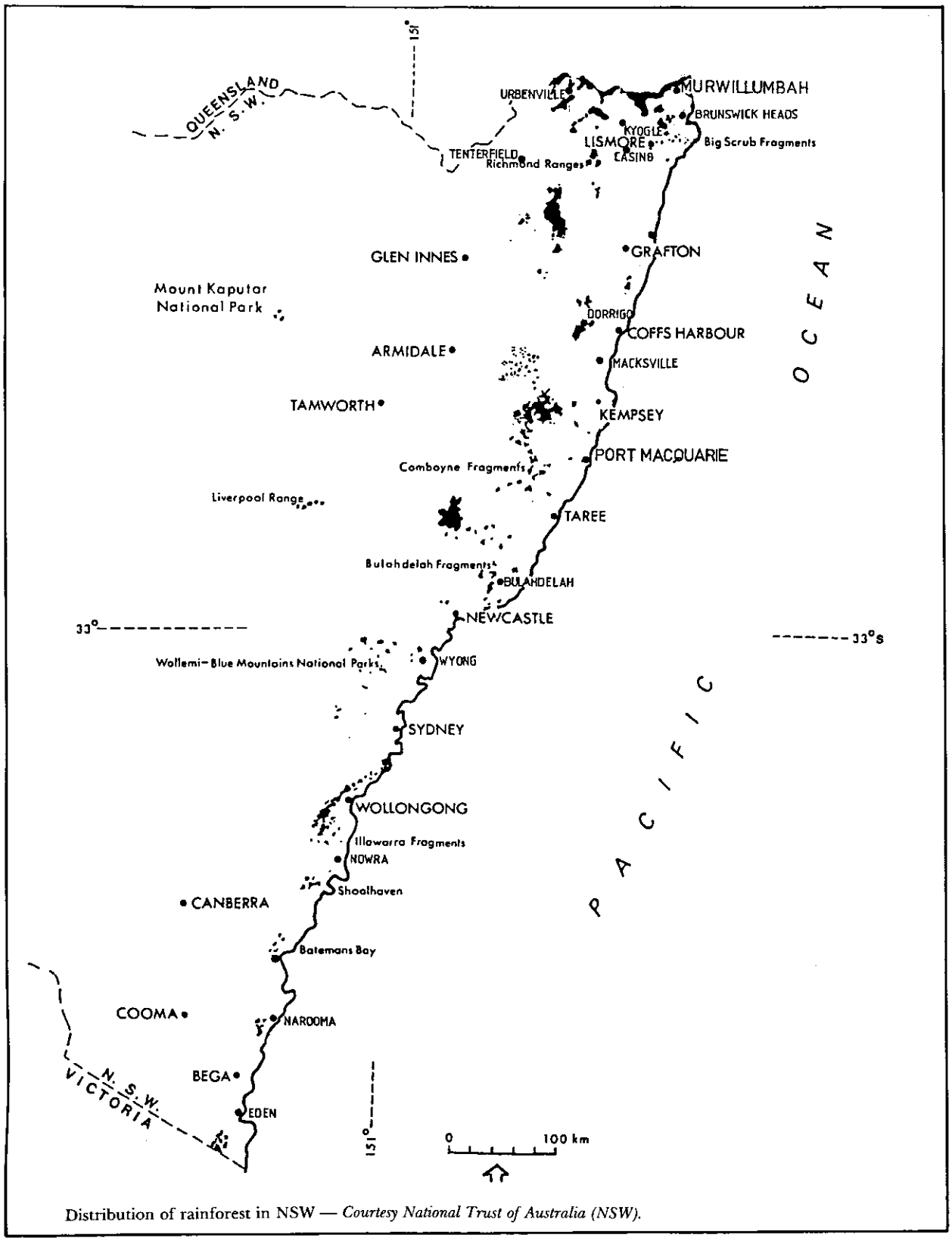
Appendix 4 — continued

Warung SF	110 km SW of Tamworth
Washpool NP and SF	72 km WNW of Grafton
Watagan SF	35 km N of Wyong
Waterfall R	85 km WNW of Sydney
Watergums FR	36 km S of Eden
Way Way SF	10 km SE of Macksville
Wedding Bells SF	19 km N of Coffs Harbour
Weelah NR	42 km NNW of Taree
Werrikimbe NP	64 km WNW of Port Macquarie
Werrinook FR	60 km SW of Narooma
Whian Whian SF	20 km WSW of Brunswick Heads
White Beech FR	30 km ENE of Tenterfield
Wild Cattle Creek SF	32 km W of Coffs Harbour
Willi Willi Caves NR	40 km WNW of Kempsey
Willowie Scrub	70 km NW of Grafton
Wilson Park R	3 km SSE of Lismore
Wilsons Peak FR	25 km NNW of Urbenville
Wilson River PR	37 km SW of Kempsey
Wingham Brush R	8 km NW of Taree
Woko NP	55 km WNW of Taree
Wollemi NP	120-150 km W of Newcastle
Wollumbin SF	16 km WSW of Murwillumbah
Wonga Wanga FR	20 km W of Coffs Harbour
Woodburn SF	42 km NNE of Batemans Bay
Woolgoolga Creek FR	20 km N of Coffs Harbour
Yabbra SF	16 km S of Urbenville
Yacaaba Headland (Myall Lakes NP)	50 km NE of Newcastle
Yadboro SF	35 km NNW of Batemans Bay
Yahou Island NR	32 km NE of Bulahdelah
Yambulla SF	40 km SW of Eden
Yarrahapinni SF	5 km SE of Macksville
Yatteyattah R	45 km SSW of Nowra

LEGEND OF LAND TENURE CLASSIFICATION

FP	Forest Preserve
FR	Flora Reserve
NP	National Park
NR	Nature Reserve
PR	Primitive Reserve
R	Reserve for Preservation of Native Flora, Public Recreation or for Aborigines
SF	State Forest

APPENDIX 5



Distribution of rainforest in NSW — *Courtesy National Trust of Australia (NSW).*

APPENDIX 6

Rare or threatened plant species in New South Wales rainforests

	Risk Code	Action Code	State	Regional Subdivision
ACANTHACEAE				
Isoglossa eranthemoides	3VC	—	QN	47 56
AGAVACEAE				
Cordyline congesta Narrow Palm Lily	2RC	—	QN	47 56
ANGIOPTERIDACEAE				
Angiopteris evecta Giant Fern	3RC	—	QN	33 39 41 43 45 46 47 56
APOCYNACEAE				
Ochrosia moorei Southern Ochrosia	2RC	—	QN	47 56
Parsonsia sp. *(hederacea)*	2RC	—	N	56
Parsonsia lilacina Crisped Silkpod	3RC	—	QN	45 47 56
Parsonsia tenuis Slender Silkpod	2RC	—	QN	47 56
ASCLEPIADACEAE				
Cynanchum elegans White-flowered Wax Plant	2EC	—	N	51 54 56
Marsdenia longiloba Slender Marsdenia	3EC	—	QN	47 56
Thozetia racemosa Rusty Water Vine	3VC	—	QN	43 45 47 56
Tylophora woollsii	2E	i	N	56 57
ASTERACEAE				
Acomis acoma	3RC	—	QN	43 45 47 56
Helichrysum vagans Sprawling Ever-lasting	2RC	a	QN	47 56
Helichrysum whitei	3RC	—	QN	47 56
Olearia flocktoniae Dorrigo Daisy-bush	2E	—	N	56
CELASTRACEAE				
Denhamia moorei Mountain Denhamia	2VC	—	N	56
CORYNOCARPACEAE				
Corynocarpus rupestris				
ssp. *arborescens*	3VC	—	QN	45 47 56
ssp. *rupestris* Glenugie Karaka	2RC	a	N	56
CUCURBITACEAE				
Trichosanthes subvelutina Velvet-leaved Cucumber	3RC	—	QN	45 47 56
CUNONIACEAE				
Acrophyllum australe	2VC	i	N	54
CYPERACEAE				
Cyperus rupicolus	2RC	—	QN	47 56

Appendix 6 — continued

	Risk Code	Action Code	State	Regional Subdivision
DAVIDSONIACEAE				
Davidsonia sp. Smooth Davidson's Plum	2E	i	QN	47 56
DICKSONIACEAE				
Dicksonia youngiana Bristly Treefern	3RC	a	QN	45 47 56
DRYOPTERIDACEAE				
Lastreopsis silvestris Mountain Shield Fern	2RC	a	QN	47 56
Lastreopsis smithiana Smooth Shield Fern	2RC	a	QN	47 56
ELAEOCARPACEAE				
Elaeocarpus williamsianus	2E	—	N	56
ESCALLONICEAE				
Argophyllum nullumense Silver Leaf	3RC	a	QN	45 47 56
Corokia whiteana Corokia	2VC	—	N	56
EUPHORBIACEAE				
Austrobuxus swainii Pink Cherry	3RC	a	QN	47 56
Baloghia marmorata Marbled Baloghia	3VC	—	QN	47 56
Fontainea australis Southern Fontainea	2EC	i	N	56
Fontainea oraria Coast Fontainea	1E	i	N	56
FABACEAE				
Cassia brewsteri var. *marksiana* Marks Cassia	3VC	i	QN	39 47 56
Desmodium acanthocladum Spiny Trefoil	2VC	i	N	56
Millettia australis Blunt-leaved Native Wistaria	3RC	a+	QN	44 47 56
Sophora fraseri	3VC	—	QN	47 56
HYMENOPHYLLACEAE				
Hymenophyllum pumilum	3RC	—	N	54 57
Sphaerocionium lyallii	3RC	—+	N	54 55 57
LAMIACEAE				
Plectranthus argentatus Silver Cockspur Flower	3RC	—	QN	47 56
LAURACEAE				
Cryptocarya floydii Gorge Laurel	3RC	a	QN	44 46 53 56
Cryptocarya foetida Stinking Laurel	3VC	i	QN	45 47 56
Cryptocarya dorrigoensis Dorrigo Laurel	2RC	i	N	56
Cryptocarya nova-anglica	3RC	a	N	53 56
Cryptocarya williwilliana Willi Willi Laurel	2RC	i	N	56
Endiandra globosa Black Walnut	2RC	i	QN	47 56
Endiandra hayesii Rusty Rose Walnut	3VC	—	QN	47 56
Endiandra floydii	2E	i	N	56
LILIACEAE				
Neoastelia spectabilis New England Astelia	2RC	t	N	56
LORANTHACEAE				
Muellerina myrtifolia Myrtle-leaf Mistletoe	3RC	—	QN	43 44 46 47 56

Appendix 6 — continued

	Risk Code	Action Code	State	Regional Subdivision
LYCOPODIACEAE				
Lycopodium phlegmaria Tassel Fern	3RC	—+	QN	33 39 47 56
MELIACEAE				
Owenia cepiodora Onion Cedar	2EC	—	QN	47 56
MENISPERMACEAE				
Tinospora tinosporoides Arrow-head Vine	3VC	a	QN	47 56
MIMOSACEAE				
Acacia bakeri Marblewood	3VC	—	QN	45 47 56
Acacia clunies-rossiae Bluebush	2VC	t	N	54 57
Archidendron muellerianum Veiny Lace-flower	3RC	a	QN	47 56
MYOPORACEAE				
Myoporum betcheanum Mountain Boobialla	3RC	—	QN	47 56
MYRSINACEAE				
Ardisia bakeri	2RC	—	QN	47 56
Rapanea sp.	2E	—	N	56
MYRTACEAE				
Austromyrtus fragrantissima Sweet Myrtle	3EC	—	QN	47 56
Backhousia anisata Ringwood	2RC	a	N	56
Choricarpia subargentea Giant Ironwood	3VC	—	QN	43 45 47 56
Rhodamnia maideniana Smooth-leaved Brush Turpentine	2RC	—	QN	47 56
Rhodamnia whiteana Cliff Malletwood	2VC	—	QN	47 56
Syzygium hodgkinsoniae Smooth-barked Rose Apple	3VC	—	QN	46 47 56
Syzygium moorei Rose Apple	2VC	i	QN	47 56
Syzygium paniculatum Magenta Lilly Pilly	3EC	i	N	56 57 58
Uromyrtus australis Peach Myrtle	2EC	i	N	56
Uromyrtus sp. (McPhers)	2RC	—	QN	47 56
ORCHIDACEAE				
Acianthus amplexicaulis Lobed Gnat Orchid	3RC	—	QN	39 47 56
Bulbophyllum argyropus	3RC	i+	QN	47 56
Bulbophyllum globuliforme	3RC	—	QN	45 46 47 56
Bulbophyllum tuberculatum	2R	—+	QN	47 56
Bulbophyllum weinthalii Hoop Pine Orchid	3RC	i	QN	46 47 56
Dendrobium schneiderae	3RC	—	QN	40 43 45 46 47 56
Papillilabium beckleri	3RC	—	QN	47 56 57
Sarcochilus dilatatus	3RC	—	QN	43 44 45 47 56
Sarcochilus fitzgeraldii Ravine Orchid	3VC	—	QN	47 56
Sarcochilus hartmannii	3VC	—	QN	47 56
Sarcochilus hartmannii	3VC	—	QN	47 56
Sarcochilus weinthalii	3EC	—	QN	46 47 56
Schistotylus purpuratus	3RC	i	N	53 56
PHILYDRACEAE				
Helmholtzia glaberrima Stream Lily	2RC	a	QN	47 56

Appendix 6 — continued

	Risk Code	Action Code	State	Regional Subdivision
PITTOSPORACEAE				
Pittosporum sp. aff. *bicolor*	3RC	—	NV	58 65 67 68
Pittosporum oreillyanum Thorny Pittosporum	2RC	at	QN	47 56
PODOCARPACEAE				
Microstrobus fitzgeraldii	2VC	it	N	54
PROTEACEAE				
Floydia praealta Ball Nut	3VC	a	QN	45 47 56
Hakea sp. aff. *macraeana* Pine-leaved Hakea	2RC	—	N	56
Helicia ferruginea Rusty Oak	2RC	a	QN	47 56
Macadamia tetraphylla Rough-shelled Bush Nut	2VC	—	QN	47 56
Oreocallis pinnata Tree Waratah	3RC	a	QN	47 56
RANUNCULACEAE				
Clematis fawcettii Lobed-leaf Clematis	3VC	—	QN	46 47 53 56
RHAMNACEAE				
Pomaderris notata	2RC	—t	QN	47 56
RUBIACEAE				
Coprosma sp. aff. *nitida*	2RC	—	N	53
Randia moorei Spiny Gardenia	3EC	i	QN	47 56
RUTACEAE				
Acronychia baeuerlenii	3RC	a	QN	47 56
Acronychia littoralis Scented Acronychia	3EC	i	N	56
Bosistoa floydii Five-leaved Bonewood	2RC	i	N	56
Bosistoa selwynii Heart-leaved Bonewood	3VC	i	QN	43 44 45 47 56
Bosistoa transversa Yellow Satinheart	3VC	—	QN	45 47 56
Sapindaceae				
Diploglottis campbellii Small-leaved Tamarind	2E	i	QN	47 56
Lepiderema pulchella Fine-leaved Tuckeroo	2RC	—	QN	47 56
SAPOTACEAE				
Amorphospermum whitei Rusty Plum	3RC	a	QN	47 56
SCROPHULARIACEAE				
Euphrasia bella Mt Merino Eye-bright	2EC	i	QN	47 56
SIMAROUBACEAE				
Quassia sp. (Moonee)	2E		N	56
Quassia sp. aff. *bidwillii* Southern Quassia	3RC	a	N	56
SYMPLOCACEAE				
Symplocos baeuerlenii Shrubby Hazelwood	2VC	a	QN	47 56
THELYPTERIDACEAE				
Pneumatopteris pennigera Lime Fern	3RC	a+	QNVT	47 56 64 70 72 75
Pneumatopteris sogerensis Giant Creek fern	3RC	t	QN	33 39 47 56
TILIACEAE				
Corchorus cunninghamii	3E	—	QN	44 47 56
WINTERACEAE				
Tasmannia glaucifolia Alpine Pepper Bush	3RC	—	N	53
Tasmannia purpurascens Purple Pepper Bush	2VC	—t	N	53

Appendix 6 — continued

KEY TO ABBREVIATIONS

A. Risk Code

From Briggs, J. D. and Leigh, J. H., 1988. Rare or Threatened Australian Plants. Special Publication No. 14. Aust. NP & WS.

Distribution Category

1. Type locality only.
2. Very restricted distribution in Australia = less than 100 km.
3. Range over 100 km but of small populations, mainly restricted to highly specific habitats.

Conservation Status

X Presumed *extinct* (not collected in last 50 years).
E *Endangered* species in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.
V *Vulnerable.* Not presently endangered but at risk over a longer period through continued depletion (100 plants or less for trees and shrubs) or largely occurring on sites likely to experience changes in land use.
R *Rare,* e.g., large populations in a very restricted area or small populations over a wider range.
K *Poorly known.* Suspected to be rare.

Supplementary Code

C *Conserved* in National Parks, etc., but not necessarily adequately.
\+ Distribution *beyond Australia.*

B. Action Code

t Total population conserved.
a Location known, population secure.
i Location known, population not secure, rescue required.
— Location not adequately known, survey required.
d No recent records, searching warranted.

C. State Code

Q Queensland
N New South Wales
V Victoria

D. Regional Subdivision Code

Queensland

33	North-east	North of Tully
39	Burdekin	Bowen to Tully
40	Bowen	Mackay to Bowen
41	Leichhardt	Injune to Pioneer River
43	Fitzroy	Bundaberg to Mackay
44	Burnett	Kingaroy to Moura
45	Mary Valley	Nambour to Bundaberg
46	Darling Downs	NSW to Chinchilla
47	Moreton	Coolangatta to Nambour

New South Wales

51	Central Western Slopes	Young to Muswellbrook
53	Northern Tablelands	Liverpool Range to Tenterfield
54	Central Tablelands	Goulburn to Liverpool Range
55	Southern Tablelands	Victoria to Goulburn
56	North Coast	Newcastle to Tweed Heads
57	Central Coast	Nowra to Newcastle
58	South Coast	Victoria to Nowra

Victoria

64	South-west	South Australia to Geelong
65	Otway Ranges	Cape Otway to Lorne
67	Gippsland	Melbourne to Cape Howe
68	Strzelecki Ranges	

Tasmania

70	King Island	
72	North-west	West Point to Wynyard
75	North Central	Wynyard to Launceston

APPENDIX 7

Outstanding trees of New South Wales rainforest

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
A. PALMS				
Arecaceae	*Archontophoenix cunninghamiana*	25	30	Round Mountain
	Livistona australis	30	40	Yahou Island NR
B. CONIFERS				
Araucariaceae	*Araucaria cunninghamii*	62	130	Nulla Five Day SF
Cupressaceae	*Callitris macleayana*	39	79	Moonpar SF
Podocarpaceae	*Podocarpus elatus*	35	85	Boatharbour NR
C. FLOWERING PLANTS				
Akaniaceae	*Akania lucens*	25	45	Middle Creek FR
Alangiaceae	*Alangium villosum*	25	90	New England NP
Anacardiaceae	*Euroschinus falcata*	45	75	Boatharbour NR
	Rhodosphaera rhodanthema	27	75	Not recorded
Annonaceae	*Ancana stenopetala*	5	4	Mt Warning NP
	Polyalthia nitidissima	18	30	Cudgen Lake
Apocynaceae	*Alstonia constricta*	18	30	Captains Creek FR
	Neisosperma poweri	10	15	Mt Cougal
	Ochrosia moorei	10	25	Marshall Falls
Araliaceae	*Polyscias elegans*	30	75	Not recorded
	P. murrayi	20	50	Not recorded
Asteraceae	*Bedfordia arborescens*	12	45	Currawan Creek
	Olearia argophylla	15	40	Mt Imlay NP
Atherospermataceae	See *Monimiaceae*			
Boraginaceae	*Ehretia acuminata*	30	85	Daisy Patch FR
Burseraceae	*Canarium australasicum*	40	120	Whian Whian SF
Capparaceae	*Capparis arborea*	20	30	Mt Cougal
Celastraceae	*Cassine australis*	20	40	Royal NP
	Denhamia celastroides	18	50	Not recorded
	D. moorei	6	10	Cunnawarra FR
	D. pittosporoides	6	25	Chandler Gorge
	Hedraianthera porphyropetala	9	30	Tomewin
	Maytenus bilocularis	12	20	Not recorded
	M. disperma	15	50	Rotary Park
	M. silvestris	15	25	Not recorded
	Siphonodon australis	30	45	Wilson Park
Corynocarpaceae	*Corynocarpus rupestris*	22	40	Upper Coopers Creek
Cunoniaceae	*Caldcluvia paniculosa*	40	90	Border Ranges NP
	Callicoma serratifolia	26	60	Washpool NP
	Ceratopetalum apetalum	40	140	Coolamangera FR
	Geissois benthamii	35	140	Border Ranges NP
	Pseudoweinmannia lachnocarpa	35	250	Numinbah NR
	Schizomeria ovata	38	150	Moonpar SF
	Vesselowskia rubifolia	8	25	Barrington NP
Davidsoniaceae	*Davidsonia pruriens* var. *jerseyana*	10	17	Mooball
	D. sp. nov.	18	67	Burringbar

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
Ebenaceae	*Diospyros australis*	20	25	Not recorded
	D. fasciculosa	30	40	Not recorded
	D. mabacea	25	30	Oxley River
	D. major var. *ebenus*	6	10	Hogans Scrub WR
	D. pentamera	40	60	Not recorded
Elaeocarpaceae	*Elaeocarpus eumundi*	25	50	Uralba NR
	E. grandis	35	200	Dorrigo NP
	E. holopetalus	25	200	Brown Mountain FR
	E. kirtonii	35	200	Allyn River
	E. obovatus	45	150	Boatharbour NR
	E. reticulatus	30	45	Williams River
	E. williamsianus	15	18	Burringbar
	Sloanea australis	30	60	Not recorded
	S. woollsii	55	251	Bulga SF
Epacridaceae	*Acrotriche aggregata*	15	30	Marengo SF
	Trochocarpa laurina	13	44	Eastwood
	T. sp.	10	30	Mt Hyland NR
Escalloniaceae	*Abrophyllum ornans*	8	30	Not recorded
	Anopterus macleayanus	15	22	Wild Cattle Creek SF
	Argophyllum nullumense	8	15	Mt Warning NP
	Cuttsia viburnea	18	25	Not recorded
	Polyosma cunninghamii	15	25	Not recorded
	Quintinia sieberi	25	75	Not recorded
	Q. verdonii	17	30	Not recorded
Eucryphiaceae	*Eucryphia moorei*	30	80	Budawang Range
Euphorbiaceae	*Actephila lindleyi*	12	17	Black Scrub FR
	Alchornea ilicifolia	6	10	Not recorded
	Austrobuxus swainii	37	100	Moonpar SF
	Baloghia inophylla	24	50	Not recorded
	B. marmorata	10	12	Davis Scrub NR
	Bridelia exaltata	35	40	Boatharbour NR
	Claoxylon australe	9	30	Not recorded
	Cleistanthus cunninghamii	9	20	Not recorded
	Croton acronychioides	14	15	Black Scrub FR
	C. insularis	15	25	Gangat
	C. stigmatosus	15	15	Hortons Creek
	C. verreauxii	20	20	Not recorded
	Drypetes australasica	25	60	Not recorded
	Excoecaria agallocha	9	30	Terranora
	E. dallachyana	15	45	Not recorded
	Fontainea australis	5	10	Oxley River
	F. oraria	7	10	Lennox Head
	Glochidion ferdinandi	35	70	Eureka
	G. sumatranum	30	30	Round Mountain
	Macaranga tanarius	6	30	Goonengerry
	Mallotus claoxyloides	9	23	Not recorded
	M. discolor	30	50	Johnstons Scrub
	M. philippensis	25	40	Not recorded
	Omalanthus populifolius	6	13	Not recorded
	Petalostigma pubescens	12	75	Ramornie
	P. triloculare	15	25	Sherwood
Eupomatiaceae	*Eupomatia laurina*	15	25	Maxwells FR
Fabaceae	*Cassia brewsteri* var. *marksiana*	25	50	Stotts Island NR
	Castanospermum australe	35	120	Numinbah NR
	Erythrina vespertilio	25	75	Ettrick
Fagaceae	*Nothofagus moorei*	48	294	Chichester
Flacourtiaceae	*Casearia multinervosa*	10	20	Flagstone Creek
	Scolopia braunii	25	50	Not recorded
	Xylosma terraereginae	4	6	Broken Head NR
Gyrostemonaceae	*Codonocarpus attenuatus*	12	15	Willi Willi
Icacinaceae	*Citronella moorei*	50	200	Allyn River
	Pennantia cunninghamii	30	90	Not recorded
Lauraceae	*Beilschmiedia elliptica*	35	102	Minyon Falls FR

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima		
		Height m	Diameter cm	Location
Lauraceae	*Beilschmiedia obtusifolia*	30	90	Not recorded
	Cinnamomum oliveri	30	75	Washpool NP
	C. virens	30	60	Not recorded
	Cryptocarya bidwillii	20	30	Ettrick
	C. dorrigoensis	6	10	Orara West SF
	C. erythroxylon	57	122	Murray Scrub FR
	C. floydii	15	22	Chandler Gorge
	C. foetida	20	20	Brunswick Heads NR
	C. foveolata	45	120	Spirabo SF
	C. glaucescens	30	90	Not recorded
	C. laevigata	6	5	Not recorded
	C. meissneriana	10	25	Not recorded
	C. microneura	25	30	Not recorded
	C. nova-anglica	20	45	Werrikimbe NP
	C. obovata	40	90	Not recorded
	C. rigida	10	20	Not recorded
	C. triplinervis	20	60	Boatharbour NR
	C. williwilliana	6	10	Carrai
	Endiandra compressa	30	45	Wanganui
	E. crassiflora	20	40	Not recorded
	E. discolor	40	90	Not recorded
	E. floydii	15	25	Numinbah NR
	E. globosa	25	40	Hogans Scrub
	E. hayesii	35	60	Minyon Falls FR
	E. introrsa	40	90	Dorrigo NP
	E. muelleri	30	75	Border Ranges NP
	E. pubens	35	45	Minyon Falls FR
	E. sieberi	30	90	Not recorded
	E. virens	10	20	Boambee SF
	Litsea australis	20	30	Not recorded
	L. reticulata	40	150	Not recorded
	Neolitsea australiensis	40	50	Murray Scrub FR
	N. dealbata	12	20	Not recorded
Locaniaceae	*Strychnos arborea*	18	30	Not recorded
Malvaceae	*Hibiscus heterophyllus*	6	25	Not recorded
	H. splendens	6	7	Not recorded
	H. tiliaceus	10	50	Woodburn
Meliaceae	*Anthocarapa nitidula*	27	60	Yabbra SF
	Dysoxylum fraseranum	57	355	Koreelah SF
	D. muelleri	35	120	Davis Scrub NR
	D. rufum	32	74	Murray Scrub FR
	Melia azedarach var. *australasica*	45	120	Not recorded
	Owenia cepiodora	25	75	Ettrick
	O. venosa	20	45	Mt Lindesay
	Synoum glandulosum	30	50	Border Ranges NP
	Toona australis	55	290	Yabbra SF
Mimosaceae	*Acacia aulacocarpa*	15	40	Brunswick Heads NR
	A. bakeri	40	90	Black Scrub FR
	A. melanoxylon	35	100	Mt Dromedary FR
	A. orites	30	60	Whian Whian SF
	Archidendron grandiflorum	20	50	Mt Warning NP
	A. hendersonii	18	60	Ocean Shores
	A. muellerianum	20	60	Not recorded
	Pararchidendron pruinosum	15	35	Bruxner Park FR
Monimiaceae	*Atherosperma moschatum*	30	30	Eucryphia FR
	Daphnandra micrantha	40	75	Andersons Sugarloaf
	D. tenuipes	20	45	Boorganna NR
	Doryphora sassafras	50	120	Middle Creek FR
	Hedycarya angustifolia	20	40	Mt Dromedary FR
	Wilkiea austroqueenslandica	9	18	Border Ranges NP
	W. huegeliana	8	7	John Gould Island NR
	W. macrophylla	4	8	Nashua

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
Moraceae	*Ficus coronata*	15	20	Not recorded
	F. fraseri	35	60	Murray Scrub FR
	F. macrophylla	50	240	Johnstons Scrub
	F. obliqua	50	330	Chichester SF
	F. rubiginosa	30	150	Not recorded
	F. superba var. *henneana*	35	75	Not recorded
	F. virens var. *sublanceolata*	30	180	Tyalgum
	F. watkinsiana	54	560	Moore Park NR
	Streblus brunonianus	30	45	Murray Scrub FR
Myoporaceae	*Myoporum acuminatum*	9	50	Kiama
	M. betcheanum	8	20	Cangai SF
Myrsinaceae	*Ardisia bakeri*	10	15	Numinbah NR
	Rapanea howittiana	23	60	Werrinook FR
	R. variabilis	15	50	Not recorded
	Tapeinosperma pseudo-jambosa	3	4	Numinbah NR
Myrtaceae	*Acmena ingens*	40	90	Numinbah NR
	A. hemilamptra	36	100	Johnston's Scrub
	A. smithii	30	60	Dingo Creek FR
	A. smithii — rheophytic race	6	20	Arandin FR
	Archirhodomyrtus beckleri	15	25	Not recorded
	Austromyrtus acmenoides	18	30	Not recorded
	A. sp. aff. *acmenoides*	22	40	Mt Warning NP
	A. bidwillii	18	30	Woko NP
	A. fragrantissima	10	20	Boatharbour NR
	A. hillii	15	22	Ettrick
	A. sp. aff. *lasioclada*	9	23	Nightcap NP
	Backhousia anisata	46	177	Dorrigo NP
	B. myrtifolia	30	40	Olney SF
	B. sciadophora	45	101	Black Creek FR
	Choricarpia leptopetala	20	35	Little Jilliby Creek
	C. subargenta	8	20	Mullumbimby
	Decaspermum humile	25	45	Nightcap NP
	Lophostemon confertus	4	320	Border Ranges NP
	Pilidiostigma glabrum	5	8	Not recorded
	Rhodamnia argentea	30	85	Cambridge Plateau FR
	R. rubescens	25	75	Cambridge Plateau FR
	R. whiteana	20	35	Mossy Gardens
	Rhodomyrtus psidioides	12	25	Not recorded
	Syzygium australe	35	60	Boonabilla Creek
	S. corynanthum	30	90	Not recorded
	S. crebrinerve	40	120	Numinbah NR
	S. francisii	45	150	Booyong Reserve
	S. hodgkinsoniae	11	15	Not recorded
	S. luehmannii	30	90	Round Mountain
	S. moorei	40	60	Not recorded
	S. oleosum	15	30	Not recorded
	S. paniculatum	15	35	Not recorded
	Tristaniopsis collina	30	45	Carrai
	T. laurina	39	145	Dingo SF
	Uromyrtus australis	12	15	Whian Whian SF
	U. sp. (Lamington)	3	12	Limpinwood NR
	Waterhousea floribunda	30	75	Uki
Nyctaginaceae	*Pisonia umbellifera*	6	25	John Gould Island NR
Oleaceae	*Nestegis ligustrina*	3	6	Egan Peaks NR
	Notelaea johnsonii	7	7	Hayters Hill
	N. longifolia	15	55	Camels Hump NR
	N. microcarpa var. *velutina*	10	20	Wollomombi Gorge
	N. venosa	10	25	Marengo SF
	Olea paniculata	30	90	Wilson Park
Pittosporaceae	*Citriobatus lancifolius*	25	30	Wilson Park
	Hymenosporum flavum	22	45	Border Ranges NP
	Pittosporum bicolor	10	10	Wadbilliga NP
	P. sp. aff. *bicolor*	18	25	Werrinook FP

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
	Pittosporum rhombifolium	25	45	Not recorded
	P. undulatum	25	35	Not recorded
Proteaceae	*Banksia integrifolia* var. *compar*	25	60	Barrington Tops NP
	Floydia praealta	35	60	Limpinwood NR
	Grevillea hilliana	30	35	Brunswick Heads NR
	G. robusta	42	90	Unumgar SF
	Hakea eriantha	9	15	Mt Dromedary FR
	Helicia ferruginea	20	20	Not recorded
	H. glabriflora	15	30	Not recorded
	Hicksbeachia pinnatifolia	12	30	Big Scrub FR
	Lomatia arborescens	12	45	Kunderang Brook
	L. fraseri	7	20	Mt Hyland NR
	Macadamia tetraphylla	18	45	Not recorded
	Oreocallis pinnata	24	65	Moonpar SF
	Orites excelsa	30	75	Not recorded
	Stenocarpus salignus	30	60	Murray Scrub FR
	S. sinuatus	40	75	Boatharbour NR
	Triunia youngiana	4	5	Not recorded
Rhamnaceae	*Alphitonia excelsa*	42	116	Koreelah SF
	A. petriei	20	25	Mooball
	Emmenosperma alphitonioides	35	75	Boatharbour NR
Rubiaceae	*Canthium coprosmoides*	25	50	Yabbra SF
	C. odoratum	15	25	Mt Lindesay
	C. lamprophyllum	30	50	Mt Warning
	C. vacciniifolium	6	20	Mt Seaview NR
	Hodgkinsonia ovatiflora	25	60	Upper Duck Creek
	Ixora beckleri	10	15	Not recorded
	Psychotria daphnoides	5	8	Not recorded
	P. loniceroides	5	10	Not recorded
	P. simmondsiana var. *glabrescens*	5	10	Mt Matheson
	Randia benthamiana	8	15	Not recorded
	R. chartacea	6	8	Mt Neville
	Randia moorei	10	18	Terranora
Rutaceae	*Acradenia euodiiformis*	20	60	New England NP
	Acronychia bauerlenii	10	8	Quandong Falls
	A. imperforate	15	30	Iluka NR
	A. laevis	6	10	Boomerang Falls
	A. littoralis	9	35	Brunswick Heads
	A. oblongifolia	18	30	Border Ranges NP
	A. pauciflora	10	10	Rotary Park
	A. pubescens	15	18	Border Ranges NP
	A. suberosa	18	30	Border Ranges NP
	A. wilcoxiana	15	25	Not recorded
	Bosistoa floydii	20	75	Dorrigo NP
	B. pentacocca	18	25	Booyong Reserve
	B. selwynii	22	50	N. Pumpenbil Creek
	B. transversa	15	35	Terranora
	Bouchardatia neurococca	15	15	Mt Warning NP
	Correa lawrenciana var. *lawrenciana*	4	10	Dorrigo NP
	Euodia elleryana	25	60	Wardell
	E. micrococca	35	60	Johnstons Scrub
	E. vitiflora	14	18	Broken Head NR
	E. sp.	20	35	Daisy Patch FR
	Flindersia australis	40	186	Murray Scrub FR
	F. bennettiana	40	90	Not recorded
	F. collina	25	60	Captain's Creek FR
	F. schottiana	45	100	Border Ranges NP
	F. xanthoxyla	45	90	Cambridge Plateau FR
	Geijera paniculata	12	30	Rotary Park
	G. salicifolia var. *latifolia*	30	75	Boatharbour NR
	G. salicifolia var. *salicifolia*	30	50	Chandler River Gorge

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
	Halfordia kendack	27	75	Border Ranges NP
	Medicosma cunninghamii	10	10	Mt Warning
	Melicope erythrococca	25	60	Richmond Range
	M. octandra	27	76	Border Ranges NP
	Microcitrus australasica	10	10	Black Scrub FR
	Micromelum minutum	7	10	Lismore
	Pentaceras australis	18	45	Border Ranges NP
	Sarcomelicope simplicifolia	18	33	Not recorded
	Zanthoxylum brachyacanthum	15	35	Mt Warning NP
Santalaceae	*Exocarpos latifolius*	8	15	Pimlico Island
Sapindaceae	*Alectryon coriaceus*	6	15	Iluka NR
	A. forsythii	8	36	Wollomombi Falls
	A. subcinereus	20	45	Beaury SF
	A. subdentatus	11	20	Mt Seaview NR
	A. tomentosus	15	30	Toonumbar SF
	Arytera distylis	24	35	Wilson Park
	A. divaricata	36	73	Murray Scrub FR
	Atalaya multiflora	25	40	Booyong Reserve
	A. salicifolia	25	45	Border Ranges NP
	Castanospora alphandii	35	120	Numinbah NR
	Cupaniopsis anacardioides	10	50	Iluka NR
	C. flagelliformis	10	40	Meerschaumvale
	C. foveolata	13	15	Andersons Sugarloaf
	C. newmanii	6	5	Tyalgum
	C. parvifolia	25	50	Toonumbar SF
	C. serrata	9	8	Lower Tweed
	Diploglottis australis	36	75	Border Ranges NP
	D. campbellii	24	90	Eungella
	Elattostachys nervosa	29	47	Murray Scrub FR
	E. xylocarpa	20	50	S. Yabbra
	Guioa semiglauca	18	30	Yabbra SF
	Harpullia alata	5	6	Nightcap NP
	H. hillii	20	50	Mt Sebastopol
	H. pendula	24	200	Burnt Down Creek FR
	Jagera pseudorhus	30	50	Murray Scrub FR
	Lepiderema pulchella	15	40	Rous River
	Mischocarpus anodontus	20	20	Black Scrub FR
	M. australis	35	50	Boatharbour NR
	M. lachnocarpus	20	22	Boomerang Falls
	M. pyriformis	18	50	Sea Acres NR
	Rhysotoechia bifoliolata	22	60	Horton's Creek
	Sarcopteryx stipata	40	75	Griers Scrub
	Toechima dasyrrhache	8	23	Bellinger River
	T. tenax	18	30	Not recorded
Sapotaceae	*Amorphospermum antilogum*	20	50	Terranora
	A. whitei	20	50	Bruxner Park FR
	Planchonella australis	30	120	Dorrigo NP
	P. chartacea	12	27	Wardell
	P. cotinifolia	15	40	Flagstone Gully
	P. laurifolia	36	90	Middle Pocket
	P. myrsinoides	12	25	Mallanganee FR
	P. pohlmaniana	20	55	Border Ranges NP
Simaroubaceae	*Ailanthus triphysa*	35	86	Murray Scrub FR
	Guilfoylia monostylis	20	65	Daisy Patch FR
	Quassia sp. aff. *bidwillii*	5	10	Mt Nardi
Solanaceae	*Duboisia myoporoides*	20	45	Johnstons Scrub
Sterculiaceae	*Argyrodendron actinophyllum*	50	170	Unumgar SF
	A. trifoliolatum	45	200	Numinbah NR
	Brachychiton acerifolius	37	100	Mt Nothofagus FR
	B. discolor	30	75	Mallanganee FR
	B. populneus	32	116	Old Koreelah
	Commersonia bartramia	25	50	Hogan's Scrub WR
	C. fraseri	8	15	Olney SF
	Sterculia quadrifida	18	45	Cobaki

Appendix 7 — continued

Family	Genus and Species	Recorded Maxima Height m	Diameter cm	Location
Symplocaceae	*Symplocos baeuerlenii*	7	15	Nightcap NP
	S. stawellii	20	80	Black Scrub FR
	S. thwaitesii	17	45	Broken Head NR
Thymelaeaceae	*Phaleria chermsideana*	10	20	Sailor's Hill FR
Ulmaceae	*Aphananthe philippinensis*	32	104	Murray Scrub FR
	Celtis paniculata	39	90	Murray Scrub FR
	Trema aspera	6	15	Toonumbar SF
Urticaceae	*Dendrocnide excelsa*	43	434	Tooloom Scrub FR
	D. moroides	4	3	Cudgen Lake
	D. photinophylla	30	87	Border Ranges NP
	Pipturus argenteus	8	20	Border Ranges NP
Verbenaceae	*Clerodendrum floribundum*	30	30	Booyong Reserve
	C. tomentosum	15	25	Not recorded
	Gmelina leichhardtii	59	267	Terania Creek
	Premna lignum-vitae	30	90	Border Ranges NP

KEY TO LAND CLASSIFICATION CATEGORIES

Forestry Commission of NSW

FP Forest Preserve. Interim measure towards Flora Reserve.
FR Flora Reserve. Primarily scientific purpose.
SF State Forest. Primarily timber production if suitable.

NSW National Parks and Wildlife Service

NP National Park. Recreation and scientific purposes.
NR Nature Reserve. Scientific purposes only.
SRA State Recreation Area. Primarily for recreation.
WR Wildlife Refuge. Voluntary protection by privare owner — not binding.

*Localities recommended for dedication for conservation purposes.