

## RAINFOREST IN EASTERN TASMANIA — FLORISTICS AND CONSERVATION

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(with two tables, four text-figures and one appendix)

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Six floristic communities are described from rainforest in northern and eastern Tasmania. The communities occur in lower rainfall areas, where they are often restricted to fire-protected sites. They have climatic envelopes which are significantly distinct from each other and from rainforest in higher rainfall areas. The conservation status of the communities is assessed.

**Key Words:** rainforest, Tasmania, conservation, relicts.

### INTRODUCTION

Temperate rainforests worldwide are restricted mainly to the coastal and maritime zones, and generally occur in areas of high rainfall (Kellogg 1992). All the rainforests of Tasmania are relicts of extensive rainforest which once occurred on the ancient continent Gondwana (Hill 1990, Nelson 1981). Many of the genera which are characteristic of rainforest in Tasmania occur also in the warm temperate rainforest facies on the Australian mainland, from which the Tasmanian flora may have been derived (Hill & Read 1987). These genera retain close relatives in other parts of the disintegrated supercontinent, especially New Zealand, New Caledonia and South America (Nelson 1981). Such genera include *Nothofagus*, *Eucryphia*, *Lagarostrobos*, *Phyllocladus*, *Aristotelia*, *Coprosma*, and *Uncinia* (Jarman & Brown 1983). The largest areas of rainforest in Tasmania are in the northwest. In the west and southwest the rainforest is more fragmented and occurs as a mosaic together with scrub and buttongrass moorlands (Jarman *et al.* 1984). Large patches of rainforest also occur in the northeast highlands. Smaller outlying patches of rainforest occur in the drier lowland and eastern highland regions of Tasmania. These outliers are presumed to be leftovers from past periods when the climate was more suited to rainforest (Macphail 1976, 1979). The distribution, composition and ecology of these forests are the subject of this paper.

### THE STUDY AREA

The study area was defined using the modified Nature Conservation Regions (NCR) of Orchard (1988). The study area comprises NCR 4a (north coast and hills), 4b (midlands), 7a (east coast and tiers), and 7b (southern midlands). South Bruny Island lies within NCR 10b (south [dolerite]) but was included because its rainforests are considered significant outliers. Two sites in NCR 6 (northeast highlands) are included, as they are lowland sites within low rainfall areas. The southwest portion of NCR 4a was excluded, because the forests in this area are closely related to the western rainforests.

Species nomenclature follows Buchanan *et al.* (1989).

### METHODS

TASFORHAB profiles (Peters 1984) were collected from relict rainforest patches throughout the study area. These profiles record the floristics, species abundance and the structure of the forest. A number of profiles already on the TASFORHAB data base were used to cross-check results, and to locate potential rainforest sites.

### ANALYSIS

The collected data set of 82 profiles was analysed using DECORANA (Hill & Gauch 1980) and TWINSPLAN (Hill 1979) (fig. 1). A few sites which were clearly misclassified were subsequently manually resorted. The classifications which resulted have been interpreted using the terminology established by Jarman *et al.* (1984).

The climatic profile of each site was determined using BIOCLIM (Busby 1986, Nix 1986). A principal components analysis of the sites was run using the 16 BIOCLIM variables, in order to determine the degree of autocorrelation among the climate variables and to explore the different climates among the sites. The relationships between the selected climate variables and the floristic ordination scores were explored using stepwise regression. Stepwise regression was used in preference to full multiple regression to determine the most parsimonious set of predictor variables.

Discriminant analysis of the floristic groups using the BIOCLIM variables as data vectors was used to further explore the relationship between climate and the floristic groups.

### RESULTS

Four floristic groups were identified by the analysis (fig. 1):

- (1) Callidendrous sassafras–musk rainforest (two communities) (C1.2 and C3.2, Jarman *et al.* 1991);
- (2) Callidendrous myrtle rainforest (two communities) (C1.1, Jarman *et al.* 1991);
- (3) Thamnic sassafras–laurel rainforest (one community) (CT8, Jarman *et al.* 1991);
- (4) Callidendrous–thamnic myrtle rainforest (one community) (CT7, Jarman *et al.* 1991).

Detailed floristics for these communities are given in the appendix.

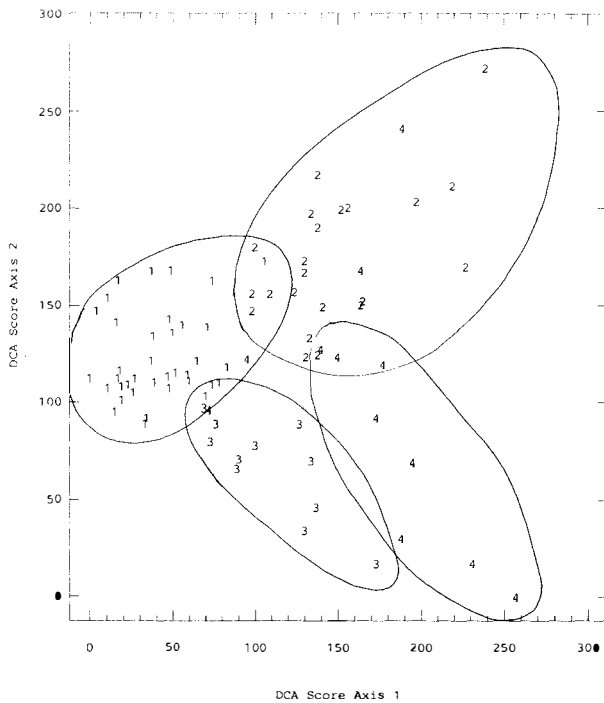


FIG. 1—Ordination of the floristic data. The labels correspond to the TWINSpan groups and to the classificatory groups described in the text.

### Principal Components Analysis

The first three principal components accounted for 94% of the variation between the sites. Figure 2 is a plot of the rainforest patches on the first two principal component axes, with the points labelled according to the floristic group to which they were assigned following classification of the sites by TWINSpan. It is clear from the figure that the northeastern sites (callidendrous sassafras rainforest [northeast] and the callidendrous myrtle riverine patches [labelled 1 and 4 respectively in the figure]) are climatically distinct from the other sites.

### Regression Analysis

The stepwise regression analysis indicates that rainfall in the driest month and the mean temperature of the coolest month are important factors in predicting the occurrence of the different floristic groups (table 1). Both variables are closely related to the first DCA axis.

### Discriminant Analysis

The discriminant analysis clearly separates the rainforest communities into three regional groups (fig. 3):

- a northeast group comprising callidendrous sassafras musk rainforest (northeast) and callidendrous myrtle rainforest (riverine) which occurs only in northeast Tasmania;
- an eastern group comprising callidendrous sassafras musk

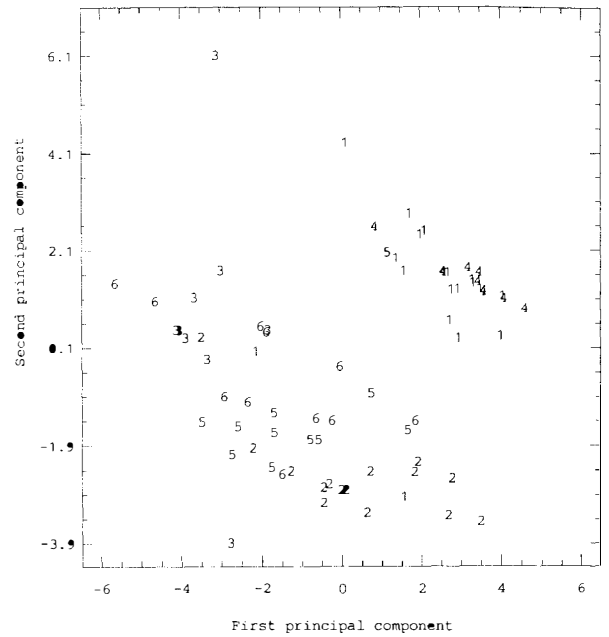


FIG. 2—Scatterplot of the rainforest patches on the first two principal components axes derived from the principal components analysis of the BIOCLIM data. The labels correspond to the six rainforest communities: (1) Callidendrous sassafras–musk rainforest (north east); (2) Callidendrous sassafras–musk rainforest (eastern highlands); (3) Callidendrous myrtle rainforest (highlands); (4) Callidendrous myrtle rainforest (riverine); (5) Thamnic sassafras–laurel rainforest; (6) Callidendrous–thamnic myrtle rainforest).

rainforest (eastern highlands) and callidendrous myrtle rainforest (highland) which occurs predominantly in eastern Tasmania;

– a southeast group comprising thamnic sassafras–laurel rainforest and callidendrous–thamnic myrtle rainforest. Patches of all of these occur either on the Tasman and Forestier Peninsulas or on Bruny Island.

Clearly the regional climate has a strong influence on the structure and floristics of rainforest in eastern Tasmania. Two of the climatic factors discriminating among the groups are the rainfall of the driest quarter, which has been shown previously (Jackson 1965, Busby 1986) to be an important factor in the distribution of rainforest statewide, and the mean rainfall of the wettest quarter. Overlaid on this are temperature, local topographic and microclimatic effects, which determine the nature of particular rainforest patches at particular sites.

## COMMUNITY DESCRIPTIONS

### 1. Callidendrous sassafras–musk rainforest

Two closely related but distinct facies were defined within this group. One occurs in the northeast of the state, the other is restricted to the eastern highlands. The sassafras–musk rainforests of the northeast have a characteristic “fringe” forest of *Acacia melanoxylon* over a shrubby understorey. They occur at altitudes ranging from 90–400 m a.s.l. and on granite or sedimentary-derived soils. The sassafras–musk rainforests of the eastern highlands lack *A. melanoxylon*; they

TABLE 1  
Stepwise regression of the climate variables against the floristic ordination scores

Selection: Forward	Maximum steps: 500	F-to-enter: 4.00	
Control: Manual	Step: 2	F-to-remove: 4.00	
R-squared: 0.44001	Adjusted: 0.42584	MSE: 0.2362	Df: 79
<b>Variables in model</b>	<b>Coefficient</b>	<b>F-Remove</b>	
Mean temperature, coolest month	-27.5742	12.3317	
Rainfall, driest month	3.71691	45.2788	
<b>Variables not in model</b>	<b>P. Corr.</b>	<b>F-Enter</b>	
Annual temperature range	0.0973	0.74	
Temperature, wettest quarter	0.1449	1.67	
Coefficient of variation of rainfall	0.1779	2.54	
Annual rainfall	0.0701	0.38	
Rainfall, coolest quarter	0.0914	0.65	
Temperature warmest quarter	0.0963	0.73	
Temperature coolest quarter	0.1143	1.03	
Rainfall, wettest month	0.1067	0.89	
Temperature, driest quarter	0.1506	1.80	

occur at altitudes ranging from 100–800 m a.s.l., but usually over 400 m, and exclusively on dolerite-derived soils.

Throughout their range both facies are dominated by *Atherosperma moschatum*. The tall pyramidal crowns cast a soft green shade, which harbours a rich epiphytic fern flora on most sites. *Pittosporum bicolor* is an infrequent but widespread small tree, which is nearly always found growing as an epiphyte, either on tree ferns or old logs, as its seedlings are much favoured by browsing animals. *Notelaea ligustrina* is also an infrequent but widespread small tree, which is characteristically festooned with mosses and lichens, notably *Usnea* spp. (old man's beard).

Where the canopy is deep and well formed, the sparse understorey contains scattered ground ferns (*Blechnum watsii*, *Polystichum proliferum*, *Histiopteris incisa*), tree ferns (*Dicksonia antarctica*) and epiphytic ferns. Where the canopy is more broken, the most prominent understorey shrub is *Olearia argophylla*, which also often fringes patches of rainforest. *Olearia argophylla* seedlings are very rare in undisturbed rainforest, but the shrub is very long lived and persists by suckering and layering, and by producing new shoots from windthrown shrubs.

*Coprosma quadrifida* and *Pimelea drupacea* are common small shrubs. The vines *Parsonsia brownii* and *Clematis aristata* are both widely scattered throughout the range of the community. Tree ferns (*Dicksonia antarctica*) are ubiquitous, forming galleries alongside streams and creeks and being more widely scattered elsewhere. The ground ferns *Blechnum watsii* and *Polystichum proliferum* are also common and widespread. *Histiopteris incisa* is inconspicuous, except in disturbed areas where it may form extensive colonies. Epiphytic ferns range from common to abundant. On drier sites, only the more robust species, such as *Microsorium diversifolium*, *Rumohra adiantiformis* and *Grammitis billardieri*, are prominent, whilst filmy ferns are restricted to the most protected niches, such as the underside of logs and tree ferns. On wetter sites, the epiphytic flora is diverse and luxurious, with all available surfaces clothed with mosses, lichens and/or epiphytic ferns.

The northeast forests are characterised by a fringing forest of *Acacia melanoxylon* over a shrubby understorey containing any of *Pomaderris apetala*, *Olearia argophylla*, *Beyeria viscosa*, *Zieria arborescens*, *Acacia verticillata* and *Olearia lirata*. *Cyathea australis* (prickly tree fern) is also commonly present in this fringing forest. The ground ferns *Allantodia australis* and *Lastreopsis acuminata* are characteristic of this community; both are very rare in the eastern highlands.

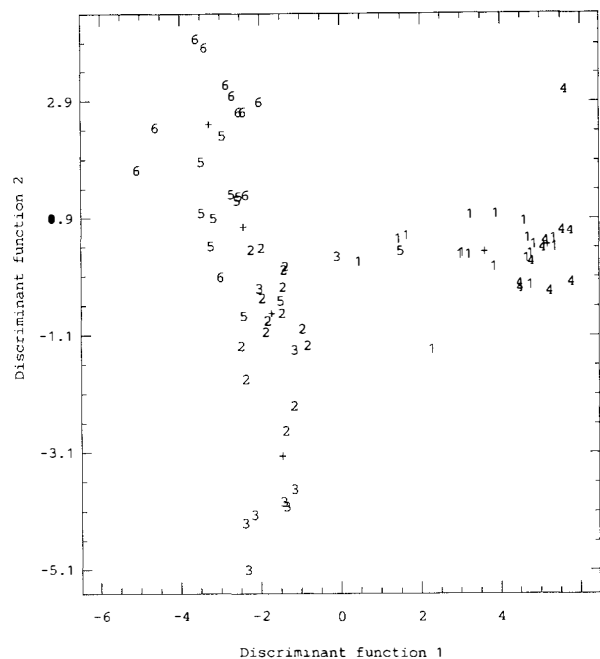


FIG. 3 — Scatterplot of the rainforest patches along the first two discriminant functions. The labels are as for figure 2.

The eastern highlands forests usually grade into wet sclerophyll forests. Fringing forests of *Acacia melanoxylon* do not occur and *Cyathea australis* is very rare. The dolerite-based streams of the eastern highlands have rocky beds, which support the water ferns *Blechnum chambersii*, *B. fluviatile* and *B. patersonii* (usually as widely scattered plants). These species are rare in the northeast forests, where stream beds are mainly composed of fine alluvial material, an unsuitable substrate.

Distribution (figs 4A & B)

This community extends from Mt Walter in the south to the Asbestos Ranges on the central north coast. In most cases it occurs as a narrow (<100 m wide) band, extending along deeply incised streams. It is sporadically more extensive on optimal sites, where it spreads across steep southeast-facing slopes. The community also occurs in the Florentine Valley, where it is found also as an understorey to *Eucalyptus regnans* (Gilbert 1959).

## 2. Callidendrous Myrtle Rainforest

Two closely related but distinct communities are defined within this group. Highland rainforests occur as extensive (10–75 ha) patches on southeast facing slopes, usually at altitudes of 300–700 m a.s.l. Riverine rainforests occur as long narrow patches extending along streams and rivers, usually at altitudes of less than 300 m. The riverine rainforests have a better developed understorey, particularly on the river banks, where available light levels are higher. The riverine rainforests also have a complement of streamside and floodbank species, which do not occur in the highland forests.

### 2A. Callidendrous Myrtle Rainforest (highland)

This community is dominated by large trees of *Nothofagus cunninghamii* which, on good sites, may reach 30 m in height. *Atherosperma moschatum* is usually subdominant, although local pure thickets can occur. When present, *Acacia dealbata* and *A. melanoxylon* are locally common and apparently associated with past disturbance. *Pittosporum bicolor* is widespread and uncommon, and is nearly always found growing as an epiphyte on *Dicksonia antarctica*.

When the canopy is closed, the understorey is sparse and open, comprising widely scattered straggling shrubs of *Coprosma quadrifida*, *Aristotelia peduncularis* and *Pimelea drupacea*. Where the canopy is more broken, large spreading shrubs of *Olearia argophylla* are often present. *Bedfordia salicina* and *Pomaderris apetala* are also often present in gaps or in disturbed areas. The latter three species are also prominent on the fringes of rainforest patches. The vine *Clematis aristata* is widespread but uncommon and easily overlooked, as its foliage is carried high in the canopy.

*Dicksonia antarctica* is widespread and common, particularly along drainage lines where the canopy is more open. *Cyathea australis* occurs sporadically on the margins of the community. The ground ferns *Blechnum wattsi* and *Polystichum proliferum* are widespread and abundant. These two species can form pure or mixed local thickets. In areas where the canopy is particularly dense, the ground ferns may be absent altogether and the ground is carpeted with a layer of myrtle twigs.

Epiphytes are not well developed. Mosses and lichens are widespread but do not attain the luxuriance found in some communities. Epiphytic ferns are scattered throughout the forest but are not conspicuous. *Microsorium diversifolium* is the most prominent of these, often forming large colonies along the larger branches of myrtles.

Disturbed areas or large canopy gaps, caused by windthrow or myrtle wilt, are often colonised by one or more of *Histiopteris incisa*, *Hypolepis rugosula*, *Urtica incisa*, *Hydrocotyle hirta*, *Australina pusilla* and *Gahnia grandis*. Of these, *Histiopteris incisa* is often the most abundant and can form extensive colonies. All of the above species are found in undisturbed rainforest, but generally as widely scattered individuals.

### 2B. Callidendrous Myrtle Rainforest (riverine)

Where this community is wide enough to extend away from the streamsides, it is similar to the highland form, with large myrtles over an open, park-like understorey. However, the narrowness of many of these patches admits more light than penetrates the more extensive highland patches. As a result, wet sclerophyll species such as *Zieria arborescens*, *Monotoca glauca* and *Olearia lirata* are able to persist beneath the canopy. *Acacia dealbata*, *A. melanoxylon*, *Pomaderris apetala* and *Notelaea ligustrina* are more common in the riverine than in the highland forests. The presence of the first three of these species is often related to past disturbance.

*Todea barbara* and *Sticherus tener* are found only on stream banks. Floodbanks in streams and rivers often support a diverse and temporary (until the next flood) assemblage of adventive species such as *Carex appressa*, *Juncus* spp., *Cirsium* spp., *Acaena novae-zelandiae* and a variety of small herbaceous species.

Distribution (figs 4C & D)

The community occurs in three main areas. In the Dazzler Ranges (central north coast) between Beaconsfield and Devonport, riverine forests extend along Wallaby Creek, Saxons Creek, Andersons Creek (Holwell Gorge) and the Supply River. In the northeast, riverine forests are found along the Forester and Ringarooma Rivers, and extensively along the Great Musselroe River and its tributaries. A single small highland patch occurs on the upper eastern slopes of Mt Horror. In the east, the community is found in the Douglas–Apsley region, mostly as disjunct highland patches; a few small patches of riverine forest are found along the Douglas River and its tributaries. Closely related forests are common in northwestern and western Tasmania, generally on more fertile, low-altitude sites (Jarman *et al.* 1984)

## 3. Thamnic Sassafras–Laurel Rainforest

Floristically this community is closely related to callidendrous sassafras–musk rainforest. Structurally, however, it is quite distinct. *Atherosperma moschatum* again dominates the canopy, but the trees are shorter, often with dead tops, and the canopy is more broken. *Pittosporum bicolor*, *Pomaderris apetala* and *Notelaea ligustrina* are all infrequently present as small trees. *Phyllocladus aspleniifolius* is dominant in two small patches, on Prossers Sugarloaf near Orford and near Bishop and Clerk on Maria Island. Elsewhere it is rare or absent. Beneath the broken canopy, the understorey development is greater than in the callidendrous sassafras–musk rainforests of the east and northeast.

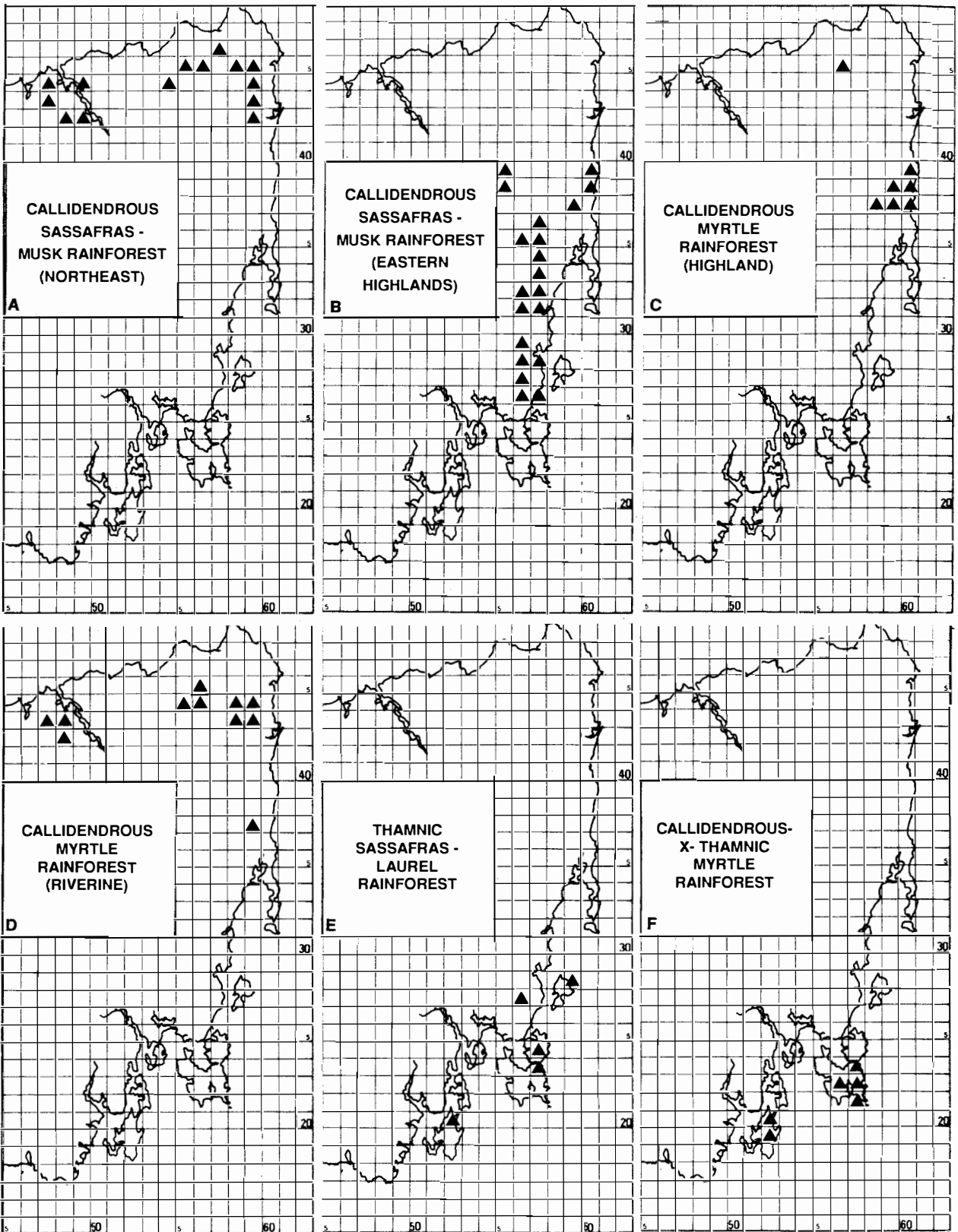


FIG. 4 — The distribution of (A) callidendrous sassafras–musk rainforest (northeast); (B) callidendrous sassafras–musk rainforest (eastern highlands); (C) callidendrous myrtle rainforest (highland); (D) callidendrous myrtle rainforest (riverine); (E) thamnic sassafras–laurel rainforest; (F) callidendrous–thamnic myrtle rainforest.

*Olearia argophylla* and *Anopterus glandulosus* dominate the understorey, both forming dense local thickets in places. A variety of other shrubs is also present, usually as scattered plants, including *Cyathodes glauca*, *Pomaderris apetala*, *Coprosma quadrifida*, *Tasmannia lanceolata* and *Pimelea drupacea*. *Dicksonia antarctica* is common, and the ground ferns *Blechnum wattsi* and *Polystichum proliferum* are abundant.

The epiphytic flora of this community is luxurious and dominated by moss. Epiphytic ferns are widespread but scattered and never reach the abundance found in the callidendrous sassafras–musk rainforests. Lichens are similarly widespread but scattered, with the exception of the crustose species which are ubiquitous on smooth-barked tree trunks. Mosses in this community are exceptionally well developed, a multihued carpet of green covering most surfaces up to about 2 m above ground level, with some mosses extending higher into the canopy. The abundance of mosses of varying shades of green and the relatively high light levels are the distinguishing characteristics of the community.

#### Distribution (fig. 4E)

This community extends from Bruny Island (a single small patch) in the south to Maria Island in the east, with a notable outlier on Prossers Sugarloaf. It generally occurs at altitudes between 300 and 550 m a.s.l., and is found only on moderate to steep southeast-facing slopes. The stronghold of the community is the Forestier Peninsula, where there are a number of patches, including one of more than 100 ha. The community is not known from outside the study area.

### 4. Callidendrous–Thamnic Myrtle Rainforest

The myrtle dominated rainforests of Bruny Island and the Tasman Peninsula are very diverse, with considerable local structural and floristic variation. Much of this variation is related to past disturbance. Rather than attempt to describe all the variation observed, the communities have been pooled on the basis of their dominant floristics.

The forests are generally dominated by *Nothofagus cunninghamii*. With rare exceptions the dominants are of poor form, with major limbs missing and some dieback generally evident in the crown. Where the dominants are of good form, the forest is open and park-like, with a sparse understorey of *Blechnum wattsi*. More commonly, the understorey is dense and diverse, and progress through it is very slow.

*Anopterus glandulosus* (native laurel) dominates the understorey on both Bruny Island and the Tasman Peninsula, and forms impenetrable local thickets, over a ground layer dominated by *Blechnum wattsi*. On Bruny Island, *Anodopetalum biglandulosum* (horizontal) and *Gahnia grandis* fill most of the gaps not occupied by *Anopterus glandulosus*, with a variety of smaller shrubs such as *Olearia persoonioides*, *Richea dracophylla* and *Cyathodes glauca* crammed into any leftover space. *Anodopetalum biglandulosum* does not occur on the Tasman Peninsula — the understorey of these forests is still thick but progress through them is possible. *Dicksonia antarctica* is more prominent in the peninsula forests than on Bruny Island.

With the exception of crustose lichens, which are widespread and abundant on smooth-barked trees, epiphytes are poorly developed in these forests. Mossy banks are rarely encountered in local canopy gaps. Epiphytic ferns are very

scattered, although they may be locally common on preferred sites.

#### Distribution (fig. 4F)

This community is quite widely distributed on Bruny Island, extending from Simpsons Creek south along the South Bruny Range to Mt Bruny. On the Tasman Peninsula the community is less common, small isolated patches occurring on the eastern side of the peninsula between Plateau Road and Mt Fortescue, with two small outliers on Mt Arthur and Mt Clark. The altitude range of the community is from 50–500 m a.s.l., and it is found on moderate to steep south to northeast facing slopes. The community is also found in small scattered patches in southwestern Tasmania (Jarman *et al.* 1984).

## DISCUSSION

Cool temperate rainforest reaches its greatest Australian extent in Tasmania, with only restricted occurrences on the mainland (Howard & Ashton 1973, Jarman *et al.* 1991). It is generally restricted to areas where the annual rainfall exceeds 1000 mm and the rainfall in summer is greater than 50 mm per month (Jackson 1965). The climatic profile of *Nothofagus*-dominated rainforest has been defined by Busby (1986) as a minimum annual rainfall of 930 mm (range 930–3500 mm), with precipitation in the driest month exceeding 50 mm. Throughout the study area, the climate is marginal for the survival of rainforest, with rainfall in the range 850–1150 mm and summer droughts being common (Jackson 1988). The presence and survival of the eastern outlying rainforest patches is therefore largely dependent on the relationship between climate, topography and altitude.

In the north, northeast and southeast, rainforest patches occur in fire-shadow sites, i.e. in relatively moist sites which are protected from fire either by physical barriers, such as rivers or block or boulderscree, or by topographic influences such as marked changes in slope or aspect. Patches also occur on steep southeast-facing slopes where the degree of insolation is markedly reduced, especially in winter, and where moisture availability remains high except in the most extreme conditions.

In the east, where the average rainfall is less than 800 mm per annum and the climate is least favourable for rainforest, the rainforest patches are restricted to steep southeast-facing slopes. Increasing altitude reduces the amount of topographic protection patches require, because of cooler ambient temperatures and fog precipitation or cloud trapping at higher altitudes, and consequent stripping of moisture by the vegetation.

Similar rainforest to that described above has also been recorded from Victoria. Howard & Ashton (1973) described *Nothofagus cunninghamii* dominated forest from the Central Highlands, the Otway Ranges and the Strzelecki–Wilson's Promontory areas. In all areas, the *Nothofagus*-dominated forests occupy similar niches to those occupied by similar forests in Tasmania, that is, fire-protected riverine sites or deep gullies. Their structural type, "tall closed forest", is closely related to callidendrous myrtle rainforest, with the presence of *Hedycarya angustifolia* (a small tree) being the only significant difference. Forbes *et al.* (1981) have described cool temperate rainforest from eastern Gippsland which is structurally and floristically very similar to callidendrous

TABLE 2  
Percentage frequencies of species by classificatory groups

Species*	Floristic group†					
	1A	1B	2A	2B	3	4
<i>Lastreopsis acuminata</i>	32	0	0	0	0	0
<i>Allantodia australe</i>	26	0	0	0	0	0
<i>Asplenium bulbiferum</i>	32	22	0	0	0	25
<i>Acacia dealbata</i>	11	28	60	89	0	0
<i>Blechnum chambersii</i>	0	28	10	11	0	0
<i>Beyeria viscosa</i>	0	61	2	22	8	0
<i>Urtica incisa</i>	37	22	30	0	17	8
<i>Parsonia straminea</i>	63	44	10	11	8	33
<i>Acacia melanoxylon</i>	68	0	80	22	8	33
<i>Zieria arborescens</i>	37	33	40	0	8	8
<i>Hydrocotyle hirta</i>	26	67	20	11	58	0
<i>Asplenium terrestre</i>	42	67	30	44	50	8
<i>Blechnum nudum</i>	47	17	90	22	17	8
<i>Monotoca glauca</i>	16	0	50	0	17	17
<i>Polyphlebium venosum</i>	89	67	70	22	50	17
<i>Olearia argophylla</i>	84	100	40	89	75	75
<i>Hymenophyllum cupressiforme</i>	68	78	60	89	67	8
<i>Notelaea ligustrina</i>	42	50	60	44	58	50
<i>Pomaderris apetala</i>	58	39	60	44	83	33
<i>Ctenopteris heterophylla</i>	37	89	10	2	67	42
<i>Hypolepis rugosula</i>	58	72	40	44	50	42
<i>Hymenophyllum australe</i>	68	56	30	11	83	67
<i>Histiopteris incisa</i>	89	72	70	89	75	58
<i>Pimelea drupacea</i>	58	78	30	56	75	33
<i>Microsorium diversifolium</i>	95	94	100	67	92	75
<i>Polystichum proliferum</i>	84	89	70	89	92	67
<i>Rumohra adiantiformis</i>	95	78	60	33	92	83
<i>Hymenophyllum flabellatum</i>	89	78	100	67	100	42
<i>Dicksonia antarctica</i>	100	100	100	100	100	100
<i>Atherosperma moschatum</i>	100	100	100	100	100	100
<i>Blechnum waitsii</i>	89	72	100	100	75	100
<i>Pittosporum bicolor</i>	84	94	90	100	83	92
<i>Coprosma quadrifida</i>	89	78	90	33	100	58
<i>Tmesipteris billardieri</i>	79	28	70	78	100	42
<i>Grammitis billardieri</i>	58	83	50	78	100	75
<i>Hymenophyllum rarum</i>	68	78	40	56	100	67
<i>Aristotelia peduncularis</i>	32	28	30	35	33	67
<i>Clematis aristata</i>	37	61	10	44	75	33
<i>Gahnia grandis</i>	21	11	30	56	25	33
<i>Tasmannia lanceolata</i>	26	17	40	44	75	75
<i>Drymophila cyanocarpa</i>	5	17	20	33	25	33
<i>Nothofagus cunninghamii</i>	0	0	100	100	0	100
<i>Hymenophyllum peltatum</i>	5	22	0	67	8	50
<i>Sticherus tener</i>	5	0	50	0	0	42
<i>Todea barbara</i>	0	0	0	40	0	0
<i>Bedfordia salicina</i>	5	11	0	67	8	8
<i>Cyathodes glauca</i>	5	22	0	0	75	50
<i>Anopterus glandulosus</i>	0	0	0	0	100	25
<i>Phyllocladus aspleniifolius</i>	0	0	0	0	33	42
<i>Richea dracophylla</i>	0	0	0	0	17	25
<i>Gaultheria hispida</i>	0	0	0	0	8	42
<i>Cenarrhens nitida</i>	0	0	0	0	8	42
<i>Eucryphia lucida</i>	0	0	0	0	0	17
<i>Olearia persoonioides</i>	0	0	0	0	0	17
<i>Anodopetalum biglandulosum</i>	0	0	0	0	0	25

\* Only species with frequencies greater than 15% in at least one group are included.

† Groups as in the appendix.

sassafras–musk rainforest. The major differences between the Tasmanian and Victorian sassafras rainforests are that in Victoria the acacias (*Acacia dealbata*, *A. frigescens* and *A. melanoxylon*) are more common and *Elaeocarpus holopetalus* (blueberry ash, a small tree which is known from King and Flinders Islands but does not extend to mainland Tasmania) is common.

Outliers of warm temperate rainforest (dominated by *Acmena smithii*) reach to Wilsons Promontory but do not extend to Tasmania.

The phytosociology of Tasmanian cool temperate rainforest *per se* is discussed by Jarman *et al.* (1991). The floristic classification presented here agrees closely with that of Jarman *et al.*, although some difference is inevitable, given that Jarman *et al.* were considering rainforest throughout Tasmania, and that the present study only considered relict rainforest.

The floristics and structure of these rainforest communities are strongly influenced by the dominant tree species. *Nothofagus cunninghamii* and *Atherosperma moschatum* are the dominant rainforest trees throughout eastern Tasmania. The two species are markedly different in their habit, their ecological role, their epiphytic flora and their dispersal abilities. *Atherosperma moschatum* has plumose achenes which can be carried large distances, whereas *Nothofagus cunninghamii* seed, although winged, is rarely carried further than 40 m. It seems, therefore, a reasonable hypothesis, that *Nothofagus cunninghamii* has been eliminated from many areas which it has been unable to recolonise, whereas *Atherosperma moschatum* may also have been eliminated in the past but, via its superior seed dispersal ability, has been able to recolonise suitable sites. Those rainforest patches dominated by *Nothofagus cunninghamii* may therefore be viewed as true relicts, patches which have persisted since times of different climates, whereas patches dominated by *Atherosperma moschatum* may be true relicts, but, also, may have re-established following exogenous disturbance.

In eastern Tasmania, it appears that climate is directly limiting the distribution of rainforest. We have insufficient evidence to determine whether the floristic composition of rainforest in eastern Tasmania is controlled directly by climate or indirectly through the influence of climate on edaphic factors and/or fire.

### Rainforest Conservation

All of the communities described above are well represented in state reserves and national parks. All except thamnisc sassafras–laurel rainforest are also represented in forest reserves. A number of relict rainforest patches around the state are also within RAP (Recommended Areas for Protection) (Working Group for Forest Conservation 1990), which will probably result in further formal reservation of rainforest patches in the future. As rainforest within Nature Conservation Regions 4 and 7 is a rare plant community it is additionally protected from any forest-harvesting operations under the Forest Practices Act. Studies on the impacts of disturbance will be reported elsewhere.

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## APPENDIX

### Floristics of the communities

#### 1A. Callidendrous sassafras–musk rainforest (northeast)

Dominant species:

*Atherosperma moschatum*

Most prominent understorey species:

*Olearia argophylla*, *Dicksonia antarctica*, *Blechnum watsii*

Other species often present (trees and shrubs):

*Acacia melanoxylon*, *Pittosporum bicolor*, *Coprosma quadrifida*, *Parsonsia brownii*, *Pimelea drupacea* (herbs); *Grammitis billardieri*, *Histiopteris incisa*, *Hymenophyllum australe*, *H. cupressiforme*, *H. flabellatum*, *H. rarum*, *Hypolepis rugosula*, *Microsorium diversifolium*, *Polyphlebium venosum*, *Polystichum proliferum*, *Rumohra adiantiformis*, *Tmesipteris billardieri*, *Urtica incisa*

Additional species sometimes present (trees and shrubs):

*Notelaea ligustrina*, *Pomaderris apetala*, *Aristotelia peduncularis*, *Clematis aristata*, *Tasmannia lanceolata*, *Zieria arborescens* (herbs); *Asplenium bulbiferum*, *A. terrestre*, *Blechnum nudum*, *Ctenopteris heterophylla*, *Allantodia australis*, *Lastreopsis acuminata*, *Gahnia grandis*, *Hydrocotyle hirta*

#### 1B. Callidendrous sassafras–musk rainforest (eastern highlands)

Dominant species:

*Atherosperma moschatum*

Most prominent understorey species:

*Olearia argophylla*, *Dicksonia antarctica*, *Polystichum proliferum*, *Microsorium diversifolium*

Other species often present (trees and shrubs):

*Pittosporum bicolor*, *Beyeria viscosa*, *Clematis aristata*, *Coprosma quadrifida*, *Pimelea drupacea* (herbs); *Asplenium terrestre*, *Blechnum watsii*, *Ctenopteris heterophylla*, *Grammitis billardieri*, *Histiopteris incisa*, *Hymenophyllum australe*, *H. cupressiforme*, *H. flabellatum*, *H. rarum*, *Hypolepis rugosula*, *Polyphlebium venosum*, *Rumohra adiantiformis*, *Tmesipteris billardieri*, *Hydrocotyle hirta*

Additional species sometimes present (trees and shrubs):

*Acacia dealbata*, *Notelaea ligustrina*, *Pomaderris apetala*, *Aristotelia peduncularis*, *Parsonsia brownii*, *Zieria arborescens* (herbs); *Asplenium bulbiferum*, *Blechnum chambersii*, *B. fluviatile*, *B. nudum*, *B. patersonii*, *Uncinia tenella*, *Urtica incisa*

#### 2A. Callidendrous myrtle rainforest (highland)

Dominant species:

*Nothofagus cunninghamii*

Subdominant:

*Atherosperma moschatum*

Most prominent understorey species:

*Olearia argophylla*, *Dicksonia antarctica*, *Blechnum watsii*, *Polystichum proliferum*

Other species often present (trees and shrubs):

*Acacia dealbata*, *Pittosporum bicolor*, *Bedfordia salicina*, *Pimelea drupacea* (herbs); *Asplenium terrestre*, *Grammitis billardieri*, *Histiopteris incisa*, *Hymenophyllum cupressiforme*, *H. flabellatum*, *H. peltatum*, *H. rarum*, *Microsorium diversifolium*, *Tmesipteris billardieri*

Additional species sometimes present (trees and shrubs):

*Acacia melanoxylon*, *Leptospermum lanigerum*, *Notelaea ligustrina*, *Pomaderris apetala*, *Aristotelia peduncularis*, *Clematis aristata*, *Coprosma quadrifida*, *Tasmannia lanceolata* (herbs); *Rumohra adiantiformis*, *Drymophila cyanocarpa*, *Gahnia grandis*

#### 2B. Callidendrous myrtle rainforest (riverine)

Dominant species:

*Nothofagus cunninghamii*

Subdominant:

*Atherosperma moschatum*

Most prominent understorey species:

*Dicksonia antarctica*, *Blechnum watsii*, *Polystichum proliferum*, *Microsorium diversifolium*

Other species often present (trees and shrubs):

*Acacia dealbata*, *A. melanoxylon*, *Notelaea ligustrina*, *Olearia argophylla*, *Pittosporum bicolor*, *Pomaderris apetala*, *Coprosma quadrifida*, *Monotoca glauca* (herbs); *Blechnum nudum*, *Grammitis billardieri*, *Histiopteris incisa*, *Hymenophyllum cupressiforme*, *H. flabellatum*, *Polyphlebium venosum*, *Rumohra adiantiformis*, *Sticherus tener*, *Tmesipteris billardieri*

Additional species sometimes present (trees and shrubs):

*Aristotelia peduncularis*, *Pimelea drupacea*, *Zieria arborescens* (herbs); *Asplenium terrestre*, *Hypolepis rugosula*, *Hymenophyllum australe*, *H. rarum*, *Todea barbara*, *Drymophila cyanocarpa*, *Gahnia grandis*, *Hydrocotyle hirta*, *Urtica incisa*

3. *Thamnic sassafras–laurel rainforest*

Dominant species:

*Atherosperma moschatum*

Most prominent understorey species:

*Anopterus glandulosus*, *Olearia argophylla*, *Dicksonia antarctica*,  
*Polystichum proliferum*

Other species often present (trees and shrubs):

*Pittosporum bicolor*, *Pomaderris apetala*, *Clematis aristata*,  
*Coprosma quadrifida*, *Cyathodes glauca*, *Pimelea drupacea*,  
*Tasmannia lanceolata* (herbs); *Blechnum wattsi*, *Ctenopteris*  
*heterophylla*, *Grammitis billardieri*, *Histiopteris incisa*,  
*Hymenophyllum australe*, *H. cupressiforme*, *H. flabellatum*, *H.*  
*rarum*, *Microsorium diversifolium*, *Rumohra adiantiformis*,  
*Tmesipteris billardieri*, *Hydrocotyle hirta*

Additional species sometimes present (trees and shrubs):

*Notelaea ligustrina*, *Phyllocladus aspleniifolius*, *Aristotelia*  
*peduncularis*, (herbs); *Asplenium terrestre*, *Hypolepis rugosula*,  
*Polyphlebium venosum*, *Gabnia grandis*

4. *Callidendrous–thamnic myrtle rainforest (one community)*

Dominant species:

*Nothofagus cunninghamii*

Subdominant:

*Atherosperma moschatum*

Most prominent understorey species:

*Anopterus glandulosus*, *Dicksonia antarctica*, *Blechnum wattsi*

Other species often present (trees and shrubs):

*Pittosporum bicolor*, *Aristotelia peduncularis*, *Cenarrhenes nitida*,  
*Coprosma quadrifida*, *Cyathodes glauca*, *Olearia argophylla*,  
*Tasmannia lanceolata* (herbs); *Grammitis billardieri*, *Histiopteris*  
*incisa*, *Hymenophyllum australe*, *H. peltatum*, *H. rarum*,  
*Microsorium diversifolium*, *Polystichum proliferum*, *Rumohra*  
*adiantiformis*

Additional species sometimes present (trees and shrubs):

*Acacia melanoxylon*, *Eucryphia lucida*, *Notelaea ligustrina*,  
*Phyllocladus aspleniifolius*, *Pomaderris apetala*, *Anodopetalum*  
*biglandulosum*, *Clematis aristata*, *Gaultheria hispida*, *Parsonsia*  
*brownii*, *Pimelea drupacea*, *Richea dracophylla* (herbs); *Ctenopteris*  
*heterophylla*, *Hymenophyllum flabellatum*, *Hypolepis rugosula*,  
*Sticherus tener*, *Tmesipteris billardieri*, *Gabnia grandis*, *Uncinia*  
*tenella*