VEGETATION OF LORD HOWE ISLAND

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ABSTRACT

Pickard, John (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, New South Wales, Australia 2000) 1983. Vegetation of Lord Howe Island. Cunninghamia 1(2): 133–265.* Lord Howe Island (31°30'S, 159°05'E) is a 1520 ha oceanic island. Some 80% is basaltic, the remainder is calcarenite derived from the coral reef on the west side of the island. There are four physiographic regions: northern hills rising to 209 m, central hills rising to 121 m, central lowlands of calcarenite, and southern mountains rising to 875 m and occupying about 55% of the island. Rainfall is 1676 mm with a marked maximum in July-August. Diurnal and seasonal variarion in wind speed and direction occurs; the annual mean is c. 5.5 km/h. Mean annual temperature is 19.1°C.

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The island was discovered in 1788 and settled in 1833. It is part of New South Wales and is administered by the Lord Howe Island Board. Despite continuous occupation for almost 150 years, less than 20% of the island is disturbed and less than 10% cleared.

Twenty-five associations in 20 alliances and 14 subformations are mapped at 1:15,840, and described using a novel tabular format. A key to associations is presented. About 57% of the island supports monotypic forests of six species, four of them endemic. Scrub, grass and herbland covers the rest. Marked physical and chemical differences between basalt and calcarenite are difficult to detect in the vegetation except locally. Salt spray driven by almost constant on-shore winds appears to be a major determinant of vegetation distribution. One million pairs of seabirds nest on the island but are in equilibrium with the vegetation. Individual plants in the nesting areas show different responses to the birds, but the communities are unaffected. Five introduced mammals (goats, pigs, rats, cattle and man) have greatly altered the vegetation locally. The most important are cattle and man. Cattle grazing prevents regeneration of native plants and encourages the spread of vigorous introduced pasture grasses. Disturbance by man has been episodic according to the economic conditions prevailing. A feature is a series of abandoned gardens of different ages scattered through the northern section of the island. These show old-field succession and the effects of different combinations of limiting factors leading to steady states. Cattle are particularly important in maintaining some of these. Palm-seeding has little long-term effect on the *Howea* forests but the industry should move to plantations and nurseries for seeds and seedlings for export. The settled areas of the island are continually disturbed to presumably improve the aesthetic appearance. Recently some areas have been replanted with native species to replace the previously destroyed vegetation. Despite recommendations for conservation, little has been done.

INTRODUCTION

Lord Howe Island (31°30'S, 159°05'E) is a small oceanic island in the South Pacific Ocean some 600 km east of Australia. The island is crescent-shaped, about 10 km long and from 0.3 to 6 km wide. A coral reef about 5 km long on the western side of the island is the most southerly in the world. Most of the 1520 ha of the island is basaltic but about 20 per cent is calcarenite derived from coral sand. Two mountains occupy about half of the island in the south and rise to 875 m. Several small islets occur offshore within 3 km of Lord Howe.

The island was first sighted in 1788 and has been settled since 1833. There is no archaeological evidence of earlier inhabitants. Today, about 250 permanent residents work in the tourist industry or provide services such as radio communications, weather observations, civil aviation and local government. Some 4000 tourists visit the island each year. The island is politically part of New South Wales and is administered by the Lord Howe Island Board. The Board is comparable to a municipal council, although many of the members are government appointees. Day-to-day management is by the Island Superintendent, an employee of the Board, and his staff.

Despite its long settlement, Lord Howe has largely escaped the fate of many small isolated islands. Less than 20 per cent of its vegetation is disturbed and less than 10 per cent cleared. Most of the island is heavily forested although scrub and grassland occurs on the more exposed areas and offshore islets. About 57 per cent of the island supports monotypic stands of six tree species, four of them endemic. Two, *Howea forsterana* and *H. belmoreana* are well known throughout the world as cultivated palms. Much of the flora of 400 species has affinities with New Zealand and the Pacific. About 30 per cent of the flora is introduced, and of the native species, 30 per cent are endemic.

Feral animals are present (rats, goats, pigs and cats) with variable consequences to the biota. Several birds are now extinct, but so far as is known, no plants. The pressure of goat browsing on the rich endemic flora of the southern mountains prompted Mr Peter S. Green of the Royal Botanic Gardens, Kew to urge the New South Wales Government to undertake an environmental survey of the island. The Government agreed and the survey, co-ordinated by Dr Harry F. Recher of The Australian Museum, Sydney, commenced in 1970.

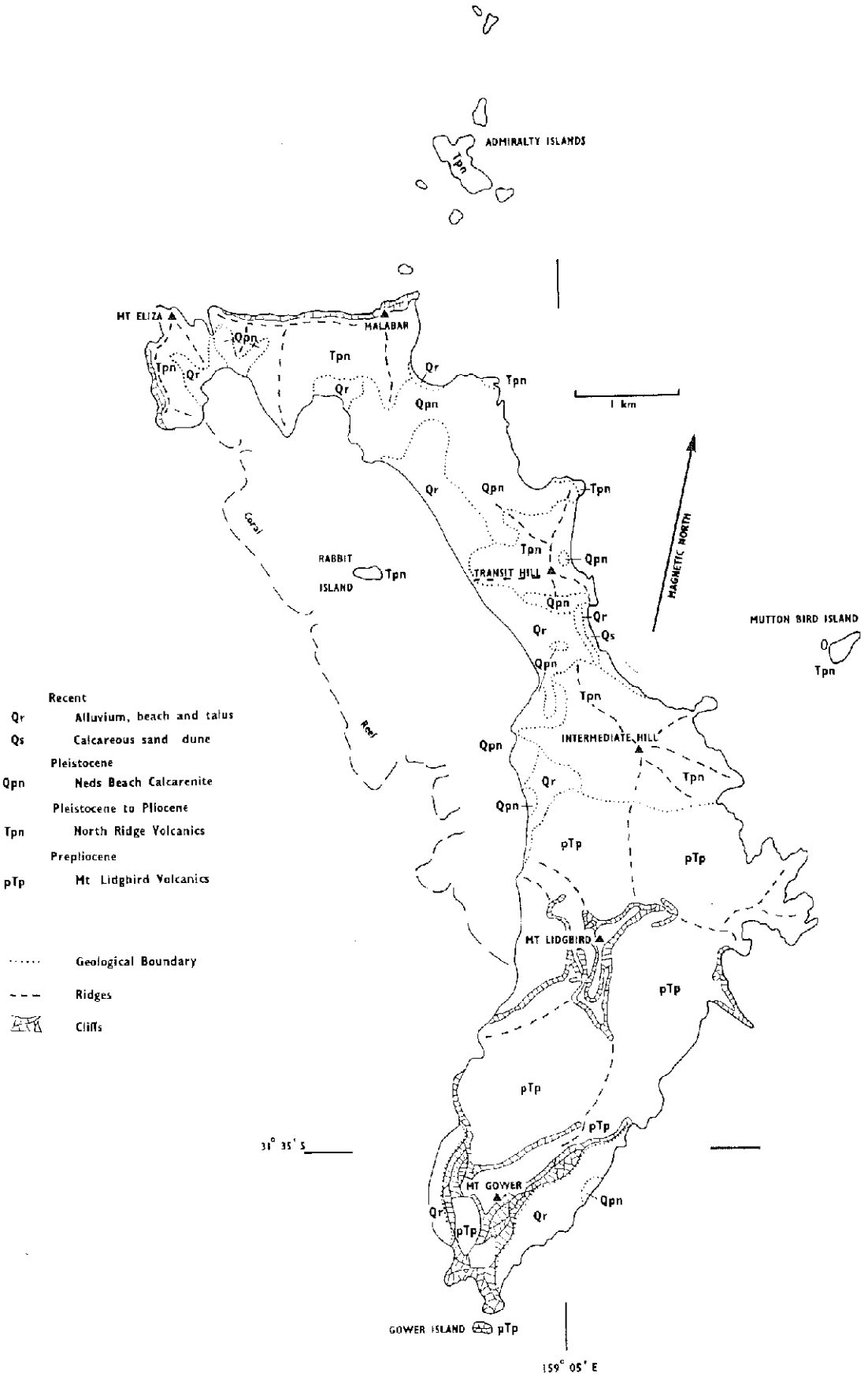


Figure 1. Geological map. Source: modified after Standard (1963) and Sutherland & Ritchie (1974).

The aim of the Environmental Survey was to describe the ecosystems of Lord Howe Island and to provide biological information for the assessment of future management options (Recher & Clark, 1974). As the vegetation is of great intrinsic interest and is a major determinant of faunal distribution, the National Herbarium of New South Wales decided to undertake a survey of the vegetation. I commenced the survey in 1970 and continued with field work after the immediate requirements of the Environmental Survey were completed in 1974 (Pickard, 1974). The aims of the vegetation survey were broadened beyond describing the vegetation and preparing a vegetation map, to include testing different methods of data collection and analysis. This paper presents descriptions of the vegetation based on a subjective classical approach. A projected second paper describes the objective approach using numerical analysis of floristic and structural data (Pickard, 1978).

Other aspects of the study which are discussed here include the influence of geology, climate, fauna and settlement on the vegetation. Information gained during a survey of the palm seed industry, keys to the vegetation, a handbook of the ferns, data and discussion on the distribution of angiosperms, on plant invasions and extinctions, on the origins of the flora and on the effects of feral animals will be published elsewhere (Pickard, 1980; unpublished data). Similarly, detailed descriptions of the vegetation of the offshore islands, Mount Gower and Little Slope will be presented elsewhere (Pickard 1976, 1978, unpublished data).

The nomenclature of the vascular plants follows current practice at the National Herbarium of New South Wales (Jacobs & Pickard, 1981), where my extensive voucher collection is lodged. Authorities for most angiosperms are given by Rodd (1974) although his list is now incomplete. Authorities for ferns are listed by Pickard (unpublished data)*. Nomenclature of place names follows Pickard (unpublished data); the place names used are not necessarily approved geographical place names under the Geographic Names Act of New South Wales.

Geology

Lord Howe Island is a small erosional remnant of the Lord Howe Volcano situated on the western edge of the Lord Howe Rise in the Tasman Sea. A series of volcanic eruptions, followed by extensive erosion, began about 30 million years ago and another period of volcanic activity occurred during the Miocene (about 10 million years ago); subsequent erosion has reduced the volcano from about 1200 m to its present height of 875 m. The older volcanics outcrop in the northern and central hills and the northern offshore islands, whereas the younger volcanics form the southern mountains, according to recent studies (Game, 1970; Sutherland & Ritchie, 1974). This contrasts with an earlier opinion (Standard, 1963) that the Lidgbird (southern) volcanics are older (Figure 1).

Sediments of Pleistocene or younger age occur on low-lying, flat land between the hills. Aeolian calcarenite, formed from wind-blown coral sand, was deposited in several stages during the Pleistocene. Elsewhere, recent alluvium or talus deposits occur (Standard, 1963).

Physiography

The physiography of the island mirrors the geological background. Four main

*Since this paper was accepted for publication, a number of names have changed, for example, *Howea forsterana* is now *H. forsteriana,* and *Drypetes australasica* is now *D. lasiogyna* var. *australasica.* For logistic reasons, these remain unaltered here. The current (1983) names of both angiosperms and ferns are listed by Rodd & Pickard (this issue).

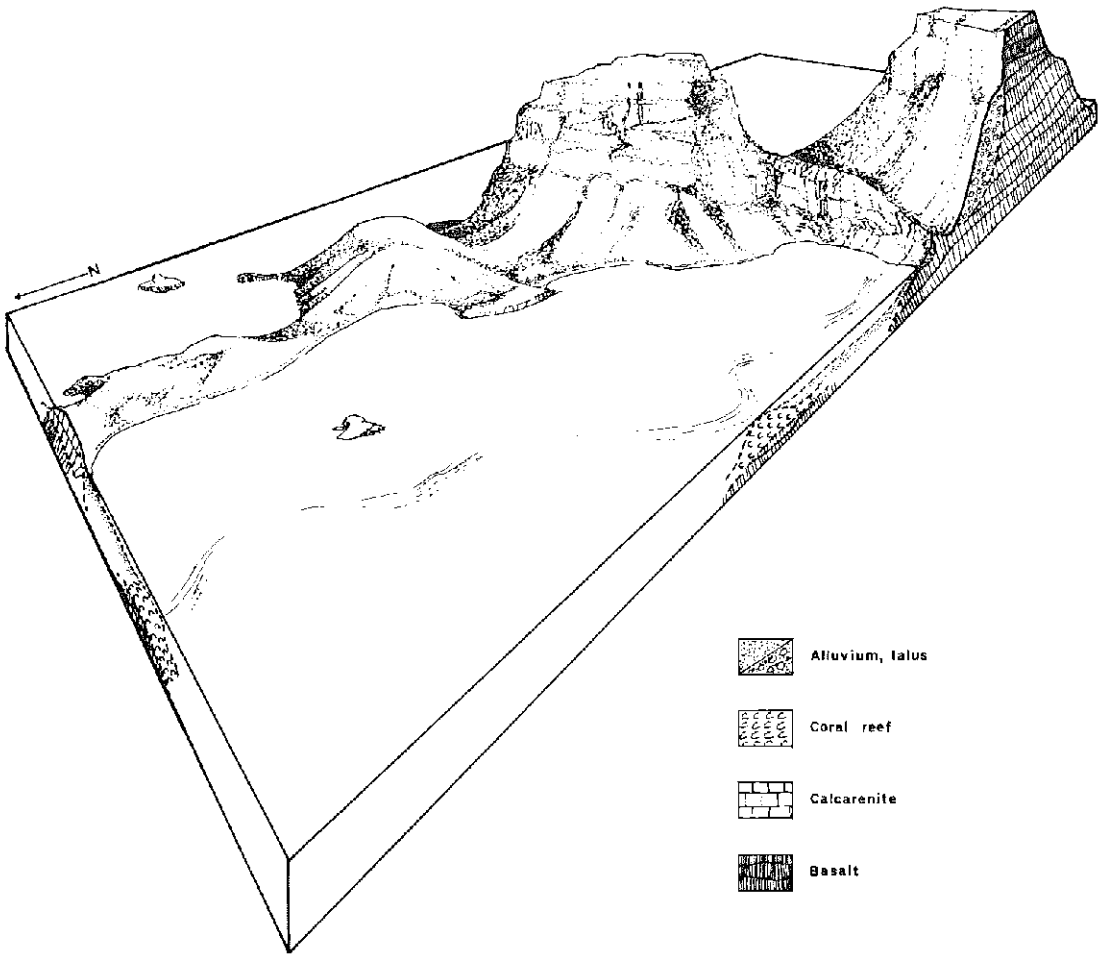


Figure 2. Block diagram of the southern end of Lord Howe Island. Mount Gower on the right is separated from Mount Lidgbird by Erskine Valley. Smoking Tree Saddle, north of Mount Lidgbird marks the beginning of the central hills. Intermediate Hill is the dome, with Mutton Bird Point and Mutton Bird Island to the north. Flat ground at Mosely Park continues around the base of Transit Hill. Rabbit Island sits in the lagoon behind the shelter of the coral reef.

patterns can be distinguished: southern mountains, calcarenite slopes and alluvial flats, and northern and central hills (Figures 2, 3, 4; Etheridge, 1889b; Standard, 1963).

The southern mountains (Figure 2) run south from Smoking Tree Saddle; steep slopes and basalt cliffs rise to 850 m and include Mount Lidgbird (777 m) and Mount Gower (875 m). The summit of Mount Gower is a plateau falling from east to west down a series of small cliffs separated by gently to steeply sloping benches. A number of subparallel semi-permanent creeks drain the plateau and fall over the cliffs on the western edge of the summit. Cliffs form the edge of the plateau on all sides except the north and the south; below them debris avalanche slopes run down to sea level. In the north, a narrow ridge runs down to The Saddle and then up to Mount Lidgbird. In the south, a steep spine (Razorback) drops sharply for 300 m before plunging 600 m down cliffs into the sea.

Unlike Mount Gower, Mount Lidgbird is a narrow ridge above several tiers of cliffs. The slopes below the cliffs are uniformly bouldery. Several large landslides have fallen from the tiers of cliffs in the last 20 years. The two mountains are separated by Erskine Valley which runs west from the Saddle down to sea level. On the eastern foot of Mount Lidgbird a series of bouldery slopes cut by creeks, basalt outcrops and landslides, known as Fern Patches, run down to broken cliffs above the sea.

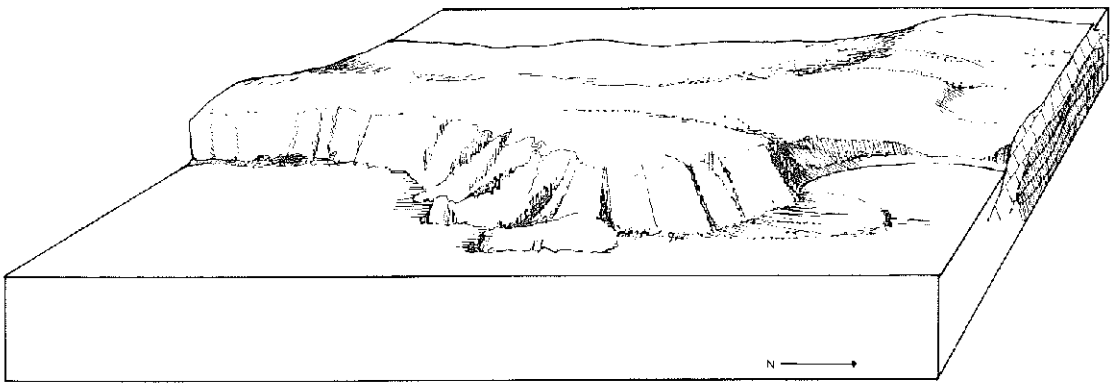


Figure 3. Block diagram of the calcarenite ridge looking west over Jims Point. Highly porous calcarenite underlies the gentle slopes which have no external surface drainage. The east coast has cliffs with sandy beaches such as Neds Beach on the right.

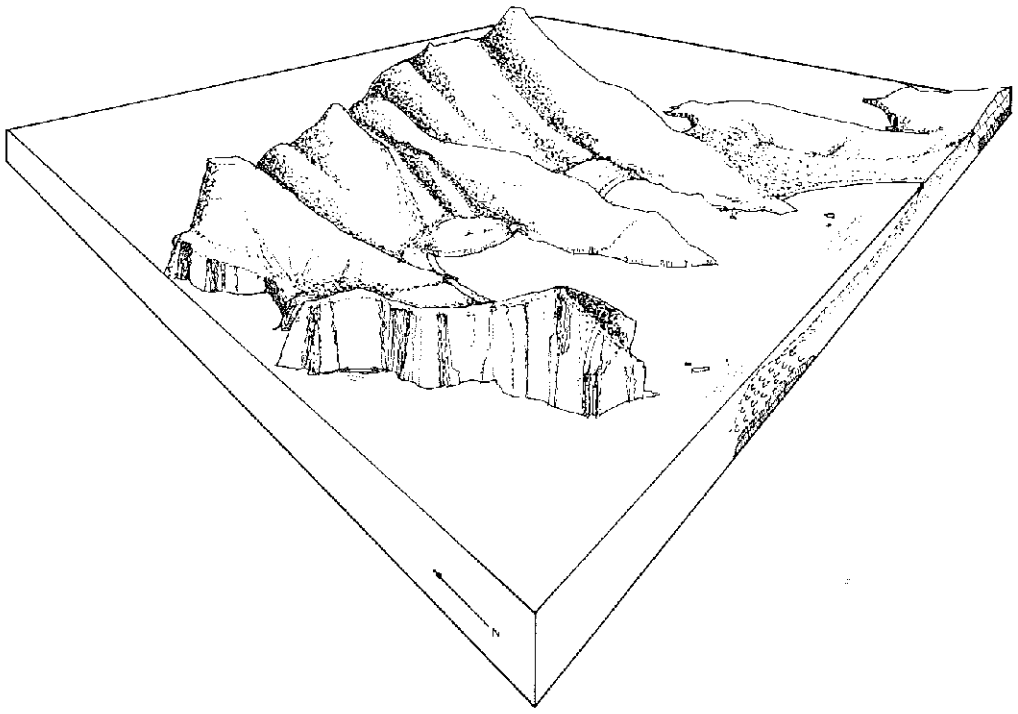


Figure 4. Block diagram of the northern hills looking east towards Malabar. On the right the calcarenite ridge runs gently down to Lagoon Beach. Malabar Ridge and Dawsons Point Ridge rise to an undulating east-west ridge in the north. Steep cliffs fall from this ridge into the sea. Old Settlement Beach is behind Dawsons Point Ridge. Mount Eliza is isolated by Old Gulch (hidden) and New Gulch, low-lying areas behind North Beach. In the foreground, cliffs fall into the sea from the ridge running south to Phillip Point (North Head).

Far Flats, another boulder slope, runs down from the cliffs on the west. The northern slopes of Mount Lidgbird fan out radially from Salmon and King Beaches on the west, over Smoking Tree Saddle to the jagged sea cliffs from Edmanoch Point to Sugarloaf Point. All these slopes are steep and bouldery in their upper sections but less so near sea level.

The central hills (Figure 2) are gently rounded basalt hills between Smoking Tree Saddle in the south and Neds Beach in the north. Intermediate Hill (250 m), situated between Smoking Tree Saddle and the alluvial flats of Moseley, is dome-shaped, with

rounded ridges and concave sides. Drainage from the hill is essentially radial and few of the streams are perennial. Although most of the ridges are rocky, several benches with impeded drainage occur on the western side of the summit. Landslides are not common, but one fell near the crest of the main north-south ridge and flowed down the western slopes in 1977. Cliffs form the eastern foot of the slopes but these rarely exceed 30 m. Mutton Bird Point, which projects from these cliffs, is almost detached and only a narrow spine of eroding basalt ties it to the island. In the west, the ridges and spurs run out onto more gentle slopes terminating above calcarenite cliffs on the lagoon.

Transit Hill (121 m) is essentially a smaller and simpler version of Intermediate Hill. It is more complex geologically as there are two calcarenite deposits on its flanks. One, Little Mutton Bird Ground, covers about 0.7 ha and occurs on the eastern side above basalt cliffs about 40 m high, while the other, of about 10 ha, lies in the catchment of Edies Glen, northwest of the summit.

North of Transit Hill, the basalt splits into two tongues, one heading northeast to Brodies Point, the other through Middle Beach Common before disappearing under calcarenite behind the school. Between these tongues lie Valley Garden and Valley of the Shadows. Valley Garden is a circular solution depression in the calcarenite close to its junction with the basalt, while Valley of the Shadows is an elongate depression with little external surface drainage except on the north.

The main ridge continues north towards Neds Beach as a broad, round and gentle calcarenite rise which is a major part of the third physiographic pattern (Figure 3). There are few distinct spurs. With the exception of basalt outcrops near Stevens Point, the eastern margin is a series of low calcarenite cliffs. In the west, the ridge slopes down into broad flats of alluvium and sand which run behind Lagoon Beach. These flats run the full length of the beach except near Windy Point where a spur from Transit Hill terminates in a low abrupt point. Thre are no surface streams. Several sections of the flats are swampy but most appear well-drained. Along the western foot of Intermediate Hill, there are some calcarenite slopes and low cliffs. The very swampy and flood-prone alluvial flats of Soldier or Big Creek are included in this pattern. Old Settlement Beach marks the northern limit of the flats. Here a small calcareous sand dune, about 2 m high, occurs between the beach and the swamps of Old Settlement Creek. A similar low dune occurs along the full length of Lagoon Beach but the dune at Blinky Beach, on the eastern side of the island, is about 10 m high.

The northern hills (Figure 4) rise abruptly from the flats as parallel ridges separating steep, bouldery creeks. These ridges rise to a major east-west ridge at 160 m elevation. This ridge is asymmetric and the cliffs on the northern side form the northern edge of the island. The highest point, Malabar (209 m), occurs at the eastern end, at the junction with Malabar Ridge, which runs south down to the flats. Further east, Dawsons Point Ridge runs south from Kims Lookout to Dawsons Point in the lagoon. Unlike the steep, narrow Malabar Ridge, this is rather gentle and wide. The sides of both are steep and very bouldery.

Mount Eliza (147 m) dominates the area behind North Beach. Its southern ridge is steep and markedly convex but north from the summit, it falls down cliffs to Phillip Bluff (Fishy Point). Mount Eliza is isolated from ridges on both sides by Old Gulch on the east and New Gulch on the west. These are bays eroded into the coastline but also low points on the island. Between North Beach and Old Gulch, the maximum altitude is only about 12 m. Alluvium extends most of the way from North Beach to Old Gulch but only half way to New Gulch. Here a broad valley separates Mount Eliza from the ridge marking the western edge of the northern hills. Like the other ridges, this runs north-south, and like the major northern ridge, it terminates in cliffs.

TABLE 1

Chemical analyses of basalt, calcarenite and soil, expressed as percentages of calcium oxide and phosphorus pentoxide.

		CaO%	P_2O_5%
Basalt: all analyses	(n = 14)	8.2	0.43
Lava	(n = 9)	7.7	0.51
Dykes	(n = 5)	9.0	0.38
Calcarenite:	(n = 4)	52.3	trace
Soil (Parent material not known)	(n = 5)	no data	6.24

Sources: Game (1970), Wilkinson (1882).

Offshore islets occur at various distances from Lord Howe. All are basaltic and surrounded by cliffs up to 50 m high. The summits are usually rounded with many rock outcrops. Pockets of soil are mostly shallow but on Roach and Mutton Bird they are somewhat deeper. The main group, the Admiralty Islands, lie north of Lord Howe and include seven islets of different sizes. The largest, Roach Island, of about 16 ha rises to 86 m. Mutton Bird Island and Sail Rock are 1.2 km off Mutton Bird Point. Gower Island, 120 m off the southern tip of Lord Howe, has a flat summit at 30 m height. Rabbit Island is within the lagoon, about 800 m off Windy Point. The basalt spire of Balls Pyramid juts 550 m out of the sea some 19 km southeast of Lord Howe.

Soils

The soils on the island have not been studied in any detail. Past observations have been sparse and restricted to brief descriptions of wells and a few chemical analyses (Table 1). During the present study very few observations were made.

There are marked physical and chemical differences between the two major substrates, calcarenite and basalt, which are reflected in the soils (Table 1). Soils on calcarenite are coarse sands, on basalts they are clays. Between 1970 and 1973 the New South Wales Department of Public Works drilled over 100 holes for airstrip investigations. A typical core is:

0 – 1.5 m	Sand and coral
1.5 – 4.0 m	Volcanic ash, coral, silt and sand
7.0 –10.0 m	Coral
10.0 – m	Volcanic ash, fines, silt and sand.

It is unfortunate that no detailed studies have been made on these cores. The log above apparently indicates two periods of volcanic activity separated by a marine transgression (if the coral is correctly identified and is not calcarenite).

Soil profiles, classified as Uc 1 (Northcote, 1971), were examined on calcareous beach sand at North Beach and elsewhere. Very few profiles were examined on basalt because of the stony nature of the soil. Stones from 20 to 200 mm diameter and larger are very common and can occupy up to 20 per cent of the volume of basaltic soils. The interstitial matrix is generally clay textured and appears to be Uf 3.4 (Northcote, 1971) i.e. uniform, fine-textured soil.

TABLE 2

Selected climatic elements recorded on Lord Howe Island

Element	Variable	Format	Period (Years)	Figure*	Source**
Rainfall	Raindays	Monthly	10 & 15	6	Gentilli 1971
	Rainfall	Hourly	5 (1967-1972)	7	
		Monthly	46	8	Anon. 1969
			70 (1886-1967)	8	
		Annual	70 (1886-1967)	9	
Wind	Speed 0900 h	Monthly	4		Gentilli 1971
	1500 h	Monthly	4		Gentilli 1971
	Speed & direction frequency 0900 h	Monthly	7 (1965-1971)	10	
	1500 h	Monthly	7 (1965-1971)	10	
	Maximum gust Speed	Annual	23 (1940-1963)	—	Whittingham 1964
	Direction	Annual	23 (1940-1963)	—	Whittingham 1964
Cloud	Cloud 0900 h	Monthly	10	12	
	1500 h	Monthly	10	12	
Temperature	Temperature	Monthly	27	13	Anon. 1969, Gentilli 1971
Relative Humidity	Daily Index	Monthly	28	14	Anon. 1969
	Relative Humidity 0900 h	Monthly	28	14	Anon. 1969, Gentilli 1971
	1500 h	Monthly	9	14	Gentilli 1971

* Refers to the figure where the data are graphed.

**Where no source is given the data are unpublished Bureau of Meteorology records.

The following profile is developed on the summit plateau of Mount Gower:

0 - 7.5 cm	Litter and decomposing organic material, colour 5YR2/2*, pH 5.5.
7.5 - 15.0 cm	Plastic clay, colour 7.5YR3/2, pH 6.0.
15.0 - 17.5 cm	Mottled grey clay, 2.5YR3/0 matrix with mottles of 7.5YR3/2, pH 6.0. Sharp boundary.
17.5 -150.0 cm	Decomposed rock, reddish with yellow mottles around hard "core stones" c. 5 mm diameter, pH 6.5.

The soil profiles (0 -17.5 cm) was very soft with a high moisture content. The grey clay band at 15-17.5 cm appeared to be a gley horizon.

Climate

Climatic data have been recorded at the Meteorological Station for varying periods up to 70 years (Table 2). The Meteorological Station is situated on the low ridge between Transit Hill and Neds Beach above Middle Beach. It is exposed to the

*Munsell colour charts used for colour determinations.

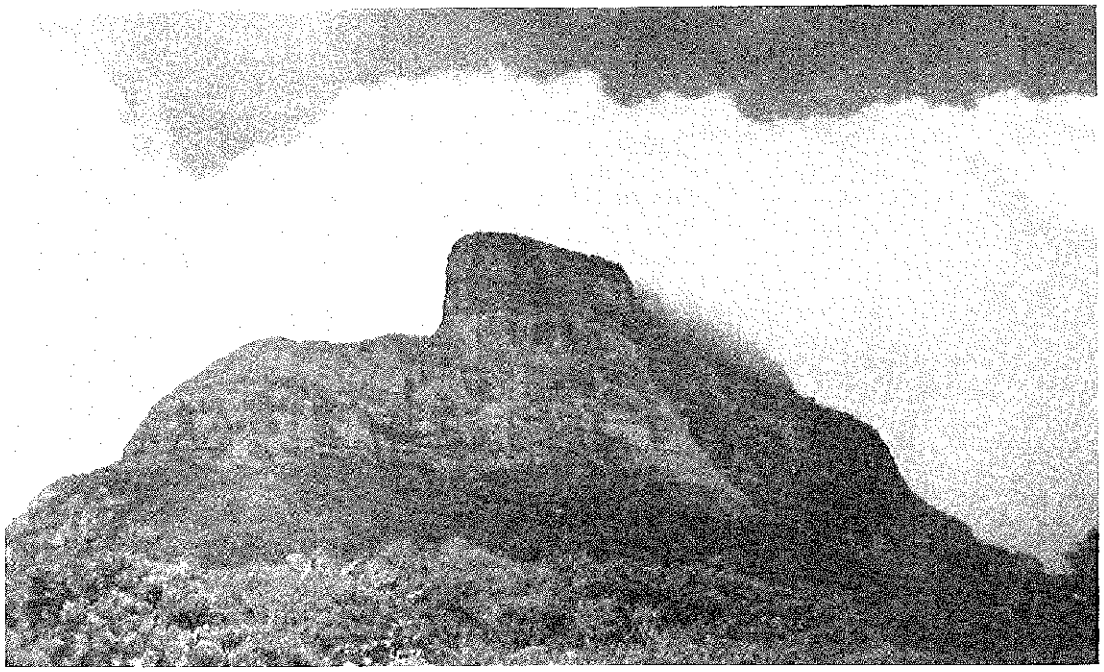


Figure 5. Heavy orographic cloud on Mount Lidgbird bringing very intense rain to the southern mountains. Looking south from Boat Harbour.

southwest. Winds from the NNW and E-SSE are unreliable and of extreme gustiness (Whittingham, 1964). Data from the Meteorologial Station are unrepresentative of the climate at the southern end of the island. Here the mountains generate orographic cloud (Figure 5), modify wind patterns and consequently greatly alter the climatic regime.

Records of climatic variables are not all available for comparable periods (Table 2). Only those variables likely to affect vegetation are considered here. Unpublished data are available from the Bureau of Meteorology for rainfall (daily), low cloud 0900 and 1500h (monthly), all types of cloud (monthly), thunder, cloudy and clear days (monthly), dew (monthly), wind speed and direction frequency (daily and nightly), wind maximum gust speed, direction and time of occurrence (daily) and wind maximum gust month of occurrence (annual). Frost, fog and snow have never been observed on the island. Evaporation and solar radiation are not recorded.

Regardless of the original units, I express all measurements in SI units in the discussion. On diagrams both SI and imperial units are shown where appropriate. All times are expressed as Lord Howe Island time which is Greenwich Mean Time plus 10 h 30 min, and Australian Eastern Standard Time plus 30 min.

Correlations between some variables were calculated using monthly means (Table 3). On *a priori* grounds some significant correlations can be expected: evaporation with temperature and precipitation (as these are used to calculate evaporation); raindays with temperature, evaporation, precipitation, thunder days, wind speed and temperature; wind speed with evaporation and thunderdays. Some of the significant correlations are probably due to mutual associations with one or more other variables. For example, partial correlation coefficients reveal that the correlation between wind speed 0900 h and evaporation ($r = -0.751$, $p<0.01$) is largely due to the correlation between wind and temperature ($r = -0.850$, $p<0.001$). The correlation between wind speed 0900 h and evaporation, free from the mutual association of temperature with both, is $r = -0.190$ (n.s.).

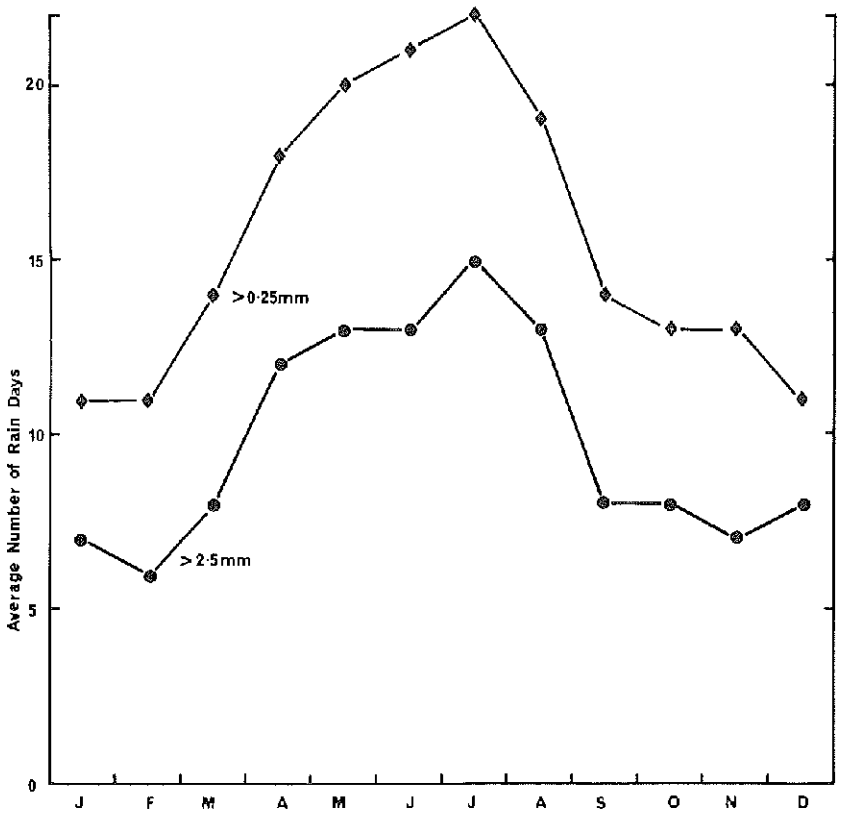


Figure 6. Mean monthly number of raindays. Raindays are defined as days with more than 0. 25 mm (♦) and more than 2.5 mm(●) recorded rain.
Source: Gentilli (1971) ♦ 15 years, ● 10 years

TABLE 3

Correlation matrix of mean monthly climatic data

		Fig.†	1	2	3	4	5	6	7	8
1	Mean minimum temperature	13								
2	Mean wind speed 0900 h	10	-0.850 ***							
3	Mean wind speed 1500 h	10	-0.813 ***	0.853 ***						
4	Evaporation	13	0.815 **	-0.751 **	-0.680 *					
5	Mean monthly raindays (>0.25 mm)	6	-0.703 *	0.676 *	0.628 *	-0.942 ***				
6	Mean monthly raindays (>2.5 mm)	6	-0.675 *	0.635 *	0.605 *	-0.883 ***	0.971 ***			
7	Mean monthly rainfall	8	-0.558	0.516	0.422	-0.801 **	0.886 ***	0.876 ***		
8	Mean monthly cloud cover 0900 h	12	0.634 *	-0.639 *	-0.497	0.367	-0.310	0.400	-0.153	
9	Mean monthly cloud cover 1500 h	12	0.240	-0.181	-0.227	-0.259	0.389	0.398	0.519	0.511

†Figure: Refers to the figure where the data are graphed.
Significance level: blank not significant; * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

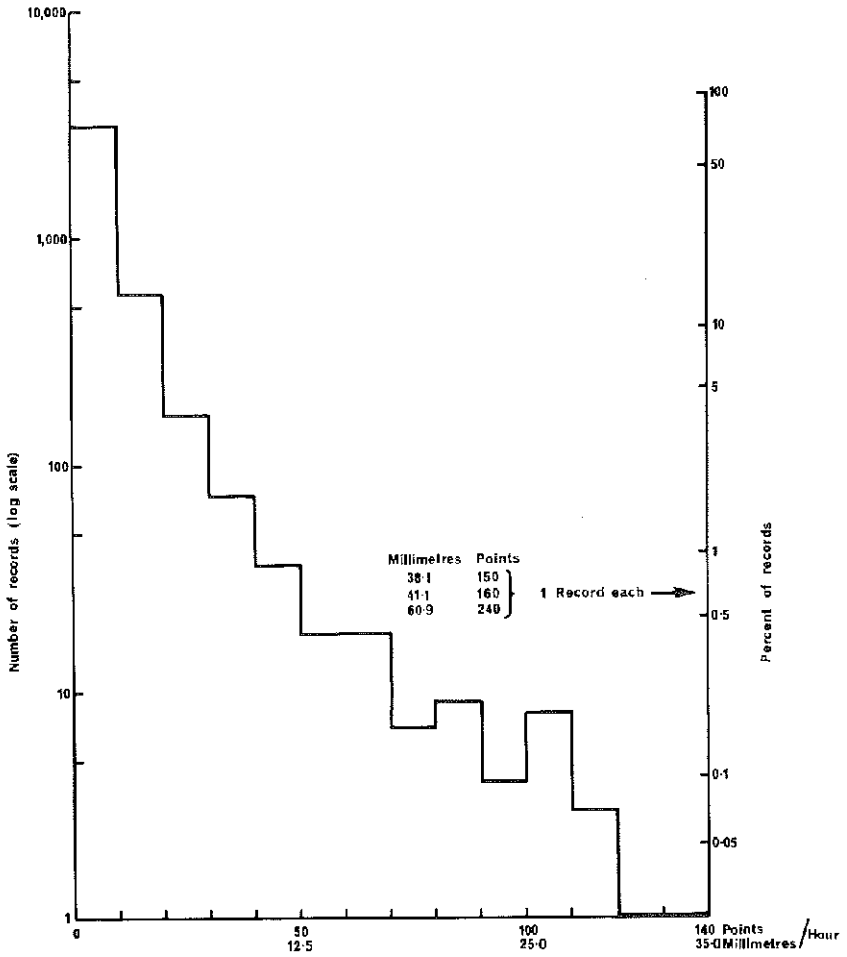


Figure 7. Frequency histogram of hourly rainfall.
Source: Bureau of Meteorology unpublished data, July 1967-July 1972.

Rainfall

Gentilli (1971) provides data for mean monthly number of days with falls of rain exceeding 0.25 mm and 2.5 mm (Figure 6). The average number of raindays per month doubles from about 11 in summer to 22 in winter. This seasonal pattern is similar to that of monthly precipitation (Figure 8). Sixty to seventy per cent of rain days account for 90 per cent of the rainfall.

The hourly intensity of rainfall is extremely skewed (Figure 7) with fewer than 1 per cent of the recorded falls exceeding 12.7 mm and fewer than 0.2 per cent exceeding 25.4 mm. There are rare intense falls, for example, in the 4 029 rain hours represented in Figure 7 there is one fall each of 38.1, 50.5 and 61.0 mm. These falls greatly influence soil, and hence vegetation, instability. Landslides are extremely likely following such falls of rain. Hourly intensity can vary considerably over a short time span. For example, on 15.4.1968 there was a fall of 37.5 mm in one hour with no rain in the immediately preceding or following hours. At the other extreme are long periods with no precipitation: between July 1967 and July 1972, the 4 029 hours of rain recorded are less than 10 per cent of the total number of hours. The most common pattern is a period of several hours light rain giving a substantial total fall. There is marked seasonality of precipitation (Figure 8) with a peak in winter and a low in summer. Both sets of monthly data (for 46 and 70 years) show the seasonal pattern, but as could be expected, the 70 year curve is the smoother. Evaporation, calculated using Fitzpatrick's (1963) method, exceeds precipitation in summer (December-February). Total annual precipitation is variable between extremes of 2870 mm in

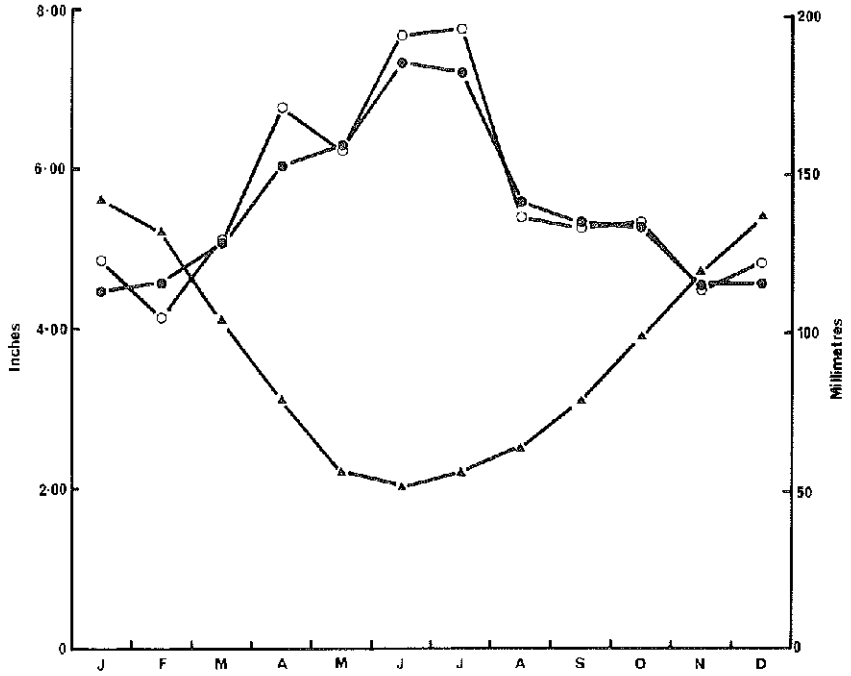


Figure 8. Mean monthly rainfall (46 year mean ○ , 70 year mean ●) and estimated evaporation.
Source: 46 year rainfall (○) Anon. 1969.
70 year rainfall (●) Bureau of Meteorology, unpublished data, 1886-1967. Evaporation (▲) based on temperature and rainfall data in Anon. (1969).

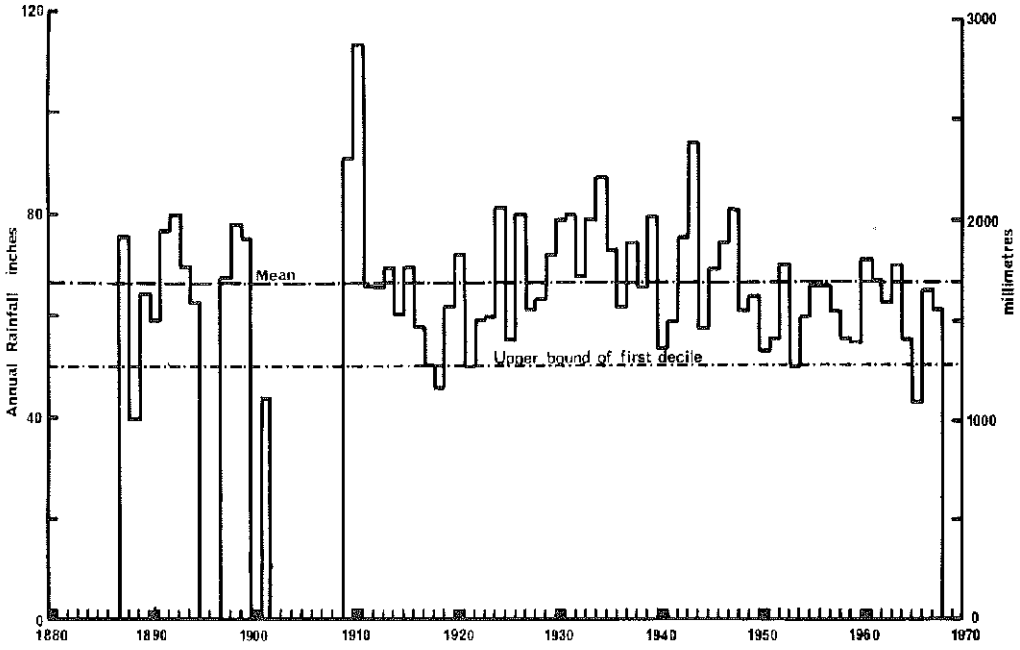


Figure 9. Annual rainfall. See text for explanation of first decile.
Source: Bureau of Meteorology unpublished data, 1886-1967.
Records for 1895, 1896, 1900, 1902-1908 are missing or incomplete.

1910 and 1000 mm in 1888 (Figure 9). The median of 1655 mm is very close to the mean (1676 mm).

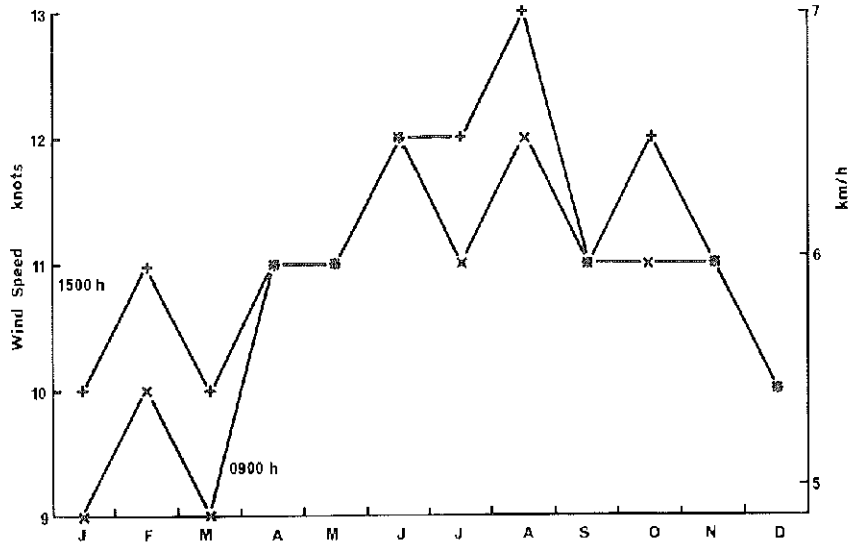


Figure 10. Mean monthly 0900 (×) and 1500 (+) h wind speed. Sources: Bureau of Meteorology unpublished data, Gentilli (1971) 4 years.

Although none of the usual definitions of drought is particularly relevant to natural vegetation, the first decile definition of Gibbs & Maher (1967) appears to be the most appropriate. They define a drought year as one whose rainfall lies in the lowest 10 per cent of the total years accounted for. Thus, on Lord Howe Island, over the 70 years considered, the 7 years (10 per cent of 70) of drought were 1887, 1901, 1917, 1918, 1921, 1953 and 1965 (Figure 9). All seven had an annual precipitation of less than 1270 mm.

Wind

Mean monthly wind speed varies both diurnally and seasonally (Figure 10). The afternoon (1500 h) winds are always stronger than the morning (0900 h) winds. The seasonal trends in wind speed for both morning and afternoon are broadly similar ($r = 0.853$, $p < 0.001$). Mean speed increases from summer through autumn to a maximum in winter then decreases through spring to a minimum in summer. The uneveness in the data (Figure 10) is a consequence of the short record (Table 2).

A more informative examination of the wind is provided by calculation of onshore wind resultants using only vectors for the three onshore directions at the particular aspect (Figure 11). Thus, for the north aspect, only winds from the northwest, north and northeast are used. Following the method of Landsberg and Bagnold described by Jennings (1957) the vectors are calculated as:

$$b = 10^{-3} \sum_{j=3}^{12} n_j (v_j - V_t)^3$$

where b = length of the individual vector for the direction under consideration

n_j = % frequency of wind of Beaufort speed class j in the direction

v_j = mean speed in miles/h of the Beaufort speed class j

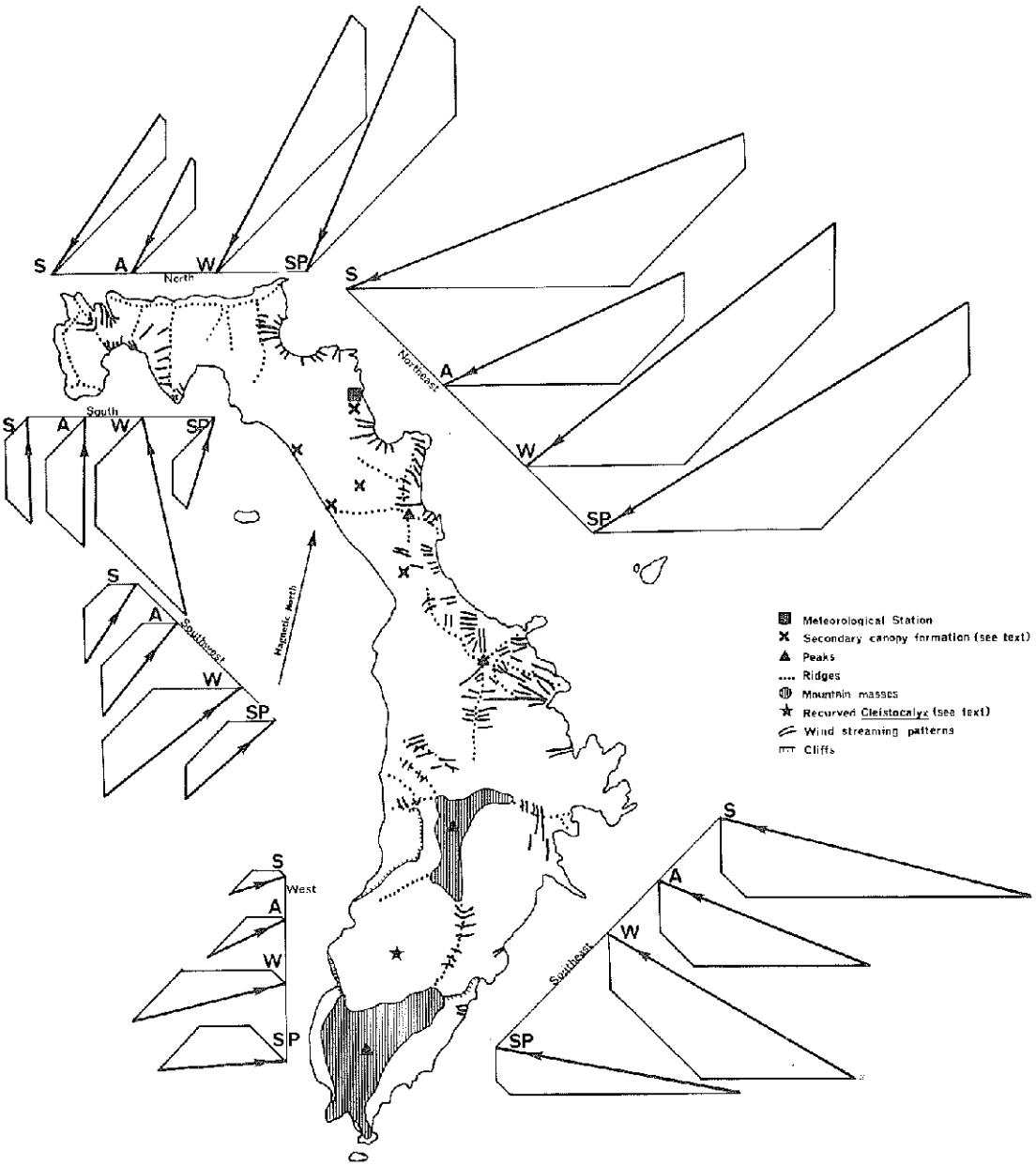


Figure 11A. Onshore wind resultants for 0900 h for six aspects and each season. S = Summer (Dec, Jan, Feb), A = Autumn (Mar, Apr, May), W = Winter (June, July, Aug), SP = Spring (Sept, Oct, Nov). Source: Bureau of Meteorology unpublished data, 1965-1971.

The constant V_t = 10 miles/h [16 km/hr] (corresponding to 3 on the Beaufort scale) is assumed to be the threshold wind speed for sand drift, and is retained here as very low speed winds probably have little or no effect on the vegetation.

The striking feature of the onshore resultants is the dominance of winds from the southeast and northeast (Figure 11). The magnitude of the resultants changes seasonally with the afternoon winds more variable than the morning winds. Changes in direction are slight throughout the year.

Annual maximum wind gust data for 1940–1962 are presented by Whittingham (1964). As there are only 23 observations, only the gross features will be considered.

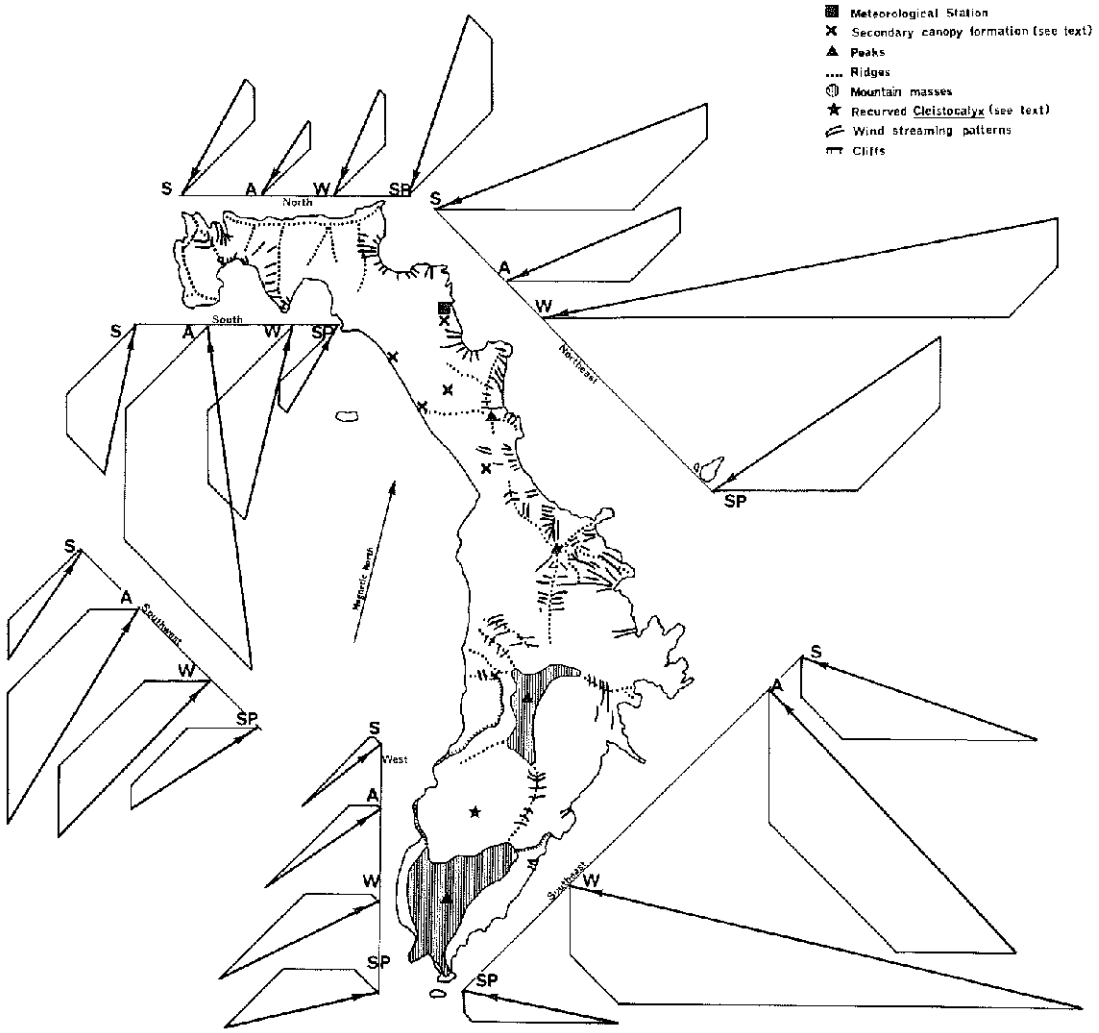


Figure 11B. Onshore wind resultants for 1500 h for six aspects and each season. S = Summer (Dec, Jan, Feb), A = Autumn (Mar, Apr, May), W = Winter (June, July, Aug), SP = Spring (Sept, Oct, Nov). Source: Bureau of Meteorology unpublished data, 1965-1971.

The mean is 125 km/h and the range is relatively small; the strongest recorded was 178 km/h in 1948 and the weakest 89 km/h in 1962. The monthly distribution is seasonal with maxima in autumn-winter and minima in summer. Maximum gusts have occurred from all directions but there is a slight trend towards northerly dominance. The maximum gust data bear little similarity to the mean wind data, for example, the largest number of maximum gusts occurs in autumn-winter while the period of highest mean wind speed is late winter-spring.

Cloud

The island is very cloudy. The minimum mean monthly cloud cover is about 60 per cent in August. Both morning (0900 h) and afternoon (1500 h) monthly cloud trends are irregular; broadly similar trends occur in summer and midwinter only. The southern mountains generate their own orogenic cloud cover (Figure 5) and are always cloudier than the lowlands. For most of the year there is consistently higher cloud cover in the afternoon (Figure 12). The rainday and hourly rainfall data both indicate that precipitation is chiefly as small falls. However, the lack of correlation between cloud cover and raindays (both those >0.25 and >2.5 mm) and rainfall ($r = -0.310$, $r = 0.400$ and $r = -0.153$ respectively, Table 3) indicates that on many cloudy days it does not rain.

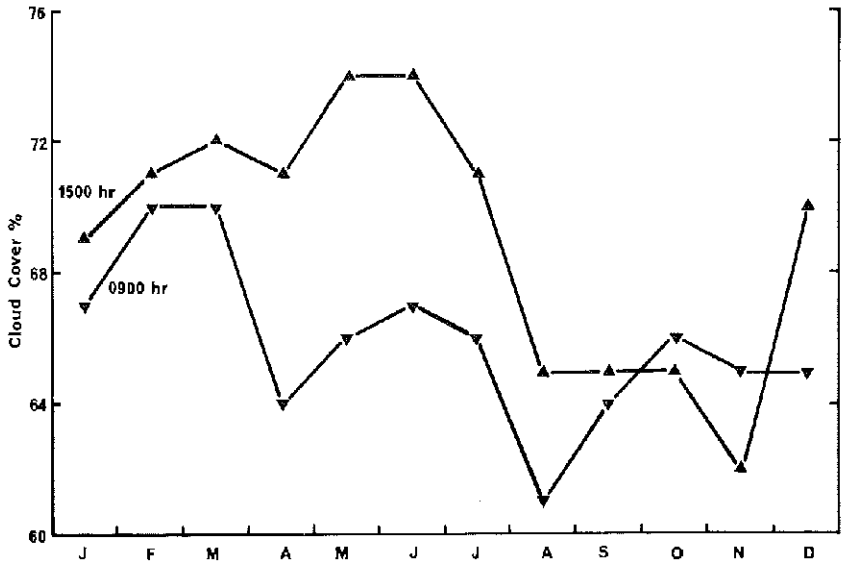


Figure 12. Mean monthly 0900 (▼) and 1500 (▲) h cloud cover.
Source: Bureau of Meteorology unpublished data, 10 years.

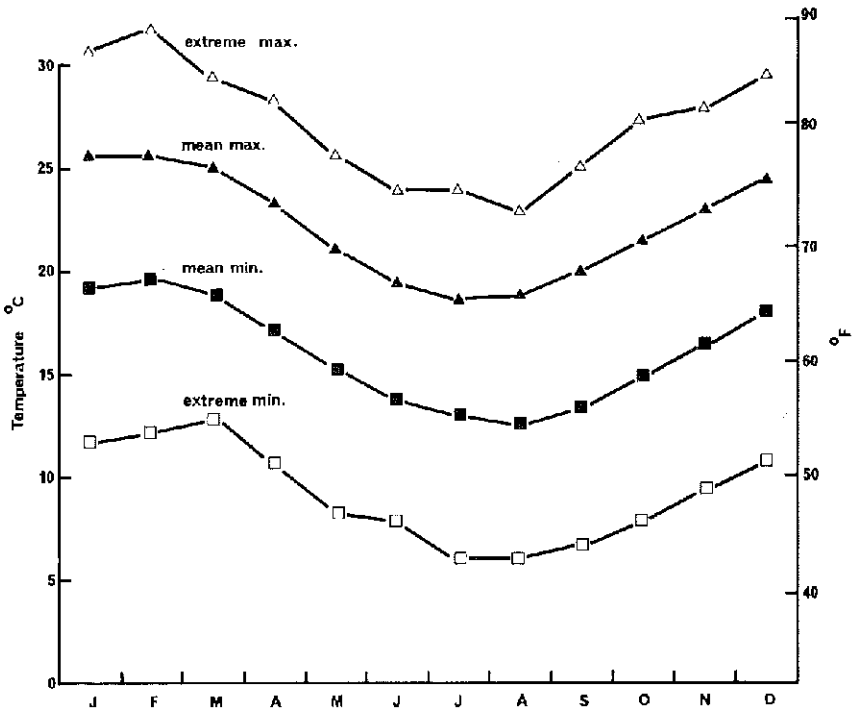


Figure 13. Mean (maximum ▲, minimum ■) and extreme (maximum △, minimum □) monthly temperatures. Source: Gentilli (1971), Anon. (1969), 27 years.

Temperature

Main annual temperature is 19.1°C and there is a consistent 7°C difference between mean maximum and minimum (Figure 13). The highest temperature ever recorded is either 31.5°C (Bureau of Meteorology, unpublished data) or 43.5°C (Russell, 1895). The lowest ever is 6.0°C (Bureau of Meteorology, unpublished data). No frosts have been recorded.

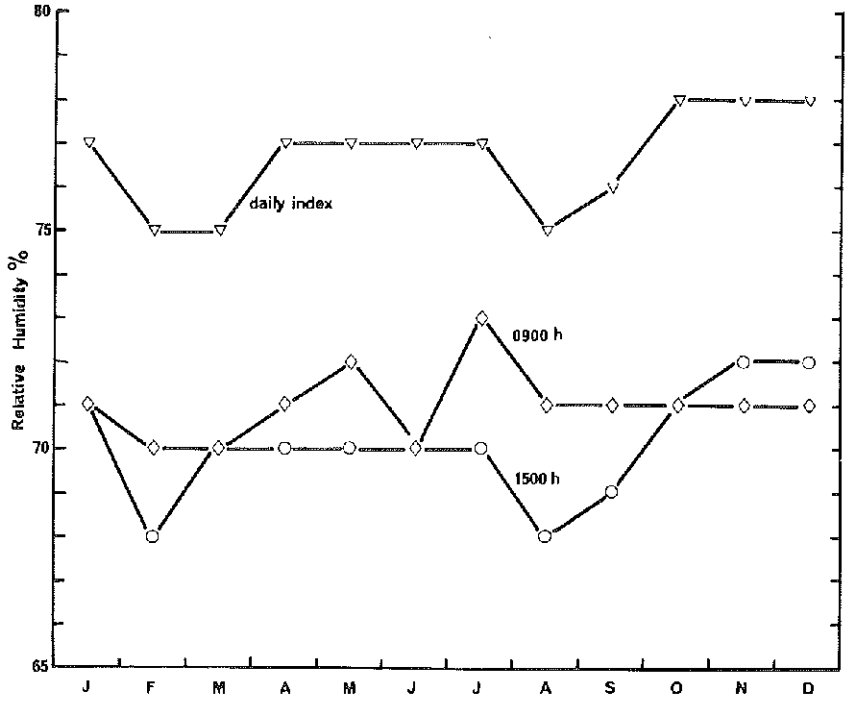


Figure 14. Mean monthly relative humidity.
Source: Anon. (1969), Gentilli (1971)—Daily index (▽) 28 years
Gentilli (1971)—0900 h (◇) 28 years
1500 h (○) 9 years

The temperature on the mountains can be estimated using a lapse rate of 5.5–8.0C degrees fall per 1000 m rise. Thus temperatures on the summits would be about 6–8°C lower than at the Meteorological Station and the mean minimum and extreme minimum at the Station would be equivalent to the mean maximum and mean minimum temperatures respectively on the mountain (Figure 13). These ranges agree with results from a maximum/minimum thermometer left on the summit of Mount Gower (875 m) from February 1974 to February 1975; a maximum of 25.5°C and a minimum of 0°C was recorded (H.J. de S. Disney, pers. comm.).

Relative Humidity

Not surprisingly, humidity on the island is always high (Figure 14). The morning (0900 h) humidity is between 70 and 73 per cent; and the afternoon (1500 h) varies between 68 and 72 per cent. The monthly trends for daily and afternoon (1500 h) humidity are similar but the morning (0900 h) trend is more erratic.

History of settlement

Lieutenant Henry Lidgbird Ball discovered Lord Howe Island on 17 February 1788 and it was first settled in 1833 or 1834. For the next 40 years or so the islanders depended on subsistence farming and fishing, supplemented by goods traded with passing whalers. By 1870 whaling had declined and the island's economy was based on the export of onions which had commenced about 1860. Fungal diseases destroyed the onion industry in 1875.

Palm seeds were exported in about 1880 and quickly became the major industry. However, competition between islanders was so cut-throat they received very little payment. Formation of the Kentia Palm Seed Co-operative Company in 1906 improved matters but conditions again worsened. In 1911, and again in 1912, Royal

Commissions investigated the industry (Langwell, 1911; Bevan, 1912) with profound consequences: land tenure changed from permissive occupancy to leasehold, a board of control was established and the New South Wales Government retained control of the seed industry. The industry crashed during World War I with loss of European markets and no labour for harvesting. The invasion of the island by rats in 1918 rang the death knell of the industry.

Tourists began visiting Lord Howe about 1925 and numbers gradually increased until tourism became the major industry. In 1955 the Lord Howe Island Act was passed to reconstitute management under the Lord Howe Island Board and to revise land tenure. Today the Island depends on tourism and a revitalized and better managed palm seed export which supplies the Board with income for essential public works. Nicholls (1951) and Rabone (1940, 1959) give further details of the history.

Fauna

Like many oceanic islands, Lord Howe has an impoverished fauna except for sea-birds. Fullager *et al.* (1974) estimate that up to 1 million pairs of sea-birds nest on the island. Most of these are Sooty Terns (*Sterna fuscata*)*, Wedge-tailed Shearwaters (*Puffinus pacificus*), Providence Petrels (*Pterodroma solandri*) and Fleshy-footed Shearwaters (*Puffinus carneipes*). Details of their distribution are given in Table 8, p.235). Several species of terrestrial birds also occur (Fullagar *et al.*, 1974). The only other native land vertebrates are two small reptiles, a gecko and a skink (Cogger, 1971), and a small insectivorous bat.

Several species have been deliberately introduced since 1788. Domestic livestock include cattle (*Bos taurus*), horses (*Equus caballus*), goats (*Capra hircus*), pigs (*Sus scrofa*) and chickens (*Gallus gallus*); pets include cats (*Felis catus*) and dogs (*Canis familiaris*). House mice (*Mus musculus*) were introduced accidently about 1868 and black rats (*Rattus rattus*) in 1918 (Hindwood, 1940). A few rabbits (*Oryctolagus cuniculus*) were reported on Rabbit Island in 1869 (Hill, 1870) but appear to have never roamed on Lord Howe itself. They were dead by 1887 (Etheridge, 1889a).

Horses, poultry, dogs, mice and to a lesser extent cats, are restricted to the cleared and settled areas and appear to have little effect on the vegetation. The distribution and effect of the other exotic animals are summarized in Table 9 (p.000). As I have considered the status and effects of goats, pigs, rats and cattle in detail elsewhere (Pickard 1976, 1978, unpublished data) they will only be discussed briefly here.

Early reports on the vegetation

Virtually every visitor to the island has commented, in greater or lesser detail, on the vegetation and the flora. All early descriptions are very general, for example, in February 1788, Ball (in Anon., 1789, p.180) saw ". . . cabbage-palms, mangroves and machineal trees even up to the summits of the mountains". Three months later, in May 1788, Watts (in Anon., 1789, p.223) expands this: "this island is well covered with wood, the chief of which is the large and dwarf mangroves, the bamboo and the cabbage tree. The different vegetables met with were scurvy grass, wild celery, spinach, endive and samphire."

Clearly the "cabbage tree" is *Howea* and/or *Hedyscepe*. Ball and Watts would not have seen *Lepidorrhachis* as it is restricted to the summits of Mounts Gower and Lidgbird. The "mangrove" is unlikely to be either *Avicennia* or *Aegiceras,* which are very restricted, and there is no evidence of greater or lesser numbers of mangroves

*Authorities for sea-birds are given in Fullagar *et al.* (1974).

in the past. Both Ball and Watts were probably referring to any of a number of genera of common lowland trees with glossy dark leaves, including, for example, *Drypetes* or *Cryptocarya*. The "machineal" is probably either the red-fruited *Ochrosia elliptica*, a shrub of the hind dunes, or *Drypetes*, which also has a red fruit. The "bamboo" is most likely *Flagellaria indica*. Of the vegetables, "celery" refers to one of the *Apium* species, "samphire" to *Sarcocornia* and "spinach" to *Tetragonia*, but the others are unknown.

Subsequent reports from 1835 (White, 1853), 1851 (Foulis, 1853) and 1853 (Denham, 1853) are similar and add little. Denham was accompanied by John Denis MacDonald, whose report (1853) is difficult to obtain but the sections on vegetation are fully quoted by Maiden (1898). Macgillivray was the naturalist/zoologist with Denham on the *Herald* but his report (Macgillivray, 1854) is less detailed than MacDonald's.

In June 1869, Charles Moore, Director of the Botanic Gardens, Sydney, spent three days on the island. He was the first botanist to visit the island. Moore published six essentially identical papers on the island (Moore 1869-1871) but these are more concerned with the flora than the vegetation and his description is of little use for the vegetation study except for notes on abandoned gardens (see p.241).

If Moore's observations are accurate, his descriptions could indicate some local changes, for example, on the northern (i.e. eastern) side of the island "*Hibiscus Patersonii [Lagunaria patersonia], Ochrosia elliptica* and *Myoporum acuminatum [M. insulare]* . . . were reduced to a low-sized and nearly impenetrable scrub, the more so as they were usually intermixed with *Guilandina Bonducella [Caesalpinia bonduc],* as sub-climbing prickly shrub". In 1977 *Caesalpinia* was known from three sites; one in a small creek draining the NE flank of Transit Hill, the second on calcarenite between Old Settlement Beach and the Public Jetty and third on Neds Beach. This latter site is the one referred to by Moore and is a relatively short stretch of sandy cliff some 200 m long. Currently *Caesalpinia* could scarcely be described as "intermixed". Field notes on more recent specimens from this site (lodged in the National Herbarium of New South Wales) describe it as follows: "a few plants noted" (Boorman, date 1920), "a few scattered specimens" (Balgooy no. 1044, date 1965), and "two small colonies about 15 m apart" (Rodd no. 1491, date 1970). Thus either the abundance has altered, or Moore's description is coloured; the latter seems more likely. Moore further observed that ". . . *Viscum opuntioides [Korthalsella japonica]* . . . was observed growing in considerable quantities, but only upon two kinds of trees, *Hemicyclia [Drypetes]* and *Elaeodendron*". Maiden (1898) records *Korthalsella* also on *Cryptocarya triplinervis, Coprosma putida* and *Pimelea longifolia*. Oliver (1916) adds *Ochrosia elliptica* and I have seen it on *Alyxia ruscifolia* and *Dysoxylon pachyphyllum*. Once again it seems that Moore's observations are inadequate. R.D. FitzGerald and E.S. Hills, who accompanied Moore, give entertaining descriptions (in Anon., 1870) but add little detail.

In April 1882, J. Duff, a collector from the Botanic Gardens in Sydney, spent 13 days collecting on the island. His only observation worth noting here is "that the tree ferns formerly to be found on the banks of creeks, and other moist places of low land, at the foot of Mounts Gower and Lidgbird, are now nearly extinct, their disappearance being doubtless caused by plant collectors procuring the plants most accessible" (Duff, 1882). As fewer than 10 scientific collectors had visited the island, Duff must be referring to islanders collecting large quantities for the commercial trade. However, there is also evidence that pigs were widespread at that time and they could be partially responsible for the reduction in ferns. W. Botting Hemsley published a compilation of the flora in 1896 but as he had never visited the island his paper merely repeats previous descriptions. The next botanist to visit was Joseph Henry Maiden, Director of the Botanic Gardens in Sydney, who spent nine days on the island in March 1898. Maiden (1898) makes numerous observations on the flora and on

the habits of the islanders, but adds little to the earlier descriptions of the vegetation. His subsequent papers (1899, 1901, 1902, 1914, 1920) add more detail on the flora. The Reverend W.W. Watts collected ferns and mosses in July-August 1911. His three papers (1912, 1914, 1915) refer specifically to ferns. He provides incidental information on some sites but these do not help detect changes.

The most complete report is that of W. Reginald B. Oliver who spent 15 days on the island in November 1913. Oliver (1917) systematically described a number of formations and associations which I have listed as synonyms in the Vegetation Table. He also described some areas in sufficient detail that comparisons are possible, for example, Little Slope (Pickard 1976, 1978, unpublished data) and New Gulch (see p.238). J.L. Boorman visited the island about 1920, but his observations appear to be very unreliable, for example, he says (Boorman, 1921) that *Cleistocalyx fullagari* ". . . grows about 50–80 ft. above sea-level never extending above or below this level." This is incorrect, as *Cleistocalyx* dominates stands from 150–450 m altitude in Erskine Valley, from 15 m to 250 m on Intermediate Hill, and from 80 to 120 m in the Northern Hills. Scattered individuals also occur beyond these ranges. As so many similar mistakes can be demonstrated, all his observations must be subject to doubt. There have been no recent detailed descriptions of the vegetation. Several botanists have visited and collected, for example, R.D. Hoogland (Canberra), A.C. Beauglehole (Melbourne) and P.S. Green (Kew), but they made no general ecological observations. Various visiting scientists from other disciplines have commented, in passing, on the vegetation (for example, Standard, 1963; Paramanov 1958, 1963). None of these reports is of much use in assessing changes.

VEGETATION

Methods

Sampling

Numerous traverses were made to sample as wide a range of vegetation as possible (Figure 15). On these traverses I made notes on salient features of the vegetation, paying particular attention to boundaries. With one or two exceptions, all data are qualitative and based on subjective judgements. Quantitative and semi-quantitative data were recorded for particular purposes from specially located sites and transects. Thus data from 73 randomly located sites used elsewhere for objective analysis of the vegetation (Pickard 1978, unpublished data) are incorporated here where relevant. Similarly palm height, stand density and basal area were measured at up to 312 points on 21 transects designed to sample variation in major palm-seeding areas (Pickard 1978, 1980).

Erection of vegetation units

Describing the process of erecting vegetation units for mapping is very difficult. Because of this, many ecologists criticize vegetation mapping for its subjectivity and apparent non-reproducibility. In recent years a plethora of reviews and comparisons of techniques has appeared (see, for example, Whittaker (1973) at one extreme or Küchler (1967) at the other). Rather than add to the already excessive literature I will attempt to describe how I arrived at the units shown on the vegetation map.

Before field work I read critically all available descriptions of the environment (Standard, 1963) and the vegetation (Maiden, 1898 *et seq.;* Moore, 1869 *et seq.;* and

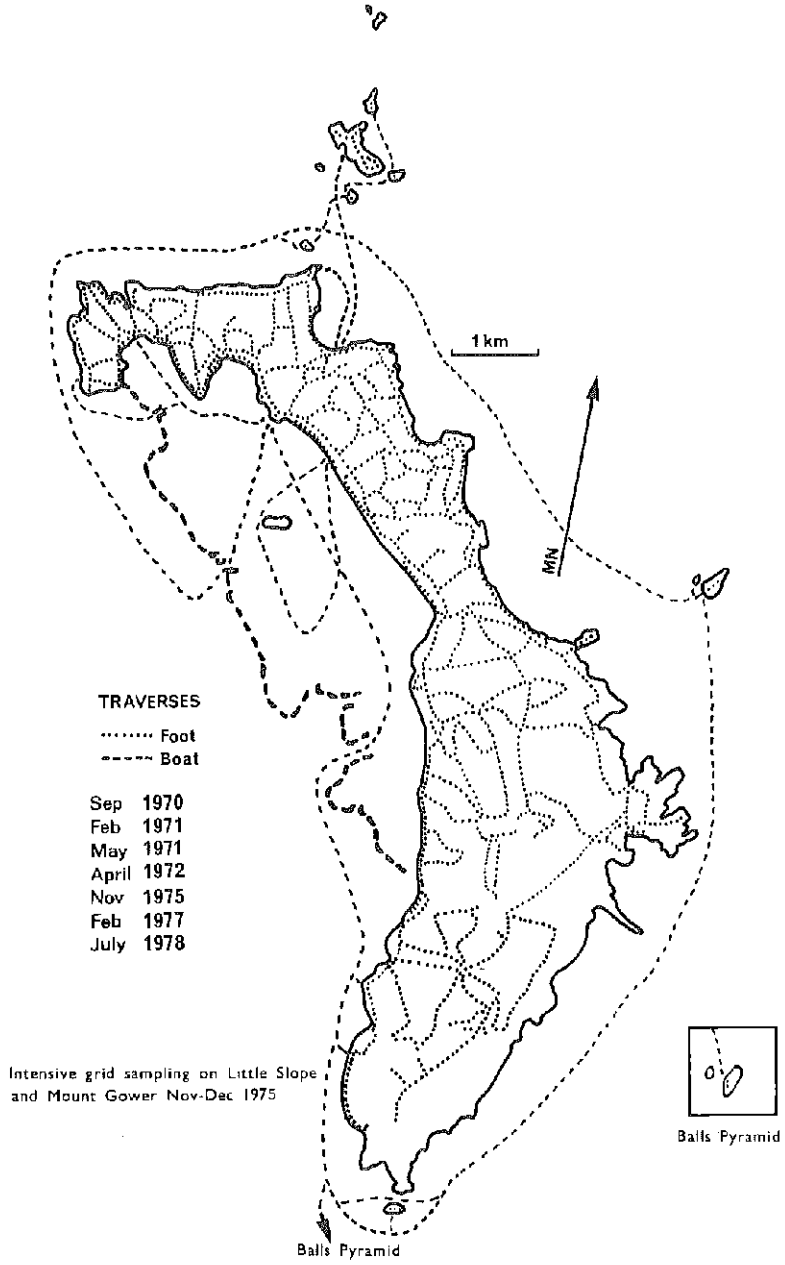


Figure 15. Field traverses on the island.

especially Oliver, 1917) and examined the airphotos to develop some familiarity with the island. During initial field work (September, 1970 and May, 1971) I was largely occupied learning to recognize the flora and forming impressions of the range of variation in the vegetation. This was formalized by airphoto interpretation and preliminary mapping (June, 1971). After considering the structural classifications of Specht (1969), UNESCO (1973), Webb (1959, 1968) and Fosberg (1967) I chose the last as being most intuitively satisfying in this vegetation at the scale of 1:15 840. Mapping of communities proceeded divisively at the formation level into forest, scrub, grass etc. At the association level I worked both divisively and agglomeratively with what appeared to me to be predominant species, that is, those classed as abundant, widespread and easily recognized. I made a conscious effort to map the vegetation using only vegetation characteristics and not features of the environment. However, the vegetation on some habitats such as beaches and cliffs is so heterogeneous that I mapped these areas as physiographic rather than vegetation units.

The first draft map was very uneven, with many fragmented units. This reflected my unfamiliarity with the range of variation of the vegetation, for example, the widespread *Drypetes-Cryptocarya* Alliance was subdivided into a large number of associations, facies and variants. These were erected in the first flush of enthusiasm in a new and unfamiliar environment. During subsequent field work I became more familiar with the variation, and reduced the number of units. This is the reverse of the "group-size dependency" property of some computer classification strategies (Clifford, 1976). In this case once a group is formed and grows by the addition of further individuals, the vegetation hyperspace is dilated and the groups appear to recede from all other groups. Thus, as it grows, it becomes progressively more difficult to join. In revising my earlier mapping the reverse occurred: I reduced the number of units by increasing the size of the large units. There is considerable inertia in the process and once the initial framework was erected no further major units were recognized.

Classification Hierarchy

The hierarchy of units is:

STRUCTURAL (after Fosberg, 1967)

Primary Structural Group
Based on spacing e.g. Closed *vs* Open.
Formation
Based on habit and stature e.g. Forest, Scrub, Grass etc.
Subformation
Based on dominant growth-form with emphasis on leaf texture e.g. Orthophyll Grass, Sclerophyll Grass.

FLORISTIC

Alliance
Based on the dominant genera e.g. *Howea.*
Association
Based on the dominant species e.g. *Howea forsterana, Howea belmoreana.*

Where there is only one association in an alliance, the alliance has the same name.

Some of the structural category names appear unnecessarily complex, for example, "Megaphyllous broad sclerophyll forest" for "palm forest". These arise where other options in Fosberg's (1967) system do not occur on Lord Howe. I have used the full names for comparability with other areas because the International Biological Program adopted Fosberg's system as a standard.

Mapping

The map was prepared by air photo interpretation, field checking and reinterpretation combined with map correcting. Initial interpretation was on black and white vertical airphotos at 1:18 700 and 1:21 400 scales taken in April 1966. Incomplete coverage of colour photos at the same scales and date was used for checking. The appearance types were mapped onto a 1:15 840 topographic base map. All subsequent work was on maps at this scale. Some checks were made on 1975 vertical colour photos at scales 1:4 000 and 1:18 000. The final map was drawn using a combination of cartographic and photographic methods*. Since the first draft map was drawn most of the boundaries have been field checked and all the vegetation types have been examined many times in a range of sites. A summarized version of the map was published in Pickard (1974).

*The vegetation map is in the pocket at the end of the paper.

Presentation of Results

(i) Field key to Associations: Mapping on any scale precludes showing small areas of an association on the map. These "inclusions" are difficult to describe but their existence can be noted in a tabular description. A more important consequence of inclusions is that the map may appear incorrect at a given location. For example, a user may be in an inclusion of *Drypetes-Cryptocarya* forest within what is mapped as palm forest of *Howea forsterana*. The key to vegetation allows a user to name a given stand independently from the map and retrieve the information in the vegetation tables.

(ii) Vegetation tables: Küchler (1967) and Whittaker (1973) have adequately reviewed the methods of describing vegetation but only Küchler pays attention to the presentation of results. A major weakness of prose descriptions of vegetation is elegantly described by Küchler (1967, 143) "A beautiful and eloquent description may be highly readable, and each individual aspect, thus described, can be visualized by the reader. But the usual subjective approach emphasizes one aspect here another there." Tabular descriptions are very common in the literature of terrain evaluation (e.g. Stewart, 1968; Mitchell, 1973). The main advantage is direct comparability of data and quick reference. Tabular descriptions have been successfully used by Boyland (1974) to describe vegetation as part of a wider terrain evaluation program. Independently I developed a tabular method for Lord Howe Island, based primarily on methods used by Grant (1975a, b).

The table forms the basis of the description of the vegetation associations erected during the survey. Each table presents a summary and the ranges of the data relevant to each association. This, together with the photograph, should be sufficient to give an adequate picture of the unit. Each association is fully described in the vegetation table, but relations between the units are difficult to perceive in that table. The complete hierarchy is set out in Table 4.

RESULTS

Key to Vegetation Associations

Users must distinguish between occurrences of individuals of a species and the occurrence of a vegetation association. For example, *Lagunaria patersonia* forms communities of Broad Orthophyll Swamp Forest on low-lying flats. Individuals and clumps occur also at the base of the cliffs at the southern end of Mount Lidgbird, but in this case *L. patersonia* is an integral segment of the flora of the *Dracophyllum fitzgeraldii-Metrosideros nervulosa* Association.

KEY

1. Closed vegetation, crowns or peripheries of plants mostly touching or overlapping.
2. Trees dominant. EVERGREEN CLOSED FOREST Formation
3. Dominated by generally straight trees and/or palms and/or pandans without extensive development of non-vascular epiphytes.
4. Dominated by trees with orthophyllous leaves generally much less than 250 mm long.
5. Forest on well-drained soils, lianes variable but abundant. Generally many tree and shrub species present. RAINFOREST Subformation

TABLE 4

Conspectus of associations

Formation	Subformation	Alliance	Association	Symbol
CLOSED FOREST	Rainforest	*DRYPETES-CRYPTOCARYA*	*Drypetes australasica-Cryptocarya triplinervis*	DaCt
			Drypetes australasica-Cryptocarya triplinervis exposed variant	DaCtx
			Drypetes australasica calcarenite variant	DaC
		CLEISTOCALYX-CHIONANTHUS	*Cleistocalyx fullagari*	Cf
			Chionanthus quadristamineus	Cq
			Lowland Mixed Forest	LM
		CRYPTOCARYA GREGSONII	*Cryptocarya gregsonii*	Cg
	Broad Orthophyll Swamp Forest	*LAGUNARIA*	*Lagunaria patersonia*	Lp
	Megaphyllous Broad Sclerophyll Forest	*HOWEA*	*Howea forsterana*	Hf
			Howea belmoreana	Hb
		HEDYSCEPE	*Hedyscepe canterburyana*	Hc
		PANDANUS	*Pandanus forsteri*	Pf
	Gnarled Mossy Forest	*BUBBIA-DRACOPHYLLUM*	*Bubbia howeana-Dracophyllum fitzgeraldii*	BhDf
CLOSED SCRUB	Broad Orthophyll Scrub	*BOEHMERIA-MACROPIPER*	*Boehmeria calophleba-Macropiper excelsum* var. *psittacorum*	BcMep
	Broad Sclerophyll Swamp Scrub	*AEGICERAS*	*Aegiceras corniculata*	Ac
	Narrow Sclerophyll Scrub	*MELALEUCA-CASSINIA*	*Melaleuca howeana*	Mh
			Cassinia tenuifolia	Ca
	Broad Sclerophyll Scrub	*DODONAEA*	*Dodonaea viscosa*	Dv
		DRACOPHYLLUM-METROSIDEROS	*Dracophyllum fitzgeraldii-Metrosideros nervulosa*	DfMn
DWARF SCRUB	Orthophyll Dwarf Scrub	*ATRIPLEX*	*Atriplex cinerea*	Ax
OPEN SCRUB	Broad Sclerophyll Swamp Scrub	*AVICENNIA*	*Avicennia marina* var. *australis*	Ama
BROAD LEAVED HERB VEGETATION		*IPOMOEA-CARPOBROTUS*	*Ipomoea cairica-Carpobrotus glaucescens*	IcCg
			Mixed Fern and Herb	MFH
TALL GRASS	Sclerophyll Tall Grass	*CYPERUS*	*Cyperus lucidus*	Cl
SHORT GRASS	Orthophyll Short Grass	*POA*	*Poa poiformis*	Pp
CLOSED AND OPEN SUBMERGED MEADOW	Submerged Meadow	*ZOSTERA-HALOPHILA*	*Zostera capricorni-Halophila ovalis*	ZcHo
PHYSIOGRAPHIC UNITS	Cliffs Coral Sand and Beach Basalt Boulder Beach Calcarenite Coral Boulder Beach			
DISTURBED AREAS				

6. Low to mid-height forest (6–9 m), generally dominated by *Drypetes australasica* and *Cryptocarya triplinervis*. Plank buttresses rare; leaves orthophyllous or ± sclerophyllous, microphyll and notophyll. Occupying a variety of habitats on basalt and aeolian calcarenite from sea level to 400 m but generally below 220 m elevation. *DRYPETES-CRYPTOCARYA* Alliance

7. Forest of variable height dominated by *Drypetes australasica* usually with *Cryptocarya triplinervis* as co-dominant. On a variety of sites but not subject to extremes of exposure or substrate.
Drypetes australasica-Cryptocarya triplinervis Association DaCt

7.* Low forest dominated by *Drypetes australasica; Cryptocarya triplinervis* present but not co-dominant. Shrubs abundant, lianes present, leaves sclerophyllous, microphyll with some notophyll. Occupying sites subject to environmental extremes.

8. Scrubby communities on exposed sites.
Drypetes australasica-Cryptocarya triplinervis exposed facies DaCtX

8.* Scrubby communities of steep outcrops of aeolian calcarenite.
Drypetes australasica calcarenite facies DaCtC

6.* Mid-height to tall forest (to 15 m) generally dominated by *Cleistocalyx fullagari, Chionanthus quadristamineus,* or *Cryptocarya gregsonii*. Plank buttresses occasional to common; leaves more orthophyllous particularly of understorey, leaves microphyll to megaphyll but chiefly notophyll and mesophyll. Occupying sites chiefly in the southern mountains generally up to 450 m elevation but some stands up to 610 m.

9. Dominated by *Cleistocalyx* and/or *Chionanthus* or with a range of dominants (excluding *Cryptocarya gregsonii*). Chiefly in the southern mountains up to 450 m elevation. *CLEISTOCALYX-CHIONANTHUS* Alliance

10. Tall monotypic forest of *Cleistocalyx fullagari* to 15 m, plank buttresses abundant, lianes occasional, with leaves generally notophyll.
Cleistocalyx fullagari Association Cf

10.* Mid-height (5–15 m); mixed forest, plank buttresses occasional.

11. Forest dominated by *Chionanthus quadristamineus,* often monotypic but commonly mixed. Trees with large (>20 mm diameter) fruits common; thick robust lianes common, few shrubs, palms common. On scree of large boulders with deep interstices. *Chionanthus quadristamineus* Association Cq

11*. Forest with no single dominant. On low-angle sheltered sites, particularly in southern mountains. Multistratal, many shrubs.
Lowland Mixed Forest LM

9*. Dominated by *Cryptocarya gregsonii,* on steep basaltic soils around the southern end of Mount Lidgbird between 350 and 660 m elevation.
CRYPTOCARYA GREGSONII Alliance
Cryptocarya gregsonii Association Cg

5*. Forest on low-lying poorly drained coal sand or aeolian calcarenite flats. Generally monotypic and dominated by *Lagunaria patersonia,* no shrubs present.
BROAD ORTHOPHYLL SWAMP FOREST Subformation
LAGUNARIA Alliance
Lagunaria patersonia Association Lp

4*. Dominated by palms and/or pandans with sclerophyllous leaves much longer than 250 mm.
MEGAPHYLLOUS BROAD SCLEROPHYLL FOREST Subformation

12. Palms dominant, either on aeolian calcarenite, coral sand or basalt.

13. Dominated by *Howea* spp. Generally lowland, but stands occur up to 360 m; on either aeolian calcarenite, coral sand or basalt. Non-vascular epiphytes rare, ferns common. *HOWEA* Alliance

14. Dominated by *Howea forsterana;* widespread on lowlands and up to 360 m, on either aeolian calcarenite, coral sand or basalt, if the latter then generally low-angle sites. Forest up to 20 m high, generally 15 m; emergents in patches up to 25 m high, understorey density and composition very variable.
Howea forsterana Association Hf

14*. Dominated by *Howea belmoreana;* less common on lowlands, restricted to the northern hills and southern mountains up to 250 m elevation, on basalt, often on screc slopes. Forest up to 12 m high with few or no emergents. Understorey generally sparse and scattered. *Howea belmoreana* Association Hb

13*. Dominated by *Hedyscepe canterburyana.* Lower montane, between 335 and 830 m elevation and generally above 610 m; always on basalt, generally stony and wet soil, often on high-angle sites. Low forest to 8 m high with dense understorey. Non-vascular epiphytes and ferns abundant.
HEDYSCEPE Alliance
Hedyscepe canterburyana Association Hc

12*. Pandans and mesic trees dominant, always on basalt, generally in moist sheltered gullies and valleys, from sea level to 150 m elevation. Generally on low-angle sites with impeded drainage but some stands are on sites with slopes >20°. Shrubs and small trees sparse, herbs sparse. *PANDANUS* Alliance
Pandanus forsteri Association Pf

3*. Dominated by generally gnarled trees and straight palms, with extensive development of non-vascular epiphytes. Dominated by *Bubbia howeana* and *Dracophyllum fitzgeraldii.* Never found below 750 m elevation.
GNARLED MOSSY FOREST Subformation
BUBBIA-DRACOPHYLLUM Alliance
Bubbia howeana-Dracophyllum fitzgeraldii Association BhDf

2*. Trees not dominant.

15. Shrubs and dwarf shrubs dominant.

16. Shrubs >1.5 m high dominant.
CLOSED EVERGREEN SCRUB Formation

17. Orthophyll shrubs dominant. High altitude community, multiple stems prominent, tree ferns abundant, filmy ferns and terrestrial mosses abundant. Dominated by *Boehmeria calophleba* and *Macropiper excelsum* var *psittacorum* generally restricted to above 610 m elevation.
BROAD ORTHOPHYLL SCRUB Subformation
BOEHMERIA-MACROPIPER Alliance
Boehmeria calophleba-Macropiper excelsum var *psittacorum* Association BcMep

17*. Sclerophyll shrubs dominant.

18. Dominated by broad-leaved shrubs.

19. Dominated by mangroves, dense scrub communities in tidal estuaries. One layer only. *Aegiceras corniculata* dominant and monotypic, pneumatophores rare, some invasion by herbs at fringes. Dense canopy to 4.5 m. Disturbed stands are virtually open scrub and have mid-dense field layer of succulent herbs.
BROAD SCLEROPHYLL SWAMP SCRUB Subformation
AEGICERAS Alliance
Aegiceras corniculata Association Ac

19*. Not dominated by mangroves; scrub communities of variable density on steep slopes, more than one layer.
BROAD SCLEROPHYLL SCRUB Subformation

20. Dominated by *Dodonaea viscosa*. Rather sparse closed scrub to 5 m high with dense sedge understorey. Leaf size mesophyll. On basalt sites between 30 and 300 m elevation. Few other shrub species present.

DODONAEA Alliance
Dodonaea viscosa Association Dv

20*. No single dominant. Dense but variable scrub to 6.5 m high with fern and herb understorey. Leaf size very variable, from megaphyll to nanophyll. On basalt sites between 340–610 m elevation and generally between 380–530 m. Many shrub species present, palms and tree-ferns conspicuous.

DRACOPHYLLUM-METROSIDEROS Alliance
Dracophyllum fitzgeraldii-Metrosideros nervulosa Association DfMn

18*. Dominated by shrubs with narrow nanophyll leaves.

CLOSED EVERGREEN SCLEROPHYLL SCRUB Formation
GREEN MICROPHYLLOUS EVERGREEN SCRUB/NARROW SCLEROPHYLL SCRUB Subformation
MELALEUCA-CASSINIA Alliance

21. Dominated by *Melaleuca howeana*. Dense scrub to 4 m high, but occasionally to 6 m, with even surface, generally appearing dark green. On exposed sites, both basalt and calcarenite, usually <150 m elevation.

Melaleuca howeana Association Mh

21*. Dominated by *Cassinia tenuifolia*. Dense scrub to 5 m with uneven surface, generally appearing light blue or grey. On exposed basalt sites, usually <150 m elevation. *Cassinia tenuifolia* Association Ca

16*. Dwarf shrubs <1.5 m high dominant. Dense communities to 1 m high on unstable talus material below Malabar and at Middle Beach. Dominated by *Atriplex cinerea*, some grass present.

DWARF SCRUB Formation
ORTHOPHYLL DWARF SCRUB Subformation
ATRIPLEX Alliance
Atriplex cinerea Association Ax

15*. Herbs and graminoids dominant.

22. Dominated by broad-leaved herbs.

BROAD-LEAVED HERB Formation
EVERGREEN BROAD-LEAVED WEEDY VEGETATION Subformation

23. Dominated by twiners and herbs: *Ipomoea cairica, Carpobrotus glaucescens* and *Commelina cyanea*. On coastal cliffs and off-shore islands, very exposed sites. *IPOMOEA-CARPOBROTUS* Alliance
Ipomoea cairica-Carpobrotus glaucescens Association IcCg

23*. No single dominant although ferns prominent. Generally at bases of cliffs in southern mountains, also on landslide scars.

MIXED FERN AND HERB Alliance
Mixed Fern and Herb Association MFH

22*. Not dominated by broad-leaved herbs.

24. Dominated by grass or graminoids.

25. Dominated by graminoids taller than 1 m. Dominated by sclerophyllous sedges with erect leaves narrower than 5 cm. Dominated by *Cyperus lucidus*, in a variety of sites generally of low elevation and close to coast.

TALL GRASS Formation
SCLEROPHYLL TALL GRASS Subformation
CYPERUS Alliance
Cyperus lucidus Association Cl

25*. Dominated by orthophyllous grasses, less than 1 m tall, generally weeping.

Dominated by *Poa poiformis,* exposed sites at low elevations close to coast and generally within reach of salt spray.

SHORT GRASS Formation
ORTHOPHYLL SHORT GRASS Subformation
POA Alliance
Poa poiformis Association Pp

24*. Dominated by *Zostera capricorni* and *Halophila ovalis* on floor of lagoon.
CLOSED SUBMERGED MEADOW Formation
SUBMERGED MEADOW Subformation
ZOSTERA-HALOPHILA Alliance
Zostera capricorni-Halophila ovalis Association ZcHo

1*. Open or sparse vegetation, crowns or peripheries of plants mostly not touching.

26. Generally dominated by *Cryptocarya gregsonii,* on steep basaltic soils in southern mountains between 350 and 610 m elevation. Tree layer open although scrub layer may be closed. OPEN FOREST Formation
CRYPTOCARYA GREGSONII Alliance
Cryptocarya gregsonii Association Cg

(Open phases of other forests are not separated from the more common closed phases.)

26*. Dominated by *Avicennia marina* var. *australasica* in shingle and mud on shore of Hunter Bay. OPEN SCRUB Formation
BROAD SCLEROPHYLL SWAMP SCRUB Subformation
AVICENNIA Alliance
Avicennia marina var. *australasica* Association Ama

Vegetation Table

Each association in the Vegetation Table is described over two pages where the information is arranged in a series of blocks. I have tried to present the descriptions in a systematic manner to facilitate comparison of associations and retrieval of information. Although much of the table is self-explanatory the following notes will help in some sections.

BLOCK 1. FORMATION. The hierarchy used is listed in Table 4. The **formation** and **subformation** to which each association belongs was determined using Fosberg's (1967) key. The **number** is the number of the subformation in Fosberg's structural classification. It is included here to facilitate comparison with other areas. The **alliance** is the highest floristic category used in this paper. The name gives the alliance to which the association has been assigned.

BLOCK 2. NAME. The full name of the **association** is given. The **symbol** is generally formed from the initial letters of the generic and specific names of the dominants. It is used elsewhere in the table and on the vegetation map. The **area** was estimated using a dot grid laid over the map. **Oliver equivalent** is the name (if any) of the association described by Oliver (1917) which best applies to the unit(s) erected here. The **UNESCO equivalent** to the formation and subformation of Fosberg (1967) is listed to allow comparison with other areas where the UNESCO (1973) system has been used. Although the UNESCO system was designed for scales of 1:1 million and smaller, the formations on Lord Howe are sufficiently dissimilar to allow its use at a scale of 1:15 840.

BLOCK 3. PHYSIOGRAPHY. A general description of the type of site the association usually occupies. This is described in the following order: altitude, aspect, slope, exposure and position on slope. The last is an indication of the topographic position of the association on a scale: top, shoulder, upper-, mid-, lower- and toe-slopes and flats. Other categories, for example, cliffs are self-explanatory. The usual **geological substrate** of the association is briefly described. Similarly, **soil** features are listed. The abbreviations follow Northcote (1971). Other relevant data are also listed.

BLOCK 4. MAP. The shaded area shows the distribution of the association. The **photograph** shows a typical stand of the community (also see the photographs listed in Block 10).

BLOCK 5. STRUCTURE. These are typical values for the community. **Basal area** values are mostly single results measured using glass prisms (Dillworth & Bell, 1974) calibrated in sq ft/ac and converted to sq m/ha. **Emergents** are defined as outstanding plants whose crowns are exposed on all sides above the main canopy (Webb *et al.,* 1976). Their **distribution** is described on a four point scale: scattered, very scattered, occasional and none. The **canopy** is the more or less continuous leafy layer formed by the crowns of the tallest plants which touch or almost touch one another (Webb *et al.,* 1976). The **surface** of the canopy is described on a scale of roughness, as follows: smooth, even (variation in height <¼ of total height), uneven (variation in height >¼ of total canopy height). Webb *et al.,* (1976) use and illustrate a similar scale. **Cover** is a four-point scale to describe the density of the main canopy: closed (adjacent crowns are touching or overlapping), dense (the average space between crowns is less than the diameter of the crowns), mid-dense (average spacing is greater than one crown diameter), sparse (average spacing is greater than two crown diameters), and open (average spacing is much greater than two crown diameters). **Strata number** are frequently difficult to recognize, and I doubt their value in descriptions. However, I have included them as an index of vertical complexity of the associations. **Boundaries** refers to the nature of the boundaries between the strata i.e., their distinctiveness. **Composition** of the strata is described in conventional terms. The **ground vegetation** is defined as less than 1 m high. In low formations, for example, Short Grass, this is equivalent to the canopy. The **density** is described in general terms and the **composition** noted. **Special life-forms** is something of a misnomer but includes such types as pandans, palms, lianes and epiphytes. To call palms on Lord Howe Island 'special' is incorrect because they occur over most of the island and dominate some 18 per cent of the vegetation.

BLOCK 6. STRUCTURAL FEATURES OF CANOPY PLANTS. The features listed are useful in describing a community and have been used successfully, both subjectively (Webb 1959, 1968; Pickard 1974, 1978) and objectively (Webb *et al.* 1970, 1976; Pickard 1978), to classify rainforest and other vegetation. The **life-form** of the plant making up the canopy is listed. The **density** and **shape** of the **crown** is described in general terms. The lowest **position of branches** on the stems is described using the following scale (illustrated in Webb *et al.,* 1976): uppermost top, upper third, about half-way down stem, more than half-way down stem, and at or near the base of the stem. The angle the branches make with the stem is crudely described under **"type"** as either horizontal or divergent. **Stems** are described rather simply in terms of their straightness: straight, crooked, leaning, bent at base and branchy. **Bark** textures grade into one another in the field, but one form or other is frequently more prominent in the community. Six types are common on Lord Howe Island: smooth and glassy, smooth with fine cracks, smooth but with small spikes, flaky in patches, rough and flaky, and fibrous. **Roots** are described as 'normal' if there is no sign of swelling or buttresses at the base of the stem. Five other categories are used: slight swelling at the base of the stem, spur buttresses, plank and other large buttresses, stilt roots, and surface spreading roots. **Leaf size** is estimated in the five classes of Webb (1968): nanophyll (<2.5 cm long), microphyll (2.5–7.5 cm long),

notophyll (7.5–12.5 cm long), mesophyll (12.5–25 cm long) and megaphyll (>25 cm long). Leaf **shape** is classed into broad, linear and narrow; **margins** into entire, toothed and dissected. Leaf **texture** classes follow Fosberg (1967): sclerophyll, leathery, orthophyll and succulent.

BLOCK 7. DISTURBANCE. Many communities are disturbed to varying degrees. This is more fully described in the text and only summmarized here. The disturbing **agent** is listed and the **degree** of disturbance noted. This refers to both the whole community as well as individual stands. The main **locations** of disturbance are described in regional terms. The nature of the disturbance and other relevant information are listed also.

BLOCK 8. FLORISTICS. The common species in each life-form category are listed. If a species which normally grows to be a tree occurs as a shrub or small tree in the community, it is listed under the latter. Naturalized species are indicated with an asterisk(*).

BLOCK 9. INCLUSIONS. The presence of any inclusions of other communities is noted using the symbol of the relevant association. The **relationship** of the association to other communities is briefly noted, again using the symbols. **Boundaries** between communities in the field are frequently not as abrupt as the boundaries on the map imply; they are more realistically described here.

BLOCK 10. OTHER DATA. Any other relevant information is listed. Under **sites** are listed the numbers of the sites used in the objective survey (Pickard 1978, unpublished data) on which the community occurs. Similarly, the numbers of sites which support disturbed vegetation are listed. Any **photographs** of the association used as Figures in the text are listed.

Abbreviations: n.a. not applicable
n.d. not determined

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest

Number: 1A1.1 Alliance: DRYPETES-CRYPTOCARYA

DRYPETES AUSTRALASICA—CRYPTOCARYA TRIPLINERVIS

Symbol: DaCt Area: 355 ha, 23.4%

Oliver equivalent: Lowland low forest *Hemicyclia australasica [Drypetes australasica]* Association

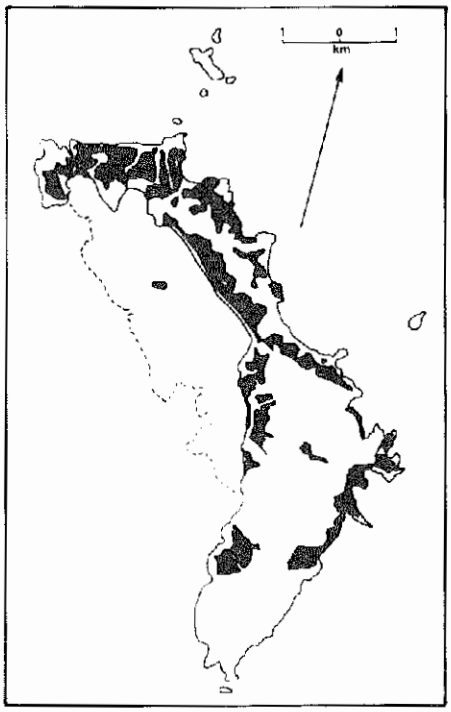
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4a

PHYSIOGRAPHY

Generalized site description: Altitude 0–400 m, generally <220 m; all aspects, common on S and W; 0°–50° slope; exposure moderate to low; top to toe-slope and flat.

Geology: Basalt and calcarenite and recent coral sand

Soil: Variable, Uf



Georges Bay Ridge, E of Boat Harbour. Altitude 60 m.

STRUCTURE Basal area: 717 sq m/ha

Emergents Height:20 m Distribution: Occasional, patches

Canopy Height:13 m Surface: Variable
Cover: Dense-sparse Strata number: 4 Boundaries : Diffuse
Composition: Trees, small trees, shrubs, herbs.

Ground vegetation (<1 m) Density: Variable
Composition: Herbs, sedges, creepers.

Special life-forms: Pandans variable, from absent to abundant; palms variable; lianes common; vascular epiphytes occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Dense
Type: Divergent

Shape: Round
Stem: Straight

Branch position: Upper third and half

Bark: Smooth, fine cracks

Roots: Normal, slight swelling

Leaf size: Notophyll
Texture: Sclerophyll, leathery

Shape: Broad

Margin: Entire

DISTURBANCE

Agent: Pigs, goats, man

Degree: 0–100%

Location: Various—pigs on Fern Patches, goats on Northern Hills, man on lowlands.

Pigs—rooting up of herbs etc.; goats—localised only; man—all forms of clearing, grazing of domestic stock.

FLORISTICS (common species only)

Trees
Cryptocarya triplinervis
Drypetes australasica
Elaeodendron curtipendulum
Howea belmoreana
Howea forsterana
Lagunaria patersonia
Olea paniculata
Pandanus forsteri

Shrubs
Cassinia tenuifolia
Myoporum insulare
Rapanea spp.
Xylosma spp.

Lianes
Malaisia scandens
Smilax australis

Herbs
Commelina cyanea

Sedges
Carex hattoriana

Ferns
Adiantum hispidulum
Asplenium oblongifolium

INCLUSIONS: Small areas of most recorded units.

Relationship to other units: Structurally to Cf, Lg and LM;
floristically to Hf, Hb and other forests.

Boundaries: Generally merge with most adjoining units especially Ca, Mh, DaCtX etc.

OTHER DATA

Lowest recorded basal area 435 sq m/ha, highest 1132 sq m/ha.
As the unit is very variable, the values of the parameters and descriptors may not be typical of individual sites and stands.

Sites: 2, 8, 18, 23, 32, 34, 46, 47, 53, 60.

Disturbed sites: 42, 49, 54, 55, 71.

Photographs: 29, 30, 31, 33, 34, 37, 38, 39, 40, 43, 45, 46, 49, 50.

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest-Mesophyllous Forest

Number: 1A1.1–1B1.4a Alliance: DRYPETES-CRYPTOCARYA

DRYPETES AUSTRALASICA—CRYPTOCARYA TRIPLINERVIS EXPOSED FACIES

Symbol: DaCtX Area: 62 ha, 4.1%

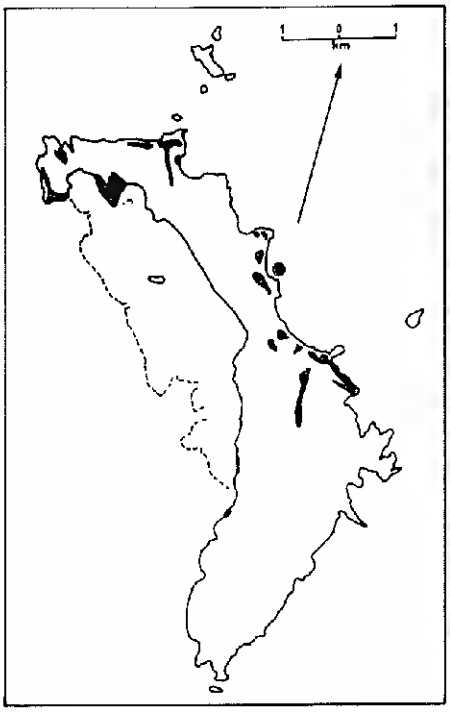
Oliver equivalent: Hill scrub *Hemicyclia australasica [Drypetes australasica]* Association

UNESCO equivalent: Subtropical ombrophilous lowland forest IA4.a; evergreen broad-leaved sclerophyll thicket IIA1.d

PHYSIOGRAPHY

Generalized site description: 0–250 m, generally <210 m; all aspects; low slope to 30°; very exposed; ridge summits and cliff tops.

Geology: Basalt Soil: Stony surface of angular to subround basalt rocks c.150 mm.



Side of Dawsons Point Ridge above Wedding Lilies. Altitude 60 m.

STRUCTURE Basal area: 639 sq m/ha

Emergents Nil

Canopy Height: 2–4 m Surface: Even
Cover: Closed Strata number: 2 Boundaries: Sharp, distinct
Composition: Small trees, herbs; occasionally a shrub layer is present.

Ground vegetation (<1 m) Density: Mid-dense
Composition: Grasses, sedges, herbs and creepers.

Special life-forms: Vascular epiphytes common, lianes abundant, small palms occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Dense
Type: Divergent

Shape: Round-flat Branch position: More than half
Stem: Erect, usually short

Bark: Smooth, fine cracks

Roots: Normal, surface

Leaf size: Micro-, some notophyll
Texture: Sclerophyll

Shape: Broad Margin: Entire

DISTURBANCE

Agent: Goats

Degree: Low

Location: Cliff edges in Northern Hills.

This disturbance is of local impact only. It is typified by destruction of trees and shrubs and growth of introduced plants.

FLORISTICS (common species only)

Trees
Baloghia lucida
Cryptocarya triplinervis
Drypetes australasica
Elaeodendron curtipendulum
Lagunaria patersonia

Shrubs
Alyxia ruscifolia
Cassinia tenuifolia
Dodonaea viscosa
Leucopogon parviflorus
Pimelea congesta

Lianes
Jasminum didymum
Smilax australis

Herbs
Commelina cyanea

Sedges
Carex hattoriana
Scirpus nodosus

INCLUSIONS: Some Ca, Mh and Cliff.

Relationship to other units: Close to Ca, Mh and DaCt.

Boundaries: Merges with Ca, DaCt and Cliff.

OTHER DATA

Some local occurrences of rare plants; *Koeleria phleoides, Cheilanthes distans, Plectorrhiza erecta, Pyrrosia confluens* and *Dianella intermedia.*
Some very stunted forms (e.g. slopes of Mount Eliza) have the appearance of scrub but have affinities with DaCtX.

Sites: 26, 53, 59, 60, 63, 68.

Disturbed sites: Nil.

Photograph: 25.

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest
Number: 1A.1 Alliance: DRYPETES-CRYPTOCARYA

DRYPETES AUSTRALASICA CALCARENITE FACIES

Symbol: DaCtC Area: 2 ha, 0.1%

Oliver equivalent: Lowland low forest *Hemicyclia australasica [Drypetes australasica]* Association.

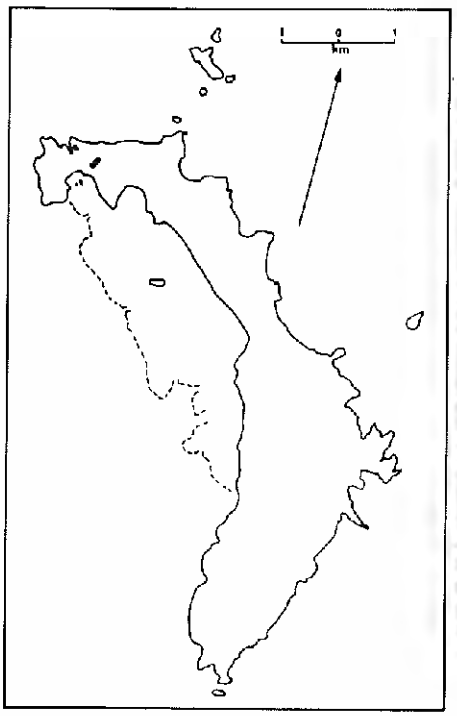
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a

PHYSIOGRAPHY

Generalized site description: 15–70 m altitude, S and W aspect; slope 5° to cliffs, generally 10°–30°; ± zero to very exposed; on ridge top and top-slope.

Geology: Calcarenite Soil: Stony, probably Uc

Other: Many outcrops of calcarenite, surface littered with plates and blocks of calcarenite.



Ridge above The Pulpit, North Beach area. Altitude 40 m.

STRUCTURE Basal area: 350 sq m/ha

Emergents Nil

Canopy Height: 4 m Surface: Smooth
Cover: Mid-dense Strata number: 2 Boundaries: Sharp
Composition: Small trees and herbs. Shrubs abundant in exposed sites.

Ground vegetation (<1 m) Density: Sparse
Composition: Herbs, sedges and twiners.

Special life-forms: Lianes prominent locally.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Mid-dense
Type: Divergent

Shape: Round Branch position: Upper half
Stem: Straight-crooked

Bark: Smooth

Roots: Normal and surface spreading

Leaf size: Notophyll
Texture: Sclerophyll, leathery

Shape: Broad Margin: Entire

Many stems are light in colour.

DISTURBANCE

Agent: —

Degree: Virtually nil.

Location: —

FLORISTICS (common species only)

Trees
Cryptocarya triplinervis
Drypetes australasica
Elaeodendron curtipendulum
Howea forsterana
Planchonella myrsinoides

Shrubs
Alyxia ruscifolia
Cassinia tenuifolia
Myoporum insulare
Pimelea congesta

Lianes
Smilax australis

Grasses & Sedges
Carex hattoriana
Oplismenus imbecillus

INCLUSIONS: Nil.

Relationship to other units: Scrubbier phases close to Ca and Mh; entire unit close to DaCt; close to DaCtX although fewer shrubs.

Boundaries: Sharp to Cf; diffuse to DaCt.

OTHER DATA

This is a facies of DaCt restricted by the nature of the substrate and exposure.

Sites: Nil.

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest

Number: 1A1.1 Alliance: CLEISTOCALYX-CHIONANTHUS

CLEISTOCALYX FULLAGARI

Symbol: Cf Area: 126 ha, 8.3%

Oliver equivalent: Upland high forest *Acicalyptus Fullagari [Cleistocalyx fullagari]* Association

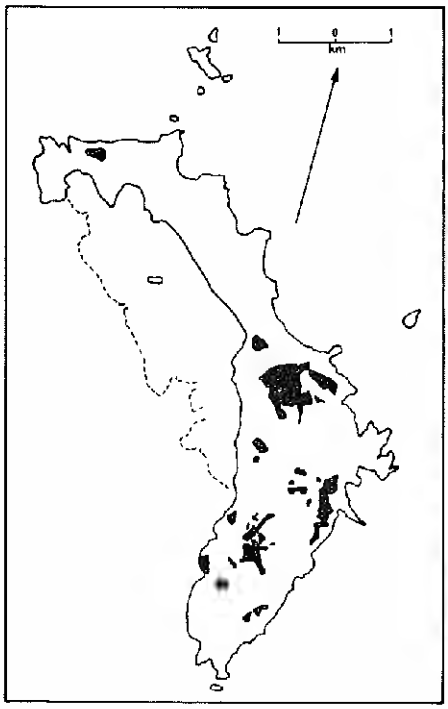
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a

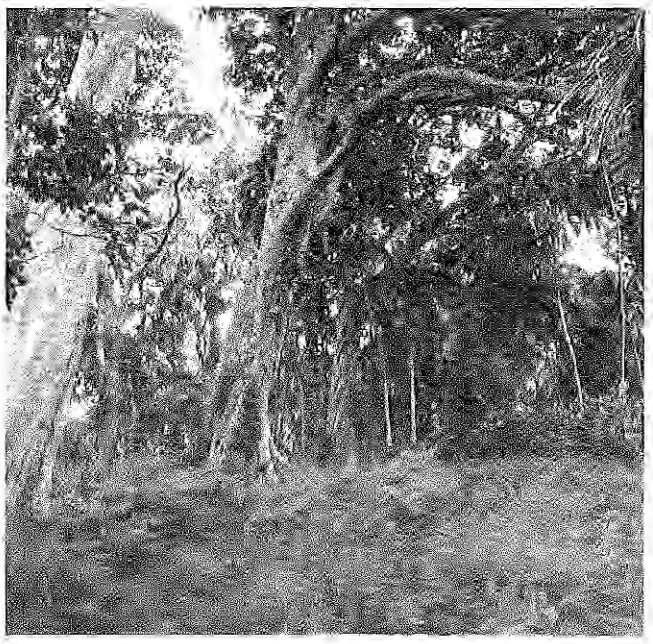
PHYSIOGRAPHY

Generalized site description: Altitude 0–490 m; E, N and W aspects; slopes 5°–35°; moderately exposed; mid- and top-slopes, rarely on toe-slope.

Geology: Basalt Soil: Stony

Other: Only found on screes of large boulders if interstices are soil-filled.





W foot of Intermediate Hill.
Altitude 16 m.

STRUCTURE Basal area: 850 sq m/ha

Emergents Height: 13 m Distribution: Scattered, patches

Canopy Height: 12 m Surface:Even
Cover: Closed Strata number: 3 Boundaries: Reasonably sharp
Composition: Trees, small trees, herbs.

Ground vegetation (<1 m) Density: Mid-dense
Composition: Sedges, creepers and ferns.

Special life-forms: Lianes occasional, tree-ferns occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS — Life-form: Tree

Crown density: Mid-dense to dense
Type: Divergent
Shape: Slightly flat on top.
Stem: Straight and leaning
Branch position: Upper half

Bark: Flaky in patches
Roots: Large plank buttresses

Leaf size: Notophyll
Texture: Sclerophyll
Shape: Broad
Margin: Entire

Dead wood common in crowns.

DISTURBANCE — Agent: Man, pigs

Degree: Low to severe

Location: Transit Hill, Erskine Valley.

Pigs rooting disrupt ground cover leaving a ± bare soil surface.

FLORISTICS (common species only)

Trees
Chionanthus quadristamineus
Cleistocalyx fullagari
Guioa coriacea
Howea belmoreana

Small trees
Bubbia howeana
Randia stipulosa

Sedges
Carex hattoriana

Ferns
Pteris microptera

INCLUSIONS: Some Cq, LM and Hb.

Relationship to other units: Close to Cq with which it may merge.

Boundaries: Generally very sharp but may merge into DfMn and LM.

OTHER DATA

Stands of Cf generally project above adjacent communities.

Sites: 7, 24, 36, 38, 39, 45, 67.

Disturbed site: 43.

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest

Number: 1A1.1 Alliance: CLEISTOCALYX-CHIONANTHUS

CHIONANTHUS QUADRISTAMINEUS

Symbol: Cq Area: 93 ha, 6.1%

Oliver equivalent: Mountain low forest *Notelaea quadristaminea [Chionanthus quadristamineus]* Association

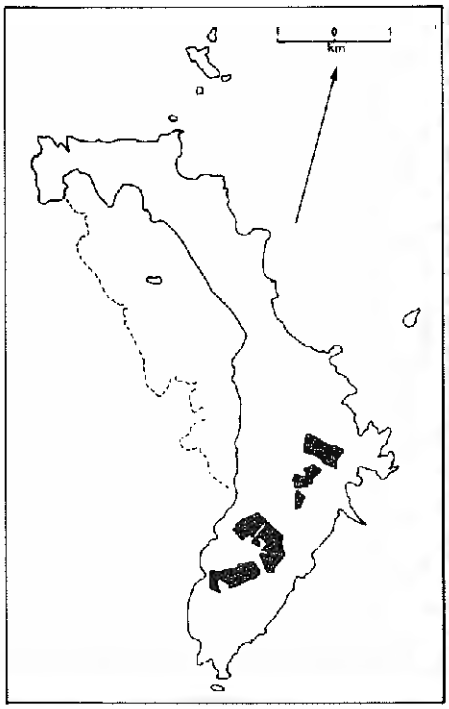
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a

PHYSIOGRAPHY

Generalized site description: Altitude 75–450 m; all aspects; slope 10°–30°; low to moderate exposure; mid-slope and in some gullies.

Geology: Basalt Soil: Unknown, very stony

Other: Common scree of large boulders (0.5–3 m) with deep interstices.



N side of Erskine Valley.
Altitude 400 m.

STRUCTURE Basal area: n.d.

Emergents: Nil

Canopy Height: 10 m Surface: Even-uneven
Cover: Mid-dense Strata number: 3 Boundaries: Sharp-diffuse
Composition: Trees, small trees, herbs.

Ground vegetation (<1 m) Density: Variable
Composition: Ferns, sedges, creepers, mosses.

Special life-forms: Lianes abundant, hummock-forming mosses may be locally common on surfaces of boulders.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Mid-dense
Type: Divergent

Shape: Round
Stem: Crooked

Branch position: Upper half

Bark: Smooth

Roots: Unknown

Leaf size: Mesophyll
Texture: Leathery

Shape: Broad

Margin: Entire

Large woody fruits.

DISTURBANCE

Agent: Pigs

Degree: Low to moderate

Location: Southern mountains.

Although surface soil is sparse and shallow between the boulders, pigs root up ferns and sedges.

FLORISTICS (common species only)

Trees
Chionanthus quadristamineus
Dracophyllum fitzgeraldii
Howea belmoreana
Symplocos candelabrum

Small trees
Bubbia howeana
Dysoxylum pachyphyllum

Shrubs
Coprosma spp.

Lianes
Flagellaria indica
Malaisia scandens

Ferns
Cyathea spp.
Histiopteris incisa
Microsorium howense
Pteris microptera

INCLUSIONS: Hb, Cf, DaCt, DfMn and LM.

Relationship to other units: Appears floristically distinct although the closest affinities are with Cf.

Boundaries: Sharp-diffuse.

OTHER DATA

Generally the dominant vegetation on large boulder screes, with little soil material, in Erskine Valley and the southern mountains in general.

Sites: 11, 12, 19.

FORMATION: Evergreen Closed Forest SUBFORMATION: Rainforest

Number: 1A1.1 Alliance: CLEISTOCALYX—CHIONANTHUS

LOWLAND MIXED FOREST

Symbol: LMF Area: 192 ha, 12.6%

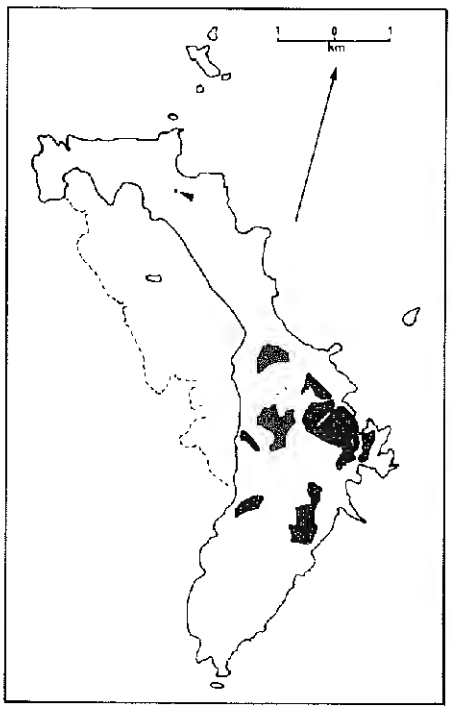
Oliver equivalent: Nil

UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a

PHYSIOGRAPHY

Generalized site description: Altitude 30–375 m; E and W aspects, although also on N and S; slope variable 0°–40°; exposure moderate to low; mid-slope to valley bottom, occasionally on top-slope.

Geology: Basalt Soil: Very stony, probably Uf



Peach Tree Ridge, W of Intermediate Hill.
Altitude 150 m.

STRUCTURE Basal area: 740 sq m/ha

Emergents Height: 20 m Distribution: Occasional or rare

Canopy Height: 7–13 m Surface: Even-uneven
Cover: Mid-dense Strata number: 3 Boundaries: Diffuse
Composition: Trees, small trees, herbs. Shrubs usually uncommon.

Ground vegetation: (<1 m) Density: Dense
Composition: Seedlings, herbs, sedges and creepers.

Special life-forms: Pandans common; palms common; lianes and epiphytes common.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Mid-dense
Type: Divergent

Shape: Variable
Stem: Erect, straight

Branch position: Upper half

Bark: Variable, usually smooth

Roots: Normal, some spurs, planks and stilts

Leaf size: Micro- to megaphyll
Texture: Orthophyll and sclerophyll

Shape: Broad

Margin: Entire

Compound leaves occasional, driptips occasional.

DISTURBANCE

Agent: Pigs

Degree: Low to severe

Location: Erskine Valley, Fern Patches, valley of Rocky Run.

The effect is variable. In extreme cases the pigs leave a loose mobile soil surface littered with pebbles after killing the ferns and sedges.

FLORISTICS (common species only)

Trees
Cleistocalyx fullagari
Euodia polybotrya
Guioa coriacea
Hedyscepe canterburyana
Howea belmoreana
Olea paniculata
Pandanus forsteri

Small trees
Bubbia howeana
Coprosma putida
Psychotria carronis
Xylosma spp.

Shrubs
Cassinia tenuifolia

Lianes
Flagellaria indica
Malaisia scandens

Sedges
Carex hattoriana

Ferns
Adiantum hispidulum
Nephrolepis cordifolia
Pteris microptera

INCLUSIONS: Cf, Cq, DaCt.

Relationship to other units: Closest to Cf and Cq.

Boundaries: Generally diffuse to Cf, Cq and DaCt.

OTHER DATA

A very mixed community without obvious dominants.
Stands may show single species dominance but these are not common.
Some mesic varieties occur, for example, between Red Ground and Boat Harbour.
The isolated stand near Neds Beach is remarkable for being on calcarenite.
The reason is unknown.

Sites: 4, 6, 9, 13, 14, 20, 22, 28, 33, 35, 70.

FORMATION: Evergreen Closed Forest with closed lower layers

SUBFORMATION: Rainforest

Number: ?1D1.1

Alliance: CRYPTOCARYA GREGSONII

CRYPTOCARYA GREGSONII

Symbol: Cg

Area: 7 ha, 0.4%

Oliver equivalent: ?Mountain low forest *Notelaea quadristaminea [Chionanthus quadristaminens]* Association

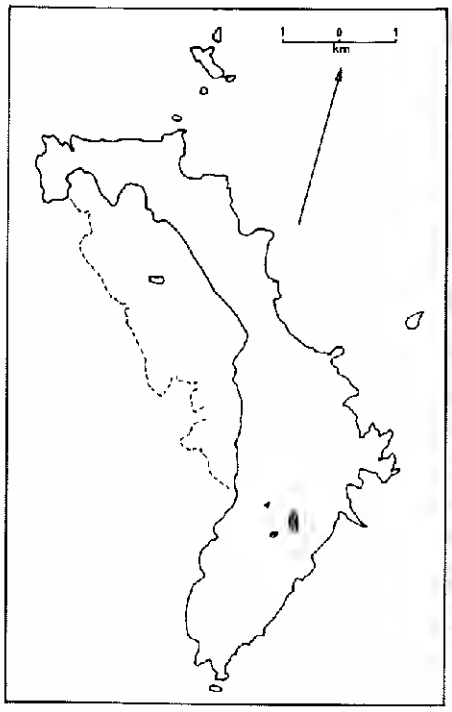
UNESCO equivalent: Subtropical ombrophhilous submontane forest IA4.b

PHYSIOGRAPHY

Generalized site description: Altitude 350–600 m; aspect E and W; slope 10°–15°; moderate to high exposure; slopes at foot of cliffs, top-slopes.

Geology: Basalt

Soil: Very stony, probably Uf



E side of Mount Lidgbird c.250 m N of the Tableland. Altitude 450 m.

STRUCTURE

Basal area: n.d.

Emergents: Nil

Canopy Height: 20 m

Surface: Uneven

Cover: Mid-dense to sparse

Strata number: 2

Boundaries: Sharp

Composition: Trees, herbs. Small trees and shrubs not common.

Ground vegetation (<1 m)

Density: Variable

Composition: Ferns, herbs, sedges; dependent upon disturbance.

Special life-forms: Thick lianes common, tree-ferns occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Mid-dense
Type: Divergent

Shape: Round
Stem: Leaning

Branch position: Upper third and half

Bark: Smooth

Roots: Spurs and surface spreading

Leaf size: Noto-microphyll
Texture: Sclerophyll

Shape: Broad

Margin: Entire

Large fruits common.

DISTURBANCE

Agent: Pigs

Degree: Moderate to severe

Location: Fern Patches, near the Tableland.

Pigs rooting for rhizomes and roots leave the soil surface bare or greatly denuded. Introduced plants (especially *Ageratina adenophora*) are locally common.

FLORISTICS (common species only)

Trees
Cryptocarya gregsonii
Dracophyllum fitzgeraldii
Euodia polybotrya
Hedyscepe canterburyana
Symplocos candelabrum

Shrubs/Woody herbs
Macropiper excelsum var. *psittacorum*

Lianes
Malaisia scandens

Herbs
**Ageratina adenophora*
**Gnaphalium* spp.

Sedges
Carex hattoriana

Ferns
Pteris microptera

INCLUSIONS: Possibly some DfMn

Relationship to other units: Closest to DfMn of which it may be only a taller, more open phase.

Boundaries: Diffuse to DfMn.

OTHER DATA

This unit often occurs as open forest, for example, top of Fern Patches, E of Mount Lidgbird. The stand on the southern spur of Mount Lidgbird is different from all others — the soil is not stony and is heavily burrowed by Providence Petrels (*Pterodroma solandri*).

Sites: Nil.

FORMATION: Evergreen Closed Forest SUBFORMATION: Broad Orthophyll Swamp Forest

Number: 1A1.2a Alliance: LAGUNARIA

LAGUNARIA PATERSONIA

Symbol: Lp Area: 6 ha, 0.4%

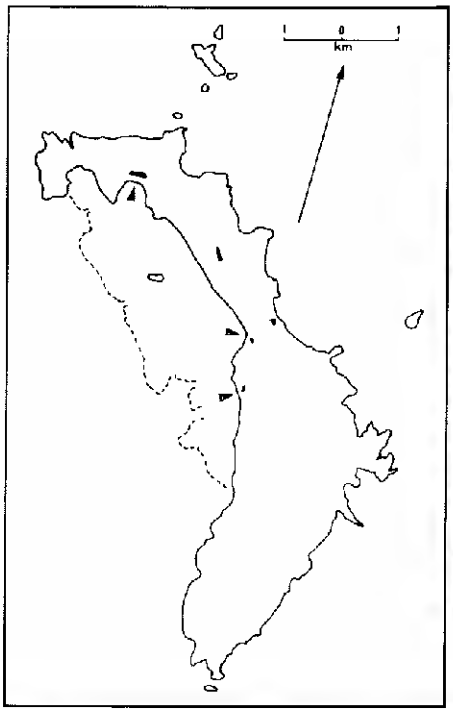
Oliver equivalent: Nil (Coastal scrub *Lagunaria patersonia* Association is not equivalent)

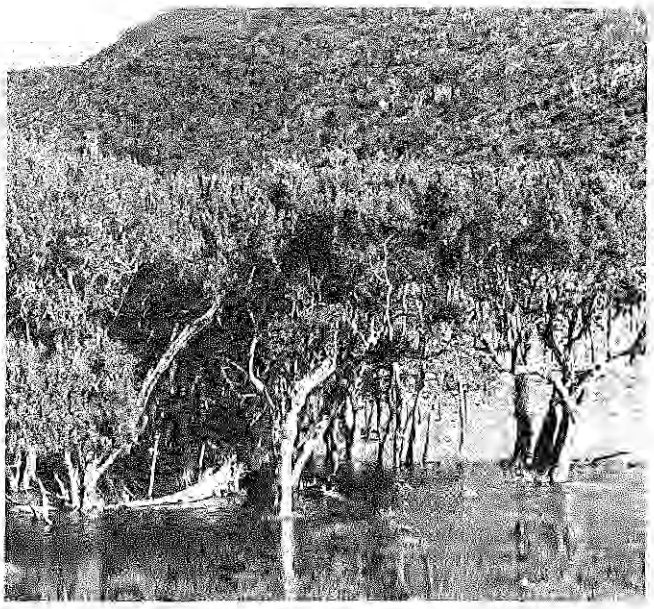
UNESCO equivalent: Broad-leaved subtropical ombrophilous swamp forest IA4.g1.

PHYSIOGRAPHY

Generalized site description: Altitude 0–20 m; nil aspect although maybe S and W; nil slope; very low exposure; valley bottom and depressions.

Geology: Calcarenite Soil:Unknown, drainage impeded. Clay subsoil in some sites. May be in brackish waters.





E edge of Moseley Park showing ephemeral standing water. Altitude c.1 m. (Destroyed 1975 after construction of airport, see Figure 44).

STRUCTURE Basal area: 1350 sq m/ha

Emergents: Nil

Canopy Height: 10 m Surface: Even
Cover: Dense Strata number: 2 Boundaries: Sharp
Composition: Trees, herbs.

Ground vegetation (<1 m) Density: Mid-dense
Composition: Herbs, grasses.

Special life-forms: Occasional palms.

STRUCTURAL FEATURES OF CANOPY PLANTS — Life-form: Tree

Crown density: Dense — Shape: Round — Branch position: More than half
Type: Divergent — Stem: Straight

Bark: Rough, flaky — Roots: Slight spurs

Leaf size: Microphyll — Shape: Broad — Margin: Entire
Texture: Orthophyll
Leaves tomentose

DISTURBANCE — Agent: Man

Degree: Partial and complete clearing

Location: All stands.

Grazing in all stands probably restricts seedling growth but it is doubtful if any stand could successfully regenerate.

FLORISTICS (common species only)

Trees
Hibiscus tiliaceus
Lagunaria patersonia

Grasses
**Axonopus compressus*
**Paspalum dilatatum*

INCLUSIONS: Nil

Relationship to other units: Not close to any unit.

Boundaries: Diffuse to Ac, Pf and DaCt, sharp to Hf and Cf.

OTHER DATA

Although *Lagunaria* is common (as individuals) on exposed cliffs it does not form communities except as swamp forest and these have been destroyed by clearing and grazing.

Sites: Nil

Photograph: 44.

FORMATION: Evergreen Closed Forest SUBFORMATION: Megaphyllous Broad Sclerophyll Forest

Number: 1A1.6b Alliance: HOWEA

HOWEA FORSTERIANA

Symbol: Hf Area: 170 ha, 11.2%

Oliver equivalent: Lowland high and low forest *Howea Forsteriana [H. forsterana]* Association

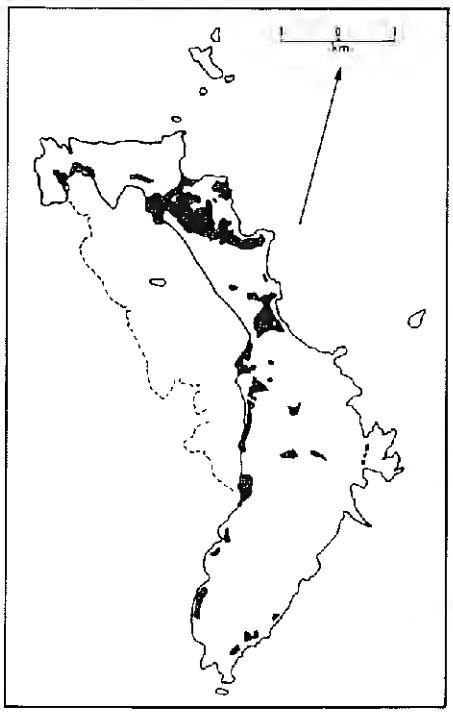
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a

PHYSIOGRAPHY

Generalized site description: Altitude 0–360 m, generally <120 m; all aspects: slope 0°–40° but generally <15°; exposure variable: flats, toe-, mid- and upper-slopes.

Geology: Calcarenite, recent coral Soil: Variable

Other: Sand and basalt.



Near Little Island, beneath Mount Lidgbird. Altitude c.2 m.

STRUCTURE Basal area: 718 sq m/ha

Emergents Height: 15–25 m Distribution: Patches

Canopy Height: 10–20 m Surface: Uneven-smooth
Cover: Dense Strata number: 2–3 Boundaries: Sharp
Composition: Trees, small trees, herbs.

Ground vegetation (<1 m) Density: 1770 palms/ha
Composition: Ferns, sedges, creepers.

Special life-forms: Slender, wiry lianes occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Dense
Type: n.a.

Shape: Round
Stem: Straight, often leaning

Branch position: n.a.

Bark: Smooth, glassy to smooth, fine cracks

Roots: Slight swelling

Leaf size: Megaphyll
Texture: Sclerophyll

Shape: Deeply divided

Margin: —

DISTURBANCE

Agent: Man, cattle

Degree: Severe

Location: Many stands north of Salmon Beach.

Cattle prevent regeneration by eating young palms.

FLORISTICS (common species only)

Trees
Cryptocarya triplinervis
Drypetes australasica
Ficus columnaris
Howea forsterana
Pandanus forsteri

Small trees
Coprosma putida
Elaeodendron curtipendulum
Myoporum insulare
Omalanthus populifolius
Randia stipulosa

Lianes
Flagellaria indica
Smilax australis

Twiners
Ipomoea cairica

Grasses & Sedges
Carex hattoriana
Oplismenus imbecillus

Ferns
Asplenium oblongifolium
Pteris microptera

INCLUSIONS: Pf, DaCt, Hb, and Cf.

Relationship to other units: Structurally similar to Hb and to a lesser extent Hc; floristically to none although understorey is similar to that of other lowland units, for example, DaCt.

Boundaries: Variable, sharp in places with DaCt but also diffuse in other places.

OTHER DATA

Range of basal area: 350–1000 sqm/ha
Range of density: 1140–2370 palms/ha
As this unit is very variable, the values of the parameters and descriptors may not be typical of individual stands.
Dominant unit on calcarenite, although DaCt also occurs here.
Ficus columnaris occurs as dome-like emergent. As an individual covers a considerable area, it can contribute significantly to total cover of a stand.

Sites: 51, 62, 66.

Disturbed Sites: 29, 31, 56, 57, 58, 64, 69.

Photographs: 22, 23, 26, 32, 35, 38, 48.

FORMATION: Evergreen Closed Forest

SUBFORMATION: Megaphyllous Broad Sclerophyll Forest

Number: 1A1.6b

Alliance: HOWEA

HOWEA BELMOREANA

Symbol: Hb

Area: 75 ha, 5.0%

Oliver equivalent: Upland high forest *Howea Belmoreana [Howea belmoreana]*

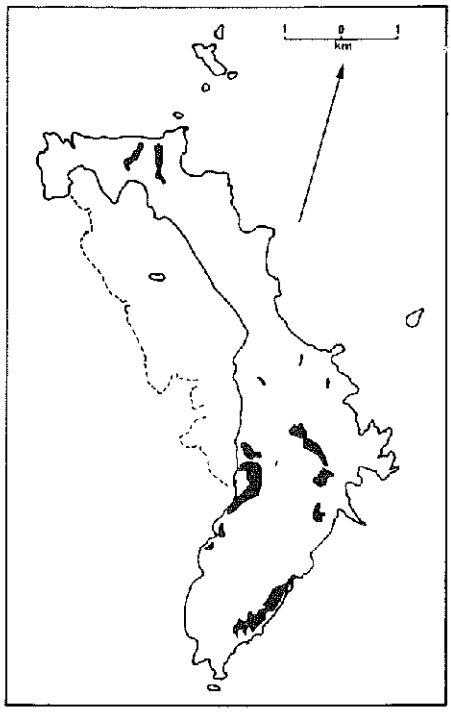
UNESCO equivalent: Subtropical ombrophilous lowland forest IA4.a

PHYSIOGRAPHY

Generalized site description: Altitude 5–250 m; all aspects; slopes 10°–30°; low exposure; mid-slopes and gullies.

Geology: Basalt, rarely calcarenite or recent coral sand

Soil: Stony, often on virtual scree



Willics Road, on Far Flats.
Altitude c.100 m.

STRUCTURE

Basal area: 773 sq m/ha

Emergents: Nil

Canopy Height: 12 m Surface: Even
Cover: Dense Strata number: 2 Boundaries: Sharp
Composition: Trees, herbs. Small trees present but scattered.

Ground vegetation (<1 m) Density: Sparse
Composition: Sedges, creepers.

Special life-forms: Banyans occasional; tree-ferns, lianes, epiphytes variable.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Dense
Type: n.a.

Shape: Conical
Stem: Straight, generally leaning

Branch position: n.a.

Bark: Smooth, glassy

Roots: Slight swelling

Leaf size: Megaphyll
Texture: Sclerophyll

Shape: Deeply divided

Margin: —

DISTURBANCE

Agent: Man, pigs, cattle

Degree: Low to severe

Location: Signal Point, Far Flats, Soldier Creek.

Small stands originally at Signal Point have been cleared. Cattle grazing prevents regeneration, pigs disturb soil surface.

FLORISTICS (common species only)

Trees
Chionanthus quadristamineus
Cleistocalyx fullagari
Drypetes australasica
Ficus columnaris
Howea belmoreana
Howea forsterana

Small trees
Bubbia howeana
Randia stipulosa

Ferns
Histiopteris incisa
Microsorium sp. aff. *diversifolium*
Pteris microptera

INCLUSIONS: Cq.

Relationship to other units: Structurally close to Hf and Hc; floristically closest to Cf or Cq.

Boundaries: Generally indistinct.

OTHER DATA

Sites: 1, 3, 5, 30.

Disturbed Sites: Nil.

FORMATION: Evergreen Closed Forest

SUBFORMATION: Megaphyllous Broad Sclerophyll Forest

Number: 1A1.6b

Alliance: HEDYSCEPE

HEDYSCEPE CANTERBURYANA

Symbol: Hc

Area: 25 ha, 1.6%

Oliver equivalent: Mountain low forest *Hedyscepe canterburyana* Association

UNESCO equivalent: Subtropical ombrophilous submontane forest IA4.b

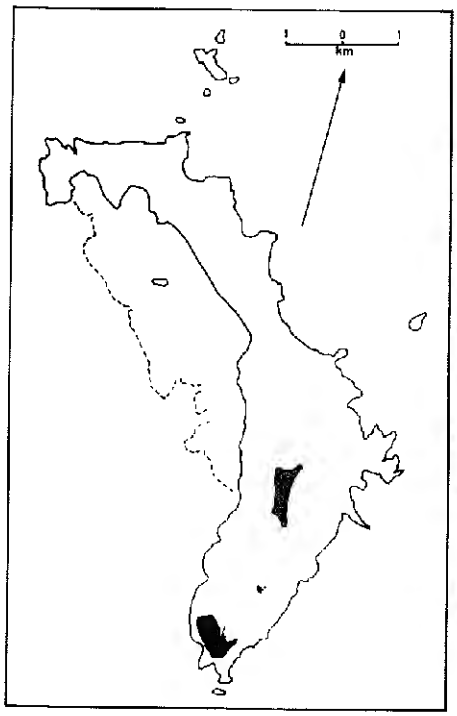
PHYSIOGRAPHY

Generalized site description: Altitude 335–830 m; generally >610 m; all aspects; slopes 15°–60° and cliffs; very exposed; top-slopes and benches.

Geology: Basalt

Soil: Unknown but stony. Probably always wet.

Other: Cloud and mist frequent.



Near summit Mount Lidgbird.
Altitude c.720 m.

STRUCTURE

Basal area: 1440 sq m/ha

Emergents Nil

Canopy Height: 8 m
Cover: Dense
Composition: Small trees, herbs.

Surface: Variable
Strata number: 2

Boundaries: Sharp

Ground vegetation (<1 m)
Composition: Herbs, twiners.

Density: Dense

Special life-forms: Tree-ferns common, epiphytes abundant; mosses and filmy ferns abundant.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Small tree

Crown density: Dense
Type: n.a.

Shape: Conical
Stem: Straight, leaning

Branch position: n.a.

Bark: Smooth

Roots: Slight swelling

Leaf size: Megaphyll
Texture: Sclerophyll

Shape: Deeply divided

Margin: —

DISTURBANCE

Agent: Birds (Providence Petrels, *Pterodroma solandri*)

Degree: Low to moderate

Location: All stands.

Burrowing by *Pterodroma solandri* probably causes mass movement of soil.

FLORISTICS (common species only)

Trees
Dracophyllum fitzgeraldii
Dysoxylum pachyphyllum
Hedyscepe canterburyana
Negria rhabdothamnoides
Pittosporum erioloma

Shrubs
Metrosideros villosa

Herbs
Elatostema reticulatum var. *grande*
Hydrocotyle javanica
Macropiper excelsum var. *psittacorum*

Sedges
Machaerina insularis
Uncinia debilior

Ferns
Blechnum spp.
Cyathea spp.
Diplazium melanochlamys
Grammitis spp.
Polystichum whiteleggei

Mosses abundant

INCLUSIONS: Cliff, BhDf, DfMn, BcMep

Relationship to other units: Structurally similar to Hb; floristically similar to BcMep and other montane units.

Boundaries: Diffuse to all adjacent units except dry cliffs.

OTHER DATA

Stems often bent at base, probably because of soil mass movement.

Sites: Nil.

Disturbed Sites: Nil.

FORMATION: Evergreen Closed Forest

SUBFORMATION: Megaphyllous Broad Sclerophyll Forest

Number: 1A1.6b

Alliance: PANDANUS

PANDANUS FORSTERI

Symbol: Pf

Area: 19 ha, 1.2%

Oliver equivalent: Mountain low forest *Pandanus forsteri* Association

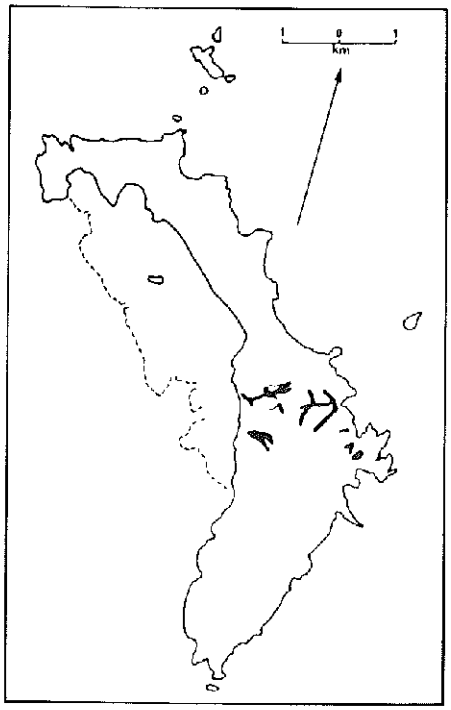
UNESCO equivalent: Subtropical ombrophilous lowland forest 1A4.a
Subtropical ombrophilous swamp forest 1A4.g

PHYSIOGRAPHY

Generalized site description: Altitude 0–150 m; aspect variable, often nil; slope variable 0°–20°, or steeper on some sites; low exposure; depressions, valley bottoms and gullies.

Geology: Basalt

Soil: Poorly drained, often flooded but not essential. Some stands on steep slopes (>10°) without impeded drainage.



Soldier or Big Creek, south of Peach Tree Ridge. Altitude c.3 m.

STRUCTURE

Basal area: n.d.

Emergents Nil

Canopy Height: 15 m
Cover: Dense

Surface: Even or uneven
Strata number: 2

Boundaries: Sharp

Composition: Pandans and miscellaneous herbs, twiners.

Ground vegetation (<1 m)
Composition: Sedges

Density: Sparse

Special life-forms: Vascular epiphytes may be very large and prominent. In pure monotypic stands the ground is littered with fallen leaves and there is no ground vegetation.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tree

Crown density: Mid-dense
Type: Divergent

Shape: Round
Stem: Erect, straight

Branch position: Upper half

Bark: Smooth, small spikes

Roots: Stilt

Leaf size: Megaphyll
Texture: Sclerophyll

Shape: Narrow

Margin: Toothed

DISTURBANCE

Agent: Man, cattle

Degree: Variable, low to complete

Location: Soldier or Big Creek and tributaries, Rocky Run.

Some pig damage in places; Rocky Run, Erskine Valley (small unmapped stands).

FLORISTICS (common species only)

Trees
Chionanthus quadristamineus
Cleistocalyx fullagari
Drypetes australasica
Howea belmoreana
Howea forsterana
Pandanus forsteri

Small trees
Bubbia howeana
Euodia polybotrya
Randia stipulosa

Lianes
Flagellaria indica

Ferns
Microsorium sp. aff. *diversifolium*
Platycerium bifurcatum
Pteris microptera

INCLUSIONS: Nil.

Relationship to other units: Close to Hb and often merges with it. It is a somewhat unsatisfactory unit but at its optimal development (Soldier or Big Creek, Rocky Run) it is worth regarding as a distinct unit.

Boundaries: Diffuse generally.

OTHER DATA

Pandanus forsteri occurs in communities (Pf) along creeks, and as individuals over most of the basaltic soils (except for some areas, notably BhDf). Individuals on slopes in rocky soils and on cliffs are at variance with the occurrence of Pf communities in creeks and swampy depressions. The reason is unknown.

Sites: 27, 37, 41, 48.

Disturbed Sites: 40.

FORMATION: Evergreen Closed Forest SUBFORMATION: Gnarled Mossy Forest

Number 1A1.3a Alliance: BUBBIA-DRACOPHYLLUM

BUBBIA HOWEANA-DRACOPHYLLUM FITZGERALDII

Symbol: BhDf Area: 28 ha, 1.8%

Oliver equivalent: Moss Forest *Dracophyllum fitzgeraldii-Clinostigma mooreanum [Lepidorrhachis mooreana]-Cyathea brevipinna*

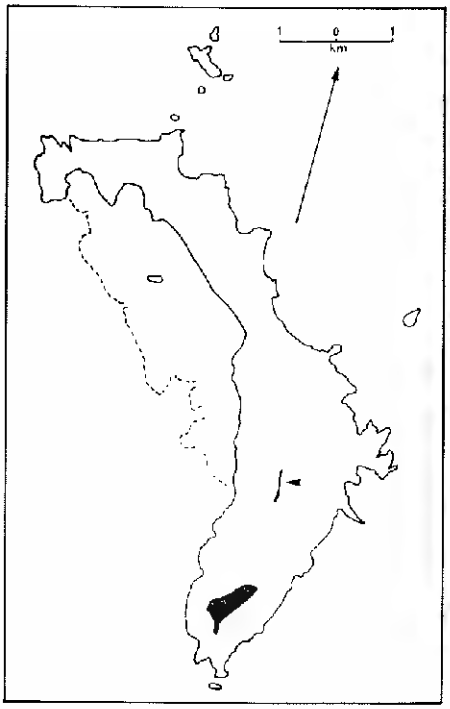
UNESCO equivalent: Subtropical broad-leaved ombrophilous cloud forest 1A4.e1.

PHYSIOGRAPHY

Generalized site description: Altitude > 750 m; aspect variable; slope usually low, but up to 45°; exposure low to very high, especially on cliff edges; on summit — both razor and broad-flat.

Geology: Basalt

Soil: Poorly developed over deeply weathered basalt. Usually above field capacity.



Summit ridge of Mount Lidgbird. Altitude 760 m.

STRUCTURE Basal area: n.d.

Emergents Nil

Canopy Height: 5 m Surface: Very smooth
Cover: Very dense Strata number: 3 Boundaries: Diffuse
Composition: Small trees, shrubs and tree-ferns, herbs and ferns.

Ground vegetation (<1 m) Density: Dense
Composition: Herbs, ferns, mosses.

Special life-forms: Non-vascular epiphytes abundant; lianes rare; large tussock sedges common; tree-ferns common.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Small tree

Crown density: Dense
Type: Divergent
Bark: Variable
Leaf size: Nano- and notophyll
Texture: Sclero- and orthophyll

Shape: Flat
Stem: Crooked, bent and branchy
Roots: Normal, surface spreading
Shape: Broad

Branch position: More than half
Margin: Entire

DISTURBANCE

Agent: Birds (see text)

Degree: Locally severe

Location: Entire unit

The birds, Providence Petrels (*Pterodroma solandri*), burrow and disturb the soil. The effects are not known. Feral rats (*Rattus rattus*) are abundant and eat seeds and leaf rachises.

FLORISTICS (common species only)

Small trees
Bubbia howeana
Dracophyllum fitzgeraldii
Elaeocarpus costatus
Hedyscepe canterburyana
Lepidorrhachis mooreana
Leptospermum flavescens
Negria rhabdothamnoides
Symplocos candelabrum

Shrubs
Dysoxylum pachyphyllum
Olearia mooneyi

Herbs
Elatostema reticulatum

Sedges
Gahnia xanthocarpa
Machaerina insularis

Ferns
Blechnum spp.
Cyathea spp.
Diplazium melanochlamys
Grammitis spp.
Microsorium spp.
Polystichum whiteleggei

Mosses, lichens and filmy ferns abundant

INCLUSIONS: Cliff, Hc.

Relationship to other units: Structurally quite distinct; floristically distinct but close to Hc and DfMn.

Boundaries: Merges with Hc and Cliff.

OTHER DATA

The BhDf on Mount Lidgird is an attenuated exposed form but is within the range of variation of the unit. Floristically complex with a high number of species.
BhDf is variable in structure—depending upon site, for example, on edges of small cliffs it becomes lower, scrubbier and more open.
Mist abundant. Never below 750 m altitude.

Sites: Nil.

FORMATION: Closed Evergreen Scrub SUBFORMATION: Broad Orthophyll Scrub

Number: 1B1.1a Alliance: BOEHMERIA-MACROPIPER

BOEHMERIA CALOPHLEBA-MACROPIPER EXCELSUM VAR. *PSITTACORUM*

Symbol: BcMep Area: 3 ha, 0.2%

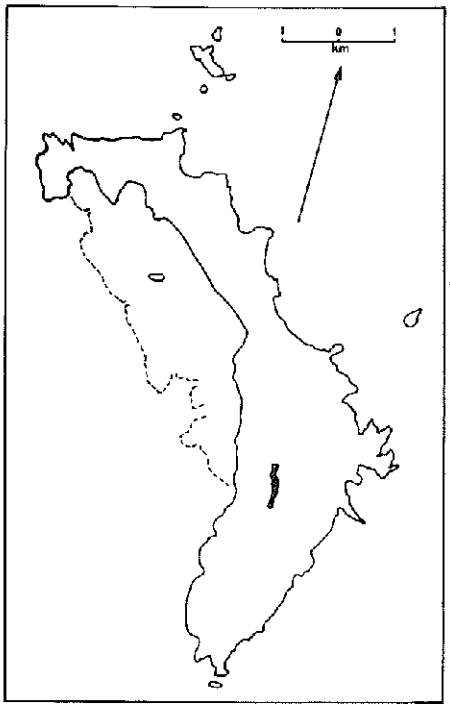
Oliver equivalent: Nil

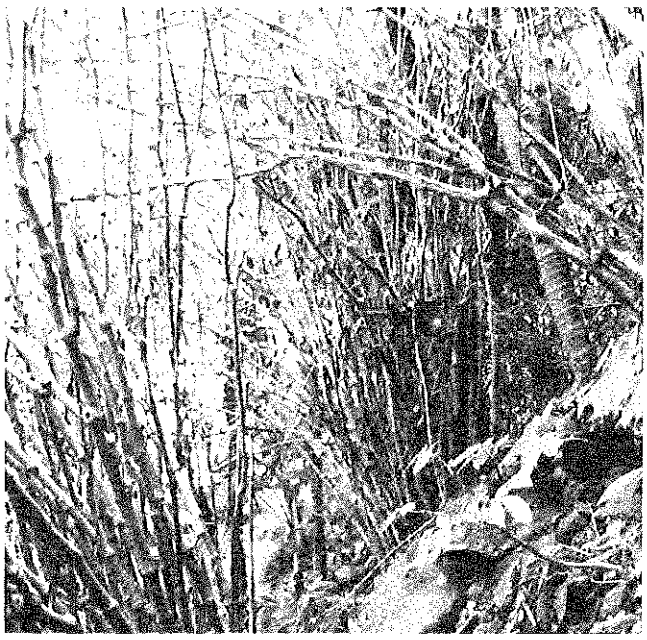
UNESCO equivalent: Evergreen broad-leaved hemi-sclerophyllous thicket IIIA1.c;
Evergreen suffruticose thicket IIIA1.e.

PHYSIOGRAPHY

Generalized site description: Altitude 530 m; N and W aspects; slopes 10° - 60°, including small cliffs; exposure moderate to high; mid-slopes, on terrace between cliffs.

Geology: Basalt Soil: Stony, probably always very wet.





Terrace above Black Face, Mount Lidgbird.
Altitude 530 m.

STRUCTURE Basal area: n.a.

Emergents Height: 4–5 m Distribution: Scattered or in patches

Canopy Height: 3–4 m Surface: Even-uneven
Cover: Closed Strata number: 2 Boundaries: Diffuse-sharp
Composition: Shrubs and herbs.

Ground vegetation (<1 m) Density: Sparse
Composition: Ferns, broad-leaved sedges and herbs.

Special life-forms: Semi-succulent herbs abundant; epiphytes not common; tree-ferns abundant, particularly as emergents.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Dense
Type: Divergent

Shape: Round
Stem: Branchy, crooked

Branch position: Base

Bark: Smooth

Roots: Normal, or surface

Leaf size: Noto- and megaphyll
Texture: Orthophyll colour, many stems pithy

Shape: Broad

Margin: Entire

Leaves are generally light green.

DISTURBANCE

Agent: Birds, (see text)

Degree: Moderate to low, locally severe

Location: Entire unit.

The Providence Petrel (*Pterodroma solandri*) nests on the terrace. Disturbance is generally low and restricted to burrowing, digging and defaecation.

FLORISTICS (common species only)

Small trees and shrubs
Boehmeria calophleba
Hedyscepe canterburyana
Macropiper excelsum var. *psittacorum*
Negria rhabdothamnoides
Pittosporum erioloma

Herbs
Elatostema reticulatum var. *grande*

Sedges
Gahnia xanthocarpa
Machaerina insularis

Ferns
Cyathea spp.
Histiopteris incisa
Pteris microptera

INCLUSIONS: Hc, Cliff, DfMn.

Relationship to other units: The unit does not appear to be closely related to any other.

Boundaries: Diffuse to Hc, Cliff, and some BhDf.

OTHER DATA

Very restricted on the island. This may reflect either disturbance by feral goats and pigs in other places or lack of suitable sites.
An unmapped stand of *Gahnia xanthocarpa* on the terrace above the Round Face of Mount Lidghird is included in this unit. It most closely resembles Cl but is floristically distinct.
Cloud cover high.

Sites: Nil.

FORMATION: Closed Evergreen Scrub

SUBFORMATION: Broad Sclerophyll Swamp Scrub

Number: 1B1.3c

Alliance: AEGICERAS

AEGICERAS CORNICULATA

Symbol: Ac

Area: 2 ha, 0.1%

Oliver equivalent: Mangrove *Aegiceras corniculata* Association

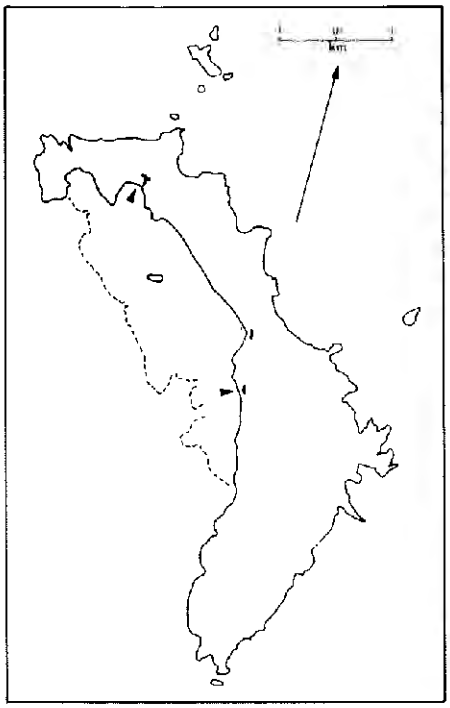
UNESCO equivalent: Evergreen broad-leaved sclerophyllous thicket IIIA1.d

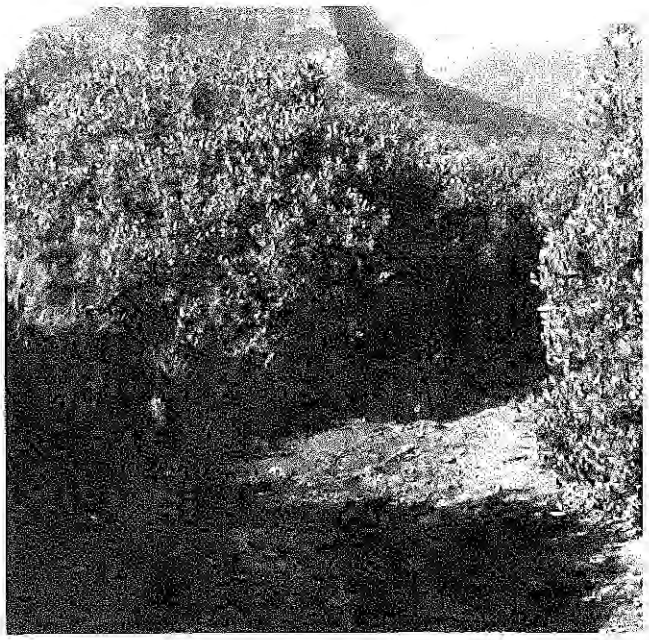
PHYSIOGRAPHY

Generalized site description: Altitude 0 m; aspect nil; slope <1°; exposure low to moderate; estuarine flats flooded at high tide.

Geology: Not known, ?sand

Soil: Slaked soil, high NaCl (inferred), drainage poor.





Creek at S end Prince William Henry Bay. Altitude 0 m.

STRUCTURE

Basal area: n.d.

Emergents Nil.

Canopy Height: 4.5 m
Cover: Dense
Composition: Shrubs, herbs.

Surface: Even-uneven
Strata number: 2

Boundaries: Sharp

Ground vegetation: (<1 m)
Composition: Succulent herbs.

Density: Sparse-Nil

Special life-forms: Probably algae on soil surface.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Dense
Type: Divergent

Shape: Round
Stem: Crooked, branchy

Branch position: Base

Bark: Smooth

Roots: Normal

Leaf size: Microphyll
Texture: Sclerophyll

Shape: Broad

Margin: Entire

Pneumatophores rare in undisturbed stands

DISTURBANCE

Agent: Man, cattle

Degree: Low to severe

Location: Old Settlement Beach, Soldier or Big Creek.

FLORISTICS (common species only)

Small trees
Aegiceras corniculata
Lagunaria patersonia

Herbs
Sarcocornia quinqueflora
Triglochin striatum

INCLUSIONS: Nil

Relationship to other units: Not closely related to any unit although it probably merges with Lp.

Boundaries: Sharp except with Lp.

OTHER DATA

This unit is gradually becoming more restricted on the island. Continued clearing and grazing in the remaining stands will probably cause the extinction of the species on the island. The least-disturbed stand appears to be that at the southwest corner of Moseley Park. There is no intact stand of large plants.

Sites: Nil

FORMATION: Closed Evergreen Scrub SUBFORMATION: Evergreen Broad Sclerophyll Scrub

Number: 1B1.4a Alliance: DODONAEA

DODONAEA VISCOSA

Symbol: Dv Area: 9 ha, 0.6%

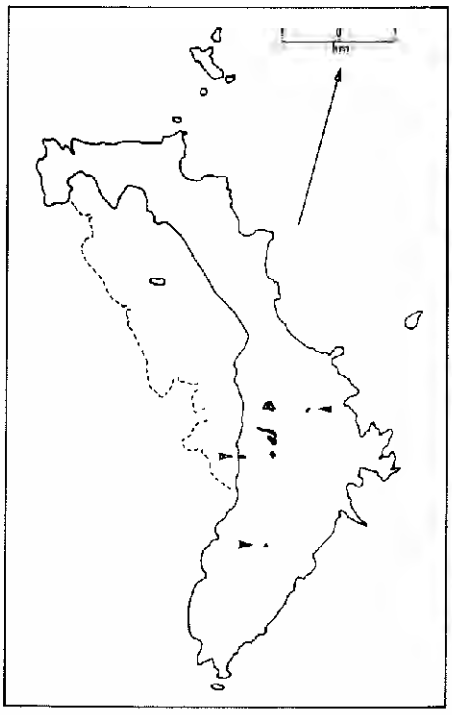
Oliver equivalent: Hill scrub *Dodonaea viscosa* Association

UNESCO equivalent: Evergreen broad-leaved sclerophyllous thicket IIIA1.d

PHYSIOGRAPHY

Generalized site description: Altitude 30–300 m; aspect variable, generally N; slope low-high 5°–25°; exposure low-extreme; mid-slopes and summits of ridges.

Geology: Basalt Soil: Unknown



Portion 130, S of "Mountain Inn".
Altitude 60 m.

STRUCTURE Basal area: n.d.

Emergents Nil.

Canopy Height: 5 m Surface: Even-uneven
Cover: Complete Strata number: 2 Boundaries: Diffuse
Composition: Shrubs, half-shrubs, herbs.

Ground vegetation (<1 m) Density: Dense
Composition: Herbs, sedges.

Special life-forms: Lianes abundant in light breaks.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Sparse
Type: Divergent

Shape: Round
Stem: Crooked, branchy

Branch position: Base

Bark: Slightly fibrous

Roots: Surface, normal

Leaf size: Mesophyll
Texture: Sclerophyll

Shape: Broad

Margin: Entire

DISTURBANCE

Agent: Man, cattle

Degree: Low to severe

Location: Portion 130, on ridge S of "Mountain Inn".

Clearing for grazing.

FLORISTICS (common species only)

Shrubs
Cassinia tenuifolia
Dodonaea viscosa
Guioa coriacea
Howea forsterana
Polyscias cissodendron

Lianes
Smilax australis

Herbs
**Ageratina adenophora*

Sedges
Carex hattoriana
Scirpus nodosus

INCLUSIONS: Nil.

Relationship to other units: —

Boundaries: Diffuse to DaCt, Cliff.

OTHER DATA

Stand below Grey Face is very exposed and stunted compared with others. The site is very stony. It can be seen at the immediate foot of the Grey Face in the photograph under "Cliff". (p.216).
The unit may be seral in some stands which occur in slump scars on spurs at the western foot of Nobbin.

Site: 44.

Disturbed sites: Nil.

Photograph: 27.

FORMATION: Closed Evergreen Scrub SUBFORMATION: Evergreen Broad Sclerophyll Scrub

Number: 1B1.4a Alliance: DRACOPHYLLUM-METROSIDEROS

DRACOPHYLLUM FITZGERALDII-METROSIDEROS NERVULOSA

Symbol: DfMn Area: 45 ha, 2.9%

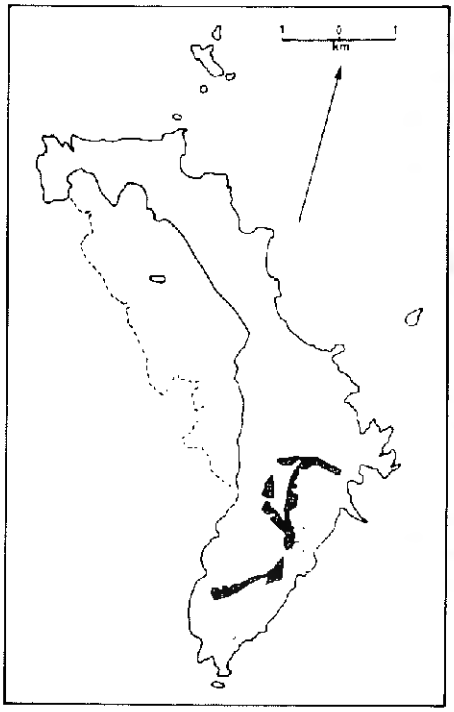
Oliver equivalent: Nil

UNESCO equivalent: Evergreen broad-leaved sclerophyll shrubland (or thicket) IIIA1.d

PHYSIOGRAPHY

Generalized site description: Altitude 340–610 m but generally between 380–530 m; all aspects, slope 10°–60°; exposure moderate to high; top slopes and benches on cliffs.

Geology: — Soil: —



Below and E of the Tableland.
Altitude 450 m.

STRUCTURE Basal area: n.d.

Emergents Nil

Canopy Height: 4–6.5 m Surface: Uneven-smooth
Cover: Variable Strata number: 3 Boundaries: Diffuse-sharp
Composition: Trees, small trees, shrubs, herbs.

Ground vegetation (<1 m) Density: Variable
Composition: Ferns, sedges, creepers.

Special life-forms: Tree-ferns abundant, palms occasional, mossy epiphytes may be abundant.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Small trees, shrubs

Crown density: Dense-mid-dense
Type: Divergent and horizontal

Shape: Round-flat
Stem: Leaning, crooked, branchy

Branch position: About half to base

Bark: Rough

Roots: Some spurs

Leaf size: Nano-to macrophyll
Texture: Variable

Shape: Variable

Margin: Variable

Extremely variable

DISTURBANCE

Agent: Goats, pigs

Degree: Moderate

Location: Most stands.

Browsing by goats; spread of naturalized plants. Rooting of pigs, exposing soil.

FLORISTICS (common species only)

Shrubs and small trees

Carmichaelia exsul
Cassinia tenuifolia
Chionanthus quadristamineus
Cryptocarya gregsonii
Dracophyllum fitzgeraldii
Drypetes australasica
Euodia polybotrya
Hedyscepe canterburyana
Leptospermum flavescens
Metrosideros nervulosa
Olearia ballii
Symplocos candelabrum

Herbs

Brachycome segmentosa
Plantago hedleyi

Ferns

Blechnum capense
Cyathea spp.
Histiopteris incisa
Pteris microptera

INCLUSIONS: Cliff, Cg, Hc, Cq, MFH.

Relationship to other units: Uncertain.

Boundaries: Diffuse to most adjacent units except Cliff.

OTHER DATA

This is an extremely variable unit and values for descriptors may not be applicable to individual sites. The stands vary enormously: on one spur there may be mesic DfMn whereas the next spur may support a more sclerophyllous and open DfMn.

Sites: 10, 17.

Disturbed sites: Nil.

FORMATION: Closed Evergreen Sclerophyll Scrub/Green Microphyllous Evergreen Scrub

SUBFORMATION: Straight Narrow Sclerophyll Scrub

Number: 1B1.7/1B1.8a

Alliance: MELALEUCA-CASSINIA

MELALEUCA HOWEANA

Symbol: Mh

Area: 42 ha, 2.8%

Oliver equivalent: Coastal scrub *Melaleuca ericifolia [Melaleuca howeana]* Association.

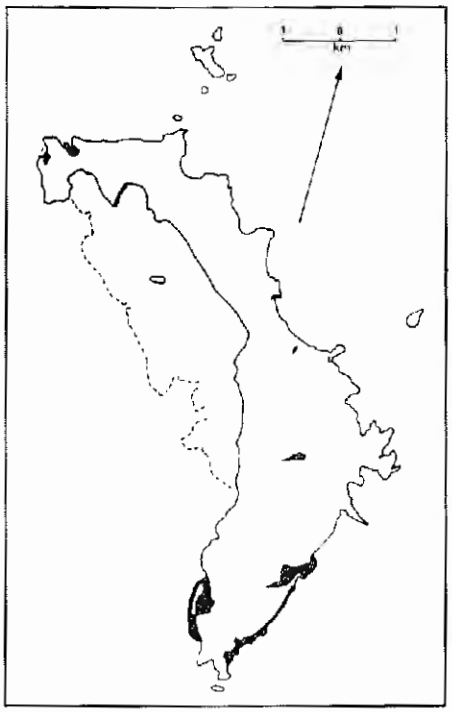
UNESCO equivalent: Evergreen microphyllous thicket (or shrubland) IIIA2.h

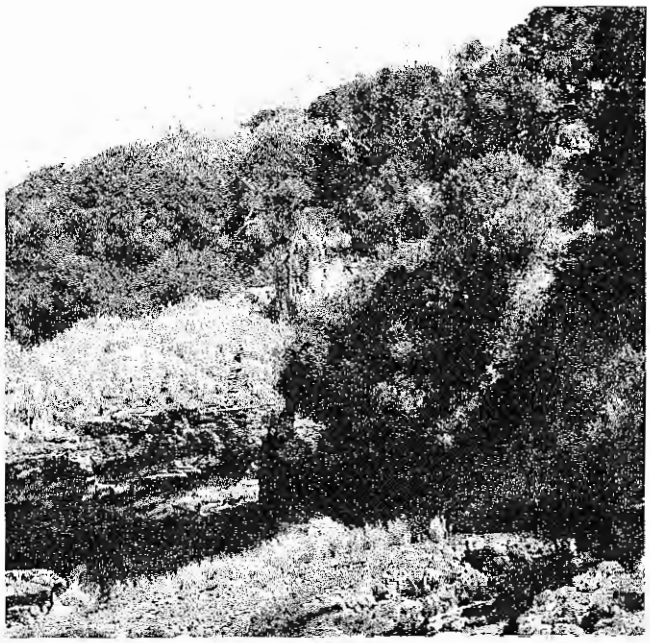
PHYSIOGRAPHY

Generalized site description: Altitude 0–500 m, generally <150 m; all aspects; slope 5° – 90°, generally 15° - 40°; moderately to extremely exposed; top slopes, ridge crests, terraces on cliffs.

Geology: Basalt, calcarenite

Soil: Unknown, often very stony





N end of Blinky Beach.
Altitude 5 m.

STRUCTURE

Basal area: n.a.

Emergents Height: 5 m

Distribution: Scattered

Canopy Height: 1.5–4 m
Cover: Dense
Composition: Shrubs and herbs.

Surface: Even-uneven
Strata number: 2

Boundaries: Sharp

Ground vegetation (<1 m)
Composition: Herbs, sedges, creepers.

Density: Variable, zero to dense

Special life-forms: Palms rare.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Dense
Type: Divergent

Shape: Round
Stem: Branchy

Branch position: Base

Bark: Flaky

Roots: Normal

Leaf size: Nanophyll
Texture: Sclerophyll

Shape: Linear

Margin: Entire

DISTURBANCE

Agent: Goats

Degree: Low to moderate

Location: Virtually all stands.

Effect appears to be limited to some opening-up of scrub and introduction of naturalized plants.

FLORISTICS (common species only)

Trees
Howea belmoreana
Lagunaria patersonia

Shrubs
Alyxia ruscifolia
Cassinia tenuifolia
Melaleuca howeana
Westringia fruticosa

Twiners
Commelina cyanea
Hydrocotyle javanica
Melanthera biflora
Muehlenbeckia complexa

Grasses & Sedges
Cyperus lucidus
Poa poiformis
Scirpus nodosus
Sporobolus virginicus

Ferns
Adiantum hispidulum
Asplenium oblongifolium

INCLUSIONS: Cliff, Ca, DaCtX, MFH, Pp.

Relationship to other units: Very close to Ca.

Boundaries: Diffuse to most adjoining units.

OTHER DATA

Some stands, for example, Old Gulch, are composed of bigger than average shrubs.
Stand at northern end of Little Slope is secondary after goat grazing.
As this unit occurs over a wide altitudinal and environmental range, the values of parameters and descriptors given here may not be typical of individual stands.
Stands generally appear dark green.
Some low altitude sites are very exposed to salt spray.

Sites: 13, 50, 52.

Disturbed sites: Nil.

Photograph: 25.

FORMATION: Closed Evergreen Sclerophyll Scrub/Green Microphyllous Evergreen Scrub

SUBFORMATION: Straight Narrow Sclerophyll Scrub

Number: 1B1.7/1B1.8a

Alliance: MELALEUCA-CASSINIA

CASSINIA TENUIFOLIA

Symbol: Ca

Area: 29 ha, 1.9%

Oliver equivalent: Coastal scrub *Cassinia tenuifolia* Association.

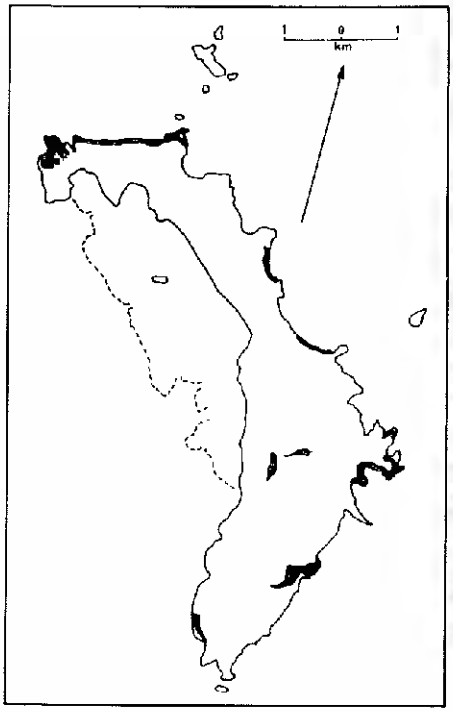
UNESCO equivalent: Evergreen microphyllous thicket (or shrubland) IIIA2.b

PHYSIOGRAPHY

Generalized site description: Altitude 0–490 m, generally <150 m; all aspects; slope 5°- 90°, generally >30°; very exposed; top slopes, ridge crests and terraces on cliffs.

Geology: Basalt

Soil: Stony, skeletal



S ridge of Mount Eliza.
Altitude 100 m.

STRUCTURE

Basal area: n.a.

Emergents Height: up to 5 m

Distribution: Scattered

Canopy Height: 1–2 m
Cover: Dense-open
Composition: Shrubs and herbs.

Surface: Uneven
Strata number: 2

Boundaries: Sharp

Ground vegetation (<1 m)
Composition: Sedges, herbs and creepers.

Density: Variable

Special life-forms: Palms rare; slender wiry lianes rare.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Dense
Type: Divergent

Shape: Round
Stem: Branchy

Branch position: Base

Bark: Flaky

Roots: Surface spreading and normal

Leaf size: Nanophyll
Texture: Sclerophyll

Shape: Linear

Margin: Entire

DISTURBANCE

Agent: Goats

Degree: Moderate, locally severe

Location: All stands.

Locally the effect of goat camps is complete denudation, but generally the goats only thin the scrub canopy and this is followed by establishment of naturalized plants.

FLORISTICS (common species only)

Shrubs
Cassinia tenuifolia
Dodonaea viscosa
Drypetes australasica
Lagunaria patersonia
Melaleuca howeana
Pimelea congesta
Westringia fruticosa

Twiners
Muehlenbeckia complexa
Tylophora biglandulosa

Herbs
Peperomia tetraphylla

Grasses & Sedges
Cyperus lucidus
Poa poiformis
Scirpus nodosus

Ferns
Microsorium sp. aff. *diversifolium*

INCLUSIONS: Cliff, Mh, DaCtX, Pp.

Relationship to other units: Very close to Mh.

Boundaries: Generally diffuse to all adjoining communities.

OTHER DATA

Stands generally appear light blue or greyish.
Many naturalized species occur in some stands.

Sites: 16, 25, 61, 65.

Disturbed sites: Nil.

Photographs: 25, 26.

FORMATION: Dwarf Scrub
Number: 1C1.2a

SUBFORMATION: Orthophyll Dwarf Scrub
Alliance: ATRIPLEX

ATRIPLEX CINEREA

Symbol: Ax

Area: 0.6 ha

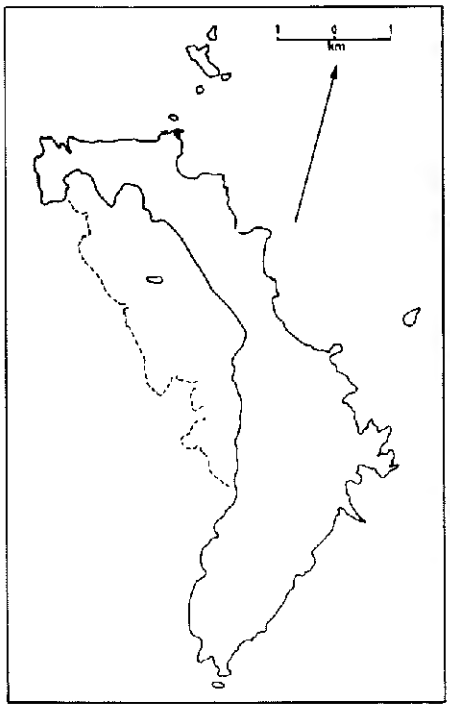
Oliver equivalent: Nil

UNESCO equivalent: Evergreen caespitose dwarf-shrub thicket 1VA1.a

PHYSIOGRAPHY

Generalized site description: Altitude 0–45 m; N aspect; slope 10°– 30°; very exposed; mid-slopes.

Geology: Recent coral sand over basalt Soil: Sandy, minimal development, Uc



Spur below and NE of Malabar.
Altitude 10 m.

STRUCTURE
Emergents Nil

Basal area: n.a.

Canopy Height: 1 m
Cover: Dense
Composition: Dwarf shrubs, herbs.

Surface: Smooth
Strata number: 2

Boundaries: Sharp

Ground vegetation (<1 m)
Composition: Rhizomatous grasses.

Density: Mid-dense to sparse

Special life-forms: –

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Dwarf shrub

Crown densiy: Dense
Type: Divergent

Shape: Round
Stem: Branchy

Branch position: Base

Bark: —

Roots: ?

Leaf size: Microphyll
Texture: Orthophyll
Leaves with glandular hairs

Shape: Broad

Margin: Entire

DISTURBANCE

Agent: Birds (see text)

Degree: Low

Location: Malabar Point.

FLORISTICS (common species only)

Shrubs
Atriplex cinerea

Grasses
Sporobolus virginicus

INCLUSIONS: Nil.

Relationship to other units: Not closely related to any other unit on the island.

Boundaries: Sharp, due to erosion as shown in photograph.

OTHER DATA

The unit is restricted to talus debris piles below sea-cliffs, for example, Malabar and (unmapped) at Middle Beach.
Isolated individuals of *A. cinerea* occur sporadically in space and time on Old Settlement, North and Lagoon Beaches.

Site: 72.

Disturbed sites: Nil.

FORMATION: Broad-leaved Herb

SUBFORMATION: ?Evergreen Broad-leaved Weedy Vegetation

Number: ?1N1.1

Alliance: IPOMOEA-CARPOBROTUS

IPOMOEA CAIRICA-CARPOBROTUS GLAUCESCENS

Symbol: IcCg

Area: 5 ha, 0.3%

Oliver equivalent: ?Rushes *Ipomoea palmata [Ipomoea cairica]* Association.

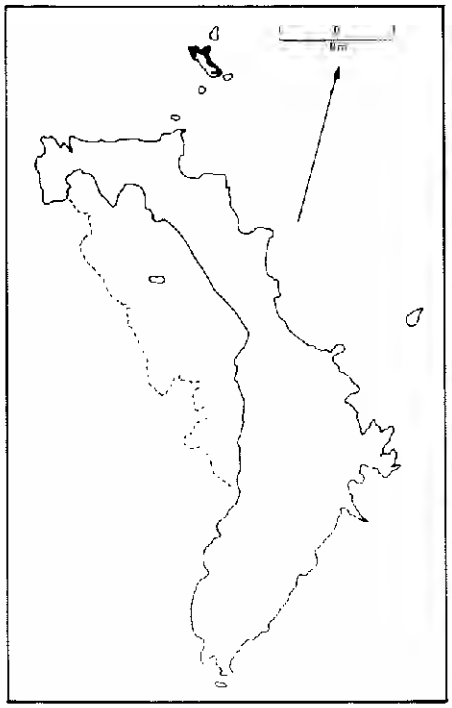
UNESCO equivalent: Perennial forb community VF1

PHYSIOGRAPHY

Generalized site description: Altitude 0–85 m; all aspects; slopes moderate to high 10°– 60°; exposure very high to extreme; entire slope and ridge summit.

Geology: Basalt

Soil: Shallow, inferred high faecal nitrogen



NW spur of Roach Island.
Altitude 45 m.

STRUCTURE

Basal area: n.a.

Emergents Height: 1.5 m

Distribution: Patches, in lee of rocks

Canopy Height: 0.3 m
Cover: Dense
Composition: Herbs and grasses.

Surface: Uneven
Strata number: 1

Boundaries: —

Ground vegetation (<1 m)
Composition: —

Density: —

Special life-forms: Creepers abundant; succulent herbs abundant; ferns very rare.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Herb

Crown density: n.a.
Type: Horizontal

Shape: Creeper
Stem: —

Branch position: Creeper

Bark: —

Roots: —

Leaf size: —
Texture: Sclerophyll, succulent

Shape: Narrow

Margin: Entire and deeply lobed

DISTURBANCE

Agent: Birds (see text)

Degree: Locally severe

Location: Roach Island

Surface nesting and burrowing are ± equally common.

FLORISTICS (common species only)

Shrubs
Celtis amblyphylla
Drypetes australasica
Melaleuca howeana

Twiner
Ipomoea cairica

Grasses & Sedges
Cyperus lucidus
Poa poiformis
Sporobolus virginicus

Herbs
Achyranthes aspera
Carpobrotus glaucescens
Commelina cyanea

INCLUSIONS: Cliff, Cl, Mh, Pp.

Relationship to other units: Close to Pp, Cliff.

Boundaries: Merges with Cliff, Cl, Pp.

OTHER DATA

Sites: Nil.

Photographs: 18, 19.

FORMATION: Broad-leaved Herb

SUBFORMATION: ?Evergreen Broad-leaved Weedy Vegetation, Evergreen Fern Meadow

Number: 1N1.3

Alliance: —

MIXED FERN AND HERB

Symbol: MFH

Area: 7 ha, 0.3%

Oliver equivalent: Nil

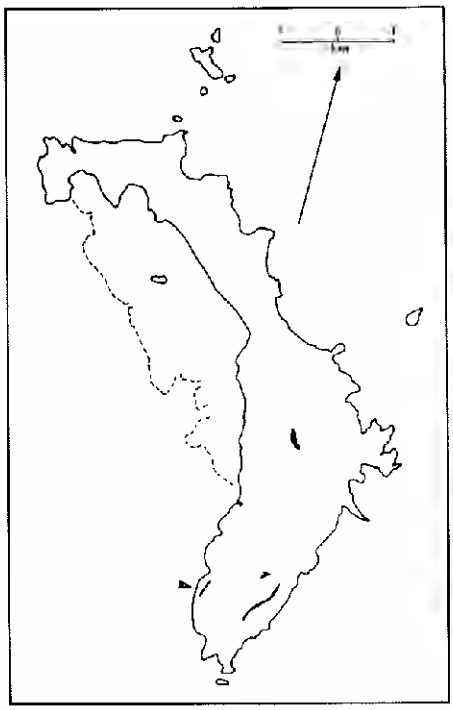
UNESCO equivalent: Perennial ruderal and clearing herb formation VF1.e

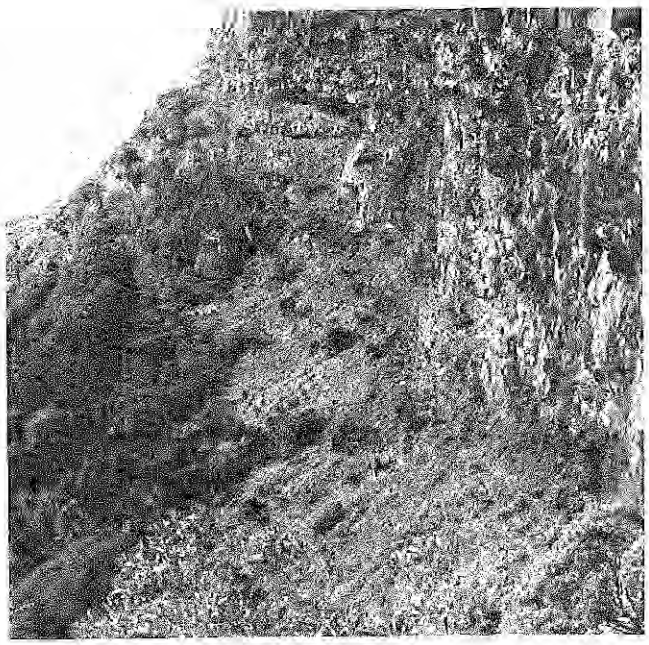
PHYSIOGRAPHY

Generalized site description: Altitude 80–500 m; aspect variable; slope usually moderate-steep 10°– 40°; exposure moderate to severe; top slopes, almost always at the foot of cliffs.

Geology: Basalt

Soil: Unknown. Stony.





Below Old Kings Cave, Mount Gower. Altitude 450 m.

STRUCTURE

Basal area: n.a.

Emergents Height: 4.5 m

Distribution: Patches

Canopy Height: 1.2 m
Cover: Dense-sparse
Composition: Herbs.

Surface: Uneven
Strata number: 1

Boundaries: —

Ground vegetation (<1 m)
Composition: —

Density: —

Special life-forms: Tree-ferns and palms occasional as emergents; ferns abundant; lianes rare.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: —

Crown density: —
Type: —

Shape: —
Stem: —

Branch position: —

Bark: —

Roots: —

Leaf size: —
Texture: —

Shape: —

Margin: —

Mostly n.a. due to nature of plants and lack of dominants.

DISTURBANCE

Agent: Pigs, goats

Degree: Low to severe

Location: Old Kings Cave.

FLORISTICS (common species only)

Small trees
Dracophyllum fitzgeraldii
Hedyscepe canterburyana

Herbs
**Bidens pilosa*
Elatostema reticulatum var. *grande*
**Ageratina adenophora*
Solanum spp.

Sedges
Carex hattoriana
Cyperus lucidus
Scirpus nodosus

Ferns
Adiantum hispidulum
Asplenium oblongifolium
Cyathea spp.
Histiopteris incisa
Pteris microptera

INCLUSIONS:—

Relationship to other units:—

Boundaries: Merges with all adjoining units especially MLM, Cq, Cliff, and Hf.

OTHER DATA

Many stands of MFH appear to be disturbed and this may indicate that the unit is seral. More detailed observations are necessary to clarify this point.

Sites: Nil.

FORMATION: Tall Grass
Number: 1L1.4

SUBFORMATION: Sclerophyll Tall Grass
Alliance: CYPERUS

CYPERUS LUCIDUS

Symbol: Cl

Area: 3 ha, 0.2‰

Oliver equivalent: Tussock sedges *Mariscus haematodes [Cyperus lucidus]* Association

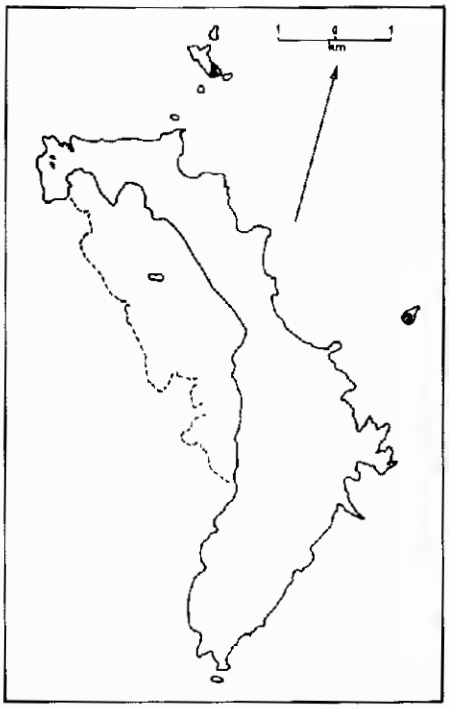
UNESCO equivalent: Tall grass steppe/with trees/with shrubs/without woody plants VB1.a/b/c

PHYSIOGRAPHY

Generalized site description: Altitude 0–70 m; aspect variable; slope low to high 5°–35°; exposure moderate-severe; entire slope and summit.

Geology: Basalt, recent coral sand

Soil: Unknown



SE spur of Roach Island.
Altitude 60 m.

STRUCTURE

Basal area: n.a.

Emergents Height: 15 m

Distribution: Patches

Canopy Height: 1.0 m
Cover: Mid-dense
Composition: Tussock sedges, herbs.

Surface: Even
Strata number: 2

Boundaries: Sharp

Ground vegetation (<1 m)
Composition: —

Density: —

Special life-forms: —

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tussock sedge

Crown density: Sparse
Type: —
Shape: —
Stem: Rhizome
Branch position: —

Bark: —
Roots: —

Leaf size: Megaphyll
Texture: Sclerophyll
Shape: Narrow
Margin: Toothed, cutting

DISTURBANCE

Agent: Birds (see text)

Degree: Low to severe

Location: All stands.

FLORISTICS (common species only)

Twiners
Commelina cyanea
Ipomoea cairica

Herbs
Crinum pedunculatum

Grasses & Sedges
Cyperus lucidus
Phragmites australis
Poa poiformis
Sporobolus virginicus

INCLUSIONS

Relationship to other units:—

Boundaries: Merge with adjoining units.

OTHER DATA

An unmapped stand on scree near Little Island differs from others in terms of secondary characteristics such as emergent palms, and epiphytic ferns on rocks.
Other stands occur between beaches (usually boulder) and forest. These are basically similar to the described unit.
A further unmapped stand, of *Gahnia xanthocarpa,* on the terrace on Mount Lidgbird (elev. 530 m) is structurally very similar but floristically distinct.

Sites: Nil.

Photograph: 21.

FORMATION: Short Grass
Number: 1M1.3

SUBFORMATION: Orthophyll Short Grass
Alliance: POA

POA POIFORMIS

Symbol: Pp

Area: 14 ha, 0.9%

Oliver equivalent: Rushes *Poa caespitosa [Poa poiformis]* Association

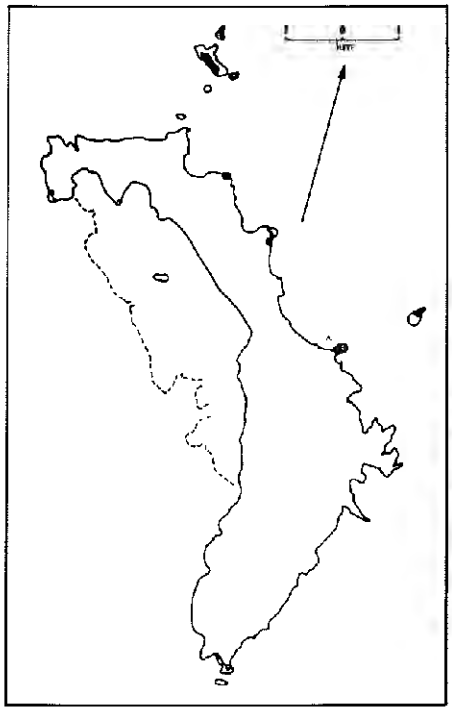
UNESCO equivalent: Mid grass steppe/with shrubs/without woody plants VB2. b/c

PHYSIOGRAPHY

Generalized site description: Altitude 10–70 m; all aspects; slope <10°; exposure very high; crests of rises, and terraces on cliffs.

Geology: Basalt

Soil: Unknown, stony, often shallow



Mutton Bird Point. Altitude 25 m.
(The man is kneeling, not standing)

STRUCTURE

Basal area: n.a.

Emergents Height: 2 m

Distribution: Scattered

Canopy Height: 0.5 m
Cover: Mid-dense
Composition: Tussock grass.

Surface: Uneven
Strata number: 1

Boundaries: —

Ground vegetation (<1 m)
Composition: —

Density: —

Special life-forms: Creepers common.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Tussock grass

Crown density: Dense
Type: —
Shape: Weeping
Stem: —
Branch position: —

Bark: —
Roots: —

Leaf size: —
Texture: Orthophyll
Shape: Linear
Margin: Entire

DISTURBANCE

Agent: Birds (see text)

Degree: Low to severe

Location: All stands.

FLORISTICS (common species only)

Shrubs
Cassinia tenuifolia
Melaleuca howeana

Twiners
Commelina cyanea
Ipomoea cairica

Grasses & Sedges
Cyperus lucidus
Poa poiformis
Scirpus nodosus

INCLUSIONS: Small areas, Cl, Cliff, Ca, Mh, DaCtX and IcCg.

Relationship to other units: Close to more open phases of Ca and Mh.

Boundaries: Merges with most adjoining units.

OTHER DATA

The stand at Mutton Bird Point is reported by some islanders to be secondary following destruction of DaCtX by browsing goats. There is no evidence to support this (Pickard, 1976).

Sites: Nil.

Photographs: 20, 25, 26.

FORMATION: Closed Submerged Meadow SUBFORMATION: Submerged Meadow

Number: 1P1.1 Alliance: ZOSTERA-HALOPHILA

ZOSTERA CAPRICORNI—HALOPHILA OVALIS

Symbol: ZcHo Area: —

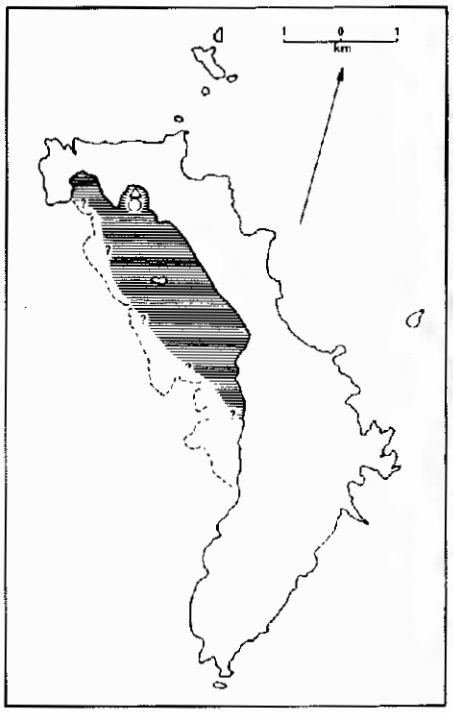
Oliver equivalent:

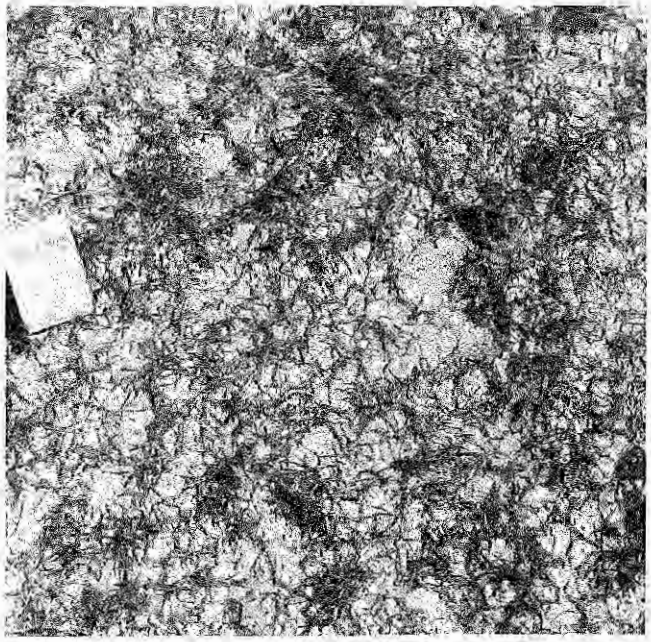
UNESCO equivalent:Rooted underwater community VIID

PHYSIOGRAPHY

Generalized site description: Altitude 0 to 3 m; aspect zero; slope low <2°; exposure very low; on floor of lagoon and exposed at low tide.

Geology: Recent lagoon sediments Soil: Variable, coral sand and mud; coral fragments when present usually <25 mm.





Hunter Bay, off Old Settlement Beach.
Altitude 0 m.

STRUCTURE Basal area: n.a.

Emergents Nil.

Canopy Height: 0.1 m Surface: Uneven
Cover: Sparse Strata number: 2 Boundaries: Sharp
Composition: Herbs and algae.

Ground vegetation (<1 m) Density: n.a.
Composition: —

Special life-forms: Algae,both as macroscopic "seaweeds" and ± microscopic forms, are abundant.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Herbs

Crown density: Sparse
Type: —
Shape: Erect
Stem: Stoloniferous
Branch position: —

Bark: —
Roots: —

Leaf size: —
Texture: Orthophyll
Shape: Narrow
Margin: Entire

DISTURBANCE

Agent: Boats

Degree: Low

Location: Various sites over Lagoon.

This disturbance is not very serious and at Lagoon Jetty the stands appear quite vigorous despite heavy boat concentrations and activity.

FLORISTICS (common species only)

Sea grasses
Halophila ovalis
Zostera capricorni

Algae

INCLUSIONS: Nil.

Relationship to other units: Nil.

Boundaries: Sharp.

OTHER DATA

The unit is not mapped but occurs in patches over the entire length of the lagoon.
The stands vary floristically from pure *Zostera* to pure *Halophila* with all possible intergrades. The reasons for this are not obvious.

Sites: Nil.

FORMATION: Open Scrub SUBFORMATION: Open Broad Sclerophyll Scrub

Number: 1G1.2b Alliance: AVICENNIA

AVICENNIA MARINA var. *AUSTRALASICA*

Symbol: Ama Area: 0.6 ha

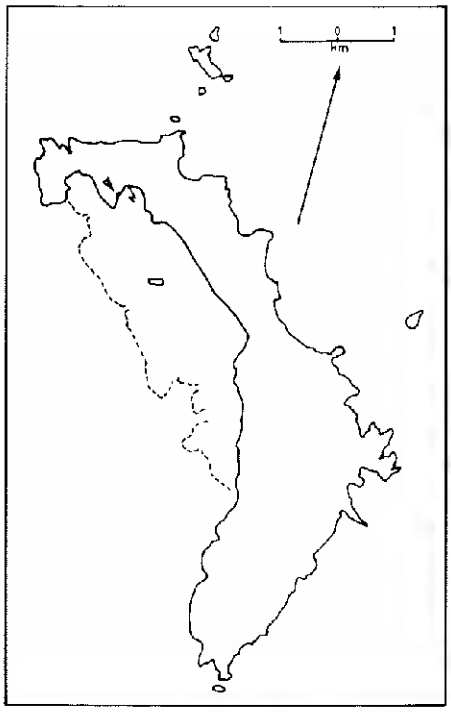
Oliver equivalent: Mangrove *Avicennia officinalis [Avicennia marina* var. *australasica]* Association.

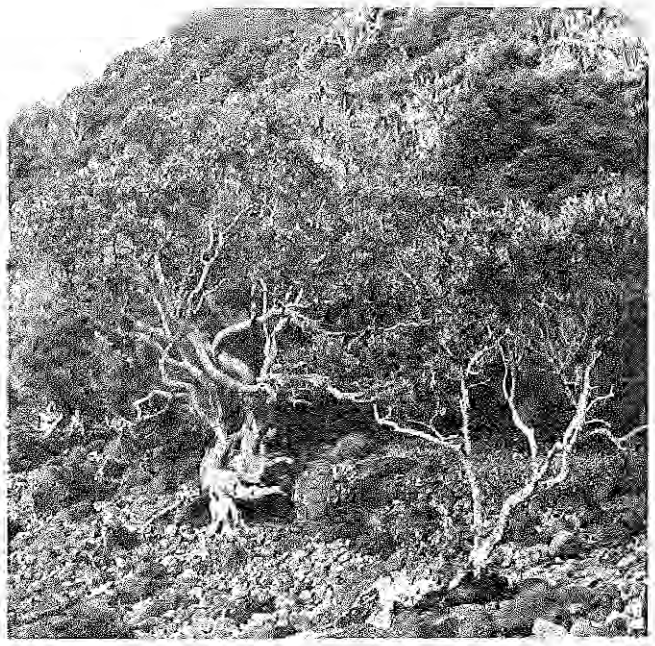
UNESCO equivalent: Evergreen broad-leaved sclerophyllous shrubland IIIA1.d

PHYSIOGRAPHY

Generalized site description: Mud and shingle between high and low tide marks.

Geology: Lagoon deposits between shingles Soil: Black mud, highly calcareous





West side of Hunter Bay, between Boat Pool and Wedding Lilies. Altitude c.1 m.

STRUCTURE Basal area: n.d.

Emergents Nil.

Canopy Height: 2.5–4 m Surface: Uneven
Cover: Sparse, open Strata number: 1 Boundaries: Sharp
Composition: Shrubs.

Ground vegetation (<1 m) Density: —
Composition: —

Special life-forms: Possibly some surface algae.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Shrub

Crown density: Sparse
Type: Divergent

Shape: Round Branch position: Upper half
Stem: Crooked, branchy

Bark: Smooth, fine cracks

Roots: Surface spreading

Leaf size: Notophyll
Texture: Sclerophyll

Shape: Broad Margin: Entire

Pneumatophores

DISTURBANCE

Agent: —

Degree: Nil.

Location: —

Other: —

FLORISTICS (common species only)

Shrubs
Avicennia marina var. *australasica*

Surface algae

INCLUSIONS: Nil.

Relationship to other units: Nil.

Boundaries: Sharp.

OTHER DATA

The most restricted community on Lord Howe and containing the rarest vascular plants. Only 9 plants were seen: 7 from 2.5 to 4 m high and 2 young plants c.1 m high. The stand is close to the Boat Pool which has a black mud bottom.

Sites: Nil.

MISCELLANEOUS HABITATS Physiographic units which are more convenient mapping units than the heterogeneous vegetation they support.

CLIFFS

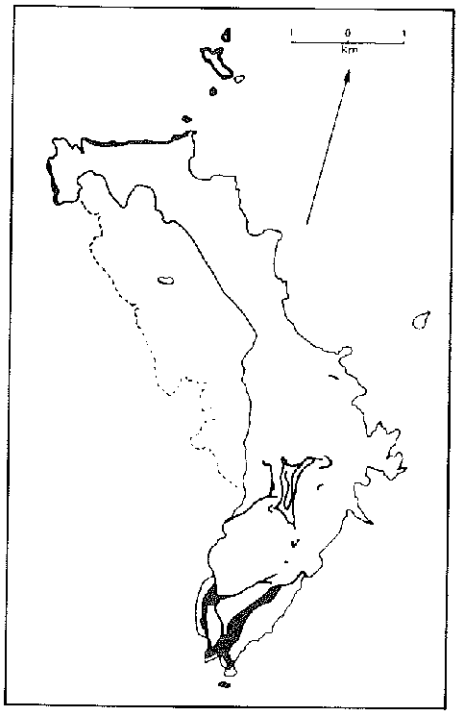
Symbol: Cliff Area: 150 ha, 9.8%

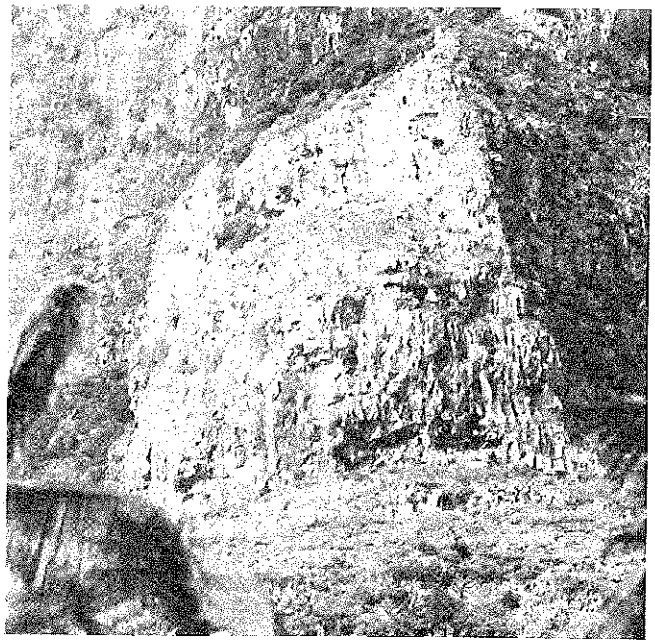
Oliver equivalent: Several—Coastal scrub, hill scrub, rushes etc.

PHYSIOGRAPHY

Generalized site description: Altitude 0–820 m; all aspects; slope >45°, generally >60°; exposure very high; on all positions on slope.

Geology: Basalt, rarely calcarenite Soil: Very variable, but generally shallow and stony





Grey Face, Mount Lidgbird.
Altitude 400 m.

STRUCTURE: Not applicable

STRUCTURAL FEATURES OF CANOPY PLANTS: Not applicable

DISTURBANCE Agent: Goats, birds (see text)

Degree: Locally severe

Location: Northern Hills and southern mountains.

Very local effects of denudation around goat camps. Faecal accumulation probably more important.

FLORISTICS (common species only)

Shrubs
Cassinia teguifolia
Melaleuca howeana

Herbs
Carpobrotus glaucescens

Grasses
Poa poiformis

The flora on the cliffs is extremely variable depending on location and adjoining vegetation.

INCLUSIONS: Many other units: DaCt, DaCtX, Hc, BhDf, BcMep, Ca, Mh, DfMn, Ax, MFH, Pp.

Relationship to other units: Nil.

Boundaries: Sharp and diffuse.

OTHER DATA

The vegetation on cliffs is so heterogeneous that it is impossible to map at this scale. Generally a cliff face supports low scrub and grass, if dry; but large ledges support vegetation similar, but simpler to that on adjacent slopes.

Site: 21.

Disturbed sites: Nil.

CORAL SAND BEACH AND DUNE

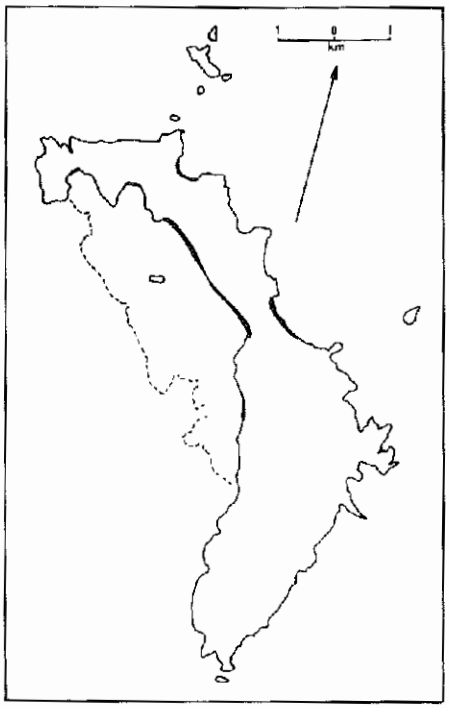
Symbol: Coral Area: 36 ha, 2.4%

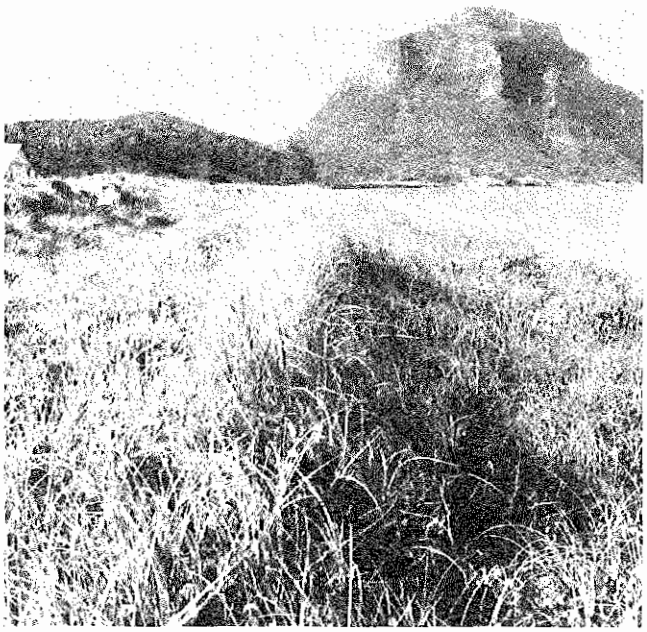
Oliver equivalent: Sand binders *Spinifex hirsutus—Ipomoea pes-caprae [Ipomoea brasiliensis]—Wedelia uniflora [Melanthera biflora]*

PHYSIOGRAPHY

Generalized site description: Altitude 1–5 m; aspect variable; slope low to moderate 1°- 20°; exposure moderate to extreme; lower slopes.

Geology: Recent beach deposits Soil: Calcareous sands with minimal development.





Lagoon Beach.
Altitude 2 m.

STRUCTURE Basal area: n.a.

Emergents Height: 4 m Distribution: Patches and occasional

Canopy Height: 1 m Surface: Even
Cover: Dense Strata number: 1 Boundaries:—
Composition: Sedges, grasses and herbs.

Ground vegetation (<1 m) Density:—
Composition:—

Special life-forms: Creepers and trailers abundant.

STRUCTURAL FEATURES OF CANOPY PLANTS: Mostly not applicable due to mixed nature of communities and lack of dominants.

DISTURBANCE Agent: Man

Degree: Low to severe

Location: All sites, especially Lagoon Beach.

Disturbance ranges from erection of buildings, garbage dumping and vehicular tracks to occasional fires.

FLORISTICS (common species only)

Small trees
Ochrosia elliptica

Shrubs
Cassinia tenuifolia

Herbs
Cakile edentula
Crinum pedunculatum

Twiners/Lianes
Ipomoea brasiliensis
I. cairica
Melanthera biflora
Muehlenbeckia complexa
Vigna marina

Grasses
Scirpus nodosus
Spinifex hirsutus

INCLUSIONS: Some Calcarenite and Coral Boulder Beach, DaCtX.

Relationship to other units:—

Boundaries: Merges with most adjoining units except Cliff.

OTHER DATA

This unit may be interpreted as a sere in the classical sense but for mapping purposes this is unnecessary. Zonation within the unit is fairly consistent at all sites: *Cakile* and *Spinifex* immediately above high tidemark, then *Scirpus* and creepers, then low scrub and forest.
On the dune near the Ac in Prince William Henry Bay is a stand of *Leucopogon parviflorus*. These are dome-shaped shrubs to 2 m. This stand is interesting as, elsewhere, *Leucopogon* occurs as individuals on basalt.

Sites: Nil.

Photographs: 45, 46.

BASALT BOULDER BEACH

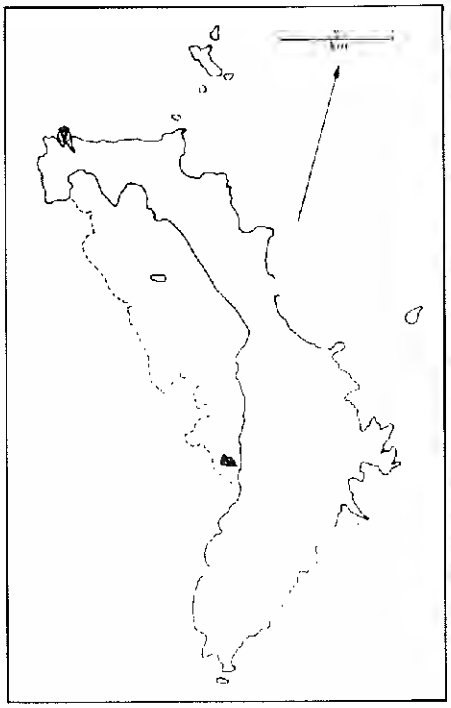
Symbol: — Area: 7 ha, 0.5%

Oliver equivalent: Low succulent plants (halophytes) *Lobelia anceps [Lobelia alata]—Mesembryanthemum aequilaterale [Carpobrotus glaucescens]* Association

PHYSIOGRAPHY

Generalized site description: Altitude 0–2 m; aspect variable; slope low <5°; exposure moderate to extreme; lower slopes.

Geology: Recent deposits Soil: Unknown



N end of Far Flats.
Altitude 1 m.

STRUCTURE Basal area: n.d.

Emergents Nil.

Canopy Height: 4–10 m Surface: Even
Cover: Dense Strata number: 3 Boundaries: Sharp
Composition: Trees, shrubs and herbs.

Ground vegetation (<1 m) Density: Dense
Composition: Herbs, trailing creepers, sedges.

Special life-forms: Succulent herbs rare (usually on calcarenite slabs underlying the basalt boulders).

STRUCTURAL FEATURES OF CANOPY PLANTS: Mostly not applicable due to mixed nature of the communities.

DISTURBANCE: Nil.

FLORISTICS (common species only)

Trees
Drypetes australasica
Howea forsterana
Lagunaria patersonia

Shrubs
Cassinia tenuifolia
Melaleuca howeana

Twiners/lianes
Canavalia rosea
Ipomoea cairica
Melanthera biflora

Grasses & Sedges
Scirpus nodosus
Sporobolus virginicus
Cyperus lucidus

Herbs
Crinum pedunculatum
Lepidium howinsulae

INCLUSIONS: Nil.

Relationship to other units: Closely related to other beach units.

Boundaries: Merges with most adjoining units.

OTHER DATA

Sites: Nil.

CALCARENITE AND CORAL BOULDER BEACH

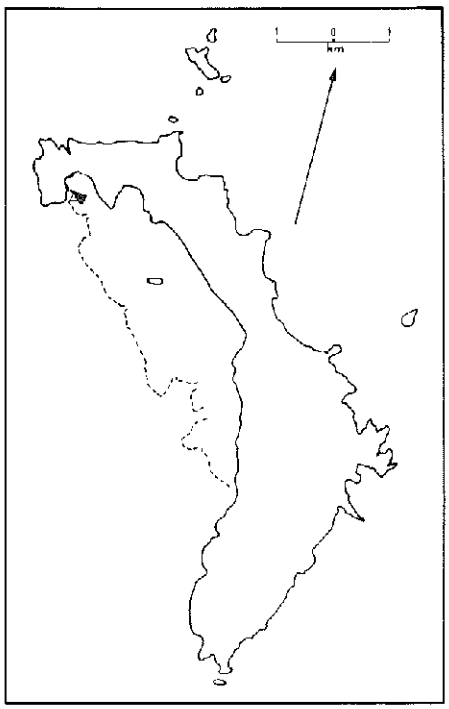
Symbol: — Area: 6 ha, 0.5%

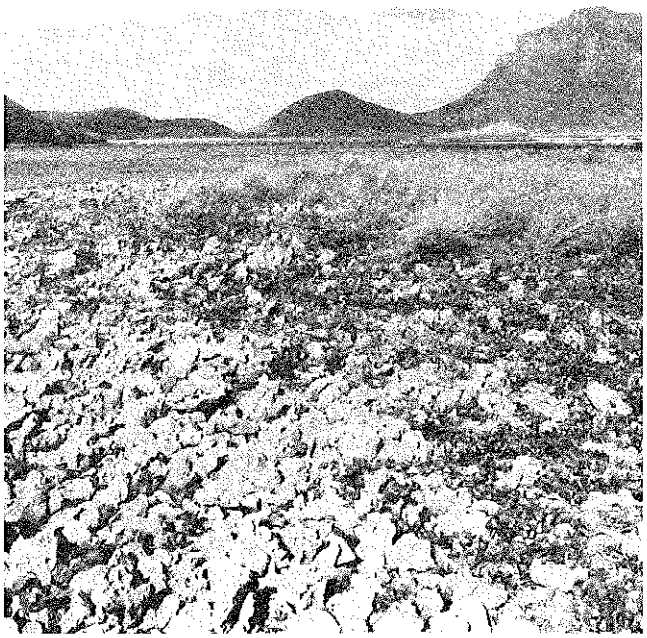
Oliver equivalent: Low succulent plants (halophytes) *Lobelia anceps [Lobelia alata]—Mesembryanthemum aequilaterale [Carpobrotus glaucescens]* Association

PHYSIOGRAPHY

Generalized site description: Altitude 0–1 m; aspect variable but generally W; slope low <5°; exposure high to extreme; lower slopes.

Geology: Recent deposits Soil: Unknown





SW end of North Beach.
Altitude 1 m.

STRUCTURE Basal area: n.a.

Emergents Height: 2 m Distribution: Occasional

Canopy Height: 1 m Surface: Even
Cover: Dense Strata number: 1 Boundaries: —
Composition: Sedges.

Ground vegetation (<1 m) Density:—
Composition:—

Special life-forms: Creepers abundant; succulent herbs occasional.

STRUCTURAL FEATURES OF CANOPY PLANTS

Life-form: Sedge

Crown density: Mid-dense

Shape: Erect

Roots: Rhizome

Leaf size: —

Shape: Terete

Margin: —

Texture: Sclerophyll

DISTURBANCE: Nil.

FLORISTICS (common species only)

Shrubs
Cassinia tenuifolia

Twiners/lianes
Canavalia maritima
Commelina cyanea
Ipomoea cairica
Melanthera biflora
Muehlenbeckia complexa
Vigna marina

Sedges
Scirpus nodosus
Cyperus lucidus

Herbs
Crinum pedunculatum

INCLUSIONS: Nil.

Relationship to other units: Closely related to other beach units.

Boundaries: Merging with most adjoining units.

OTHER DATA

As the unit occurs on actively growing beaches and spits, it may be interpreted as seral. This is not necessary for mapping purposes.
All sites are on actively prograding beaches or spits.

Sites: Nil.

DISTURBED AREAS

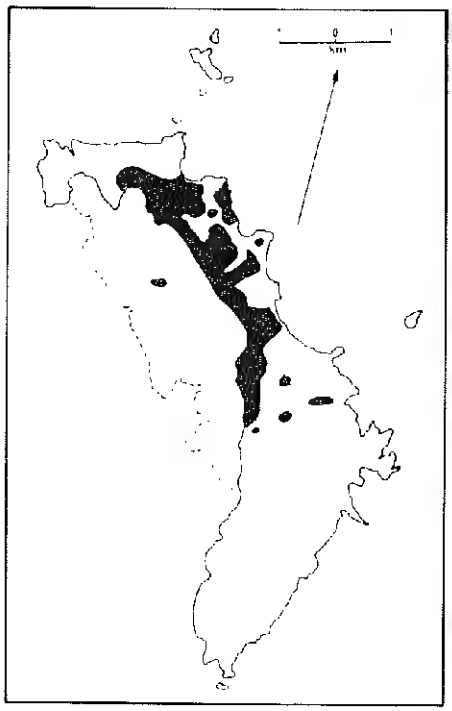
Symbol: —

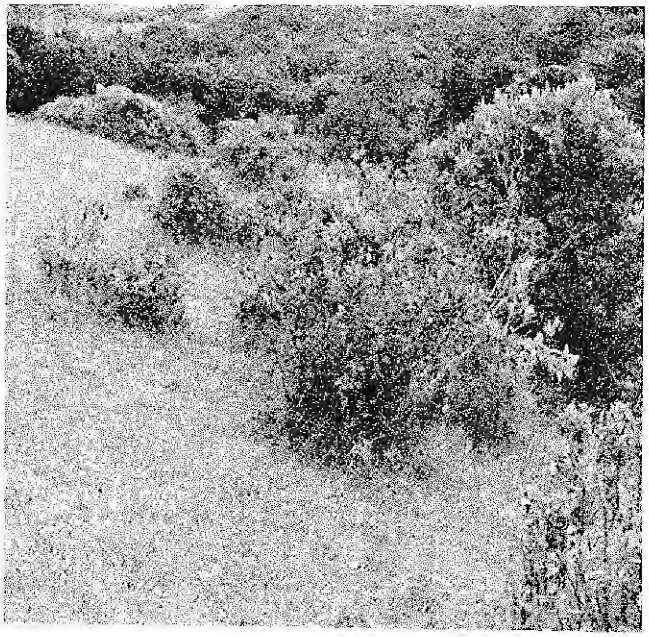
Area: 248 ha, 16.4%. This % is independent of the others.

Oliver equivalent: Nil.

PHYSIOGRAPHY

Generalized site description: All types of sites regardless of physiography within the following general limits: Altitude 0–80 m; slope 0°– 30°; all aspects; all positions on slopes.





Ray Shicks Bull Paddock, Peach Tree Ridge, W of Intermediate Hill. Altitude 50 m.

STRUCTURE

Special life-forms: Soft herbs become very abundant; rhizomatous and stoloniferous grasses common.

STRUCTURAL FEATURES OF CANOPY PLANTS: Not applicable.

FLORISTICS (common species only)

Shrubs
**Chrysanthemoides monilifera*
**Psidium cattleianum*
**P. guajava*

Herbs
**Ageratina adenophora*

Grasses
**Chloris gayana*
**Pennisetum clandestinum*
**Stenotaphrum secundatum*

Many other species generally referred to as "weeds". Regrowth of native species, e.g. *Cassinia tenuifolia*.

INCLUSIONS

Relationship to other units: —

Boundaries: Variable

OTHER DATA

Response of vegetation depends to a large extent on the unit and the nature and degree of disturbance.

Sites: 29, 40, 42, 43, 49, 54, 55, 56, 57, 58, 64, 69.

Photographs: 27, 29, 30, 31, 32, 33, 34, 35, 37, 38, 39, 40, 43, 44, 45, 46, 48.