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The main features of the vegetation and a vascular flora are given for an area of some 1 330 hectares in the north eastern sector of Great Barrier Island. Only patches of original forest remain. The predominant vegetation is regenerating forest and scrub, with small areas of grassland along the coast and on the summit ridge. Vegetation succession and floristic composition have been extensively modified by pigs and goats. A small island free of these animals, adjacent to the study area, demonstrates the impact of pigs and goats on the vegetation of the main island. The recent accelerated erosion of the area is discussed. An annotated species list of vascular plants is presented. Of the 441 taxa recorded, 334 (76%) are native.

Key words: Hauraki Gulf; Great Barrier Island; Goats; Browsing damage; Pigs; Landslides; *Metrosideros excelsa*; Pohutukawa; *Metrosideros robusta*; Northern Rata.

Botanical features of northeastern Great Barrier Island, Hauraki Gulf, New Zealand

A. E. Wright* and E. K. Cameron**

The main features of the vegetation and a vascular flora are given for an area of some 1,330 hectares in the north-eastern sector of Great Barrier Island. Only patches of original forest remain. The predominant vegetation is regenerating forest and scrub, with small areas of grassland along the coast and on the summit ridge. Vegetation succession and floristic composition have been extensively modified by pigs and goats. A small island free of these animals, adjacent to the study area, demonstrates the impact of pigs and goats on the vegetation of the main island. The recent accelerated erosion of the area is discussed.

An annotated species list of vascular plants is presented. Of the 441 taxa recorded, 334 (76%) are native. Several taxa achieve the northern limit of their distribution in the study area, and the status of rare plants found is discussed.

Keywords: Great Barrier Island, forest, scrub, grassland, vascular flora, feral goats, feral pigs, rare plants, landslips.

INTRODUCTION

Great Barrier Island (latitude 36°15'S, longitude 175°25'E, area 28,500 ha.) is the largest island off the northern coast of New Zealand. It lies approximately 90 km north-east of Auckland City and 20 km north of the Coromandel Peninsula (Fig. 1), and marks the outer limit of the Hauraki Gulf. The climate on Great Barrier Island is similar to that of districts immediately to the north of Auckland. Rainfall recorded at Port Fitzroy is between 1,593 and 2,401 mm per annum. Temperatures range from an average daily maximum of 23.8°C in February to an average daily minimum of 8.1°C in July, with an annual mean temperature of 15.6°C.

During the Offshore Islands Research Group's expedition to northern Great Barrier Island, from 30 December 1982–9 January 1983, we undertook botanical exploration of a 1,330 hectare block in the north-eastern sector (Fig. 1). This part of Great Barrier Island is composed of Mesozoic greywackes (indurated sandstone and argillite) intruded by numerous igneous dikes of much younger age (Moore and Kenny, 1985). Apart from small areas of flat land in Rangihakaea Bay and on the central ridge around Tataweka Trig (526 m), the study area consists of steep to very steep country dissected by numerous stream valleys drained by seven permanent streams. Landslips are common in the area.

Few accepted geographic place names are available for this northern block of Great Barrier Island. To achieve accurate site location in the following vegetation descriptions and species list, a number of informal names were coined by our party. These are shown in Fig. 1 and enclosed in inverted commas where used in the text.

Within the time available, we attempted to cover the area as thoroughly as possible, exploring all major ridges, valleys, and the coastline. In order to gain as complete a floristic coverage as possible, the search was also directed at the full range of habitats and microhabitats available. By the last days of field work, the find rate of additional taxa had dropped to two per day, leading us to believe that our coverage of the flora approaches 95%.

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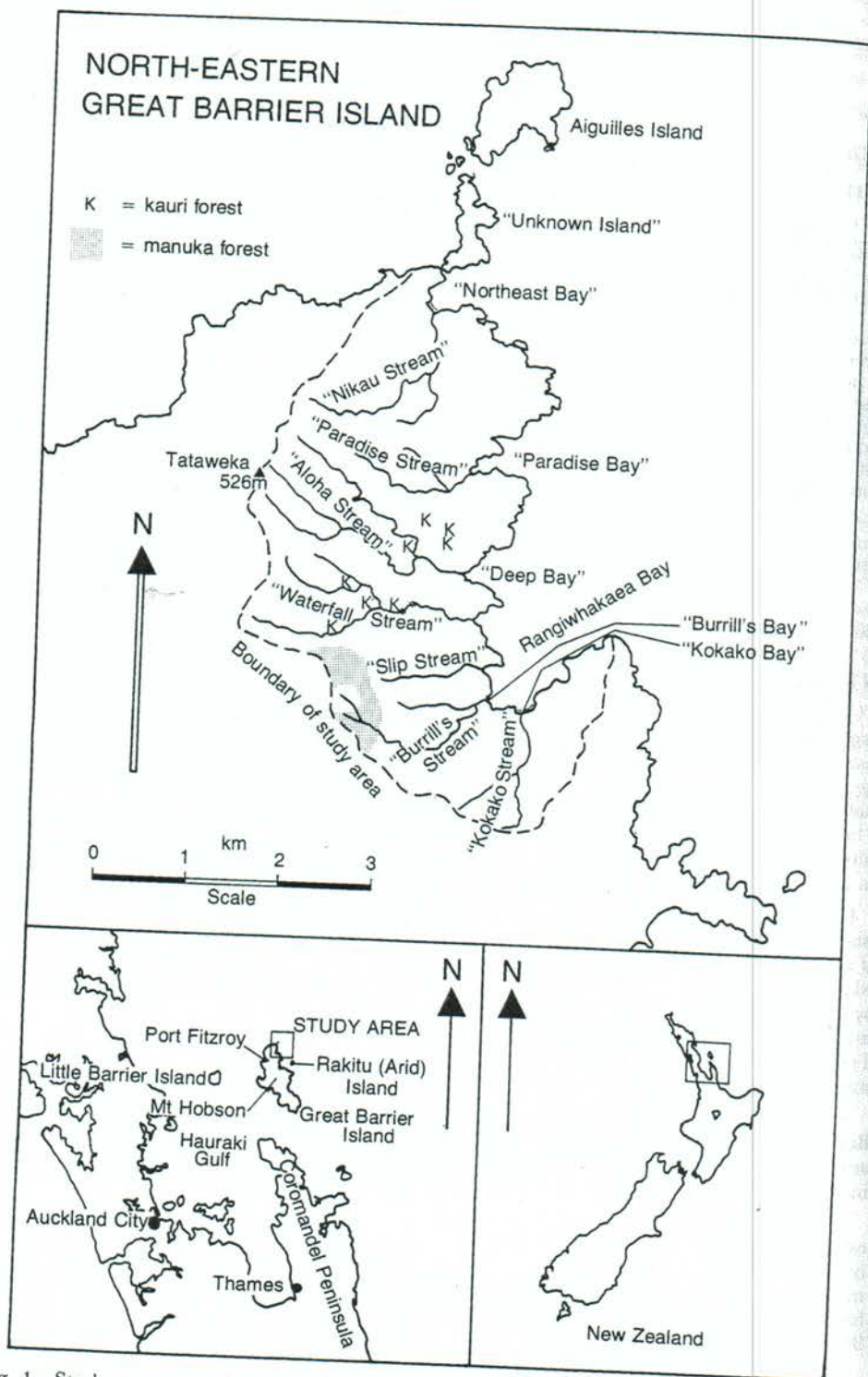


Fig. 1 - Study area at north-eastern Great Barrier Island showing place names used in the text (informal names are given in quotation marks) and location off New Zealand.

Prehistoric occupation of the coastline is evident by the large numbers of pits and terraces on the coastal ridges. No evidence of milling was seen, and little mature forest is present.

The northern and western parts of Great Barrier, excluding Katherine Bay, were first purchased from the Maoris in 1838. After being bought and sold several times the northern block of c. 4,826 hectares, including our study area, was sold to W. J. Arundel in 1898. He did not reside on the land and there was little development of the property. The block was divided into 13 lots (not surveyed) and auctioned in 1914. The only lot that sold was the one at the southern end of the central ridge (the eastern part of which is shown as manuka forest in Fig. 1). It was cleared, fenced, and farmed by its purchaser, Mr Tobey Davis. However, he never paid more than his £50 deposit, and the sale therefore lapsed (Young, 1984). In 1948 W. J. Arundel died, and in 1953 his executors unsuccessfully offered the whole block to the Crown for £6,000. It was eventually sold privately in 1954, and in 1964 it was transferred to M. T. Burrill. On 1 April 1984 the forested part of this northern block was gifted by Mr Burrill to the Department of Lands and Survey for a reserve.

The bulldozed road along the central ridge to Tataweka forms the western boundary of the study area from the leading ridge between "Kokako" and "Burrill's" streams north to Tataweka (Fig. 1), and is the only track in the area. It was established in May 1972 for the Consolidated Silver Mining Company of New Zealand Ltd., and is now partly overgrown. A single exploratory hole was drilled, and the old drill platform is still present at the end of a short dead-end road down a side ridge south-east of Tataweka.

Feral goats (*Capra hircus*) and pigs (*Sus scrofa*) have had a major impact on the vegetation and possibly also on the geomorphology of the island. Goats were present in very large numbers on northern Great Barrier by 1860 (Lloyd, 1979), where they were originally released to provide food for castaways. Pigs were liberated at Tryphena between 1845 and 1850. However, there is a small island ("Unknown Island") free from goats and pigs, separated from northern Great Barrier by a narrow gut (Fig. 2), which provided the opportunity to study the vegetational and floristic modifications caused by browsing.

Kirk (1869) published the first account of the botany of Great Barrier Island, but apparently did not explore the northern block. Subsequent collectors have worked mainly in the southern and central parts of the island. R. O. Gardner and E. K. Cameron undertook a brief field survey of the northern block in April 1980, towards the Department of Lands and Survey's Land Inventory of Great Barrier Island (R. O. Gardner and E. K. Cameron, unpublished, 1980). E. K. Cameron revisited the study area in October 1984 for three days.

VEGETATION COMMUNITIES

The main vegetation cover is advanced regenerating forest. It varies greatly in its composition and degree of modification, so mapping the different forest communities within it is difficult. The vegetation communities are therefore discussed under five broad headings.

Grasslands

Only three extensive grasslands exist; one by Tataweka trig, the other two by the coast behind "Kokako" and "Burrill's" Bays. The 1942 aerial photographs show expanses of grassland similar to those present now. At the back of the beach in "Burrill's Bay", *Spinifex hirsutus* dominates the low sand dunes. Common plants associated with the *Spinifex* include shore bindweed (*Calystegia soldanella*), hawkbit (*Leontodon taraxacoides*), sowthistles (*Sonchus* spp.), catsear (*Hypochoeris radicata*), riggut brome (*Bromus diandrus*), *Oxalis stricta* and the carpeting buffalo grass (*Stenotaphrum secundatum*). *Scirpus nodosus* and wire vine (*Muehlenbeckia complexa*) are present as occasional clumps, and *Carex pumila* forms a sward on the stream margin. Behind the dunes on the firmer land, *Spinifex* gives way to a flat area (c. 400 × 100 m²) of introduced grasses and herbaceous plants, and this continues up the southern coastal hill towards "Kokako Bay". A similar grassland community exists at "Kokako Bay", but without the *Spinifex* foredune. These two similar grasslands are dominated by the pasture grasses sweet vernal (*Anthoxanthum odoratum*), cocksfoot (*Dactylis*



Fig. 3—Vegetation degraded by goat browsing in a small valley on the northern side of "Paradise Bay".

of *Fuchsia procumbens* are found in this community, and *Astelia banksii* is common on rock outcrops.

Grassy herbfield occurs on open ridgetops, and is dominated by danthonias (*Rytidosperma biannulare*, *R. racemosum*, *R. unarede*), long-haired plume grass (*Dichelachne crinita*) and *Scirpus nodosus*, with lesser amounts of *Pimelea prostrata*, coastal toetoe, *Poa anceps*, *Picris hieracoides* and the adventive weeds *Lotus angustissimus* and centaury.

Shrubland up to c. 2 m tall occurs over much of the summit area. Here kanuka, manuka, niniao (*Helicthysum aggregatum*), *Hebe pubescens*, flax and mapou (*Myrsine australis*) dominate. Bracken (*Pteridium esculentum*), akepiro, hangehange (*Geniostoma ligustrifolium*) and mingimingi (*Cyatodes fasciculata*) are present with *Dianella nigra* and *Asplenium oblongifolium* beneath. Adjacent grassy areas are being invaded by these shrubs.

Pohutukawa forest is the fifth and most advanced community, and has established on the steep flanks of the main ridge. The 4-7 m tall forest is crowned with kanuka along the windswept summit ridge where it grades into shrubland. At the southern end of the

- Gonocarpus incanus* (A. Cunn.) Orchard Occasional in young *Leptospermum* scrub and on bulldozed track along summit ridge. AK 160890.
- G. micranthus* Thunb. subsp. *micranthus* Locally common amongst turf on bulldozed track along summit ridge near Tataweka. AK 160889.
- Griselinia lucida* Forst. f. Puka Occasional; epiphytic or rupestral (on bluffs) shrub or small tree. AK 160965.
- Haloragis erecta* (Banks et Murr.) Eichl. Shrubby haloragis Confined to "Unknown Island" where it was common. AK 160985. U.
- Hebe macrocarpa* (Vahl.) Ckn. et Allan var. *latisejala* (Kirk) Ckn. et Allan Rare; a few sparse shrubs in kauri forest remnant between main forks of "Waterfall Stream"; one c. 3.5 m tall. Several others on bank by top of waterfalls. AK 160879.
- H. pubescens* (Banks et Sol. ex Benth.) Ckn. et Allan Rare; a few plants on coastal cliffs. On goat-free "Unknown Island" the plant is common. AK 160974. U.
- Hedyocarya arborea* J.R. et G. Forst. Pigeonwood Common shrub to small tree in older scrub and young forest.
- Helichrysum aggregatum* Yeo Niniao Occasional shrub in coastal scrub and beneath coastal forest. U.
- Hoheria populnea* A. Cunn. Houhere Occasional in damper forest areas. U.
- Hydrocotyle elongata* A. Cunn. Common on stream banks and in herbfields at mouths of streams north of "Slip Stream". AK 160846.
- H. heteromeria* A. Rich. Waxweed Occasional on mossy boulders in stream beds and on stream banks. AK 160868.
- H. moschata* Forst. f. Locally common in grassland on summit ridge around Tataweka. AK 160885.
- **Hypericum humifusum* L. Trailing St. John's wort Occasional on dry banks on bulldozed track along summit ridge. AK 160894.
- H. japonicum* Thunb. Swamp hypericum Rare; single colony found growing on silt in bed of "Paradise Stream". AK 160895.
- **Hypochoeris radicata* L. Catsear Common weed of open places, scrub and disturbed sites throughout. U.
- Knightia excelsa* R. Br. Rewarewa Common tree in forest and older scrub communities. Particularly common along margin of central ridge. U.
- Lagenifera pumila* (Forst. f.) Cheesem. Common on ridgetops beneath *Leptospermum* and in the Tataweka grasslands. U.
- Laurelia novae-zelandiae* A. Cunn. Pukatea Occasional in forested stream valleys.
- **Leontodon taraxacoides* (Vill.) Merat Hawkbit Common in grassland and rock crevices along coastline. AK 160958.
- Leptospermum ericoides* A. Rich. Kanuka Abundant throughout, particularly on ridges and as scattered trees in the regenerating forest. U.
- L. scoparium* Forst. Manuka Less common than the preceding species. A pure stand occurs in the south-west corner of the study area. U.
- **Linum bienne* Mill. Australian flax Occasional in grassland in Rangiwahakaea Bay and on summit ridge. AK 160942.
- **L. trigynum* L. Yellow flax Locally abundant in dry sites on coastal cliffs.
- Lobelia anceps* Linn. f. Common in fresh-water seepages over coastal rocks; also in the Tataweka grasslands. AK 161008. U.
- **Lotus angustissimus* L. Occasional amongst coastal rocks and on slip faces. U.
- **L. pedunculatus* Cav. Lotus major Common in grassland around stream mouths.
- **L. suaveolens* Pers. Lotus hispidus Common amongst coastal rocks and on summit ridge. U.
- Lythrum hyssopifolia* L. Loosestrife Common amongst grasses on banks of lower reaches of "Burrill's Stream". AK 160930.
- Macropiper excelsum* (Forst. f.) Miq. var. *excelsum* Kawakawa Occasional in mature forest valleys. U.
- **Medicago arabica* (L.) Huds. Spotted bur medick Occasional amongst coastal rocks; locally common in grassland at Rangiwahakaea Bay. AK 161003.
- **M. lupulina* L. Black medick Common on coastal slopes with scrub and grass cover. AK 160822.
- **M. polymorpha* L. Bur medick Locally common on maritime margins of vascular plant vegetation. AKU 14072.
- Melicope simplex* A. Cunn. Occasional at streamsides in "Waterfall Valley".
- M. simplex* x *M. ternata* Single plant adjacent to falls on "Waterfall Stream". AKU 14033.
- M. ternata* J.R. et G. Forst. Occasional exposed plants, showing signs of browsing. U.
- Melicytus ramiflorus* J.R. et G. Forst. Mahoe Common understory constituent of forest throughout. U.
- **Mentha pulegium* L. Pennyroyal Common weed of damp grassland and disturbed stream banks.
- Metrosideros diffusa* (Forst. f.) Smith Common liane in forest. AK 160913.
- M. excelsa* Sol. ex. Gaertn. Pohutukawa Abundant in coastal slopes and occasional large trees on inland ridges. U.
- M. excelsa* x *M. robusta* Occasional trees on inland ridges, several at high altitudes.