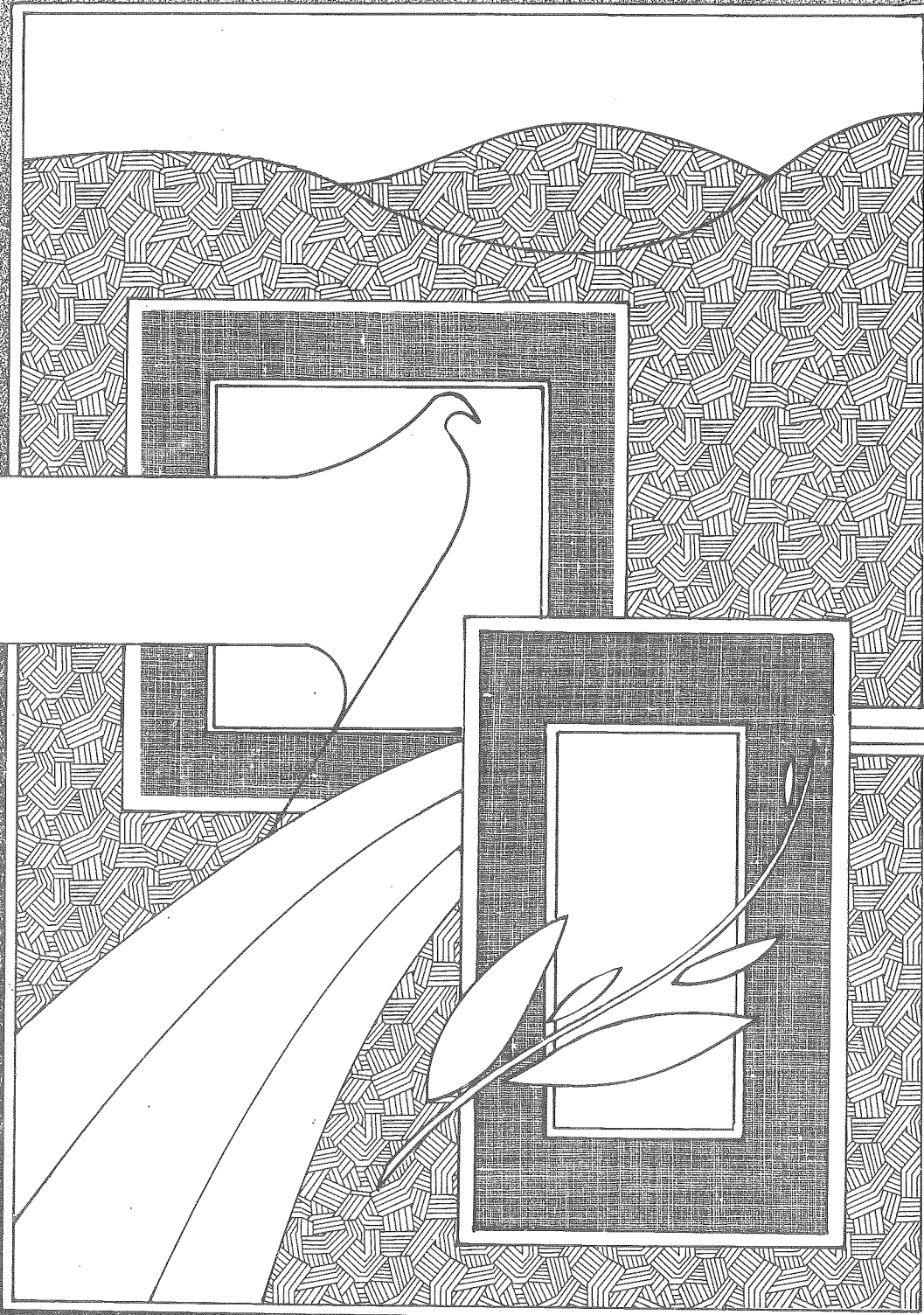


Auckland Conservancy

DEDICATED AREAS REPORT Number 16



Manganuiowae Ecological Area



MANGANUIOWAE ECOLOGICAL AREA



NZ FOREST SERVICE
AUCKLAND CONSERVANCY
CPO Box 39
AUCKLAND

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March 1985

MANGANUIOWAE ECOLOGICAL AREA

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Location (Figure 1)

The Manganuiowae Ecological Area comprises the catchment of the Manganuiowae Stream in Raetea Forest, as well as several upper catchments of the Victoria River (approximate midpoint at map reference N.Z.M.S. 1 N10 943559). The nearest town centre, Kaitaia, is 16 kilometres north-west of Raetea Forest (Fig. 1). The forest is one of 17 in the Northland State Forest Park, and is part of a large tract of indigenous forest covering the Maungataniwha Range. The reserve covers 1760 ha, and is situated in the Maungataniwha Ecological District along with five other Forest Service reserves (Department of Lands & Survey 1984). The most recent aerial photographs were flown in 1977 (N.Z. Aerial Mapping Survey No. 5006; run C, photos 11 and 12, run D, photos 11 and 12).

Access

The only public access to the reserve is a tramping track, which runs between the Mangamuka Gorge summit on State Highway 1 and Takahue Saddle Road west of Raetea Forest. The track is a trunk route of the N.Z. Walkway system, which is ultimately intended to provide a continuous walkway from North Cape to Bluff. For the fieldwork for this report access to the reserve was also gained across private land from the south.

History of Gazettal

J. Nicholls (scientist, F.R.I. Rotorua) made the initial proposal to dedicate the Manganuiowae Ecological Area (Nicholls, 1979). The proposal was considered and approved, with boundary extensions, by the Scientific Co-ordinating Committee (S.C.C.) in August 1979. Following approval in principle by the Minister of Forests in May 1980, the reserve was gazetted on the 26th of June 1981 (N.Z. Gazette No. 80, p 1910).

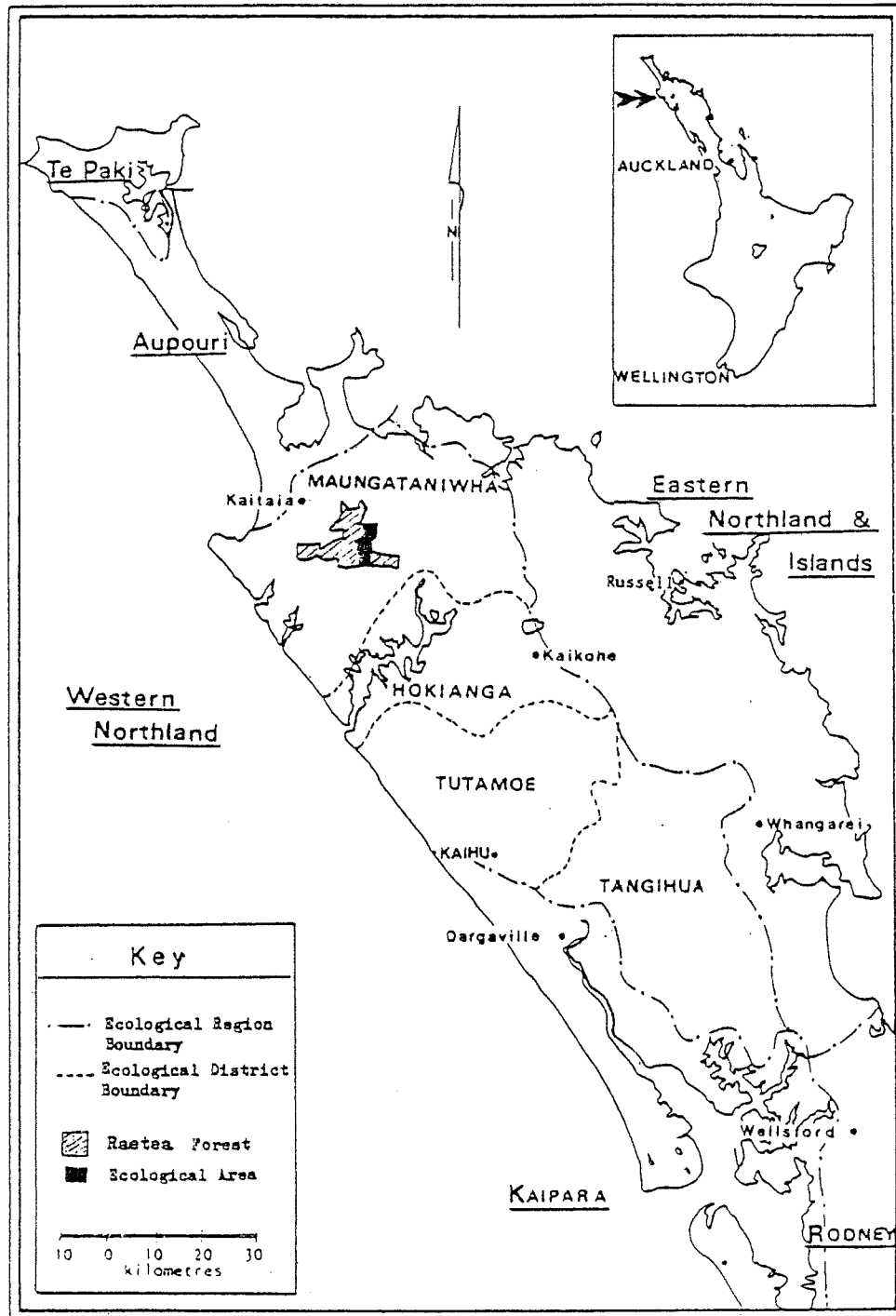
Rationale and Objectives of Designation

The reserve meets most of the guidelines for selection of Ecological Areas as set down by the S.C.C. (1983); the reserve is over 1000 ha, contains a complete catchment, has a fairly compact shape and is unroaded. It also covers a wider altitudinal range than any other reserve in the Maungataniwha Ecological District.

The Director of Environmental Forestry, K. Miers, gave the objective for reservation as to preserve:

.../

Fig.1 : Location Map of Manganuiowae Ecological Area Showing Boundaries of Ecological Regions and Districts.



(Based on Ecological Regions and Districts - 2nd Edition.

Biological Resources Centre, 1983.)



Photo 1 : Upper Manganuiowae Stm catchment, looking west towards Raetea trig (arrowed).
(Photo by J.L. Kendrick)



Photo 2 : *Loxoma cunninghamii* (Photo by S. Courtney)

"A representative area of non-kauri forest in a typical undisturbed catchment of the Maungataniwha Range, with a particularly numerous and diverse bird fauna including kokako and a wide variety of sites, from broad sheltered valley floors to steep-sided, exposed ridges".

(A letter to the Minister of Forests, May 1980, Ak Conservancy file 6/2/19).

Climate

The nearest raingauge to the reserve is at Broadwood, 1.6 km south of Raetea Forest, at 85 m a.s.l. It recorded a mean annual rainfall of 1915 mm (N.Z. Meteorological Service, 1974). Maungataniwha peak, 570 m a.s.l., is 6.4 km north-west of the reserve along the Maungataniwha Range. The annual rainfall recorded there, of 2150 mm (N.Z. Met. Service, 1975), should be more comparable to that of the reserve. The closest climatological station, at Kaitaia aerodrome, recorded mean daily maximum and minimum temperatures (1949-1980) of 19.5°C and 11.7°C respectively (N.Z. Met. Service, pers. comm.).

Topography

Raetea Forest covers the western portion of the Maungataniwha Range, which straddles the Northland peninsula between the Whangape and Whangaroa Harbours. The main topographical feature of the Ecological Area is the Manganuiowae catchment, which has a broad valley floor and steep sides, bounded by high exposed ridges. The northern part of the reserve is outside the Hokianga Harbour catchment and drains north-west into the Victoria River. Waterfalls are common throughout the reserve. The altitudinal range in the reserve is from 110 m to 744 m a.s.l.

Geology

The major rock type of the reserve is extrusive volcanic rock comprising basalt and dolerite, with some breccia and rare blocks of sandstone, mudstone and limestone (Petty, 1982). The geological age of this type is between 60-200 million years. Along the southern boundary of the reserve is an area of interbedded sandstone and mudstone, of a similar geological age as the volcanic rock.

The extrusive rock is known as the Tangihua volcanics and is typical of several rugged ranges in central and western Northland, including those of Warawara and Tangihua Forests (Town and Country Planning Branch, Ministry of Works, 1964). These volcanics were formed under the sea before being uplifted in a series of earth movements called the Rangitata Orogeny (Ballance, 1970).

Pedology and Erosion

Te Kie steepland soils, stony clay and reddish clay loam, occupy nearly all the reserve. The soils are weakly to moderately leached and excessively drained. Along the southern boundary of the reserve the soil type is Waiotira clay, which is moderately to strongly leached and well drained (Sutherland, et al., 1979). Rock outcrops are frequent, especially on steeper slopes.

Erosion is not an obvious feature in the reserve, although aerial photographs show several large earth slips in the Manganuiowae catchment.

Vegetation

The information used to give the following description was primarily obtained from fieldwork in October (13th-18th) and the 15th of November 1984. Two unpublished Forest Service reports (N.Z.F.S., 1953; N.Z.F.S., 1954) provided additional information. A botanical species list giving both scientific and common names is appended (Appendix 1).

Information on the forest structure and composition was collected using a system of recce-type plots recording the vegetation in up to five tiers, with the dominant lianes and epiphytes. The tiers are:

- emergent (above canopy height),
- canopy,
- subcanopy (below canopy height down to 2 m),
- shrub (2 m down to 50 cm), and
- groundcover (50 cm and below).

Site descriptions are grouped into types based as closely as possible on those classified by Nicholls (1976). Further discussion of this technique is given by Burns (1983). Overlay 2 of Fig. 2 shows the location of the site descriptions recorded.

I have divided the vegetation into four types:

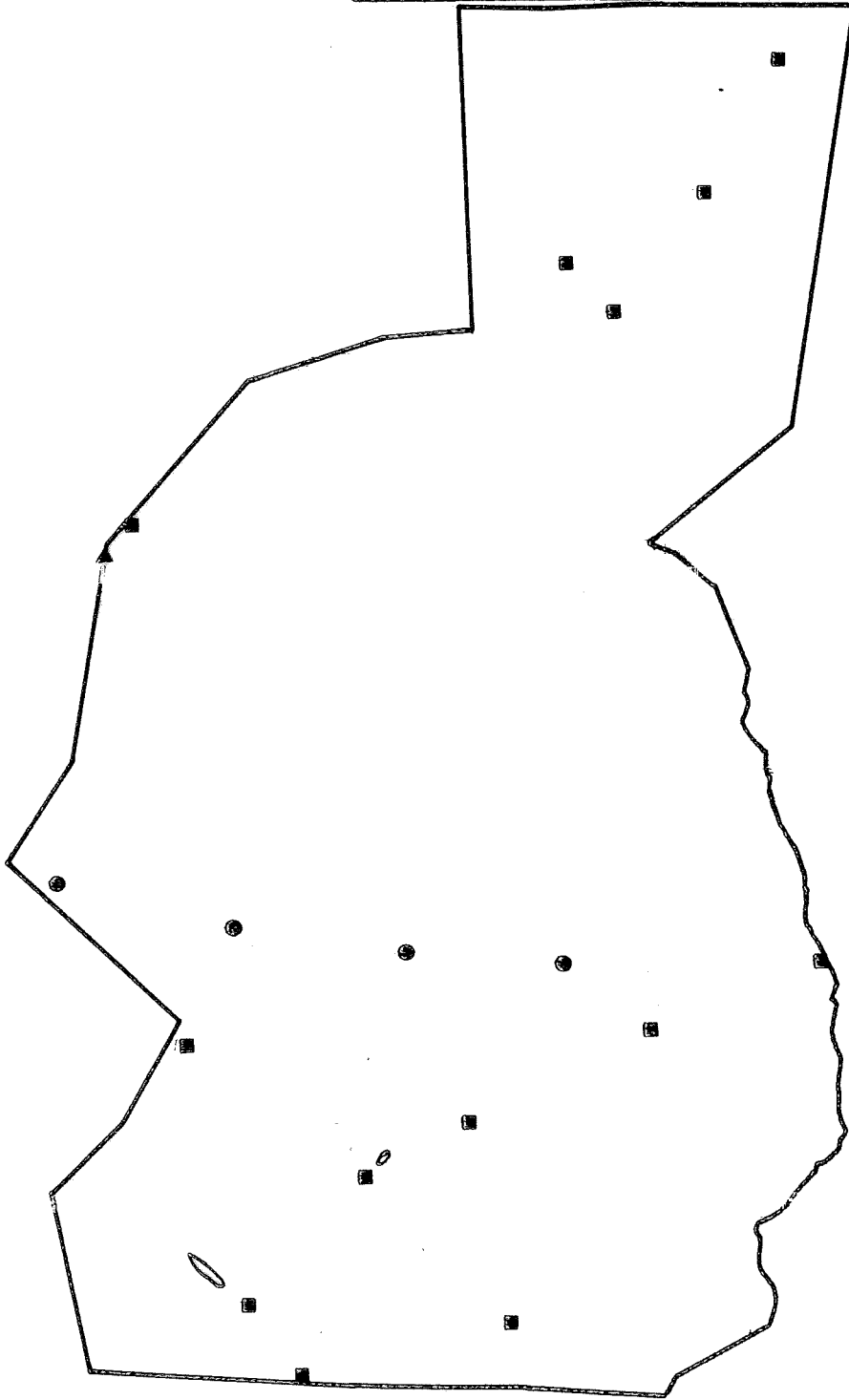
1. low altitude podocarp-hardwood forest (E2, Nicholls 1976);
2. mid altitude podocarp-hardwood forest (E3, Nicholls 1976);
3. high altitude podocarp-hardwood forest (D6, Nicholls 1976); and
4. kauri-podocarp-hardwood forest.

The extent of these forest types is shown on Overlay 1 of Fig. 2.





Overlay 2

Location of Vegetation Descriptions

- 1984 Site Description
- 1954 Recce Plot
- ▲ Microwave Transmitter
- Clearing



Overlay 1

-  Low Alt. Podocarp-Hardwood Forest
-  Mid Alt. Podocarp-Hardwood Forest
-  High Alt. Podocarp-Hardwood Forest
-  Kauri-Podocarp-Hardwood Forest

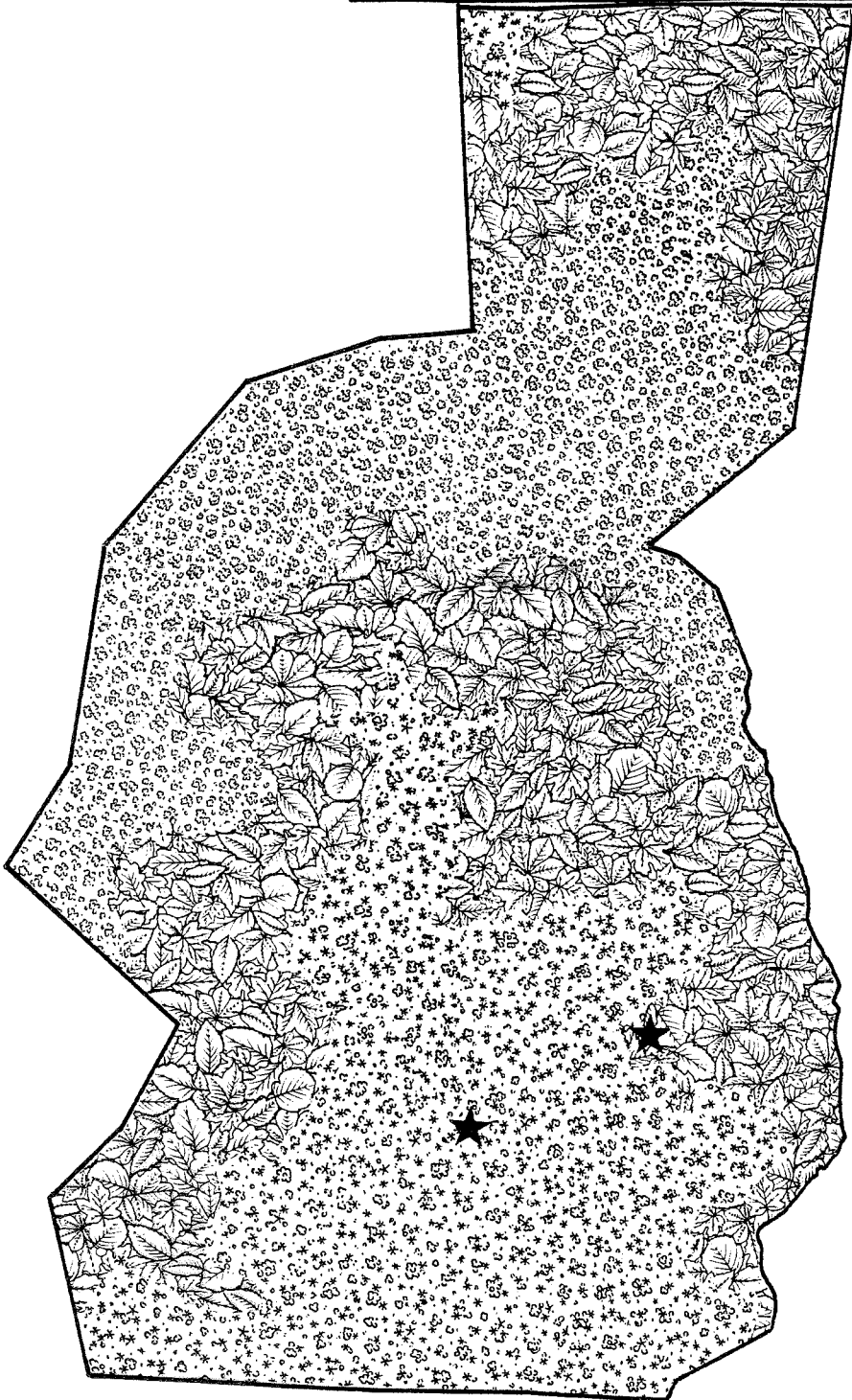
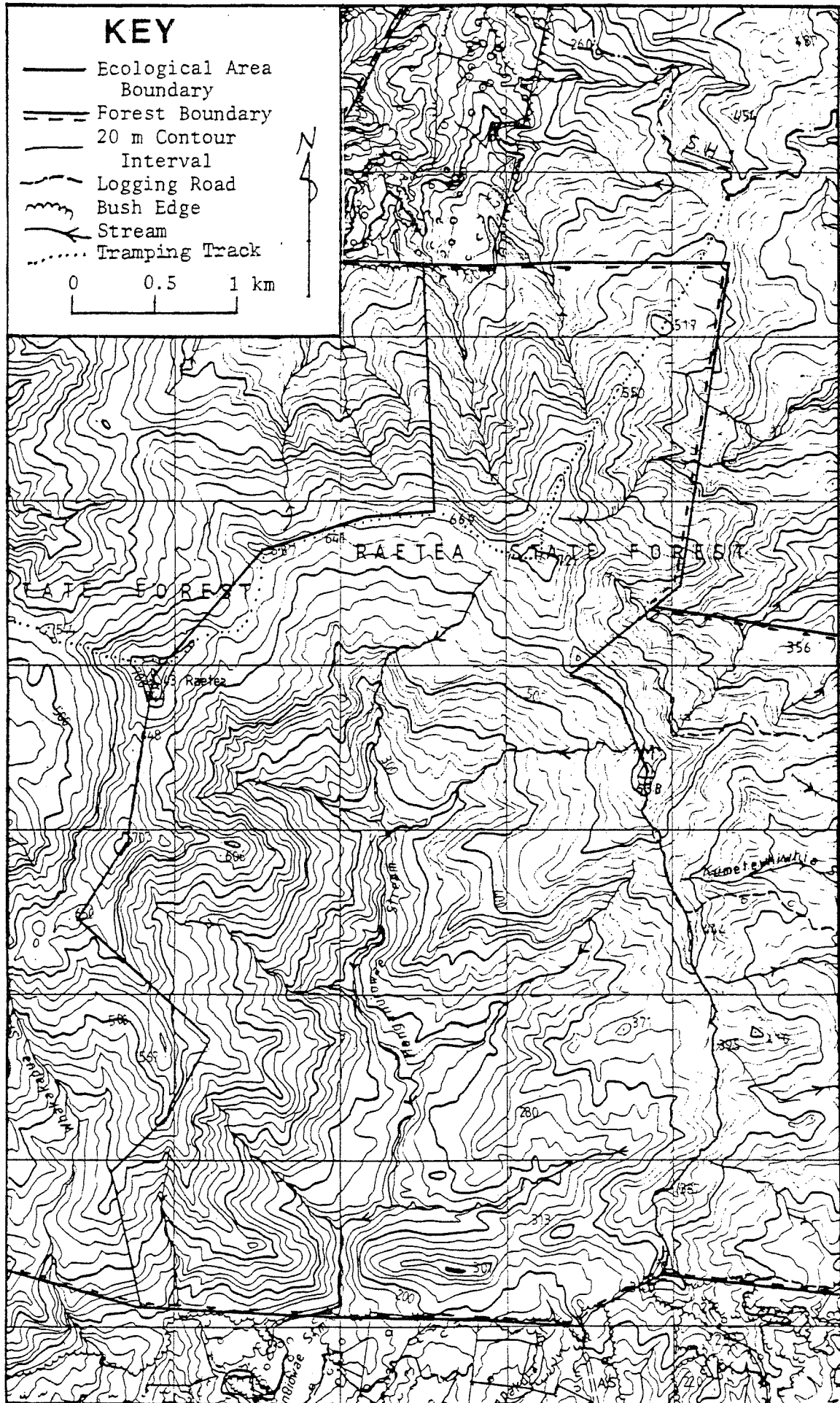


FIGURE 2 : MANGANUIOWAE ECOLOGICAL AREA



Based on N.Z.M.S. 270 series map 0 04.

Appendix 3 shows a generalised stand structure for the low altitude podocarp-hardwood forest type. This type occurs below 300 m a.s.l. in the reserve. Rimu and rata, up to 30 m high, are frequent emergents over a closed hardwood canopy, which is dominated by taraire, towai, and, to a lesser extent, kohekohe and rewarewa. Tall kahikatea are common on the streambanks and low-lying poorly drained sites. In the dense subcanopy, kohekohe, nikau and wheki predominate over a wide range of hardwood species. The shrub and ground layers tend to be more open, with hangehange, kiokio and *Coprosma* spp. as the prevalent shrub species. Parataniwha is abundant on damp slopes, and hen & chicken fern is present throughout. Supplejack and kiekie are prominent lianes, often up into the upper tiers. Puka, perching lilies and hound's tongue are frequent epiphytes.

On the easier terrain of the lower valley floor in the Manganuiowae catchment, a small swampy area (ca 1 ha) contains swamp maire as a canopy dominant. Tall rimu and kahikatea are scattered emergents while parataniwha is abundant on the ground.

Mid altitude podocarp-hardwood forest (Appendix 4 gives a generalised stand structure) is found between 300 m and 500 m a.s.l. in the reserve. As the altitude increases, miro becomes a frequent emergent with rimu, and tawa becomes abundant in the canopy. Taraire decreases correspondingly. Hinau, heketara, and *Cyathea smithii* become common in the upper tiers, with increasing altitude. Kahikatea and rimu poles occur in the canopy, and miro saplings are frequent in the dense subcanopy, especially on ridges. Kiekie is a major constituent of the ground and shrub layers. The shrub tier also contains kanono, wheki, and occasional ponga, *Astelia trinervia*, and assorted hardwoods. Where kiekie is absent, the groundcover is fairly sparse, comprising frequent hen & chicken fern, bush rice grass, and occasional *Blechnum* spp., hook sedge, *Astelia trinervia* and *Pneumatopteris pennigera*. Common epiphytes and lianes are *Asplenium* spp., *Lygodium articulatum* and several climbing rata species.

Above 500 m a.s.l. in the reserve, high altitude podocarp-hardwood forest occurs (stand structure, Appendix 5). Rimu and miro are still frequent emergents, but not as tall as at low altitudes especially on exposed ridges. Tawa and towai are codominant in the closed canopy, with hinau and heketara as common components. *Cyathea smithii* becomes abundant in the subcanopy at these higher altitudes. Other common elements of the dense subcanopy are wheki, large-leaved mahoe, five finger, kohekohe and pigeonwood. The shrub and groundcover layers are more open than the above two tiers. Hangehange, Kirk's tree daisy and kanono are prevalent in the shrub layer. The groundcover comprises predominantly piupiu, bush rice grass, *Blechnum fraseri* and hookgrass. Epiphytes, the most abundant being *Hymenophyllum* spp. (and mosses), often cover trunks and branches in a damp green sward. Perching lilies, kidney fern, *Pseudopanax edgerleyi* and *Grammitis* spp. are among the many epiphytic species.

At approx. 720 m a.s.l., on the approach to Raetea summit from the Mangamuka Gorge summit, is a small area of low shrub hardwood vegetation straddling a razor-back section of the ridge. Heketara, koromiko, tutu, kiokio, *Cordyline banksii*, neinei, mountain flax and hangehange are common in the dense vegetation which reaches 4 m in height.

The fourth forest type is kauri-podocarp-hardwood forest (generalised stand structure, Appendix 6). This forest type is a minor component of the reserve's vegetation, and was found during the fieldwork only on two knolls. A small, similar kauri stand found during the National Forest Survey (N.Z.F.S., 1954) may be one of the ones encountered in this survey. Both knolls have a single large mature kauri on them and several pole and sapling kauri. The upper knoll (at 350 m a.s.l.) has less kauri regeneration than the lower (at 210 m a.s.l.). Emergent podocarps are common at both sites (see Appendix 6), including a lone 14 m kawaka on the upper knoll. A 50 cm kawaka seedling was seen nearby. The podocarps and scattered towai and tawa form an open upper tier, below which are frequent kohekohe and pole rimu, with occasional kauri, Hall's totara and kahikatea poles, taraire, heketara and rewarewa. In the thick shrub layer *Coprosma* spp. predominate over wheki, ponga, nikau, kiekie and *Gahnia* spp. Kiekie and *Gahnia* spp. fill out the otherwise scattered ground cover in which *Blechnum fraseri* and podocarp seedlings are common. The large podocarps have many epiphytes, of which *Collospermum hastatum* and *Astelia solandri* are prominent. Other epiphytes seen include hound's tongue, epiphytic orchids, and climbing rata species.

The National Forest Survey (N.Z.F.S., 1954) found rimu to be the most abundant podocarp in Raetea Forest. Swamp maire occurs on wet sites throughout the reserve. *Loxoma cunninghamii* and *Metrosideros carminea*, listed as 'vulnerable' and 'endangered' respectively by Williams and Given (1981), occur in the reserve. *Loxoma cunninghamii* is found in several clumps on the banks of the Manganuiowae Stream. *Metrosideros carminea* is found from the banks of the Manganuiowae Stream up to well above 600 m, where it was seen in flower on several emergent rimu.

In the Ecological Area, several plants approach their northern limit, including *Elaeocarpus hookerianus*, *Pseudopanax anomalus*, *Gahnia pauciflora*, *Astelia* sp. (c.f. *A. nervosa*), *Ixerba brexioides* and *Pennantia corymbosa*.

Introduced Animals and Forest Condition

A faunal species list giving scientific and common names is provided in Appendix 2.

Of 32 circular 1 m² plots examined in the Ecological Area, none contained animal droppings. Occasional possum sign was seen, including scratches on kanono saplings and browse on mamaku. In 'Wildlife and Wildlife Values of Northland', Ogle (1982) reported that damage to kauri snails by pigs in Raetea Forest was amongst the worst seen anywhere. During the recent field inspection pig sign was seen throughout the reserve, but not noticeably more than in some other Northland forests. Forest Service cullers shot 22 pigs

in Raetea Forest in July 1965. In that year a private hunter killed 26 pigs (N.Z.F.S., Kaikohe file 34/1/2). Cattle prints and droppings were seen on ridges and easier terrain throughout the reserve. Browse was noted on the following species: nikau, kiekie, mahoe, Kirk's tree daisy, large-leaved mahoe, hangehange and *Cordyline pumilio*.

During the field inspection five stoats were seen along the southern reserve boundary. Rats are present in Raetea Forest, according to Ogle (1982, p 35).

Part of the southern boundary of the reserve is unfenced, and repairs are needed on some fenced sections. Fresh sign seen during the inspection indicates that cattle are straying into the Ecological Area from the south via the stream and the ridges to each side. Locals say that there are wild cattle well back in the reserve. Fencing along the northern reserve boundary and adjacent forest boundary is in good condition (N.Z.F.S. Auck. file 6/2).

The regeneration of canopy species, the openness of different tiers and the presence of dead or dying trees were assessed in order to get an indication of forest condition. At all sites examined, the bottom two tiers are more open than the subcanopy and canopy levels. This openness may be due in part to shading by the upper tiers, but in places cattle browse has had an obvious impact. At one site near the forest perimeter there was even regeneration of seedlings which were 50 cm high, and an open shrub tier. Overall, however, cattle browse is not concentrated in any one area, and seedlings and saplings of canopy species are numerous.

On the southern boundary, the ridge climbing west from the stream had several long open areas, possibly fire induced, sometimes grassed, and interspersed with uneven regeneration. A similar open area was found further up the catchment (see Overlay 2 Fig. 2).

Presence of Exotic Plants

Exotic species are confined to the few open places. Several pasture species occur in the clearing at Raetea summit, and in the small clearings in the Manganuiowae catchment, as well as on open banks beside the main stream. To the south where the reserve is bordered by pasture, exotic species are common in the forest margin.

Native Fauna

The Ecological Area is part of a forest tract which the Wildlife Service rates as outstanding wildlife habitat (Ogle, 1982). Kokako were heard from several places on the summit track during the field inspection for this report. This is one of the few forests in Northland where kokako are known to occur. The following extract is from Wildlife and Wildlife Values in Northland (Ogle, 1982).

"The formal survey showed the Raetea Forest block had both the highest native bird diversity and bird numbers of the seven forests surveyed. Especially notable were numbers of pied tits, pigeons and tui. Also present are kaka, kiwi, kokako, bats, kauri snails; the presence of a parakeet species is reported".

The Manganuiowae Stream contains freshwater crayfish, freshwater shrimps and eels. Information on invertebrates in the Ecological Area is sparse.

Recreational Facilities and Opportunities

The trunk route of the National Walkway System, which will ultimately link North Cape to Bluff, passes through the Ecological Area (see Fig. 2). Although firearms and animals are prohibited on the Walkway System, pig hunters as well as trampers use the track. Hunters also enter the reserve from the south, with permission from local farmers. A bivouac found in the western side of the Manganuiowae catchment was known by a farmer to have been built by pig hunters.

Parking, picnic and toilet facilities are available at the Mangamuka Gorge summit on State Highway 1.

Human History and Influence

The Historic Places Trust has no records of archaeological sites from former Maori occupation of the reserve (pers. comm. from Ak Conservancy Archaeologist).

The Land Settlement Board examined the Manganuiowae Stream valley in December 1931, and recommended putting in a road and settling the south and east of the catchment (N.Z.F.S., Kaikohe file 6/2).

During 1936-1937, 81.4 ha in the south-east of the reserve (Sawmill Area 93) was logged by K.D.V. Boxes Ltd. The main trees extracted were kahikatea and rimu (N.Z.F.S., 1953). Several army exercises have been held in Raetea Forest (N.Z.F.S., Auck. file 6/2). A live-firing zone to the north-west of the reserve was suggested in a letter from the N.Z. Land Forces in 1981 (N.Z.F.S., Auck. file 6/0/25).

Waihi Exploration and Mining Ltd. was granted two Mineral Prospecting Warrants (M.P.W.) in the early 1970's. M.P.W. No. 342 was granted for five years from 16.9.70. The portion of Raetea Forest which is now Ecological Area was within the 4010 ha application area. M.P.W. No. 358 was granted for five years from 12.3.71, and the southern part of the Manganuiowae catchment was within the 2,305.4 ha application area. No further interest has been shown by mining companies.

The Post Office erected a microwave transmitter station near Raetea trig on 17.1.75.

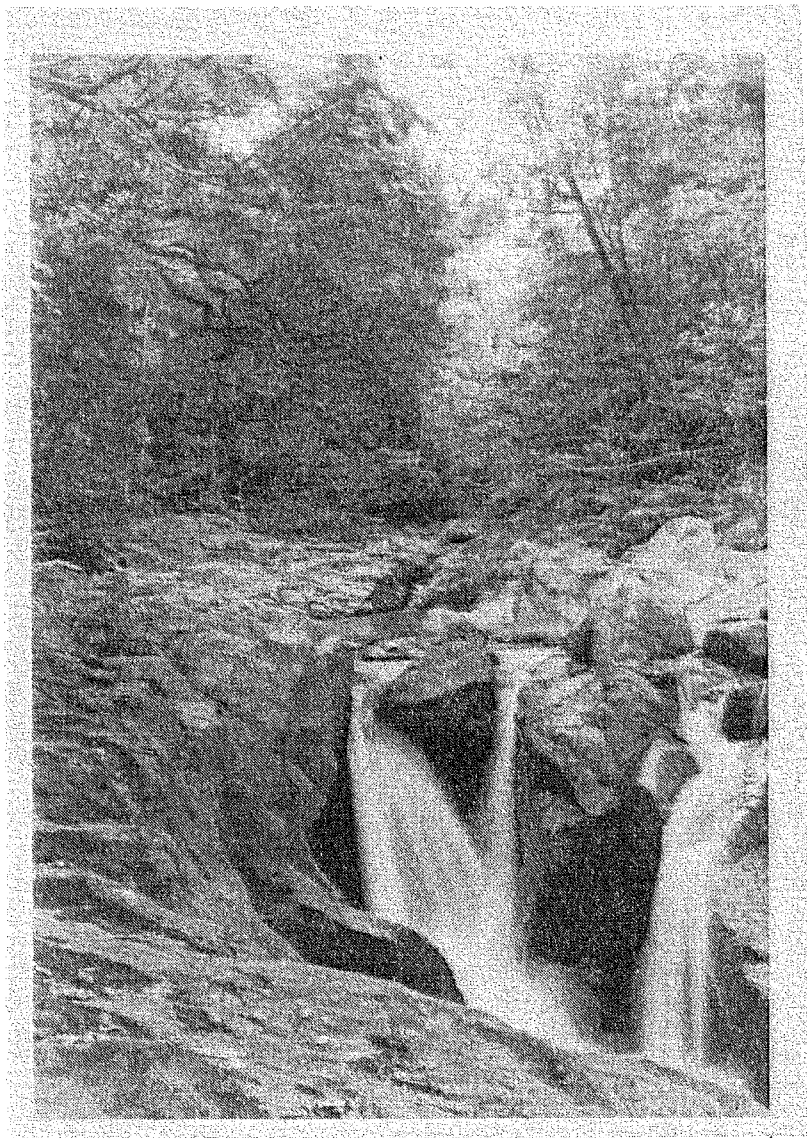


Photo 3 : Manganuiowae Stream (Photo by P. Boyack)

Research Carried Out and Suggested

The National Forest Survey recorded four plots in what is now the Ecological Area (N.Z.F.S., 1954). The N.Z. Wildlife Service (1978) Fauna Survey Unit visited Raetea Forest in 1978. The results of their survey form the basis for the Faunal Species List in Appendix 2. A further visit in 1979 confirmed the presence of kokako in the since designated Ecological Area (Ogle, 1982). Further investigation into the number and distribution of kokako in the area would be a useful line of research.

Summary, Discussion and Recommendations

The Manganuiowae Ecological Area covers a 1760 ha segment of the large tract of indigenous forest covering the Maungataniwha Range. Most of the reserve consists of the upper Manganuiowae Stream catchment. A small part of the north-facing slopes of the Maungataniwha Range is included because of its kokako population, and also because of the continuity created with the large Mangamuka Gorge Scenic Reserve. Extrusive volcanic rock, comprising basalt and dolerite, underlies the reserve. Te Kie steepland soils cover most of the area.

I have divided the vegetation into four general types: low, mid and high altitude podocarp-hardwood forest, and kauri-podocarp-hardwood forest. Frequent emergent podocarps are a feature of the vegetation, and the canopy is dense in the podocarp-hardwood types. The Maungataniwha Range is the northern known limit for a number of plants.

The presence of cattle and pigs is evident throughout the reserve, but possums are not numerous, and goats, surprisingly, appear to be absent. Despite the absence of goats, periodic pig culling is necessary in view of the heavy pig predation of kauri snails reported by Ogle (1982). A lot of cattle presently in the reserve appear to have strayed from farms along the southern boundary of Raetea Forest. The improvement of fencing along this boundary is a priority for maintaining and improving vegetation values of the reserve. The sides of the Manganuiowae catchment are so steep that cattle straying from other parts of the forest would be slow to move into the Ecological Area. Ultimately, adequate fencing of the entire forest boundary is necessary in order to exclude stock from the reserve.

The high diversity of native birds in Raetea Forest, and the presence of bats and kauri snails, are reasons for its outstanding wildlife habitat rating by the Wildlife Service. Kokako, pied tits and kaka are present in the Ecological Area. The kokako is rare in Northland, with few recent records in Northland forests (Ogle, 1982). More information on kokako in the reserve is desirable, as their welfare should be one of the reserve's main management objectives.

A good track provides access to the Ecological Area. If the trends for other Northland forests are followed, the track will receive increasing recreational use.

A small part of the reserve was logged during 1936 and 1937. A recent army proposal for a live firing zone near the reserve should not proceed, as the area is near the known location of kokako.

From the above discussion, the following management recommendations are made, in order of priority:

1. That cattle be removed from the reserve and that Raetea Forest be adequately fenced, with priority given to the southern boundary in the vicinity of the Ecological Area.
2. That N.Z.F.S. liaise with the Wildlife Service for further kokako research in Raetea Forest.
3. That N.Z.F.S. cullers reduce pig numbers in Raetea Forest.
4. That any live firing zones in Raetea Forest be well removed from the Ecological Area.

Acknowledgements

The help of Peter Bellingham, Lisa Forester and particularly Peter Boyack in the field is gratefully acknowledged. Peter Bellingham assisted with plant identifications, as did Ewen Cameron and Nigel Clunie. The co-operation of Forest Service staff in Kaikohe and Omahuta is greatly appreciated.

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APPENDIX 1 : BOTANICAL SPECIES LIST - MANGANUIOWAE ECOLOGICAL AREA

P = P.J. Bellingham, N.Z.F.S. Botanist, pers. comm.

A = Adventive

FERN ALLIES

Lycopodium varium (incl. *L. billardieri*) clubmoss
L. volubile
Tmesipteris elongata ssp. *elongata*
T. lanceolata
T. sigmatifolia
T. tannensis

FERNS

Adiantum cunninghamii maidenhair fern
A. fulvum black maidenhair fern
A. hispidulum rosy maidenhair fern
Anarthropteris lanceolata lance fern
Asplenium bulbiferum ssp. *bulbiferum* hen & chicken fern, manamana
A. flaccidum ssp. *flaccidum* raukatauri, hanging spleenwort
A. oblongifolium shining spleenwort
A. polyodon
Blechnum chambersii
B. discolor piupiu, crownfern
B. filiforme climbing sweetfern
B. fluviatile
B. fraseri Fraser's hardfern
B. membranaceum thin hardfern
B. nigrum black hardfern
B. sp. (Lomaria latifolia)
B. sp. (B. capense agg.) kiokio
Cardiomanes reniforme kidney fern
Ctenopteris heterophylla
Cyathea dealbata ponga, silverfern
C. medullaris mamaku, black tree fern
C. smithii katote, soft tree fern
Deparia petersenii (*Athyrium japonicum*)
Dicksonia lanata
D. squarrosa wheki
Diplazium australe (*Athyrium australe*)
Gleichenia cunninghamii umbrella fern, tapuwae kotuku
Grammitis billardieri strap fern
G. pseudociliata "
Histiopteris incisa swamp fern
P *Hymenophyllum armstrongii* filmy fern
H. demissum "
H. dilatatum "
H. ferrugineum "
H. flabellatum "
H. flexuosum "
H. lyallii "

<i>H. multifidum</i>	filmy fern
<i>H. rarum</i>	"
<i>H. revolutum</i>	"
<i>H. sanguinolentum</i>	piripiri
<i>H. scabrum</i>	filmy fern
<i>Hypolepis rufobarbata</i>	
<i>Lastreopsis glabella</i>	
<i>L. hispida</i>	
<i>Leptopteris hymenophylloides</i>	heruheru, crepefern
<i>Lindsaea trichomanoides</i>	
<i>Loxoma cunninghamii</i>	Northland fern
<i>Lygodium articulatum</i>	mangemange
<i>Paesia scaberula</i>	pigfern, hardfern, ringfern
<i>Phymatosorus diversifolius</i>	hound's tongue, kawaowao, maratata
<i>P. scandens</i>	moki, fragrant fern
<i>Pneumatopteris pennigera</i>	pakauroharoha
<i>Pteridium esculentum</i>	bracken
<i>Pteris macilentata</i>	
<i>P. tremula</i>	shaking bracken
<i>Pyrrosia serpens</i>	leather-leaf fern
<i>Rumohra adiantiformis</i>	climbing shield fern
<i>Trichomanes elongatum</i>	filmy fern
<i>T. endlicherianum</i>	"
<i>T. venosum</i>	"

GYMNOSPERMS

<i>Agathis australis</i>	kauri
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Dacrydium cupressinum</i>	rimu
<i>Libocedrus plumosa</i>	kawaka
<i>Podocarpus hallii</i>	Hall's totara
<i>P. totara</i>	totara
<i>Prumnopitys ferruginea</i> (= <i>Podocarpus ferrugineus</i>)	miro
<i>P. taxifolia</i> (= <i>Podocarpus spicatus</i>)	matai

DICOTYLEDONS

<i>Acaena anserinifolia</i>	bidibid
<i>Ackama rosaeifolia</i>	makamaka
<i>Alectryon excelsus</i>	titoki
<i>Alseuosmia banksii</i>	
<i>A. macrophylla</i>	karapapa
<i>A. banksii</i> X <i>A. macrophylla</i> (<i>A. X quercifolia</i>)	N.Z. honeysuckle
<i>Aristotelia serrata</i>	wineberry, makomako
<i>Beilschmiedia tarairi</i>	taraire
<i>B. tawa</i>	tawa
<i>Brachyglottis repanda</i>	rangiora

<i>Callitriche muelleri</i>	starwort
<i>C. stagnalis</i>	
P <i>Cardamine debilis</i>	broom
<i>Carmichaelia aligera</i>	putaputaweta
<i>Carpodetus serratus</i>	
<i>Centella uniflora</i>	
A <i>Cirsium arvense</i>	Californian thistle
A <i>C. vulgare</i>	Scotch thistle
<i>Clematis cunninghamii</i> (<i>C. parviflora</i>)	
<i>C. paniculata</i>	puawhanganga
A <i>Conyza floribunda</i>	fleabane
<i>Coprosma arborea</i>	mamangi
<i>C. areolata</i>	
<i>C. grandifolia</i>	kanono
<i>C. lucida</i>	karamu
<i>C. parviflora</i> s.s.	
<i>C. rhamnoides</i>	
<i>C. robusta</i>	karamu
<i>C. spathulata</i> ssp. <i>spathulata</i>	
<i>C. propinqua</i> X <i>C. robusta</i>	
<i>Coriaria arborea</i>	tutu
<i>Cyathodes fasciculata</i>	mingimingi
A <i>Digitalis purpurea</i>	foxglove
<i>Dodonaea viscosa</i>	akeake
<i>Dracophyllum latifolium</i>	neinei
<i>Dysosyllum spectabile</i>	kohekohe
<i>Elaeocarpus dentatus</i>	hinau
<i>E. hookerianus</i>	pokaka
<i>Elatostema rugosum</i>	parataniwha
<i>Epilobium nerterioides</i>	
<i>E. pedunculare</i>	
<i>E. rotundifolium</i>	
A <i>Eupatorium adenophorum</i>	Mexican devil
A <i>E. riparium</i>	mist grass
<i>Fuchsia excorticata</i>	kotukutuku
<i>Gaultheria antipoda</i>	
<i>Geniostoma rupestre</i> var. <i>crassum</i>	hangehange
<i>Geranium</i> sp.	
<i>Gnaphalium gymnocephalum</i>	
<i>G. involucreatum</i>	
<i>G. keriense</i>	
A <i>G. spicatum</i>	
<i>Griselinia lucida</i>	puka, shining broadleaf
P <i>Gunnera monoica</i>	
<i>Haloragis erecta</i> var. <i>erecta</i>	
<i>Hebe stricta</i> var. <i>stricta</i>	koromiko
<i>Hedycarya arborea</i>	pigeonwood
<i>Hoheria populnea</i> var. <i>populnea</i>	lacebark, houhere
<i>Hydrocotyle moschata</i>	
<i>Hypericum japonicum</i>	
A <i>Hypochoeris radicata</i>	catsear

<i>Ixerba brexioides</i>	tawari
<i>Knightia excelsa</i>	rewarewa
<i>Lagenifera pumila</i>	
<i>Laurelia novae-zelandiae</i>	pukatea
<i>Leptospermum ericoides</i>	kanuka
<i>L. scoparium</i>	manuka
<i>Litsea calicaris</i>	mangeao
<i>Lophomyrtus bullata</i>	ramarama
<i>Macropiper excelsum</i>	kawakawa
<i>Melicope simplex</i>	
<i>Melicytus macrophyllus</i>	large-leaved mahoe
<i>M. micranthus</i>	
<i>M. ramiflorus</i>	mahoe
<i>Metrosideros albiflora</i>	climbing rata, akatea
<i>M. carminea</i>	"
<i>M. diffusa</i>	"
<i>M. fulgens</i>	climbing rata, akakura
<i>M. perforata</i>	climbing rata, akatarotoro
<i>M. robusta</i>	Northern rata
<i>Mida salicifolia</i>	willow-leaved maire
<i>Muehlenbeckia australis</i>	
<i>Myrsine australis</i>	mapou, red matipo
<i>M. salicina</i>	toro
<i>Nertera depressa</i>	
<i>N. dichonodraefolia</i> s.s.	
P <i>N. setulosa</i>	
<i>Nestegis cunninghamii</i>	black maire
<i>N. lanceolata</i>	white maire
<i>Olearia rani</i>	heketara
<i>Oxalis lactea</i>	
<i>Paratrophis microphylla</i>	turepo
<i>Parsonsia capsularis</i>	akakiore
<i>Pennantia corymbosa</i>	kaikomako
<i>Pittosporum cornifolium</i>	karo
<i>P. kirkii</i>	
<i>P. tenuifolium</i>	kohuhu
A <i>Plantago lanceolata</i>	narrow-leaved plantain
A <i>P. major</i>	broad-leaved plantain
<i>Pratia angulata</i>	
A <i>Prunella vulgaris</i>	selfheal
<i>Pseudopanax anomalus</i>	
<i>P. arboreus</i>	five-finger
<i>P. crassifolius</i>	lancewood
<i>P. edgerleyi</i>	raukawa
<i>Pseudowintera axillaris</i>	horopito
<i>Ranunculus hirtus</i>	
<i>Rhabdothamnus solandri</i>	waiu-atua
<i>Rubus australis</i>	bush lawyer
<i>R. cissoides</i>	"
<i>Schefflera digitata</i>	pate
A <i>Senecio bipinnatisectus</i>	Australian fireweed
A <i>S. jacobaea</i>	ragwort
<i>Senecio kirkii</i>	Kirk's tree daisy
<i>S. minimus</i>	
A <i>Sonchus oleraceus</i>	puha, sow thistle
<i>Syzygium maire</i>	swamp maire, maire tawake
<i>Vitex lucens</i>	puriri
<i>Weinmannia silvicola</i> var. <i>silvicola</i>	towai

MONOCOTYLEDONS

	<i>Acianthus fornicatus</i> var. <i>sinclairii</i>	
A	<i>Anthoxanthum odoratum</i>	sweet vernal
	<i>Astelia</i> sp. (c.f. <i>A. nervosa</i>)	
	<i>A. solandri</i>	kowharawahara, perching lily
	<i>A. trinervia</i>	kauri grass
	<i>Bulbophyllum pygmaeum</i>	
	<i>Carex dissita</i>	
A	<i>C. distans</i>	
	<i>C. lambertiana</i>	
	<i>Collospermum hastatum</i>	perching lily
	<i>C. microspermum</i>	"
	<i>Cordyline australis</i>	cabbage tree, ti
	<i>C. banksii</i>	ti ngahere
	<i>C. pumilio</i>	ti koraha
	<i>Cortaderia fulvida</i>	toetoe
	<i>Corybas orbiculatus</i>	
	<i>C. rivularis</i>	
	<i>Dendrobium cunninghamii</i>	
	<i>Dianella nigra</i>	turutu, blueberry
	<i>Drymoanthus adversus</i>	epiphytic orchid
	<i>Earina autumnalis</i>	Easter orchid
	<i>E. mucronata</i>	epiphytic orchid
	<i>Freycinetia baueriana</i> ssp. <i>banksii</i>	kiekie
	<i>Gahnia lacera</i>	
	<i>G. pauciflora</i>	
	<i>G. setifolia</i>	
	<i>G. xanthocarpa</i>	toi-kiwi
	<i>Juncus gregiflorus</i>	
	<i>J. pallidus</i>	
	<i>J. planifolius</i>	
A	<i>J. tenuis</i>	
	<i>Libertia grandiflora</i>	native iris
	<i>L. pulchella</i>	"
A	<i>Lotus pedunculatus</i>	
P	<i>Luzula picta</i> var. <i>picta</i>	
	<i>Microlaena avenacea</i>	bush rice grass
	<i>M. stipoides</i>	meadow rice grass
	<i>Microtis unifolia</i>	
	<i>Oplismenus imbecillis</i>	
	<i>Phormium cookianum</i>	mountain flax
	<i>Pterostylis banksii</i>	
	<i>P. trullifolia</i>	
	<i>Rhopalostylis sapida</i>	supplejack
	<i>Ripogonum scandens</i>	nikau
	<i>Schoenus apogon</i>	
	<i>S. maschalinus</i>	
	<i>Scirpus inundatus</i>	
	<i>Uncinia banksii</i>	hook-sedge
	<i>U. uncinata</i>	hook-sedge

APPENDIX 2 : FAUNAL SPECIES LIST - MANGANUIOWAE ECOLOGICAL AREA

* Recorded in Raetea Forest, National Habitat Register Card
No. 162 by the Wildlife Service (1978)

+ Recorded by author and P. Boyack during field work 1984

NATIVE BIRDS

* <i>Apteryx australis mantelli</i>	N.I. brown kiwi
+ <i>Callaeas cinerea wilsoni</i>	N.I. kokako
+* <i>Chalcites lucidus</i>	shining cuckoo
+* <i>Circus approximans</i>	harrier hawk
+* <i>Gerygone igata</i>	grey warbler
+* <i>Halcyon sancta</i>	kingfisher
+* <i>Hemiphaga novaeseelandiae</i>	N.Z. pigeon
+ <i>Nestor meridionalis</i>	N.I. kaka
* <i>Ninox novaeseelandiae</i>	morepork
+* <i>Petroica macrocephala</i>	piebald tit
+* <i>Prothemadera novaeseelandiae</i>	tui
+* <i>Rhipidura fuliginosa</i>	fantail
+* <i>Zosterops lateralis</i>	silveryeye

INTRODUCED BIRDS

+ <i>Acridotheres tristis</i>	myna
* <i>Fringilla coelebs</i>	chaffinch
* <i>Gymnorhina hypoleuca</i>	white backed magpie
+* <i>Lophortyx californicus</i>	Californian quail
+* <i>Phasianus colchicus</i>	pheasant
+* <i>Platycercus eximius</i>	eastern rosella
* <i>Prunella modularis</i>	hedge sparrow
+ <i>Turdus merula</i>	blackbird

OTHER NATIVE ANIMALS

+ <i>Anguilla</i> sp.	eel
+ <i>Paranephrops planifrons</i>	freshwater crayfish, koura
+ <i>Paratya curvirostris</i>	freshwater shrimp
+* <i>Paryphanta busbyi busbyi</i>	kauri snail
+ <i>Rhytida greenwoodii greenwoodii</i>	native snail

INTRODUCED MAMMALS

+* <i>Bos taurus</i>	cattle
+* <i>Mustela erminea</i>	stoat
* <i>Rattus</i> sp.	rat
+* <i>Sus scrofa</i>	wild pig
+* <i>Trichosurus vulpecula</i>	possum

APPENDIX 3 :

GENERALISED STAND STRUCTURE FOR
LOW ALTITUDE PODOCARP-HARDWOOD FOREST
(E2, NICHOLLS 1976)

TIER	← INCREASING DOMINANCE →				
	HEIGHT (M)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	20-30		rimu Northern rata	kahikatea miro Hall's totara totara	matai
CANOPY	8-18	taraire towai	rewarewa kohekohe	tawa miro rimu nikau mamaku swamp maire (1)	puriri
SUBCANOPY	2-8	nikau kohekohe wheki	ponga mahoe lacebark hangehange <i>Coprosma arborea</i>	mamaku rangiora rewarewa tawa kiekie	black maire
SHRUB	0.5-2		hangehange kiokio <i>Coprosma</i> spp.	kanono <i>Rhabdothermus solandri</i> <i>Gahnia</i> spp. kiekie	kaikomako
GROUNDCOVER	0-0.5		parataniwha hen & chicken fern	<i>Pneumatopteris pennigera</i> <i>Lastreopsis hispida</i> hooksedge <i>Adiantum fulvum</i> kiekie	<i>Loxoma cunninghamii</i>
EPIPHYTES AND LIANES		supplejack kiekie	<i>Griselinia lucida</i> <i>Astelia solandri</i> <i>Collospermum hastatum</i> <i>Phymatosorus</i> spp.	<i>Metrosideros</i> spp. kidney fern <i>Blechnum filiforme</i>	<i>Metrosideros carminea</i>

DISTRIBUTION : Throughout the reserve, up to 300 m a.s.l.

NOTES : (1) common on level swampy areas

APPENDIX 4 :

GENERALISED STAND STRUCTURE FOR
MID ALTITUDE PODOCARP-HARDWOOD FOREST
(E3, NICHOLLS 1976)

TIER	← INCREASING DOMINANCE →				
	HEIGHT (M)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	18-30		rimu miro	kahikatea Northern rata Hall's totara pukatea	
CANOPY	9-16	towai tawa taraire	kohekohe rewarewa	hinau heketara rimu mamaku lancewood kahikatea	
SUBCANOPY	2-8	nikau	tawa ponga hangehange heketara miro kohekohe	<i>Cyathea smithii</i> lacebark rangiora <i>Mida salicifolia</i> kanono mahoe	
SHRUB	0.5-2		kanono kiekie wheki	ponga Kirk's daisy <i>Astelia trinervia</i> mahoe ramarama	
GROUNDCOVER	0-0.5		kiekie hen & chicken fern bush rice grass	hooksedge kiokio piupiu <i>Elechnum fraseri</i> <i>Pneumatopteris</i> <i>pennigera</i>	
EPIPHYTES AND LIANES		kiekie	mangemange <i>Asplenium</i> spp. <i>Metrosideros</i> spp.	supplejack puka <i>Collospermum</i> <i>hastatum</i>	<i>Metrosideros</i> <i>carminea</i>

DISTRIBUTION : From 300 to 500 m a.s.l.

APPENDIX 5 :

GENERALISED STAND STRUCTURE FOR
HIGH ALTITUDE PODOCARP-HARDWOOD FOREST
(D6, NICHOLLS 1976)

TIER	← INCREASING DOMINANCE →				
	HEIGHT (M)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT	14-22		rimu miro	rewarewa rata pukatea towai	
CANOPY ⁽¹⁾	6-12	tawa towai	hinau heketara	miro kohekohe toro rewarewa swamp maire	<i>Ilex</i> <i>brevioides</i>
SUBCANOPY ⁽¹⁾	2-6	<i>Cyathea smithii</i>	kohekohe <i>Meliccytus</i> <i>macrophyllus</i> five finger pigeonwood wheki	neinei pate mamaku fuchsia <i>Cordyline banksii</i> <i>Pseudopanax</i> <i>edgerleyi</i>	mangeao
SHRUB	0.5-2		Kirk's daisy hangehange kanono	<i>Astelia trinervia</i> miro kiekie kohekohe <i>Phormium</i> <i>cookianum</i>	<i>Elaeocarpus</i> <i>hookerianus</i> <i>Pseudopanax</i> <i>anomalus</i>
GROUNDCOVER	0-0.5		piupiu bush rice grass hooksedge <i>Blechnum</i> <i>fraseri</i>	<i>Libertia</i> <i>pulchella</i> kiekie kohekohe <i>Phormium</i> <i>cookianum</i>	<i>Astelia</i> sp. (c.f. <i>A. nervosa</i>)
EPIPHYTES AND LIANES		<i>Hymenophyllum</i> spp.	<i>Astelia solandri</i> <i>Collospermum</i> <i>hastatum</i> supplejack kiekie mangemange kidney fern	<i>Pittosporum</i> <i>kirki</i> <i>P. cornifolium</i> <i>Grammitis</i> spp. <i>Pseudopanax</i> <i>edgerleyi</i> <i>Blechnum</i> <i>filiforme</i>	<i>Metrosideros</i> <i>carminea</i>

DISTRIBUTION : above 500 m a.s.l.

NOTES : (1) where the vegetation is low, there is little canopy-subcanopy distinction.

APPENDIX 6 : GENERALISED STAND STRUCTURE FOR
KAURI-PODOCARP-HARDWOOD FOREST

TIER	← INCREASING DOMINANCE →				
	HEIGHT (M)	ABUNDANT	FREQUENT	OCCASIONAL	RARE
EMERGENT ⁽¹⁾	10-25		rimu	kauri kahikatea Northern rata Hall's totara miro	kawaka
CANOPY ⁽¹⁾	2-8			towai tawa	
SUBCANOPY	0.5-2		rimu kohekohe	kahikatea Hall's totara kauri heketara taraire rewarewa	
SHRUB	0-0.5	<i>Coprosma</i> spp.	wheki ponga kiekie nikau <i>Gahnia</i> spp.	<i>Astelia</i> <i>trinervia</i> kauri Kirk's daisy hangehange kanono mapou	
GROUNDCOVER	0-0.5	kiekie <i>Gahnia</i> spp.	<i>Blechnum</i> <i>fraseri</i> podocarp seedlings	hooksedge kiokio	
EPIPHYTES AND LIANES		<i>Collospermum</i> <i>hastatum</i>	<i>Astelia</i> <i>solandri</i> hound's tongue	epiphytic orchids <i>Asplenium</i> <i>flaccidum</i> climbing ratas	

DISTRIBUTION : found on two small knolls

NOTES : (1) the numerous emergents tend to form a variable, high, open canopy.