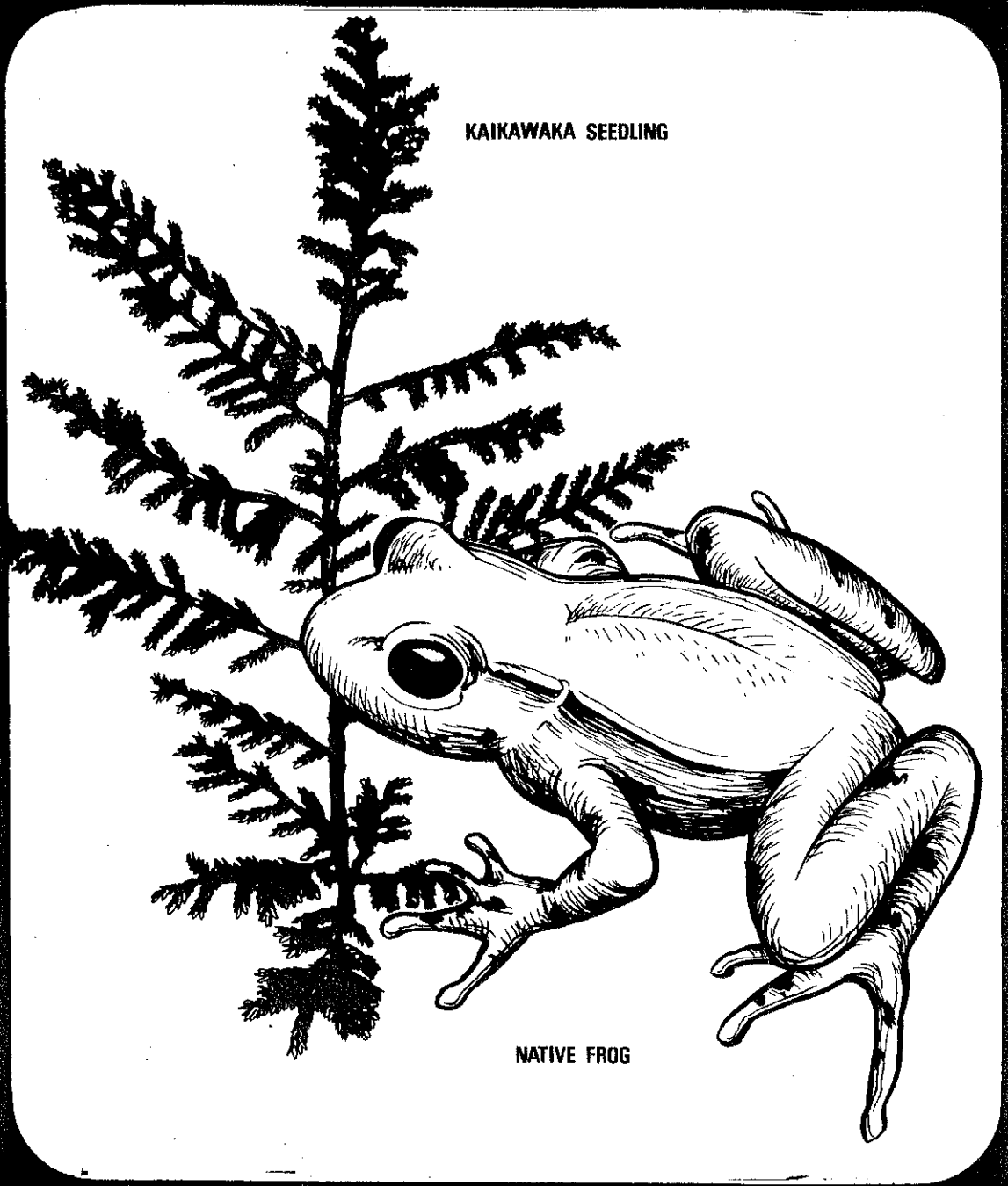
Papakai Ecological Area



ODC no. 627.4

PAPAKAI ECOLOGICAL AREA

NZ FOREST SERVICE
AUCKLAND CONSERVANCY
CPO BOX 39
AUCKLAND

(this is an unpublished internal report)

Bruce Burns
July 1984

PAPAKAI ECOLOGICAL AREA

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PAPAKAI ECOLOGICAL AREA

Location (Figure 1)

The Papakai Ecological Area is a large tract (3366.31 ha) of indigenous forest and scrub on the main axial range of the Coromandel Peninsula, north of the Tapu-Coroglen Road (mid-point at map ref. NZMS 1 N44 090490). It consists of the Papakai plateau, the summit of Maumaupaki and the connecting north-south ridge system including several adjoining catchments.

The reserve is the only gazetted Ecological Area within the Thames Ecological District (Simpson, 1982, B.R.C., 1983). However the proposed Waiomu Ecological Area as well as parts of the proposed Te Tipi and Motutapere Ecological Areas occur within the district boundaries. The reserve is bounded to the north and south by the Waikawau Block of the Coromandel State Forest Park. To the east and west, however, the reserve is bordered by pastoral and scrublands. The reserve also contains the Te Mata water supply catchment. The most recent aerial photographs are NZAM survey no. 8163, run M, photos 6,7 and 8 (flown on 25.1.84) and run N, photos 5 and 6 (flown on 10.1.83).

Access (Figure 2)

Walking access to the reserve is possible via several routes. A ridge track leaves the rest area at the summit of the Tapu-Coroglen Road and follows the ridge line to Maumaupaki. It then leads along a ridge to the Papakai trig descending from there to follow the Kaimarama River to the end of the Kaimarama Road near Whitianga.

The interior of the area may also be reached by old logging roads leading from the Te Mata river in the northwestern corner.

History of Gazettal

In 1970 John Nicholls (FRI, Rotorua) proposed a much smaller reserve (243 ha) on the Papakai plateau to reserve high altitude virgin kauri (Auckland Conservancy file 6/34). Reconsideration of the proposal led to a new recommendation of a much larger area covering most of the altitudinal range and land-forms of the region. The S.C.C.* inspected the area and approved the proposal in 1979. Final gazettal occurred on 30 May, 1982 (N.Z. Gazette no. 54, p. 1632).

Rationale and Objectives of Designation

The Papakai reserve fulfils many of the original criteria set down for selection of Ecological Areas (S.C.C. 1980). The area is large, unroaded and represents the full range of land forms and vegetation sequences of the region (except for coastal vegetation). It has a compact shape and contains the upper reaches of a number of catchments.

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* S.C.C. = Scientific Coordinating Committee now retermed the State Forests Scientific Reserves Advisory Committee.

The Coromandel State Forest Park Management Plan (NZFS 1978) states that the purpose of designation is:

> 'to reserve the only remaining sizeable virgin stands of the unique high altitude kauri forest of the Coromandel Range, and fringing softwood-hardwood forest type....'

The reserve has an IUCN* classification of IV (Nature Conservation Reserve, NZFS for IUCN 1984). IUCN management objectives of this type of reserve allow the application of manipulative management techniques to assure the survival of certain species of plants and animals. Scientific research, environmental monitoring and educational use are the primary activities associated with this category (IUCN 1978).

Topography

The Papakai Ecological Area consists of steep dissected hill country rising from the east and west to a central north-south ridge. This ridgeline features the Papakai plateau and several spectacular bluffs e.g. the summit of Maumaupaki (Camel's Back) (NZMS 1 N44 075463) and the Porua Bluffs (NZMS 1 N44 088520). The Ecological Area contains the upper reaches of a number of drainage systems including those of the Taranoho Stream, Five Mile Stream, Ten Mile Stream, Te Mata River and the Ounuora River. Slopes range from 16^{o} - 20^{o} on the high altitude plateau and low altitude slopes, to 35^{o} around the summits of the central ridge system (Water and Soil Division, M.O.W.D. 1975). From west to east, altitude in the reserve spans 120 m to 817 m to 60 m.

Climate

The closest climate recording station to the Papakai Ecological Area, with a history of observations, is at Thames. This station has measured on average 1278 mm per year and a daily temperature range between a mean minimum of 10.6°C and a mean maximum of 19.0°C (N.Z. Met. Serv. 1973). However, this recording station is at sea level and local exposure and altitude will have an over-riding effect on the climate actually experienced in the reserve. The high altitude ridges and plateaus in Papakai are much exposed to wind and often covered by mist and cloud. Further discussions of climate on the Coromandel are given in Burns (1983) and Maunder (1974).

Pedology and Erosion

The majority of the Papakai reserve is covered in hill and steepland soils related to brown granular clays with some unnamed peats on the Papakai plateau. The moderately steep lower slopes are covered with Waitakere hill soils. These are brown granular clays from weathered andesite and are of medium to low nutrient status. The steeper higher slopes, apart from some areas of bare rock, have Te Kie or Aroha steepland soils. These are also related to brown granular clays formed from weathered fresh and propylitised andesite. They consist of a thin greyish-brown stony topsoil with a weakly developed nutty and granular structure on a yellowish brown to brown stony clay loam. They are also of medium to low nutrient status and are subject to erosion (Dept of Lands and Survey, 1975, Eyre, 1977).

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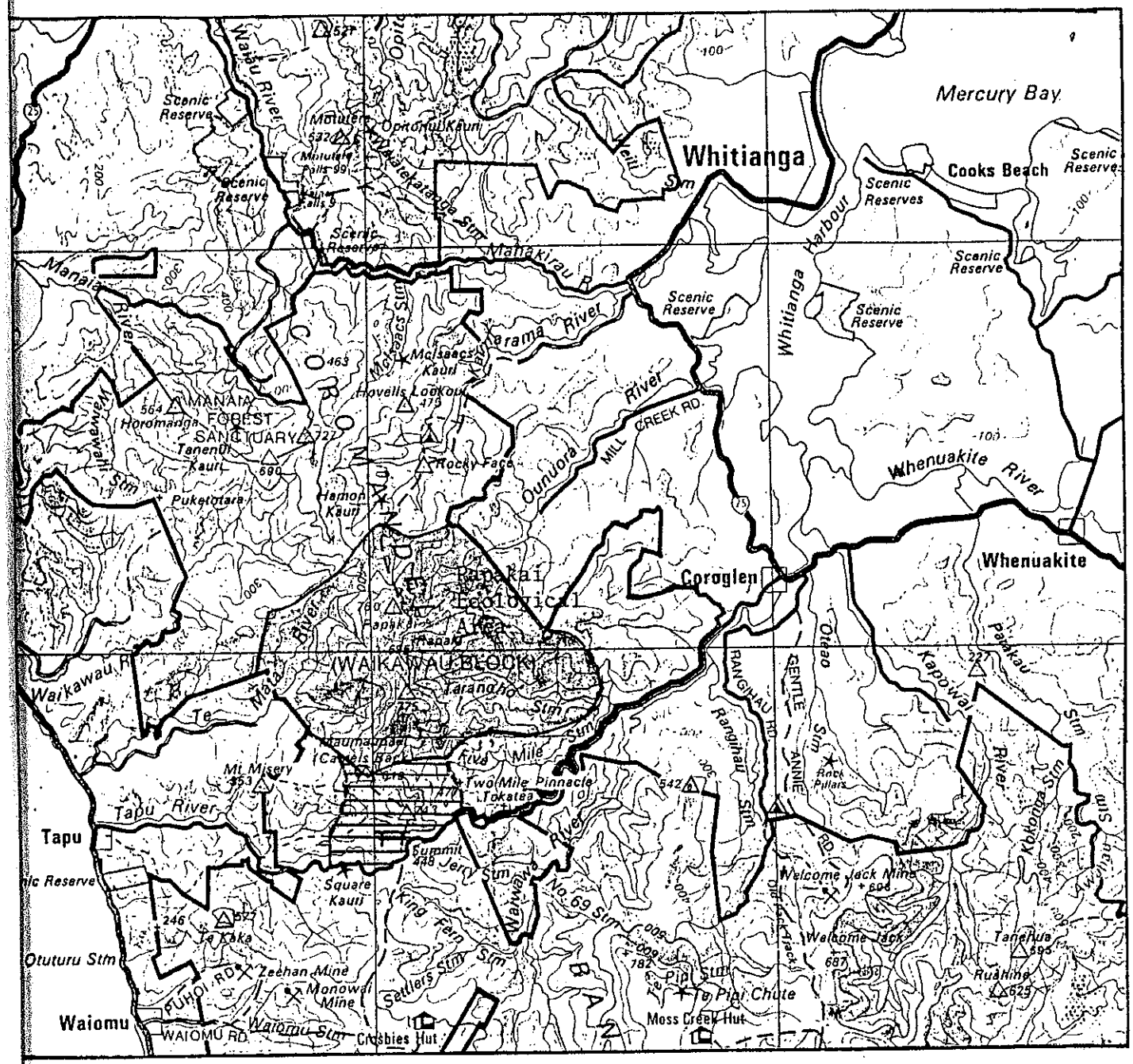
* IUCN = International Union for the Conservation of Nature and Natural Resources.



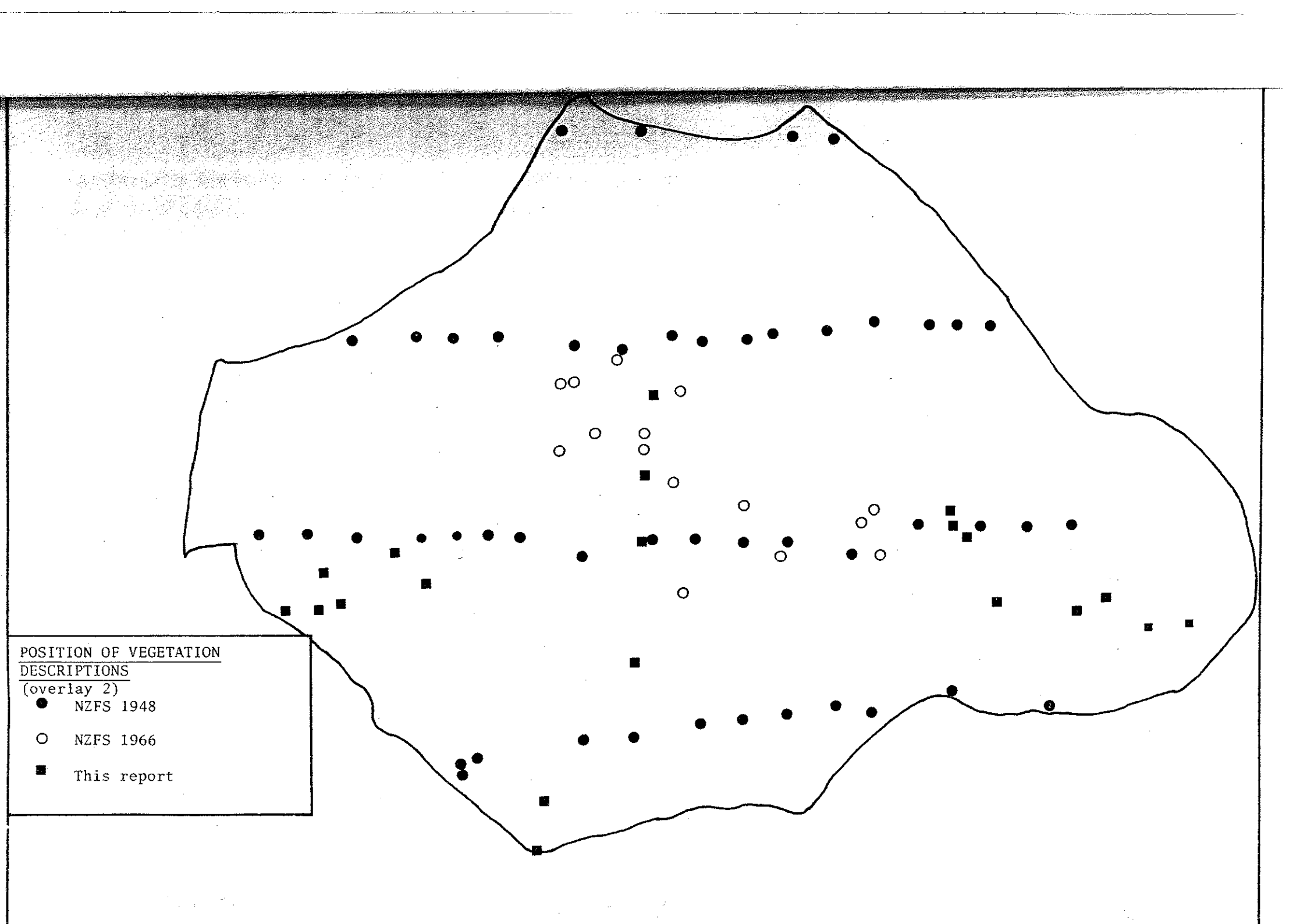
1 : Location Diagram - Papakai Ecological Area

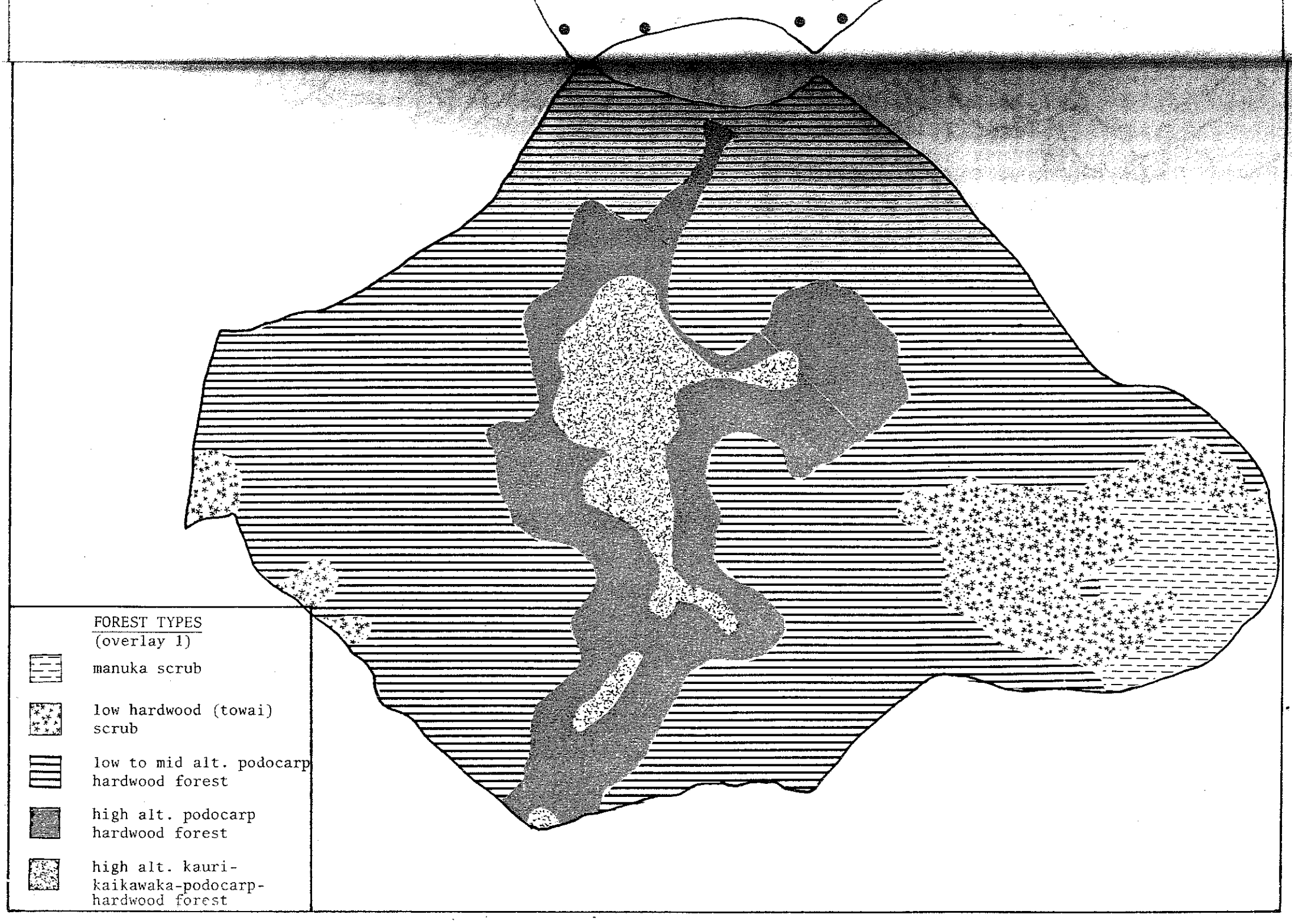
sed on NZMS 274 Coromandel State Forest Park, 1st Edition 1979, NZFS, ernment Printer, 1:150,000)

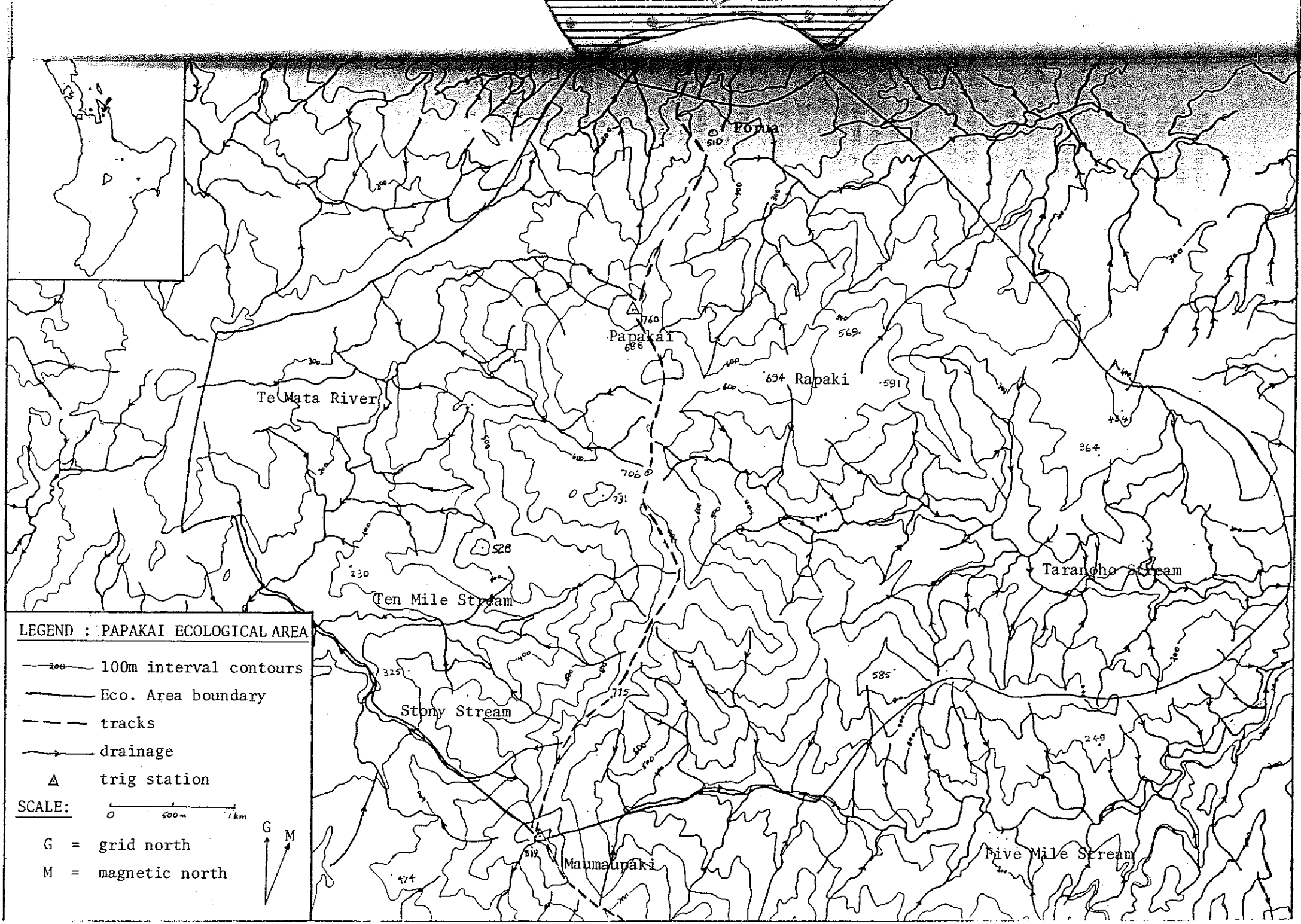
ogical Area

e Forest Park Boundary

posed Extension derson 1983)


POSITION OF VEGETATION DESCRIPTIONS
(overlay 2)
NZFS 1948
NZFS 1966
This report


FOREST TYPES
(overlay 1)
manuka scrub
low hardwood (towai) scrub
low to mid alt. podocarp hardwood forest
high alt. podocarp hardwood forest
high alt. kauri-kaikawaka-podocarp-hardwood forest


Porua
510
Papakai
760
686
569
694 Rapaki
591
Te Mata River
706
731
528
230
Ten Mile Stream
364
Tarandho Stream
325
775
Stony Stream
585
249
819
Maumaupaki
474
Five Mile Stream
LEGEND : PAPAKAI ECOLOGICAL AREA
100m interval contours
Eco. Area boundary
tracks
drainage
trig station
SCALE:
0 500m 1km
G = grid north
M = magnetic north
G
M

The Papakai Ecological Area has a number of large slips of the debris avalanche type. These occur on the steep unstable soils surrounding the central ridge. The Land Resource Inventory Worksheet for this region records erosion as severe on these slopes (Water and Soil Division, M.O.W.D. 1975). Elsewhere erosion is only slight.

Geology

The entire Papakai Ecological Area lies on a base of breccia, tuff and minor lava flows of andesite (Beeson's Island Volcanics). These were erupted during the upper Miocene and early Pliocene and consist mainly of avalanches of angular blocks and ash, and of agglomerates around volcanic vents as well as minor flows of viscous lava.

Several sheer rock bluffs occur in the reserve. These are erosional remnants of an extensive sheet of layered volcaniclastic rocks of the Beeson Island Volcanics e.g. Maumaupaki (Cornwell 1967). There has been a lack of mineralisation and hydrothermal alteration within the Papakai Ecological Area.

Vegetation

This description is based on 48 Forest Survey Tally Sheets (NZFS 1948), 13 Ecological Forest Survey Tally Sheets (NZFS 1966) and four and a half days' field work (7th, 9th, 10th, 11th April and 26th October 1983). (Overlay 2 of figure 2 shows the location of the various field descriptions made.)

The method used to describe vegetation is a modified recce-type description in which the vegetation is recorded in a number of tiers. The five tiers used are canopy emergents, canopy, subcanopy (from beneath canopy height down to 2 m), shrub (2 m down to 50 cm) and groundcover (50 cm to ground level). Site descriptions are grouped into types based as closely as possible on Nicholls' (1976) classification. Further discussion of this technique is given in Burns (1983).

I have classified the vegetation into five general types:

1. manuka scrub (interspersed with areas of dense bracken);
2. low hardwood (towai) scrub;
3. low to mid-altitude podocarp-hardwood forest with rare kauri (Nicholls' type D5);
4. high altitude podocarp-hardwood forest; and
5. high altitude kauri-kaikawaka-podocarp-hardwood (probably a mixture of Nicholls' types G7 and B11).

The extent of these types is shown on overlay 1 of figure 2. A detailed species list is given as Appendix 1, giving both scientific and common names for plants present.

Areas of bracken and manuka scrub (generalised stand structure, table 1) occur on the boundaries of the Ecological Area especially around the lower reaches of the Taranoho Stream. These probably reflect recent modification by fire.

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The second type identified is a low hardwood scrub (generalised stand structure, table 2) which probably represents a later stage in regeneration after disturbance than the manuka type described above. This type occurs on low altitude sites (below approx. 300 m a.s.l.) close to the boundaries of the Ecological Area.

The most common forest type is a low to mid-altitude podocarp-hardwood type with rare kauri poles on some ridges and stream banks (table 3 gives its generalised stand structure). It extends up to approximately 450 m altitude. However, the type boundaries are often indistinct, the vegetation changing gradually along an altitudinal gradient. Large trees emergent over this forest type are mostly northern rata with less frequent rimu, miro and Hall's totara and, in gullies, pukatea and kahikatea. Large kauri are rare. Stands of large northern rata are an outstanding feature of the western slopes of the Ecological Area. Several small swampy areas on stream flats contain dense kahikatea stands and these have been included in this type.

High altitude podocarp-hardwood forest covers the central range between about 450 and 600 m altitude (generalised stand structure, table 4). This type varies considerably in response to local exposure, and differences in altitude.

On the Papakai plateau, the summit of Maumaupaki and the main ridgeline (over 600 m altitude), the vegetation consists of variations of a high altitude kauri-kaikawaka-podocarp-hardwood forest type (generalised stand structure, table 5). The areas are much exposed to wind and often covered in mist and cloud. The soils are boggy and windthrown trees and stumps are commonplace. Around the Papakai trig and in some places on the plateau, exposure and goat damage have left zones covered in little but a low grass and fern groundcover.

Emergent kauri and rimu occur as scattered trees or in groups mostly on the plateau. Many dead 'spars' (probably of hardwoods) also stand above the main canopy. The cause of death of these trees is unknown. There is no evidence of fire or logging.

Several canopy species assume dominance where they occur but have discontinuous distributions over the forest type. These are yellow-silver pine, kaikawaka and kauri. This forest type could possibly be further divided into sub-types by the presence or absence of one or two of these species. The high altitude vegetation of the Papakai plateau and the associated north-south ridge system is scientifically interesting for the large number of uncommon species present and the vegetational processes occurring there.

Guthrie (1948-1951) describes this area as below :

> 'A most rare type of high altitude kauri, growing with tawari, quintinia, towai and other high altitude species typical of sub-alpine vegetation. Whole type area is a swamp basin, even carrying free water in parts. The basin is poorly drained, with the outlet probably above the basin floor itself, giving rise to almost lake conditions. The average kauri tree would probably be three feet in diameter by sixteen feet of log. Kauri, towai etc are covered in moss. Kauri tree form being constant and unusual in that from a definite bole, heavy horizontal limbing occurs, the terminating branches usually upright, windswept and twisted. These trees must be extremely

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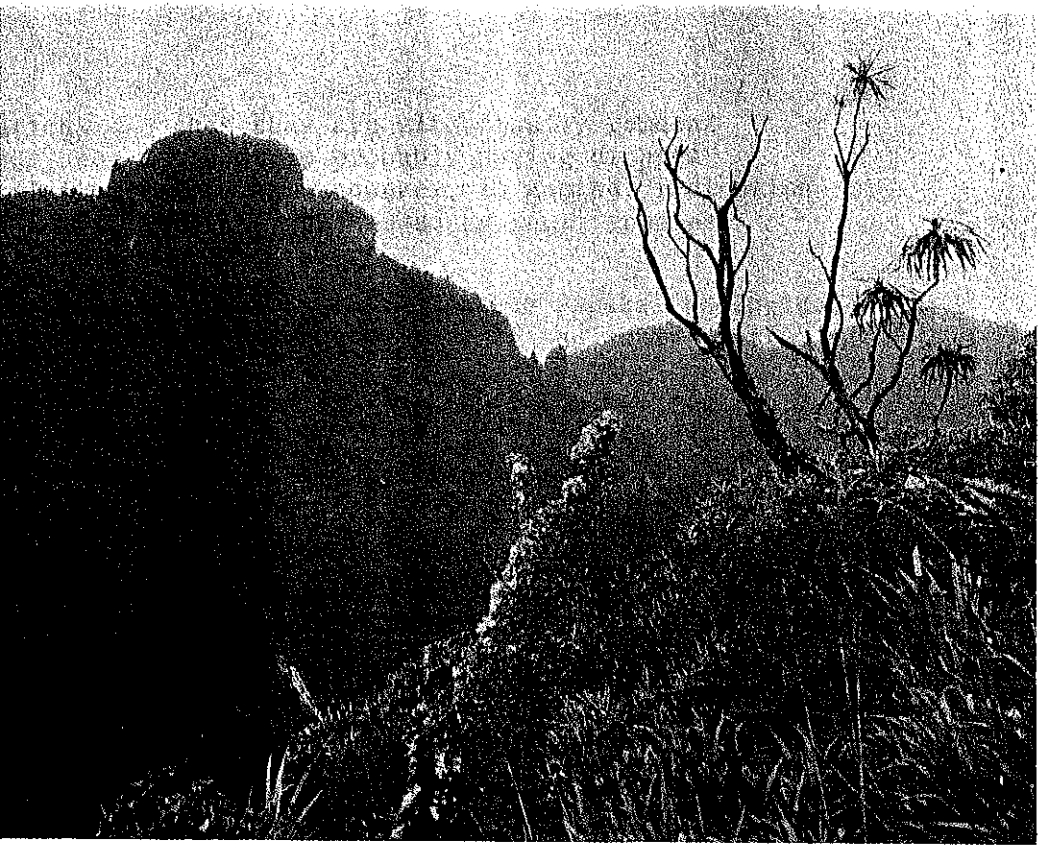

ummit of
and ridgeline
looking north
Watts)

edling of

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> old and indications are that they are climatically remnant at this altitude, the temperature probably having dropped and the rainfall increased, this, however, is another indication of the amazing tenacity of life possessed by kauri species.'

A number of rare and endangered species occur in the Papakai Ecological Area. *Celmisia adamsii* was found near the base of the rocky bluffs near Maumaupaki. The carmine flowered rata, *Metrosideros carminea*, occurs to the north of Papakai trig in mid-altitude forest. Both these species are listed as endangered in the Red Data Book of New Zealand (Nature Conservation Council 1981). Other species locally rare and found in the Papakai Ecological Area are kaikawaka, hard beech, *Archeria racemosa*, *Gaultheria paniculata*, *Metrosideros albiflora*, *Senecio (Brachyglottis) myrianthos*, *Cosproma dodonaeifolia*, *Elaeocarpus hookerianus*, *Dracophyllum patens*, *Pseudopanax simplex*, *Hebe pubescens and Pittosporum huttonianum* (NZFS 1978, Appendix 13). Braggins et. al. (1983) list species with distributional significance in the Coromandel. Eighteen species from this list are known to exist in the Papakai Ecological Area.

The processes of vegetation change which have occurred or are occurring on these high-altitude sites are unknown. What caused the death of the many trunks on the plateau; are these remnants of a former taller forest cover? What are the dynamics of the kauri and kaikawaka stands?

The exposed conditions of this ridge suggest the presence of other subalpine species. Are any other uncommon species present?

The Hamon kauri exists close to the northern boundary of the reserve. (NZMS 1 N44 077537). This is the sixth largest known kauri present on the Coromandel (NZFS 1978).

Introduced Animals and Forest Condition

Of 112 circular 4 m^2 plots examined throughout the Ecological Area intact goat pellets were only present in 16 (14.3 %). Possum and pig signs were also infrequently encountered and Anderson (1983) records the presence of occasional cattle. Nine goats were seen over four and one-half days field work and several more heard at a distance. Browse was only recorded on eleven species and was only noticeable in a few heavily used areas. High concentrations of goat pellets were found beneath the Porua bluffs (used as a shelter by goats) and in the Five Mile Stream catchment. Novis (1982) reports that although animal control operations had been carried out six years ago, the animal population was steadily increasing. He further states that numbers of goats are frequenting the higher parts of the range. His goat density map shows light to medium populations in the Papakai Ecological Area.

Pig damage was commonly observed around the lower reaches of streams and is particularly evident in the Taranoho and Five Mile Stream catchments.

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Table 1 : Generalised stand structure for low manuka scrub

Tier	← increasing dominance			
	abundant	frequent	occasional	rare
emergent			rewarewa	
canopy	manuka	rewarewa fivefinger		
subcanopy)))))		fivefinger hangehange rangiora		* tutu * *Pittosporum huttonianum*
shrub 2 m to 0.5 m))))))))		*Cordyline banksii* towai rewarewa mingimingi ponga		
groundcover		kiokio bracken *Lycopodium volubile*		* *Machaerina sinclairii*
epiphytes				

Distribution: on the boundaries of the Ecological Area particularly near the headwaters of the Taranoho Stream.

* These species occur on streambanks only.

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Table 2 : Generalised stand structure for low altitude hardwood (towai) scrub

Tier	increasing dominance ← abundant	frequent	occasional	rare
emergent		rewarewa		
canopy	towai		manuka rewarewa manuka lancewood	
subcanopy		fivefinger rangiora mingimingi	mahoe nikau manuka towai raurekau *Cordyline banksii*	
shrub 2 m to 0.5 m		ponga mahoe mingimingi mairehau	pigeonwood hangehange nikau fivefinger toro rewarewa	*Hebe macrocarpa* *Olearia rani* *O. furfuracea*
groundcover 0.5 m to 0 m	kiokio hookgrass *Dianella nigra*	bush rice grass *Asplenium* species		
epiphytes				

Distribution: on slopes and ridges below 300 m on the outskirts of the Ecological Area.

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Table 3 : Generalised stand structure for low to mid-altitude podocarp-hardwood forest with rare kauri

Tier	increasing dominance ← abundant	frequent	occasional	rare
emergent		northern rata	rimu miro Hall's Totara * pukatea * kahikatea	kauri
canopy	tawa towai rewarewa	kohekohe hinau mamaku	Hall's totara * pukatea	
subcanopy	nikau heketara mahoe ponga rangiora	towai kohekohe rewarewa pigeonwood	mapou hinau tawa	
shrub 2 m to 0.5 m	nikau heketara rangiora	pigeonwood mahoe ponga wheki rangiora kiekie raurekau	Kirk's daisy mapou karapapa	
groundcover 0.5 m to 0 m	kiokio kiekie	crown fern hookgrass *Blechnum fraseri*	hen & chicken fern karapapa *Pneumatopteris pennigera*	
epiphytes	supplejack kiekie mangemange		*Collospermum hastatum* climbing rata species	

Distribution: Most common type on slopes on either side of the main range to approx. 450 m a.s.l.

* These species occur together on wet boggy sites around streams and gullies.

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Table 4 : Generalised stand structure for high altitude podocarp-hardwood forest

Tier	increasing dominance ← abundant	frequent	occasional	rare
emergent				rimu miro Hall's totara northern rata
canopy		towai tawari tawa	rimu miro toatoa	
subcanopy))))))		tawheowheo tawari towai	korokia karamu *Cyathea smithii*	
shrub 2 m to 0.5 m)))))		horopito toro tawa heketara		
groundcover 0.5 m to 0 m		*Astelia trinervia* *Gahnia pauciflora* bush rice grass bryophytes		
epiphytes		bryophytes	*Metrosideros fulgens* *M. perforata* *Astelia solandri* kidney fern *Hymenophyllum spp.*	

Distribution: Both sides of main ridge between 450 m and 600 m altitude.

.../11

Table 5 : Generalised Stand Structure for high altitude kauri-kaikawaka-podocarp-hardwood

Tier	increasing dominance ← abundant	frequent	occasional	rare
emergent		kauri rimu		
canopy		towai tawari tawheowheo broadleaf toro southern rata rimu	* yellow silver pine * kauri * kaikawaka	
subcanopy)))))))))		neinei mountain toatoa tawheowheo towai horopito Hall's totara	kaikawaka korokia *Archeria racemosa* heketara toatoa	
shrub 2 m to 0.5 m)))))))		rimu tawari southern rata toro broadleaf	kiokio *Dracophyllum pyramidale*	
groundcover 0.5 m to 0 m	*Astelia spp.* *Gahnia spp.*	hard fern bush rice grass kiokio bryophytes		
epiphytes	bryophytes			

Distribution: Papakai plateau, central ridgeline and the summit of Maumaupa

* These species have clumped distributions and occur in localised dense sta
Yellow silver pine and kaikawaka do not occur together (possibly competit
exclusive).

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Forest condition can be assessed by considering:

1. the presence of seedlings and saplings of canopy species;
2. other evidence of plant growth and replacement e.g. presence of new shoots, flowering or fruiting individuals;
3. the open-ness of the vegetation as a whole and in different tiers; and
4. the presence of dead or dying individuals.

Seedlings and saplings of canopy trees are frequent throughout Papakai. Dead or dying trees are infrequent within the forest apart from on the ridgetop and plateau area. On the plateau, there are small open areas covered in little but a short grass/fern turf. These could be a response to the exposed conditions but grazing by goats could also maintain them in this state. Apart from these, the vegetation is nowhere exceptionally open.

Presence of Exotic Plants

Only a few exotic plant species are present in the Ecological Area. Those observed were mostly herbs. None at present pose any threat to the native vegetation.

Native Fauna

A list of wildlife recorded in Papakai is given as Appendix 2. The central Coromandel block including Papakai Ecological Area has an 'outstanding' wildlife rating (Anderson 1983). Three species of rare native birds have been recorded from the vicinity of Papakai. These are the long-tailed cuckoo and kaka from within the reserve and the kokako which occurs around Maumaupaki and the Porua bluffs.

Anderson also notes the presence of two species of native frog; the rare Archey's frog and Hochstetter's frog.

Human History and Influence

There are no known archaeological sites within the Papakai Ecological Area (Ian Lawlor - personal communication).

Logging has occurred on both the eastern and western slopes, but not on the ridge tops including the plateau kauri stands. The Te Mata River headwaters were logged for kauri during the early logging of the Coromandel (probably *circa* 1890-1900). Milling for rimu and miro by the Thames Sawmilling Company occurred in the 1960s (Auckland Conservancy file 6/34). Old logging roads still exist in this catchment. This western side of the range has not been burnt since the logging. In the Taranoho Stream catchment to the east, however, the forest was set on fire after logging for kauri. The scrub in the lower reaches has probably been regularly ablaze (S.C.C. 1979). The remains of a kauri dam is reported to exist in the Taranoho Stream (at map ref. NZMS 1 N44 107490) with remains of gates and an old skidway on a hillside (NZFS 1966).

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The region around and including the Papakai Ecological Area has had little economic importance in terms of mineral deposits. Geological investigation suggests a lack of mineralisation or base metal hydrothermal alteration (Cornwell 1967). There have been no gold mines in the Papakai Ecological Area although one was worked in the Te Mata River catchment near the western boundary. This mine, the Gentle Annie Claim, was discovered in 1887 and produced 4.8 kg of bullion. The area was abandoned in 1889. (Slane and White 1980.)

A prospecting licence was gained in 1979 over the same area (P.L. 31516 - R.W. Brown). However, due to lack of activity this licence was not renewed in 1982 (Johnston 1982).

Recreational Facilities and Opportunities

For recreation, the Papakai Ecological Area offers little. A track leading from the summit of the Tapu-Coroglen Road to the end of Kaimarama Road runs along the main ridge. It passes both the Maumaupaki and Papakai summits. Fine views are available from these heights. The track is one of the most strenuous in the State Forest Park (NZFS 1983a). Between the two peaks, the track has only been cut in recent years. It has low usage and is now often obscure and difficult to follow. An indication of track usage can be gained from the visitors book on top of Maumaupaki: only 21 signatures were entered in 1982 compared to 642 on top of Table Mountain (NZFS 1983b).

Pig hunting occurs in many of the low parts of catchments particularly those of the Taranoho and Five Mile Streams.

A twenty-bunk hut has been proposed to be sited north of Maumaupaki (NZFS 1978). However a recent recreation planning strategy for the Coromandel State Forest Park has recommended that it not be installed (Holder et. al. 1983).

> 'Huts tend to draw a large number of people... This high use of huts creates conflicts in both cultural and environmental areas. A down-graded recreational experience for the user occurs, but more importantly, the impact on local environment is magnified.'

Furthermore, Holder et. al. (1983) suggests the following strategy for the Waikawau Block (of which Papakai E.A. forms a large part).

> 'The interior of the block containing the Manaia Forest Sanctuary and other areas of important ecological significance should be managed as an undeveloped 'remote' self discovery area. People with a genuine interest in the ecological resources of the forest would use the area and pressure would be minimal.'

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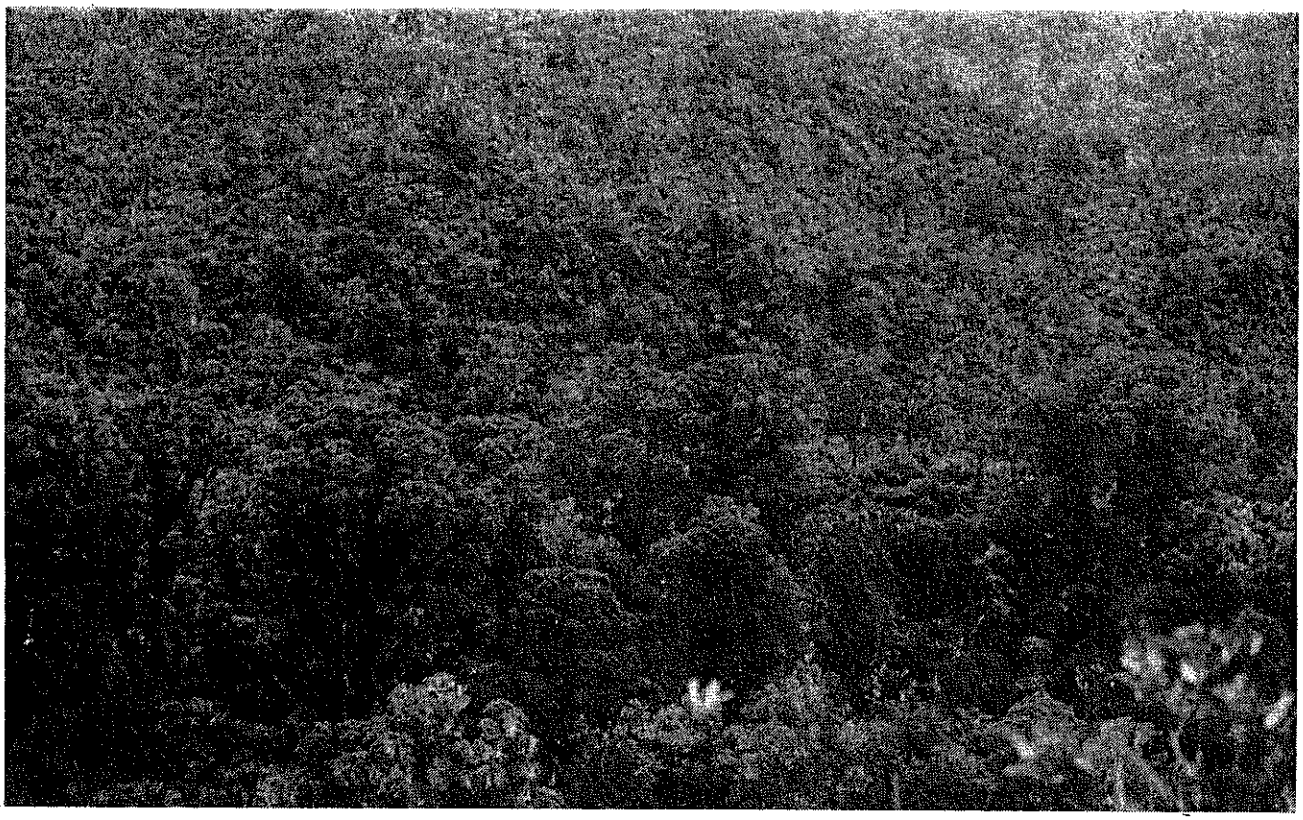

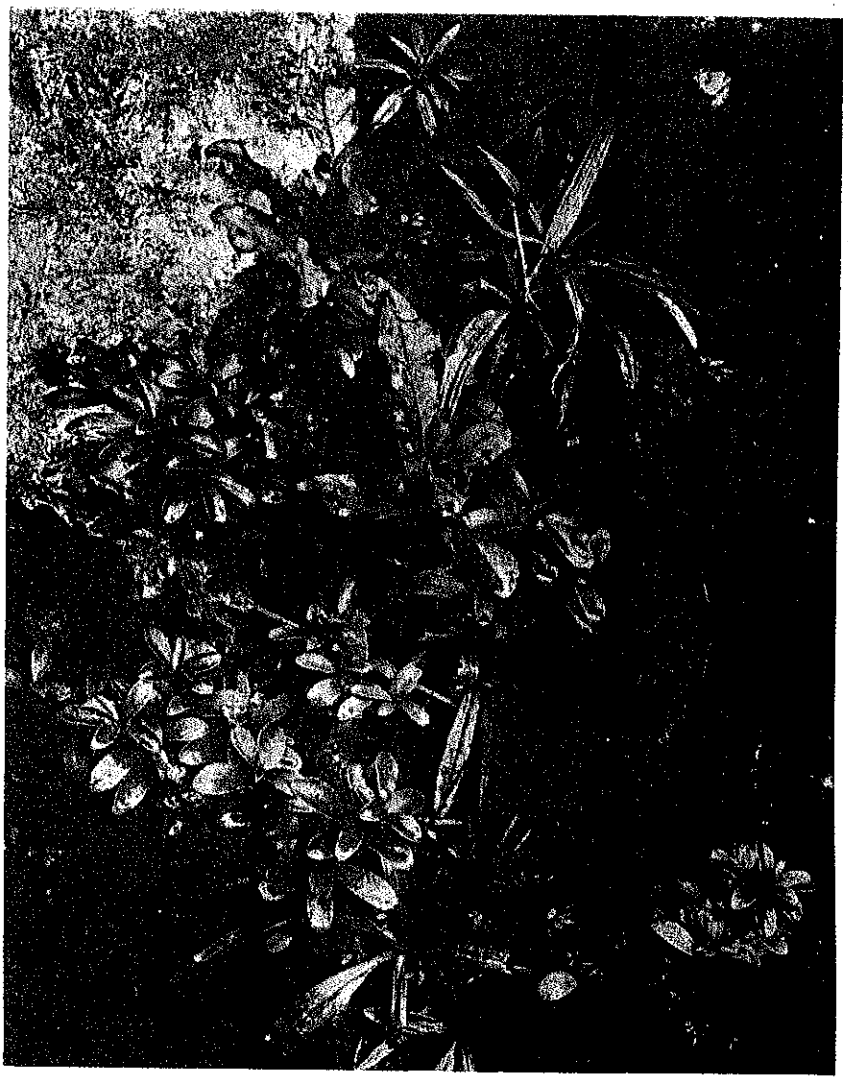

Photo 3: (above): Stand of northern rata on western slopes of reserve (photo B. Burns)

Photo 4: (right): *Gaultheria paniculata*, tawheowheo and *Celmisia adamsii* around Maumaupaki (photo D. Watts)

Beds of carnelian occur in the headwaters of the Te Mata River. This semi-precious stone is a dull red or reddish white chalcedony (cryptocrystalline quartz and much chert, commonly microscopically fibrous). Rockhounds have been active from time to time searching for this stone (Auckland Conservancy file 6/149, 1972).

Research Carried Out and Suggested

Kokako existing on the northern and southern boundaries of Papakai have been studied by Hughes (1981). He studied, observed and recorded this species here and elsewhere over its range for an MSc thesis on its vocal dynamics.

A PhD student at the University of Waikato, Alison Cree, is studying water balance in Archey's and Hochstetter's frogs. Her initial proposal indicates that she will be using sites around Maumaupaki on the southern boundary of the Ecological Area (Auckland Conservancy file 32/2/149).

There is potential for research into the history and vegetation dynamics of the Papakai plateau region (refer 'Vegetation' in this report).

Summary, Discussion and Recommendations

Papakai Ecological Area is a large (3366.31 ha) tract of indigenous forest and scrub on the main axial range of the Coromandel. It forms part of the Waikawau Block of the Coromandel State Forest Park and also lies within the Thames Ecological District. The reserve consists of the Papakai plateau, the summit of Maumaupaki and the connecting north-south ridge system, and catchments leading off this to the east and west. The country is steep and dissected with several spectacular bluffs and moderate to severe erosion. Soils are all related to brown granular clays and are of medium to low nutrient status. Some peats occur on the plateau regions. The entire Ecological Area is situated on a base of breccia, tuff and minor lava flows of andesite.

I have divided the vegetation into five general types; two of scrub and three of forest vegetation. These are short manuka scrub (plus areas of dense bracken), low hardwood (towai) scrub, low to mid altitude podocarp-hardwood forest with rare kauri, high altitude podocarp-hardwood forest and high altitude kauri-kaikawaka-podocarp-hardwood forest. A number of rare plant species occur in the Papakai Ecological Area. Notable amongst these are *Celmisia adamsii* and

Metrosideros carminea, both recorded as endangered in the Red Data Book of New Zealand (N.C.C. 1981). The central Coromandel block including the Papakai Ecological Area has an 'outstanding' wildlife rating. Three species of rare native birds have been recorded from the vicinity of Papakai Ecological Area as well as two species of rare native frog.

Apart from the plateau region, most of the reserve has been logged for kauri and some podocarps. The area has, and has had no known importance for the presence of mineral deposits.

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A brief inspection cannot be conclusive about animal numbers or their impact. However, there is evidence that in some parts of the Ecological Area goats may be jeopardising vegetation values, in particular in the Five Mile Stream catchment and around the Porua bluffs. Other introduced mammals are not noticeably abundant.

The Papakai plateau region is scientifically intriguing for its unusual plants and its unknown history. As this zone is the prime reason for the existence of the reserve, management should be directed towards its preservation and research. The proposal to place a hut close to the plateau is undesirable as huts attract high visitor numbers and associated environmental damage.

The track between Maumaupaki and Papakai trigs is often obscure. Upgrading would make the area more accessible for study without unduly encouraging use.

Anderson (1983) has proposed an extension of the Papakai to include an area between Maumaupaki and the Tapu-Coroglen Road where kokako and Archey's frog have been observed (Figure 1). Although the inclusion of known habitat of two rare and endangered species would undoubtedly increase the value of the reserve, the distribution of these species within the existing reserve should be identified before a firm proposal is formulated. The extension may not substantially increase the total area of their habitat within the existing reserve. It may equally add a variety of habitat to the reserve which is not or only poorly represented. The status of the species involved justifies consideration of Anderson's proposal.

Management recommendations in order of priority are:

1. reduce the goat population to as low a level as practical;
2. I support Holder et al. (1983) in recommending that the proposal for a hut near the Papakai trig be abandoned;
3. upgrade the track between Maumaupaki and the Papakai trig;
4. encourage external institutions to investigate the vegetation of the Papakai plateau region or instigate such investigations within the NZFS;
5. assess the value of adding an area of kokako and Archey's frog habitat to the south of the reserve in relation to habitat already existing within the Ecological Area; and
6. set up several permanent plots in different vegetation types to monitor vegetation trends.

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Appendix 1 : Botanical Species List - Papakai Ecological Area

Ferns

Adiantum cunninghamii	maidenhair fern
A. fulvum	
A. viridescens	
Asplenium bulbiferum	hen and chicken fern
A. flaccidum	hanging spleenwort
A. oblongifolium	shining spleenwort
A. polyodon	
Blechnum capense (forma a)	kiokio
B. capense (forma b : 'B minus')	
B. chambersii	
B. colensoi	
B. discolor	crown fern
B. filiforme	
B. fluviatile	
B. fraseri	
B. membranaceum	
B. nigrum	
Ctenopteris heterophylla	
Cyathea cunninghamii	
C. dealbata	ponga
C. medullaris	mamaku
C. smithii	
Dicksonia squarrosa	wheki
Doodia media	
Gleichenia cunninghamii	umbrella fern
G. dicarpa	swamp umbrella fern
Grammitis billardieri	
G. pseudociliata	
Hymenophyllum demissum	filmy fern
H. dilatatum	filmy fern
H. ferrugineum	filmy fern
H. flabellatum	filmy fern
H. multifidum	filmy fern
H. rarum	filmy fern
H. revolutum	filmy fern
H. sanguinolentum	filmy fern
H. scabrum	filmy fern
Hypolepis rufobarbata	
Lastreopsis hispida	
Leptopteris hymenophylloides	heruheru
Lindsaea trichomanoides	
Lygodium articulatum	mangemange
Paesia scaberula	hard fern or ring fern
Phymatodes diversifolium	
P. scandens	fragrant fern
Pneumatopteris pennigera	
Polystichum silvaticum	
Pteridium acquilinum var. esculentum	bracken
Pteris macilenta	
Pyrrosia serpens	
Rumohra adiantiformis	
Trichomanes elongata	
T. reniforme	kidney fern

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Fern Allies

Lycopodium billardieri	
L. deuterodensum	
L. laterale	
L. volubile	
Tmesipteris elongata	
T. tannensis	

Gymnosperms

Agathis australis	kauri
Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Lepidothamnus intermedius	yellow silver pine
Libocedrus bidwillii	kaikawaka
Phyllocladus asplenifolius var. alpinus	mountain toatoa
P. glaucus	toatoa
P. trichomanoides	tanekaha
Podocarpus hallii	Hall's totara
Prumnopitys ferruginea	miro
P. taxifolia	matai

Dicot. Trees and Shrubs

Alectryon excelsus	titoki
Alseuosmia macrophylla	karapapa
Aristotelia serra	makomako
Archeria racemosa	
Beilschmiedia tawa	tawa
Brachyglottis myrianthos	
B. repanda	rangiora
Carmichaelia arborea	
Carpodetus serratus	putaputaweta
Coprosma grandifolia	mamangi
C. colensoi	
C. dodonaeifolia	
C. lucida	karamu
C. robusta	karamu
Coriaria arborea	tutu
Corokia buddleoides var. linearis	korokia
Corynocarpus laevigatus	karaka
Cyathodes fasciculata	mingimingi
C. juniperina	mingimingi
Dracophyllum latifolium	neinei
D. patens	
D. pyramidale	
Dysoxylum spectabile	kohekohe
Elaeocarpus dentatus	hinau
E. hookerianus	pokaka
Fuchsia excorticata	kotukutuku
Gaultheria antipoda	
G. paniculata	
Geniostoma rupestre var. crassum	hangehange

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Dicot. Trees and Shrubs (cont'd)

Griselinia littoralis	broadleaf
G. lucida	shining broadleaf
Hakea acicularis	
Hebe macrocarpa var. latisepala	
H. pubescens	
H. stricta	koromiko
Hedycarya arborea	pigeonwood
Ixerba brexioides	tawari
Knightia excelsa	rewarewa
Laurelia novae-zelandiae	pukatea
Leptospermum ericoides	kanuka
L. scoparium	manuka
Litsaea calicaris	mangaeo
Lophomyrtus bullata	ramarama
Macropiper excelsum	kawakawa
Melicytis micranthus	
M. ramifloris	mahoe
Metrosideros robusta	northern rata
M. umbrellata	southern rata
Myrsine australis	mapou
M. salicina	toro
Nestegis lanceolata	white maire
Nothofagus truncata	hard beech
Olearia furfuracea	
O. rani	heketara
Phebalium nudum	mairehau
Pittosporum huttonianum	
P. tenuifolium	
Pseudopanax anomalum	
P. arboreum	five finger
P. colensoi	
P. crassifolium	lancewood
P. discolor	
P. edgerleyi	
P. simplex	
Pseudowintera axillaris	horopito
P. colorata	horopito
Quintinia serrata	tawheowheo
Rhabdothamnus solandri	
Schefflera digitata	pate
Senecio kirkii var. kirkii	Kirk's daisy
S. k. var. angustata	Kirk's daisy
Weinmannia silvicola	towai

Dicot. lianes

Clematis paniculata	puawhananga
Metrosideros albiflora	climbing rata
M. carminea	climbing rata
M. diffusa	climbing rata
M. fulgens	climbing rata
M. perforata	climbing rata
Muehlenbeckia australis	
Parsonsia spp.	
Passiflora tetandra	native passionfruit
Rubus australis	bush lawyer
R. cissoides	bush lawyer
R. fruticosus	blackberry

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Dicot. Herbs

Acaena anserinifolia
Celmisia adamsii
Centella uniflora
Cirsium vulgare
Drosera binata
Epilobium nummularifolium
E. pedunculare
E. rotundifolium
Erica lustanica
Geranium potentilloides
Gnaphalium delicatum
G. gymnocephalum
G. keriense
G. sphaericum
G. spicatum
Haloragis erecta
Hydrocotyle dissecta
H. moschata
Laginifera pumila
Leycestaria formosa
Lobelia anceps
Nertera depressa
Oxalis magellanica
Pratia anulata
Ranunculus hirtus
Senecio bipinnatisectis
S. diaschides
S. minimus
S. valerianaifolia

Grasses

Chionochloa conspicus var. cunninghamii
Cortaderia fulvida
C. selloana
Ehrhata diplax bush rice grass
Oplismenus hirtellus
Poa anceps

Orchids

Bulbophyllum pygmaeum
Chiloglottis cornuta
Corybas orbiculatus
Dendrobium cunninghamii
Drymoanthus adversus
Earina autumnalis
E. mucronata
Pterostylis trullifolia

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Other Monocots

Astelia fragrans	
A. nervosa	
A. solandri	
A. trinervia	kauri grass
Carex dissita	
C. forsteri	
C. geminata	
C. ochrosaccus	
Collospermum hastatum	
Cordyline banksii	
C. pumilio	
Dianella nigra	blue-berry
Eleocharis acuta	
E. gracilis	
Freycinetia baueriana subsp. banksii	kiekie
Gahnia lacera	
G. pauciflora	
G. setifolia	
G. xanthocarpa	
Juncus articulatis	
J. effusus	
J. gregifloris	
J. planifolius	
Libertia grandiflora	
L. pulchella	
Luzulla picta	
Luzuriaga parviflora	
Machaerina sinclairii	
Phormium cookianum	mountain flax
Rhopalostylis sapida	nikau
Ripogonum scandens	supplejack
Schoenus maschalinus	
S. tendo	
Scirpus chlorostachyus	
S. reticularis	
Typha orientalis	raupo
Uncinia distans	
U. rupestris	
U. uncinata	hookgrass
U. zotovii	

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Appendix 2 : Wildlife of the Papakai Ecological Area

(after Anderson 1983 unless otherwise stated)

Native Birds

Anthornis melanura	bellbird
Callaeas cinerea	kokako (Hughes 1981)
Chalcites lucidus	shining cuckoo
Eudynamis taitensis	long-tailed cuckoo
Gerygone igata	grey warbler
Halcyon sancta	kingfisher
Hemiphaga novaeseelandiae	N.Z. pigeon
Hirundo neoxena	welcome swallow
Nestor meridionalis	kaka
Ninox novaeseelandiae	morepork
Petroica macrocephala	pied tit
Prothemadera novaeseelandiae	tui
Rhipidura fuliginosa	N.I. fantail
Zosterops lateralis	silvereye

Introduced Birds

Acridotheres tristis	myna
Fringilla coelebs	chaffinch
Platycercus eximius	eastern rosella
Prunella modularis	dunnock
Turdus merula	blackbird
T. philomelos	song thrush

Amphibians

Leiopelma archeyi	Archey's frog
L. hochstetteri	Hochstetter's frog

Mammals

Bos taurus	cattle
Capra hircus	goat
Sus scrofa	wild pig
Trichosurus vulpecula	possum

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